Importing the Stethoscope: The Uptake of Mediate Auscultation by British Practitioners, 1816-1850.

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Submitted in accordance with the requirements for the degree of Doctor of Philosophy

The University of Leeds

School of Philosophy, Religion, and History of Science

December 2020

Acknowledgements

First and foremost, I would like to thank my supervisors—Adrian Wilson, Jonathan Topham, and Selina Hurley — who were a fantastic team. They were enthusiastic about my work and the thesis has greatly benefitted from their guidance, editing, questions, and above all patience. I am lucky to have had supervisors who were not only knowledgeable in their specific areas but also thorough in their feedback and supportive both academically and pastorally. This thesis would not have been possible without their help.

This work was generously supported by the Arts & Humanities Research Council (AH/P004350/1). This funding enabled me to complete this thesis and to visit a variety of archives and attend conferences which greatly helped my work.

This project was in collaboration with the London Science Museum and all the staff there were immensely kind and helpful. Along with Selina, I would particularly like to thank Ben Russell for his help and guidance in investigating stethoscope wood types, and Tim Boone for his feedback and support on my written work. Having access to the collections held at the museum as well as the library allowed me to discover information that has become a fundamental part of this project. I would not have made these discoveries if not for the help and support I received from my colleagues at the Museum.

During my time at Leeds I have been lucky enough to be a part of a vibrant and supportive academic community in the School for Philosophy, Religion, and History of Science. There are so many people that it would be impossible to list them all, but to name a few who have had a particularly positive impact on my time at Leeds, my thanks to: Alex Aylward, Coreen and Richard Bellis, Arthur Carlyle, Laura Chilton, Víctor Dura-Villa, Mike Finn, Jade Fletcher, Graeme Gooday, Emily Herring, Nick Marsh, Alan MacIntosh, Alice Murphy, Sarah Murphy-Young, Christina Nick, Helen Piel, Kelsey Root, Tasia Scrutton, James Stark, John Turney, and Nicola Williams. I would especially like to thank to Clare and Paul Coleman and Polina Merkulova for their steadfast friendship and academic support.

Of course, not all of the support and encouragement I received during this PhD came from friends and colleagues in PRHS. Thank you to my cousin, Tania Kaczynski, for generously letting me stay at her flat in London during my research trips. Additionally, a huge thank you in general to my wonderful family for their support throughout many of life’s challenges. For letting me bounce ideas off her even while she was writing her own thesis, thank you to Katy Laing. For their general love and support, thank you to: Imogen Angier, Claire Cholewa, Marie-Ruth Coughlan, Quenby Harley, Abi Magrill, Kasia Malczuk, Emilie van der Gucht, Lizzie Walton, Bethan Wilson, and Gemma Woodward. Thank you to the online communities of The Common Room, the Quidditch Pitch, and the Dregs; online friends can be just as important as in person ones. Finally, a particularly big thank you goes to Bex Cooper, Siân Hopper, and Sarah Turner, for their friendship all the way through my academic career and their excellent (and questionable) writing advice – stethoscopes *are* cool.

The final three acknowledgements go to people who deserve far more than a simple mention in an acknowledgment section.

Firstly, to my sister, Frances Avery. Thank you for your fantastic proof reading and enthusiasm for my ideas, and for all your love and encouragement through the years.

Secondly, to my dad, Ian Avery. Thank you for your love, support, practical advice, and a frankly awe-inspiring amount of proof reading.

Thirdly, and finally, to my fiancé, James Haley. Thank you for comforting me when things were overwhelming, reminding me it’s ok to take a break, and being patient when the thesis took priority. I promise I really am finished now.

This thesis is dedicated to the memory of my mother, Naomi Jane Avery (née Gold).

זיכרונה לברכה | May her memory be a blessing.

Thesis Abstract

The stethoscope is recognised globally as the preeminent symbol of medical expertise, but how did this global acceptance come about following its first introduction in the clinical context of post-Revolutionary Paris? This thesis examines one part of that story by addressing the three following questions. Firstly, why did practitioners in the British Isles become interested in the practice of mediate auscultation and the stethoscope? Secondly, how did they become able to form accurate diagnoses through the use of the stethoscope? Thirdly, how did their interactions with the stethoscope as a physical tool impact their understanding and uptake of the instrument?

The main claim of this thesis is that British practitioners, despite working in a different medical context to that of Paris, had their own methods of developing skill with the stethoscope. These methods allowed British practitioners to appreciate the utility of the stethoscope in making diagnoses, enabled their acquisition of the skills necessary for its use and encouraged their interaction with the instrument itself. The thesis considers in turn the methods of early adopters, its introduction into formal medical education, and the unique approaches taken in using the instrument in obstetrics. It develops a new approach to object study which combines material culture, the social history of technology, and object use. The thesis also demonstrates how the skill of practitioners became embodied in the physical stethoscopes.

The thesis answers important and neglected questions regarding the history of the stethoscope and offers a novel analysis of skill development in medicine, outlining a new approach to object study that is of relevance beyond the study of mediate auscultation and the stethoscope.

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Glossary of Terms Relating to the Stethoscope

Monaural Stethoscope – an instrument which the practitioner applies to only one ear. The original form of stethoscope, and the only form until the 1850s.

Chest piece – the part of the stethoscope which the practitioner applies to the body of the patient.

Chest part – if the stethoscope comes in separate pieces, this is the part which has the chest end on it.

Ear plate – the disk onto which the practitioner places their ear.

Ear part – if the stethoscope comes in separate pieces, this is the part which has the ear plate on it.

Obturator – a removable 'obturator' or 'plug' placed into the chest end of the stethoscope as a means of differentiating between the sounds of the lungs and the heart.

Mortise and Tenon – a form of joint which typically connects two pieces of wood, the mortise forms a hole and the tenon a 'tongue' cut exactly to fit into the mortise, to hold an object together.

Pleximeter – from the Greek words for 'to strike' and 'to measure'. A Pleximeter is a flat plate of ivory used for mediate percussion. Its inventor, French physician Pierre Adolphe Piorry used the term 'Plessimeter' which translators then termed 'Pleximeter' in English.

Introduction: Understanding the Development and Uptake of Mediate Auscultation

The stethoscope is one of the best-known symbols of medicine across the world. Due to the instrument's ubiquity many people are surprised to learn that the stethoscope is barely 200 years old. Invented by René Laennec in Paris in 1816, there are still many unanswered questions surrounding how the stethoscope became the symbol of medicine it is today. The stethoscope is the instrument of mediate auscultation, the diagnostic method of listening (auscultation) to the internal sounds of the body in order to identify disorder or illness. Practitioners can listen 'immediately' with the ear, or 'mediately' through the stethoscope. This thesis examines how the practice of mediate auscultation and use of the stethoscope first came to the British Isles and received acceptance within the medical profession between 1816 and 1850. It asks two distinct, but fundamentally interlinked, questions: Why were British practitioners initially drawn to mediate auscultation and the stethoscope? And how did they develop their skill with the method and the instrument?

Since the work of Foucault on the Parisian "birth of the clinic", many historians and researchers from other disciplines have held the view that the Parisian context was both unique and necessary for much of the medical advancement in the early-to-mid 1800s. The supposed uniqueness of the Parisian context, in which auscultation first became prevalent and in which Laennec invented the stethoscope, provides a puzzle for historians. If the Parisian systems and medical contexts were both necessary *and* unique, how did medical practitioners from other countries and contexts ever come to accept or adopt these Parisian ideas? British practitioners practiced in medical environments that appeared to be completely separate from their Parisian neighbours, with different hospital structures, pedagogical methods and legal parameters. Yet, within only a few years, some British practitioners *did* accept mediate auscultation and adopt the stethoscope into their practice. Previous historians of the subject have not given a satisfactory explanation of why British practitioners took interest in this technique and its tool, both of which came from a context that was supposedly so different from their own. Neither have they explained how, outside of the unique French setting, British practitioners were able to adequately develop their skill in mediate auscultation.

In this thesis I answer these puzzles by explaining why and how British practitioners came to adopt mediate auscultation and the stethoscope, using three core arguments. My account corrects the familiar historical claims regarding the importance of Paris in two main ways. Firstly, I demonstrate that the 'unique' Parisian methods were available to British practitioners. These methods, though less systematic in Britain when compared with France, provided ample resources for British practitioners to adopt mediate auscultation and the stethoscope. The Parisian system was not so unique as historians have previously suggested or supposed. Secondly, I argue that practitioners in the British Isles had other means of achieving the same knowledge and so did not always need to adopt or imitate Parisian methods: through a system of Observation, making a Diagnosis, and Verifying their diagnoses (ODV) British practitioners could develop skill in the diagnostic method of mediate auscultation and the stethoscope. The Parisian system was not so necessary as historians have previously suggested or supposed. In addition to these two core arguments regarding British practice and the non-essential nature of the Parisian context, I add a third core argument regarding the uptake of the stethoscope in the British Isles. I argue that the instrument of the stethoscope became so embedded in British practice between 1816 and 1850 that British practitioners began developing their own models of the instrument due to practical motivations. This was something that could only occur when practitioners were regularly and skilfully using the stethoscope.

In the rest of the introduction I will outline the historical framework in which this thesis is situated, including an overview of my sources and methodology in four sections. The first section (0.1) provides more information on the Parisian context and methods. This section introduces some of the key terminology used in the thesis and outlines the method of practice in both France and Britain which enabled practitioners to adopt mediate auscultation and the stethoscope. Section 0.2 outlines earlier historical accounts of the reception of the stethoscope in Britain, analysing where they succeeded and where they fell short. In correcting these earlier narratives, I bring in the groundwork for understanding skill development: looking at how practitioners gained the ability to practice mediate auscultation and use the stethoscope. A key concept in this thesis is making a distinction between the *practice* of mediate auscultation, the diagnostic method which involves practitioners listening to the internal sounds of the body and the stethoscope as a *tool* for that process. In this thesis I present the stethoscope as both a conceptual stand-in for the method of mediate auscultation and as a physical object in its own right. Section 0.3 discusses the range of approaches to material culture and the Social Construction of Technology (SCOT) as means of interacting with the stethoscope and interpreting it as a tool and object. The fourth and final section (0.4) provides an overview of my sources and methodology, including a detailed discussion of the unique benefits and difficulties which come from using objects in a museum collection as a key source. The second half of 0.4 gives a short overview of each chapter and the key arguments of the thesis contained in each.

That the stethoscope is an emblem of the medical profession is undeniable. Over the course of this thesis I illuminate some of its earliest steps towards becoming the ubiquitous symbol of medicine it is today.

0.1. – The Parisian Context and Symptomatic-Pathological Correlation

This thesis introduces the concepts of symptomatic-pathological correlation and Observation, making a Diagnosis, and Verification (ODV) as means through which British practitioners adopted the practice of mediate auscultation and the stethoscope. The process through which medical practitioners developed skill in a new diagnostic method, in this case mediate auscultation, relied on their ability to observe and listen to the symptoms of the living patients, make a diagnosis, and then have that diagnosis verified through some means. Mediate auscultation and the instrument of the stethoscope gained prominence in the context of Parisian medicine in the early 19^{th} century; indeed, it was in this context that Laennec invented the stethoscope. The thesis will address the unique Parisian medical context in more detail in Chapter 1; for now, suffice it to say that French practitioners in post Revolution medical institutions worked in a medical environment which had a seemingly new focus on morbid anatomy, pathological study, and the practice of clinical education in hospitals. These structures had increased clinical teaching, made all hospitals open for teaching purposes, created a centrally organised and enforced medical curriculum and established a system for the regular and legal provision of cadavers. The French medical practitioners found themselves able to routinely engage with living patients and to study dead bodies.

Michel Foucault described access to post-mortem anatomy as the 'most decisive authority' when it came to practitioners verifying their diagnosis.[1] French practitioners functioned within a clinical system where medical institutions had close control over an immense number of patients across multiple hospitals, and the cadavers from those institutions; this provided both the opportunity and the impetus for French practitioners to increase their observation and study of living patients, and to have their diagnoses verified through looking at morbid appearances upon the death of a patient.[2] Foucault termed this period the 'birth of the clinic', claiming that the organisation and practices which occurred in post-Revolutionary France were novel and distinct, bringing forth a new age of medical understanding.[3] In describing the use of dissection Foucault said that 'the living night is dissipated in the

[1] Foucault 1973, 112.
[2] Bonner 1995, 143.
[3] For more on this see Michel Foucault's 1973 *Birth of the Clinic*.

brightness of death'; post-mortems brought the unknowable internal functions into the observable realm of the practitioner, providing answers to their diagnostic and anatomical questions.[4] French practitioners observed living patients, made a diagnosis, and had their diagnoses verified at autopsy, a practice Foucault termed 'anatomo-clinical coherence'.[5]

Adrian Wilson similarly described the Parisian medical organisation as forming a "fortuitous triple combination of practices".[6] This fortuitous combination of clinical and morbid practice, Wilson argued, allowed for the practice of 'anatomico-symptomatic correlation' (later changed to anatomico-clinical correlation), the difficult process of correlating the symptoms of the living patient with the morbid anatomy seen at dissection.[7] Wilson emphasised the truly difficult aspect of this practice, one which neither historians nor practitioners at the time managed to fully articulate; the body practitioners observed at dissection must be the *same* body as the patient observed in the clinic whilst alive.[8] The *minimum* requirements for the practice included: creating a detailed and accurate record of the symptoms in the living patient; the death of the patient; the same patient must then be available for dissection; finally, the findings of the post-mortem must be meticulously recorded and collated along with the previously recorded symptoms.[9] Furthermore, all of this needed to happen multiple times per each illness for practitioners to be truly confident of any observed correlation. Laennec needed this practice, that of understanding the connection between the symptoms in the patients and the morbid changes seen at dissection, in order to understand mediate auscultation and to invent the stethoscope. Yet, as stated, the practice of anatomico-clinical correlation occurred by chance – spontaneous and fortuitous – within the new organisational structures of Parisian medicine. This element of medical practice, seeing a large

[4] Foucault 1973, 146.
[5] Foucault 1973, 68, 135.
[6] Wilson 2007, 34.
[7] Wilson 2007, 34.
[8] Wilson 2007, 30.
[9] Wilson 2007, 34.

number of patients both living and then again at dissection, was not available to practitioners in Britain, potentially limiting their interest and skill in mediate auscultation.

This thesis argues not only that British practitioners could practice anatomico-clinical correlation, if less routinely than practitioners in Paris, but additionally that there was another practice – I term it 'symptomatic-pathological correlation' – which enabled British practitioners to adopt mediate ausucltation and the stethoscope. The practice of symptomatic-pathological correlation is very similar to that of anatomico-clinical correlation: it involved observing the living patient, making a diagnosis, and having that diagnosis verified in some way. In anatomico-clinical correlation this verification necessarily took the form of post-mortem examinations, a practice which relied on a steady number of cadavers, ideally those of the same patients the practitioners had observed and diagnosed during life. In the practice of symptomatic-pathological correlation, verification relied on the knowledge of pathological anatomy, but it did *not* need to occur directly at post-mortem. In Britain, access to cadavers for dissection, especially cadavers of the same patients practitioners had diagnosed, was limited; medical practitioners therefore used items relating to pathological anatomy, such as anatomical preparations, as a means of diagnostic verification. In this way, despite working in a different institutional structure from that of Paris, British practitioners could practice symptomatic-pathological correlation: observing living patients, making a diagnosis, and having that diagnosis verified in relation to the pathological anatomy. Through this process, practitioners could develop understanding and skill with mediate auscultation and the stethoscope.

Foucault claimed that this French pathological anatomy, particularly the work of the physician Bichat within it, was new; that it marked a departure from the widespread medical practices and contexts which came before it. The practice of pathological anatomy which took place in Paris, Foucault argued, differed fundamentally from that studied elsewhere before this 'birth' of clinical practice. Russell C. Maulitz concurred with Foucault's assessment, and he gave particular attention to the work of Bichat which focussed on the tissues and membranes in the body.[10] Maulitz examined the response of British practitioners to these changes: British students experiencing French pathological anatomy and bringing the practice home with them, with additional ‘flavour’ coming just as much from the individual as it did from the change in national setting.[11] This focus on Bichat’s pathology reduces the relevance of Maulitz’ work to that in this thesis; mediate auscultation did not rely on an understanding of pathological anatomy at the level of tissues and membranes. Whilst Maulitz asks similar questions to those in this thesis – what was this French practice, what made it attractive to British practitioners and worthy of adoption, and to what extent was it successfully imported?[12] – he asked these questions in relation to the pathology of Bichat. This thesis considers pathological anatomy in relation to the use of the stethoscope, which focused primarily on whole organs, rather than tissues, and so did not need Bichat’s approach.

Furthermore, British practitioners had access to other means of verifying their diagnoses which did not rely on pathological anatomy at all. The practice of ODV need not take either the form of symptomatic-pathological correlation or of anatomico-clinical correlation, although both practices do follow that structure. Instead, British (and French) practitioners could verify their diagnosis (by confirmation or refutation) through observing successful treatments, surgeries, or in the case of diagnosing pregnancy, through the gestation (or not) and birth of a child. Methods of verification that did not rely on the practice of dissection allowed British practitioners, who had less access to cadavers than their French contemporaries, to understand and develop skill in mediate auscultation and with the stethoscope outside of the Parisian context. This did not mean that anatomical information was unnecessary for practitioners to develop these skills; the practice of anatomico-clinical

[10] Maulitz 1987, 61-62; Duffin 1989, 107.
[11] Duffin 1989, 106.
[12] Maulitz 1987, 6.

correlation certainly played a vital role in Laennec's invention and studies with the instrument. Instead, the use of the stethoscope relied on practitioners understanding the correlation between the symptoms of the living patient and the *potential* future autopsy: 'to see the living patient as post-mortem in dotted outline.'[13] The medical structures in France inadvertently encouraged the practice of anatomico-clinical correlation through increased access to post-mortems, which in turn aided the invention of the stethoscope. British practitioners had access to fewer bodies which reduced, but did not stop, the practice of anatomico-clinical correlation and encouraged them to practice other methods of ODV, either through symptomatic-pathological correlation or through completely separate means.

This thesis puts forward the concept of ODV and the practice of symptomatic-pathological correlation as new ways of understanding how British practitioners developed skill with the stethoscope. Using the ideas put forward by Foucault and Wilson, the thesis argues that the practice of anatomico-clinical correlation which formed an essential part of the invention of the stethoscope was not necessary – at least on the same scale – for British practitioners to adopt the instrument. As long as British practitioners could follow some form of observing the living patient, making a diagnosis, and having that diagnosis verified (through confirmation or refutation) then it was possible for them to develop skill in mediate auscultation and the use of the stethoscope.

0.2. – Mediate Auscultation, Skill Development, and the Uptake of Medical Technology in Britain

Previous narratives of the uptake of mediate auscultation and the stethoscope in Britain tend to fall into one of two categories: narratives of acceptance or narratives of conflict. Often using overlapping sources to argue different positions, previous historians of the stethoscope

[13] Foucault 1973, 162.

have suggested either that practitioners took up the instrument with little to no hesitation or that they resisted it for some time. In the former case, historians such as James Bishop and Lester King suggest some forward-thinking practitioners championed the diagnostic method and the instrument, bringing about a swift acceptance of both.[14] In the latter, historians such as Malcolm Nicolson and Stanley Reiser rely on the idea that practitioners were aware of the instrument but not able, or perhaps willing, to use it: they understood it academically, but not practically.[15] As with all history, it is rarely so simple. This thesis leans towards an 'acceptance' narrative but is not primarily interested in dealing with this debate. Both narratives provide a reading of different sources which can aid historical understanding of stethoscope uptake, but overall narratives rarely discuss *why* practitioners responded in a particular way and what that signifies for their adoption and skill with the stethoscope. The aim of this thesis is not to come down on one side of the narrative, but to look at both the how and the why of British practitioners taking an interest in mediate auscultation and adopting the stethoscope: focussing on the processes of developing skill and how historians should understand historical skill development.

Before getting into the narratives of mediate auscultation and stethoscope uptake in Britain, it is necessary to acknowledge the work of Jacalyn Duffin, biographer of René Laennec. Duffin's 1998 book, *To See with a Better Eye*, provides a rounded and well-researched story of Laennec's life and work, centred around his invention of the stethoscope and subsequent publications on mediate auscultation. This includes the professional-political world Laennec moved in, his public and private feuds, and his untimely death. As the most comprehensive biography of Laennec, Duffin's work mentions the British story only in so much as it impacted Laennec himself, which, given that Laennec could not speak English, was

[14] Bishop 1981; King 1959.
[15] Nicolson 1993; Reiser 2009.

remarkably little.[16] Duffin's book focuses primarily on the reception and adoption of the stethoscope in France. Practitioners in Paris had many more opportunities to develop their skill with the instrument and to study with Laennec himself. Indeed, the Chair of Anatomy at the Collège de France, Antoine Portal, who had previously been sceptical of the utility of mediate auscultation, presented information to *L'Académie Des Sciences* supporting stethoscope use following a series of investigations to evaluate Laennec's work.[17] Whilst Duffin did note a number of British students who studied under Laennec, she mentions it in passing: this thesis draws out the importance of studying and developing skill under the tutelage of Laennec and other Parisian practitioners for early stethoscope adopters.

The works of Bishop and King did focus on British practice, both presenting a narrative of harmonious uptake. Bishop suggested that the commercial availability of the instrument in London and multiple long reviews in British medical journals indicated a swift interest in and uptake of the stethoscope.[18] Bishop's account covered much of the primary evidence that practitioners, at least publicly, appreciated Laennec's work on auscultation, but he offered no explanation of why these practitioners took an interest in such matters. This thesis adds the extra dimension of considering how and why practitioners took interest in mediate auscultation and the stethoscope. King suggested that it was only the 'gifted' individuals who first took interest in the stethoscope, although their uptake met little opposition.[19] This thesis in part agrees with King, as many of the early adopters of the stethoscope conducted individual trials of the instrument and developed their skill through solitary, personal, study. This thesis expands on King's work, to look at what motivated these practitioners to undertake individual trials and how the uptake of mediate auscultation moved from these personal projects into more

[16] Duffin 1998, 213.
[17] Duffin 1998, 27; 127.
[18] Bishop 1981, 488.
[19] King 1959, 447.

widespread British medical teaching and practice. Bishop and King indicate that British practitioners had an interest in mediate auscultation and developed skill with the instrument, whilst this thesis delves further into this position to understand why and how practitioners adopted the stethoscope.

In contrast, in his book *Technological Medicine* Stanley Reiser presented a strong conflict narrative of the history of stethoscope uptake, claiming that 'despite its benefits many doctors opposed the stethoscope'.[20] In his account practitioners were generally unwilling to become students again, found the stethoscope difficult to learn, and did not want to be linked to the use of 'instruments'.[21] Reiser emphasised the distinction between physicians and surgeons; the physician, he claimed, conducted very limited physical examination, leaving tools and any bodily manipulation to the 'lower status' role of the surgeon and apothecary.[22] This thesis challenges this sort of strict dichotomy; many of the early adopters of the stethoscope were trained as surgeons before becoming physicians, and there is little to suggest that those who spoke against the stethoscope did so simply because it was an instrument.

It is strange that Reiser presented such a strong resistance narrative to the uptake of mediate auscultation and the stethoscope when the stethoscope gave practitioners what he claimed they wanted: a method of diagnosis that was more reliable than a patient account. He claimed that the stethoscope transformed the relationship between patients and doctors, as it revealed the internal sounds of the disease which practitioners could understand without the need for the patient's narrative.[23] Medical practitioners had previously relied on the symptoms the patient reported as their means of making a diagnosis: the patient's suffering formed their condition, and the practitioner could measure their success in treating the 'disease' through

[20] Reiser 2009, 9.
[21] Reiser 2009, 9.
[22] Reiser 2009, 3; 10.
[23] Reiser 2009, xiii.

their ability to alleviate as much of the suffering as possible.[24] This, Reiser observed, was not a comfortable position for practitioners who often wrote about the unreliability of the patient's account.[25] The signs afforded by mediate auscultation and the stethoscope put diagnoses and the understanding of illness into the hands of the practitioner.[26] Reiser further suggested that patients were 'concerned' by practitioners using the stethoscope; the accuracy of the diagnosis could confirm their worst fears and remove the hope that a serious or terminal diagnosis was simply incorrect.[27] Additionally, in cases of obstetric practice, the use of the stethoscope could reveal a pregnancy the patient wished to conceal, causing social outrage or scandal; the knowledge and choice fell into the hands of the physician rather than the patient. Due to there being very few sources where patient opinion is expressed, and even those accounts come from practitioners rather than the patients themselves, this thesis will not attempt to reclaim patient voices.

Malcolm Nicolson presented a slightly different approach to the conflict or acceptance discussion, suggesting that mediate auscultation received relatively little resistance in Scotland but a fraught uptake in London.[28] The reason Nicolson gave for this stark contrast between Edinburgh and London was the idea that Edinburgh put a greater emphasis on practical knowledge. Simply put, in Nicolson's narrative practitioners in Scotland had greater opportunities to develop practical skill with the instrument than practitioners in London. In his work on stethoscopy, Nicolson suggested that there existed a key difference between 'academic' and 'practical' knowledge in the adoption of physical examination.[29] It took more than reading books and responding positively to information regarding mediate auscultation

[24] Reiser 2009, 2.
[25] Reiser 2009, 2.
[26] Reiser 2009, 7.
[27] Reiser 2009, 11. He stated that even in modern use of the stethoscope there 'is something enigmatic' about doctors using the stethoscope and hearing sounds within but unknown to the patient and then making diagnoses based on them.
[28] Nicolson 1993.
[29] Nicolson 1993, 135.

for practitioners to successfully gain practical knowledge of the method and use of the stethoscope.[30] In this sense Nicolson and I are in agreement: practicing with the stethoscope and the opportunity to regularly employ the method of mediate auscultation was necessary for practitioners who wished to be able to actually understand and use the technique and instrument, though what he refers to as 'practical knowledge' I term 'skill'.

Nicolson's dichotomy between Edinburgh and London stemmed from his argument for practical experience with the stethoscope. He claimed that in Edinburgh trials of the stethoscope began almost immediately in 1819, after practitioners first read Laennec's *Traité*, although journal evidence suggests that Edinburgh physicians did not start using the instrument until the November of 1820.[31] Whilst in London, claimed Nicolson, practitioners showed purely academic interest in mediate auscultation and did not attempt practical learning until the mid-late 1820s. This thesis argues that this was not the case, and that practitioners across the British Isles had a range of methods for developing skill with the instrument.

Much of the process of developing skill happens within the confines of 'tacit' ability; that is, skills and abilities which the practitioners find difficult to codify or easily explain. Michael Polanyi, a polymath who made theoretical contributions towards physical chemistry, economics, and philosophy, first coined the term 'tacit knowledge' in his 1966 book *The Tacit Dimension.* In his book he explained that there were two ways a person could gain knowledge or develop a skill: firstly, through the slow build-up of smaller skills to form a cohesive ability, and secondly, through careful instruction or observation akin to an apprenticeship.[32] Polanyi's work has received little attention from historians, instead the idea of tacit skills took root within business and economic spheres. Whilst the concept of tacit knowledge and skill has appeared

[30] Nicolson 1993, 141.
[31] Nicolson 1993, 140.
[32] For more on Tacit knowledge see Polanyi 1988, *Personal Knowledge: Towards a Post-Critical Philosophy* and Collins 2010, *Tacit and Explicit Knowledge.*

in some historical research, only researchers interested in historical re-enactments seem to truly take concerns of tacit knowledge into account.[33] This thesis aims to change this, by approaching the adoption of the stethoscope with the notion of tacit knowledge and skill development in mind. Through close reading of the primary sources as well as attempting to recapture some elements of the use of the instrument, this thesis offers a new understanding and explanation for how historic medical practitioners developed their skill in mediate auscultation, and thus in stethoscope use.

Examining the process of skill development and the range of narratives regarding stethoscope adoption leads to a wider conversation regarding how to best understand the uptake of new medical technologies. Carsten Timmermann and Julie Anderson define medical technologies as 'the drugs, devices, and medical and surgical procedures used in medical care, and in the organisational and supportive systems within which such care is provided'.[34] John Pickstone further suggested that thinking of medical technologies as 'innovations' rather than 'inventions' allowed historians of medical technology to move away from previous approaches which had focussed more exclusively on how an idea or artefact originated rather than on how it fared after invention.[35] Within the history of medical technologies, the term innovation could refer to the introduction of an idea or artefact into a social or economic system, instead of looking at the new idea, process, or object in isolation.[36]

The rest of this section examines two methods of conceptualising the process of innovation uptake in medicine: McKinlay's seven-stage model and Rogers' S-shaped curve. The latter is a particularly well discussed approach within the history of medical technology, though Timmerman and Anderson note, and it will be demonstrated in this section, that many

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[33] Kneebone and Wood 2014.
[34] Timmermann and Anderson 2006, 1
[35] Pickstone 1992, 1; Timmermann and Anderson 2006, 2. The term began to gain prominence in the history of medical technology in the early 1990s.
[36] Pickstone 1992, 1.

researchers are now moving away from a strictly linear interpretation of uptake towards ideas of social construction and non-linear progression. It will become apparent that neither framework is perfect for understanding stethoscope uptake, but that both have something to offer for that purpose.[37] The section also considers the idea of 'diffusion', which is common in the history of medical technologies but, as will be discussed later in this section, has been largely discredited as a concept within the history of science.

John McKinlay suggested a seven-stage model of understanding the 'career' of medical innovations.[38] He outlined not only how an innovation gained acceptance but also the eventual 'erosion and discreditation' of the technology.[39] The seven stages he proposed for the life cycle of a medical innovation were: promising reports, adoption by professional organisations, public acceptance and third party (often governmental) endorsement, standard procedure with positive observational reports, randomised controlled trials (RCTs), professional denunciation, and finally discreditation.[40] McKinlay stated that these stages had no clear order to them, and that it need not be the case that every innovation goes through each stage, giving each researcher the space to choose which stages to accept or disregard based on their particular innovation of interest.[41] The ability to use or ignore certain stages is useful when considering the stethoscope through McKinlay's model: a discussion of randomised controlled trials certainly has little place in the context of early 1800 medical practice. Yet some aspects of the seven-stage approach are still valuable for understanding early stethoscope adoption. McKinlay emphasised the importance of medical journals and practitioner advocacy in the spread of knowledge about new innovations and as a means through which medical practitioners first encountered most up to date medical knowledge.[42] He further noted that written disagreement

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[37] Timmermann and Anderson, 2006, 3.
[38] McKinlay 1981, 374-411.
[39] McKinlay 1981, 398.
[40] McKinlay 1981, 376-398.
[41] McKinlay 1981, 375.
[42] McKinlay 1981, 379.

often gave the impression that resistance to an innovation was more prevalent than it may have truly been.[43]

As will become apparent throughout this thesis, the history of the uptake of mediate auscultation and the stethoscope in Britain has moments of fitting with parts of these seven stages and moments where it does not fit at all. McKinlay's model provides a rather homogeneous view of medicine and of the process through which practitioners adopt medical innovations. There is little room in McKinlay's approach for the presence of differing national, regional, or institutional processes; all of which must be taken into account in order to understand the history of mediate auscultation and the stethoscope in Britain.

The other method of understanding and mapping innovation uptake came from Everett Rogers. He suggested that the process of innovation adoption could be plotted onto a graph and that it would show an 'S-shaped curve'.[44] Rogers claimed the S-shape came about due to the general nature of adoption; it is at first slow as only a few 'innovators' adopt the new idea, then there is a large and rapid spike, finally the rate of uptake rate levels off as the innovation becomes saturated in the relevant field and there are fewer people who are yet to adopt the idea.[45] Pickstone noted that while some innovations demonstrate Rogers' S-shape curve quite well, it was not always that simple.[46] Chapter 4 of this thesis presents a pattern in the design changes of the stethoscope which appears to fit the S-shape, but it does not use Rogers' language to describe these patterns. While the pattern, and indeed the idea of using such a pattern to understand uptake seems the same, the discussion in Chapter 4 focusses on how stethoscope design changes in this pattern can help understand the uptake process and the possible concerns of medical practitioners at the time. In contrast, Rogers' approach describes

[43] McKinlay 1981, 396.
[44] Rogers 2003, 28. He first suggested this model in the 1960s.
[45] Rogers 2003, 28; Pickstone 1992, 9.
[46] Pickstone 1992, 9.

the pattern on a graph but does not offer guidance for the historian for interpreting and understanding why uptake may take this form.[47] This thesis, therefore, does not dispute the idea of the S-shaped curve as a way of describing innovation uptake, but it goes further than this description and considers how this pattern became embodied in the stethoscope as an object.

The S-shaped curve is associated with what is known as the 'invention-innovation-diffusion' model. In his overview of Rogers' work, John Pickstone stated that the S-shaped curve was 'characteristic of the diffusion process', indeed Rogers first suggested the S-shaped model in his book *Diffusion of Innovations*.[48] Johan Schot suggested that the spread and uptake of technology could not be understood in terms of 'diffusion'. Schot stated that the concept of diffusion relied on 'imitation' and argued that technology could not be freely imitated between different locations and contexts.[49] According to Schot, the concept of diffusion was too linear and did not allow for the importance of geography, environment, or selection processes involved in technological adoption and uptake.[50] Bearing out Schot's argument, it will become evident in this thesis that the uptake of mediate auscultation and the stethoscope differed considerably with the location and institutional environments of medical practitioners. Despite the objections of Schot to the concept of technological diffusion, Jennifer Stanton – in a work published almost ten years after Schot – emphasised that a focus on 'innovation, diffusion, and resistance' was something which differentiated approaches in the history of technology from other areas of study.[51] Cornelius Schubert suggested that the concept of diffusion plays a key role in the history of medical technology in a way it does not in other areas of history of

[47] Pickstone 1992, 13.
[48] Pickstone 1992; 1.
[49] Schot 1992; 7.
[50] Schot 1992, 17.
[51] Stanton 2002; 13. The term 'diffusion' is also in the title of her work: *Innovations in Health and Medicine: Diffusion and Resistance in the Twentieth Century.*

medicine or science, which reject diffusion models as being too linear.[52] Schubert argued that the uptake of technological innovations relied on complex interdependent social, economic, and technological factors rather than a process of diffusion.[53]

Historians of medical technology have emphasised the importance of teachers in the spread of new ideas and procedures. The role of individuals in raising awareness about new technologies, especially when those individuals were associated with teaching institutions, is of particular interest to historians of medical technology. Jonathan Reinarz suggested that teaching hospitals were the 'ideal platform' for introducing and 'diffusing' a new medical innovation.[54] A group of students could be taught, and could become familiar with, a new medical technology and they would then take this knowledge and skill with them when they set up their own practice or joined a different institution.[55] Different members of teaching staff could be more or less successful in encouraging students to take up their ideas: a hospital having a large number of students, or indeed any students, was not a sure sign that new technologies would thrive or be adopted there.[56] This thesis draws on these ideas; Chapters 1, 2 and 3 demonstrate both the importance of individuals advocating a new technology and the role of medical teaching institutions in the more widespread adoption of mediate auscultation and the stethoscope.

Whilst the thesis adds to the literature which emphasises the importance of medical education in the spread of new medical technologies, it does not adopt the term 'diffusion'. Instead, this thesis draws on the ideas in the history of medical technology which aim to situate medical innovations within their relevant professional and social networks and wider social

52 Schubert 2017, 5.
53 Schubert 2017, 6.
54 Reinarz 2006, 48.
55 Reinarz 2006, 48.
56 Reinarz 2006, 48.

change.[57] This approach has a lot in common with the Social Construction of Technology (SCOT), an approach which Schubert argued took a less linear approach to technological uptake and change than concepts of diffusion.[58] Stanton stated that many historians of medical technology use SCOT in their work, at least in part.[59] Timmermann and Anderson add to this, suggesting that historians of medical technology often implicitly use aspects of SCOT in their methodological approaches, commonly taking only aspects of it or using it in conjunction with other models of interpretation.[60] This thesis takes a similar approach, using parts of SCOT alongside other methods of interpretation including those seen in the history of medical innovation.

It can be quite easy to fall into the trap of assuming that all innovations come about because they present a 'real' advantage or were in some way superior to the older method or artefact. This sort of understanding is one which Stanton argued against, stating that there can be value in studying 'failed' innovations as much as there is in the ones which lasted.[61] The concept of innovations being 'better' implies that those who were against the instrument were simply 'unenlightened', an implication which only deters researchers from truly engaging with the events and processes which led to its uptake.[62] This certainly can be a trap which many conflict narratives fall into, including the ones relating to the stethoscope discussed above. Indeed, in general it is best to be wary of retrospective evaluation where there is an assumption that acceptance or long-term use must mean that an idea is 'good'.[63] This thesis does not shy away from the fact that the introduction of mediate auscultation and the stethoscope fundamentally altered how practitioners understood and interacted with disease, the body, and

[57] Stanton 2002, 1.
[58] Schubert 2017, 6.
[59] Stanton 2002, 5.
[60] Timmermann and Anderson 2006, 3.
[61] Stanton 2002, 1.
[62] Stanton 2002, 1.
[63] Pickstone 1992, 5, 14.

the patient, but it does not aim to make any claims about if this approach was objectively ‘better’ than what came before it.

0.3. – Mediated Auscultation, the Stethoscope, and Material Culture

The validity of using material evidence is no longer ‘suspect’ in comparison to the more standard textual sources, as historians embrace objects of material culture as ‘tactile manifestations of the past’.[64] The problem historians now face is how best to interact with material culture so that they can usefully and meaningfully give interpretations and gain information.[65] That the relation between historical actors and their objects constitutes interesting and important historical information is evident, and objects even outside of their initial context can embody those relationships.[66] Material objects are simultaneously important both *because of* and *in spite of* their physicality; their physical nature provides information about the perceptions of their users, much more abstract concepts embodied in the physicality of the object.[67] Even then, there are further discussions to be had around how to best use objects in historical study and the biases, both internal and external, that a researcher may face when it comes to studying objects. In this section I provide an overview of the approach this thesis takes to the study of objects, suggesting a new approach which draws on ideas from material culture, the Social Construction of Technology (SCOT), and historical re-enactment or use of historical objects. By combining these three areas, this thesis uses the changes to the physical object of the stethoscope as a means of understanding uptake and skill development in historical practitioners.

The argument of this part of the thesis is in direct opposition to the work of Donald M. Blaufox, who published the only other major work looking at both the design changes to the

[64] Hood 2009, 176.
[65] Hood 2009, 176.
[66] Jordanova 2012, 5.
[67] Robb 2015, 169.

instrument *and* possible reasons for such changes.[68] Blaufox argued that it was acoustic pressures which motivated practitioners to change their stethoscope designs, although he did note that 'many other' factors played a role, and that some models came from practitioners who had more 'complex' considerations.[69] Blaufox worked in an American context and used the private collection of Dr Nolie Mumey, to which he added his own collection of items containing a few more stethoscopes as well as other historical apparatus for measuring blood pressure.[70] When he acquired Mumey's collection, Blaufox also obtained an almost complete manuscript Mumey had been working on regarding the development of the stethoscope. Blaufox, and perhaps Mumey, argued that a person could better understand the evolution of the stethoscope if they had a basic knowledge of the acoustic principles of the instrument.[71]

Blaufox spent only a small amount of time on the very early models of the instrument, putting greater focus on the development of binaural models which appeared from around the 1850s, meaning that much of his discussion skips over the time period in this thesis. Blaufox's work is one of the first to take the stethoscope as a material object as the basis for its discussion, but the work of this thesis disagrees with Blaufox's conclusions regarding the reasons for these changes. This thesis argues that practical considerations such as affordability, portability and comfort motivated practitioners to make changes to the design of the stethoscope, rather than the acoustic reasons Blaufox suggested. It makes these arguments from evidence gained through combining approaches in material culture, SCOT, and historical use or re-enactment to form a new method of object study.

[68] P.J. Bishop's 1981 article gave an overview of the changes in stethoscope design but did not provide much explanation of why these changes occurred. His article is the only other work which addressed design change, but only Blaufox and this thesis attempt to address what motivated practitioners to make these changes.
[69] Blaufox 2002, 3.
[70] Blaufox 2002, 3.
[71] Blaufox 2002, 23.

One of the first codified models of artefact study in material culture came from Edward McClung Fleming in 1974. He noted that disciplines such as Art History and Archaeology already focussed their attention on artefacts, yet within museums and history there was not yet a model for such an approach.[72] To remedy this, Fleming suggested his own model; a fivefold classification of properties, with four operations for the researcher to perform on each.[73] Fleming took much of his inspiration from the study of early decorative arts, making his model particularly focussed on design as a decorative feature rather than a functional one.[74] Despite Fleming's model being applicable across a range of objects and the first systematic approach to object study, the model tailored itself towards decorative objects leaving inadequacies in the method when researchers were dealing with more practical or mundane artefacts.[75]

Hannan and Longair suggest the method of American art historian Jules Prown as an alternative to Fleming.[76] Prown split his method into three stages, which he noted 'ideally' would be as discrete from each other as possible: Description, Deduction, and Speculation.[77] Prown suggested that the researcher consider both how interactions with the objects make them feel as well as how historical actors would have used the artefact, as both could lead to insights about the meaning of an object.[78] In the final stage, Speculation, Prown suggested the researcher begin framing hypotheses and questions which they could then follow up using external evidence and testing.[79] Prown's model remains one of the most prominent within material culture, often forming a base from which researchers can devise their own versions for their own particular objects.[80] The important aspect of an object approach is to articulate it

[72] Fleming 1974, 153-154.
[73] Fleming 1974, 154.
[74] Fleming 1974, 154.
[75] Pearce 1994, 128.
[76] Hannan and Longair 2017, 121; Hood 2009, 179.
[77] Prown 1994, 134.
[78] Prown 1994, 136.
[79] Prown 1994, 137.
[80] Hood 2009, 180.

clearly and apply it rigorously, regardless of whether it draws on other methods or is entirely original.[81] This thesis aims to do just that, using the stethoscope as an object in historical argument to bring new insights to this area of study, using a framework similar to the one laid out by Prown but with some specific alterations to fit it with the stethoscope.

Despite the powerful arguments in favour of studying objects, historians continue to struggle with how best to use and interpret them.[82] Prown's final stage leads the researcher to the point of further investigation and interpretation of the information gained through description and deduction, but then offers little guidance on how best to go about this interpretation. Material culture focuses on the objects themselves, their physicality and features, and then leaves the researcher to interpret these findings. This thesis suggests that ideas from the Social Construction of Technology (SCOT) provide a new and interesting framework with which to interpret these objects. The SCOT approach considers how groups design artefacts, what their motivations might be and how these factors often conflict or require the designer to find a balance to accommodate all the needs of the groups interested in the object. SCOT advocates seemingly rarely interacted with the physical objects they discussed, instead focussing on a more conceptual approach to design change. In combining the SCOT approach with material culture, this thesis brings a new interpretative framework to the investigations of material culture and provides more direct and physical aspect to the SCOT approach.

According to SCOT, each artefact has choices inherent to its design.[83] These choices are directly related to the concerns of the social groups which use, or expressly do not use, the artefact.[84] Design changes occur when one of the social groups related to the artefact, users or

[81] Hood 2009, 180.
[82] Hannan and Longair 2017, 31.
[83] Williams and Edge 1996, 857.
[84] Pinch and Bijker 1984, 414; Williams and Edge 1996, 857; Lindsay 2005, 31.

non-users, identify a problem with it; these can be large or small, apply to all groups or only one, and have easy or heavily-debated "fixes".[85] In his analysis of the stethoscope, Blaufox suggested that groups interested in stethoscope design identified problems of an acoustic nature and made design changes based on this. This thesis argues that the relevant social groups for the stethoscope, primarily user-doctors and their nonuser-patients, found 'problems' relating to practical issues such as price, portability and comfort which their design alterations aimed to 'fix'. When the relevant social groups appear to reach a consensus on the design alterations having adequately 'solved' the perceived problems, 'closure' or 'stabilisation' of the design occurs.[86] Different designs which 'solve' the problems may coexist, and some problems may be redefined at a later point, eventually leading to a change in the dominant form.[87] In his work in the history of medical innovations, John Pickstone stated that to understand innovations in culture it is necessary for the researcher to deconstruct what the relevant groups understood as 'problems', 'solutions', and 'needs'.[88] This thesis examines not just the closure and stabilisation of monaural stethoscope design, arguing that the 'problems' the design changes fixed are related to comfort and practical concerns, but also considers different interpretations to explain the pattern in design changes before stabilisation occurred.

Use, or imagined use, became very important to my research into the stethoscope as a physical object. In the study of material culture, the ability to engage physically with an object is one of the most useful exercises, a process which is no less true of the stethoscope. Using SCOT, the design changes of the stethoscope were also of paramount importance: as a tool for the practice of mediate auscultation the design becomes one of the aspects which enhances or diminishes the utility of the stethoscopes. Practical use of an object in line with their original

[85] Pinch and Bijker 1984, 414-415.
[86] Pinch and Bijker 1984, 426-427; Henk et at. 1987, 257; Kline 2002, 113.
[87] Stanton 2002, 5.
[88] Pickstone 1992, 14.

intended use can give way to insights into the responses and habits of the historical users.[89] This, in turn, provides information regarding the pressures which led to design changes and can inform our understanding of the concerns of the users: vital for interpreting how adopters interacted with the instrument and responded to its uptake. This thesis argues that the changes to stethoscope design observable in the printed sources, and in the objects themselves, came from the desire of practitioners to have affordable and comfortable tools for their everyday practice.

Otto Sibum argued that the reworking and re-enactment of historical experiments could contribute to our understanding of experimental practice history.[90] Using replicas of the objects used by James Prescott Joule in his experiments, Sibum attempted to – as far as possible – accurately replicate Joule's process in order to better understand the process itself and observe anything which Joule may have left out of his accounts. Sibum stated that historical analysis in his work included the replication of experiments alongside the more traditional sources of published documentations and papers, notebooks and correspondence.[91] More recently, Roger Kneebone, a professor of surgical education, and Abigail Woods, a former veterinary surgeon now a historian of medicine, used a simulation-based re-enactment (SBR) as a method of recreating, recording and investigating aspects of historical practice.[92] Kneebone and Woods discussed the flaws in solely text-based research, especially regarding practices, as much of a procedure or experiment was not subject to verbal – or written – descriptions.[93] Hitherto historians had relied almost entirely on textual sources, so only those who published their work got the researchers' attention.[94] Kneebone and Woods explicitly acknowledged the role of tacit knowledge in these practices, and argued that researchers could use historical re-enactment to

89 Robb 2015, 177.
90 Sibum 1995, 73.
91 Sibum 1995, 74.
92 Kneebone and Woods 2014, 107.
93 Kneebone and Woods 2014, 107.
94 Kneebone and Woods 2014, 107.

recapture some of the tacit aspects which become lost in the textual sources.[95] Re-enactment forces the participants to consider the material environment and cultural constraints in a more immediate sense.[96]

Material culture emphasises this through encouraging researchers to engage with the objects as much as possible, SCOT then brings in a deeper understanding of these cultural constraints as they apply to object design. In combining the two with the added element of using the relevant historical objects or instruments, the thesis offers a new synthesis for historical approach from three already well-respected methods of analysis. This thesis, therefore, attempts to combine these three areas to form a new approach which can aid historians in understanding and interpreting objects: combining material culture and other methods of understanding and interpreting objects as their original users would have experienced them. In actively stating the combination of material culture and SCOT, this thesis is attempting something new in the historical literature. In terms of trialling instruments and attempting to understand the experiences of historical users, however, the thesis is not entirely alone. Otto Sibum, Roger Kneebone and Abigail Wood have also published their different attempts at recreating aspects of practice and tool use in order to better understand practices and their associated tools.

0.4. – Sources, Methodology, and Chapter Outlines

This thesis is concerned with the uptake of mediate auscultation and the stethoscope, which logically expands to cover areas such as skill development and medical education. Due to the dual nature of uptake – the adoption of the actual method of auscultation and the adoption of the stethoscope (mediate) auscultation – I take a varied historiographical approach throughout the thesis. Each chapter draws on a range of source types; however, with the

[95] Kneebone and Woods 2014, 111.
[96] Kneebone and Woods 2014, 111.

exception of the fourth chapter there is a great deal of overlap between them. For this reason I am going to give an overview of the sources for Chapters 1-3, then move on to discuss the specific case of Chapter 4 before providing a general chapter overview, outlining what to expect from each chapter and how they fit into the overall argument of the thesis.

In Chapters 1-3, I mainly use primary published sources from the relevant time periods. This includes published books and treatises, articles from many of the major medical journals, and government and hospital reports. These sources provide a range of different views on mediate auscultation and the stethoscope. Previous historians of medicine interested in the story of the stethoscope have paid attention to some, but not all, of these sources, with different levels of engagement with each individual piece of text. Those who support the narrative of a harmonious uptake, for example, cite the many good reviews of Laennec's original *Traité* in the British medical press. On the other hand, those who argue for a more discordant uptake note that even in their writing some advocates seem sceptical that the stethoscope would ever become widely used, whilst others suggest that some of the earliest reviews were merely empty praise rather than true understanding. This thesis examines the sources used by proponents of each narrative and gives a close reading to all of them in order to assess the validity of the claims made in the previous secondary sources.

I have paid a great deal of attention to books and treatises, in particular to the translation of Laennec's work (*Traité* 1819) by John Forbes (*Treatise* 1821) and Forbes' subsequent original work (*Original Cases*, 1824). These outline Forbes' initial approach to mediate auscultation and the stethoscope, as well as his process of learning how to use the instrument. They form a solid basis for understanding how a British medical practitioner could approach auscultation and the stethoscope and learn how to use them, without the need for the Parisian context or some of its major aspects. I supplement this discussion with journal articles and other primary sources, shorter books and treatises from other practitioners which suggest they were carrying out similar investigations. The books and other published, non-journal, works offer insight into the practice of individual practitioners as they attempted to understand and adopt mediate auscultation and the stethoscope: giving their thoughts, feelings and actions prominence in the thesis discussion around *why* they took interest in mediate auscultation and *how* they went about studying the method and instrument.

The thesis also uses some of the most prominent medical journals at the time: The *Lancet,* the *Medico-Chirurgical Review,* the *London Medical and Physical Journal,* the *Dublin Transactions,* and the *Edinburgh Medical Journal.* The editors and contributors to these journals often supported different political views and spoke to different audiences; historians can therefore draw additional meaning from their publications regarding the historical practitioners' views and approaches to medical learning and mediate auscultation. Many of these journals published lectures, either in summary or in full, as part of their main publications, alongside opinion letters and reports of new medical news and investigations. These lectures, often alongside the opinion pieces, provide vital insight into how practitioners taught and learnt their skills, mediate auscultation and the stethoscope included. Complaints about not enough cadavers being available and the use of anatomical specimens come together to paint a broad picture of how lecturers introduced ideas to their students and what practices were necessary for students to develop medical skill. These sources come to the fore in discussion surrounding medical education and skill development.

Government and hospital reports similarly play a key role in this thesis, particularly with regards to medical education and how students developed skill with the instrument. Most notable are the reports and testimonies around the 1832 Anatomy Act, which increased the legal availability of cadavers. Throughout the thesis I use secondary sources as a means of understanding and bringing light to areas which would have taken too long to research in addition to my primary areas of concern: for example, the life of John Forbes, and general information about the availability of cadavers. The primary and secondary sources appear most heavily in chapter 1-3, as these areas discuss the uptake of mediate auscultation practiced with the stethoscope and are primarily concerned with why practitioners took interest in the method and how they learnt it.

The sources in Chapter 4 are more distinct. This chapter is concerned with the stethoscope as a physical object and how practitioners interacted with it. There are two unique historical sources in this chapter: the objects themselves and medical trade catalogues, although the previously discussed primary text-based sources do play a supplementary role. I owe my ability to use the objects as a source to the collection of stethoscopes owned by the Wellcome Collection and held at the Science Museum in London, and the access to the instruments those institutions granted me. Unlike biases with textual sources, which many historians are already readily aware of, museum collections come with their own unique problems and biases, which I must address before we go any further. Two key figures in this conversation are Simon Schaffer and Samuel Alberti, yet their discussions are often geared towards objects in museums and the act of displaying to the public. While museum storage is, in itself, a form of display since the way the researcher encounters objects is never random, this is not an aspect of object work which is relevant to this thesis and as such they appear mostly absent in my discussion below.

Henry Wellcome (1852-1936), the founder of the Wellcome Collection, was a pharmaceutical entrepreneur of American birth with naturalised British citizenship.[97] It is often hard to tell what motivated any particular collector in their pursuits, or to understand what they found important about any given object that they wished to buy it, but Wellcome was very upfront and adamant in his ambitious goal of gathering objects which documented the *entire*

[97] Larson 2011, 181.

history of mankind.[98] With this goal in mind, he bought ‘anything and everything’, creating one of the largest museum collections in the world and documenting hundreds of new acquisitions every week.[99] Wellcome argued that even seemingly insignificant things might become valuable if gathered together in the right way, and he resisted any conception of having ‘completed’ a collection.[100] Following Wellcome’s death, the staff at the Wellcome Collection sold or donated hundreds of thousands of objects to other museums or libraries, whilst others went out on long-term loans to places which had larger storage facilities.[101] In the late 1970s the Wellcome Collection transferred roughly 130,000 items relating to the history of medicine to the Science Museum as a mixture of donations and long-term loans.[102] The stethoscope collection used in this thesis is one of those on long-term loan.

When it comes to artefacts it is important for researchers to interrogate the representativeness and potential bias of the collections they are using, just as they would with textual sources.[103] Objects in museums or private collections are often far outside of their original contexts, and it is often useful to look at as large a database of material evidence as possible.[104] In the case of the Wellcome Collection objects held at the Science Museum, and in keeping with Wellcome’s general ethos, there are over 600 stethoscopes. Clearly this is far too many for one researcher to properly investigate and understand in the course of a PhD project. For this reason, along with ensuring the scope of the textual sources also remained manageable, I chose to focus only on the monaural stethoscopes, the earliest models of the instrument, as Laennec’s first stethoscope in 1816 was monaural and the binaural models did not appear until around 1852. It is necessary to have a symbiotic relationship between the traditional textual

[98] Alberti 2005, 564; Larson 2011, 184.
[99] Larson 2010, 83-34, 99.
[100] Larson 2010, 93.
[101] Larson 2010, 94.
[102] Larson 2010, 94.
[103] Hood 2009, 185.
[104] Hood 2009, 187.

evidence and the material objects, so that they may inform and improve the interpretation of each other.[105] These textual sources can further aid in assessing the representativeness of the objects held in a collection. Collections can have bias in four main ways: championing 'interesting', 'whole' or 'well-documented' objects over others; unclear or uncomplete cataloguing; issues around replicas and authenticity; and complications around removing objects from their original contexts for display.

The large collection of Wellcome stethoscopes held at the science museum has a range of objects, from pristine and well-documented to broken and anonymous. This variation is likely due to the fact that auctions provided the majority of Wellcome's acquisitions, with many of the lots including a broad selection of objects and Wellcome having the means to buy a lot containing hundreds of unknown and 'useless' items in his quest to gather a 'complete' history.[106] Historians working with collections tend to be drawn to complete artefacts of (ideally) notable provenance.[107] Yet it is often only in seeing objects en masse, rather than singular ones selected for show, that researchers can truly grasp the variety of designs and begin to make out patterns.[108] The sheer number of monaural stethoscopes in the collection, often gained through auction where the tattered and the unknown objects appeared alongside notable ones, makes its representativeness in terms of scope seem relatively inclusive. Certainly, the range of instruments in the collection reflects the variety shown in the historical texts, with many instruments showing the key features of a design plus small changes which may stem from differing manufacturer processes or specific user requests. The range of instruments – from well-known to anonymous, damaged to pristine – makes the collection well suited for general study in comparison to smaller private collections, where the owner may

[105] Hood 2009, 187.
[106] Larson 2010, 97.
[107] Almond 2020, n.p.
[108] Schaffer 2011, 707.

have selected the objects for their noteworthiness. It is difficult to accuse Wellcome of sharing such bias.

The breadth of the collection, and the method of collecting, do give rise to another concern with artefact collections: the issue of cataloguing. Henry Wellcome bought 'anything and everything' and did not hire an academic cataloguing team until 1914, meaning the collection already contained thousands of objects before cataloguing truly commenced, and the teams mostly relied on guess work when it came to objects bought en masse at auction.[109] The biographical and providential information held by Wellcome and the Science Museum on the stethoscopes in the collection provides little insight into most of the objects, with incorrect dates or dates that are too broad to be of any use, and acquisition information simply noted as 'stethoscope, auction'. These catalogues are the work of non-specialists faced with thousands upon thousands of individual objects in need of documentation, and the Science Museum catalogued the objects again on the arrival of the loan, rejecting some descriptions and keeping others. That there were some broad statements, mistakes, or omissions is hardly surprising.

The effect of this is that it is near impossible to trace any stethoscope to its life pre-museum, with no knowledge of the previous owner, their status, or why they gave up their stethoscope. However, as material culture and disability history researcher Gemma Almond argues, this need not be a bad thing for investigations with artefacts. Almond argues further that, although collectors often use 'key' objects with well-known provenance to illustrate design changes, anonymous objects lend themselves to that usage just as well.[110] Researchers need not view largely anonymous collections with suspicion, as they can still use these objects to understand the 'everyday' aspect of an artefact when the biography of the object does not

[109] Larson 2009, 207; Larson 2010, 99. This was an observation from a member of staff involved in cataloguing Wellcome's hundreds of acquisitions.
[110] Almond 2020.

need to be the sole aim of the investigation.[111] Indeed, Almond continues, when looking at design changes – as she does with spectacles and I do with stethoscopes – it is no use viewing the objects in isolation and only paying attention to the few which have well-documented histories.[112] In this way the lack of documentation on the majority of the Wellcome Collection stethoscopes, in their records and those of the Science Museum, need not necessarily be a hindrance to their use as sources in this thesis.

The lack of documentation does bring with it another potential problem, as it makes it difficult for any researcher to determine which objects are authentic, which are 'fake', and which are replicas. Wellcome instructed his staff to make every effort to verify that the objects they brought into the collections were legitimate, but acquiring them by auction made that much more difficult.[113] In addition to that problem, Wellcome himself commissioned the creation of replicas with the aim of making the collections as complete as possible and in the belief that, as long the replicas were accurate, they could be just as informative.[114] The collection of stethoscopes I use in this thesis contains replicas, some obvious and some whose 'inauthenticity' (if one deems a replica from the early-20th century as such) is only speculation. Yet I find myself agreeing with Wellcome's attitude regarding well-made replicas, since those objects in the collection which are clearly replicas provide a physical object to examine where one would not usually exist, due to the materials not surviving or 'authentic' models being exceedingly rare. Whilst it is important to note that they are replicas, that is in itself not a reason to discount them from evaluation and analysis.

The final problem commonly associated with using objects in museum collections as sources is the question of how entering a museum collection alters the meaning or cultural

[111] Almond 2020.
[112] Almond 2020.
[113] Larson 2011, 193.
[114] Larson 2010, 98.

significance of an object. Alberti suggests that becoming part of a museum collection impacts an object in two ways: removing it from general circulation gives it status as an 'important' object that is worthy of collection, whilst simultaneously placing it in a collection of many 'important' things where it loses some of its significance.[115] Objects with well-known or notable provenance may become special even within a collection of special things.[116] These are the objects that tend to end up on display to the public, and Alberti notes that their 'trajectory' within the museum collection differed greatly from the majority of items not considered important or interesting enough to go on display.[117] The majority of the stethoscopes discussed in this thesis belong in that less glamourous trajectory because they were the ones stored in the basement room and accessed only rarely by cataloguers and researchers. The most famous stethoscope, with a note on it describing its very early provenance and link with the stethoscope creator himself, existed behind glass in the museum exhibit for the public to dutifully and politely peer at or ignore. This means that the 'most important' object from a display standpoint was not one I could access or examine. However, as previously discussed this need not be a major detraction from the importance of the collection nor from the conclusion in the thesis. As the approach of the thesis is to discuss general design changes and their motivations, the lack of one object – which I could still observe – from the very large collection makes only a minor difference, and the particular provenance of that model holds no particular weight. Provenance is not of 'no' importance in this thesis, but due to the lack of cataloguing for most instruments I needed to find it through other means. In this instance the other means became that of textual evidence, unrelated to the individual objects but enough to chart the general changes in design, their potential initial designers and more accurate dates.

[115] Alberti 2005, 565.
[116] Alberti 2005, 566.
[117] Alberti 2005, 568.

One such collection of textual sources is the medical trade catalogues; works which aimed themselves at other medical practitioners and advertised medical products.[118] The medical profession generally frowned upon advertisements, which they considered tantamount to professional misconduct, but catalogues avoided such accusations through marketing only to other members of the profession rather than to the lay public.[119] Claire Jones, who is the leading scholar on medical trade catalogues, argued that other historians needed to do more to study doctor's roles in consuming, and producing, medical and surgical instruments.[120] In this regard, this thesis goes a small way to remedying Jones' complaint, as it offers some explanation of the role of medical practitioners in the design and promotion of different models of stethoscope. Jones uses some ideas from the SCOT models of understanding technology, noting that assessing medical produce – particularly instruments – had much in common with the history of technology and re-emphasising the role of practitioner demands in the innovation of technological artefacts.[121]

Following practitioners' increased emphasis on pathological anatomy, a key aspect in the uptake of the stethoscope, the range of medical instruments dramatically increased in breadth and scope.[122] The rise in teaching hospitals in the late 1700s to early 1800s further provided instrument makers with the means of targeting specific practitioners at their places of learning and employment.[123] Medical instrument makers were the first to include images in their catalogues, with famous instrument maker S. Maw employing the artist J.M.W. Turner to illustrate his 1831 catalogue.[124] Turner went on to be a famous landscape artist. Unfortunately, Turner did not illustrate any of the stethoscopes Maw sold in this edition. However, the medical

[118] Jones 2013, 5.
[119] Jones 2013, 4-5.
[120] Jones 2013, 7.
[121] Jones 2013, 8-9.
[122] Jones 2013, 17.
[123] Jones 2013, 17.
[124] Jones 2013, 18-19.

trade catalogues did not truly take off until the 1880s as before then only a handful of British medical instrument makers published catalogues to promote their goods to practitioners.[125] In this thesis I use the medical catalogues as evidence for the endurance and stabilisation of some of the original monaural stethoscope designs, bringing the concerns of the medical practitioners into the realm of the medical 'market-place'.

The first half of Chapter 1 primarily addresses the first thesis question: why were British practitioners interested in mediate auscultation and the stethoscope? It then examines the life and work of James Clark, one of the very first adopters, the reasons for his interest in the stethoscope and his role in promoting the instrument to other British practitioners. The second half of the chapter addresses the second thesis question: how did early adopters develop skill with the stethoscope? This section relies on a close reading of the works of John Forbes (one of Clark's closest friends). By directing our focus to these two medical men the chapter expands on their personal interest in the mediate and skill acquisition. It forms a picture of how early British stethoscope adopters took notice of the stethoscope and managed to develop skill and practice symptomatic-pathological correlation outside of the Parisian context.

The second chapter follows on from the personal methods of early adopters seen in Chapter 1 and broadens the discussion to the teaching and learning of mediate auscultation in British medical education more generally. During the 1820s and 1830s British medical institutions began developing the idea of a medical 'curriculum', changing what it meant to study all branches of medicine. This chapter provides an overview of those changes and demonstrates how ideas around mediate auscultation, stethoscope use, and skill development fitted into this changing educational landscape. Furthermore, it argues not only that mediate auscultation and the stethoscope did fit into these educational changes, but also that advocates

[125] Jones 2013, 15.

of mediate auscultation were involved in making some of these changes. Many of the early adopters of mediate auscultation and the stethoscope were actively involved in the creation of a system of medical education which supported the practice of Observation, making a Diagnosis, and Verification (ODV), enabling students in developing skills in auscultation and stethoscope use.

Chapter 3 moves away from the standard forms of education and skill development associated with stethoscope and the Parisian context, and instead draws our focus to the investigations and debates surrounding the foetal heartbeat. It sets out the unique learning environment which occurred in obstetric practice across the British Isles, most notably in the Dublin Lying-In hospital. This practice moved away from that of symptomatic-pathological correlation and the forms of Observation, forming a Diagnosis, and Verification seen in other areas of medicine, and presents a version unique to obstetric practice. Mediate auscultation and stethoscope skill development within obstetric practice had its own set of motivations, methods, internal conflicts and areas of study which this chapter examines in detail. The unique aspects of obstetric auscultation further answer the question of how practitioners outside of Paris developed skill with the stethoscope and adds to the argument that there was not necessarily anything unique or essential about the Parisian context.

The fourth and final chapter in the thesis argues that changes in early stethoscope design came from the concerns of practitioners regarding practical issues such as price, portability, and comfort. Using the physical objects in the Wellcome Collection, held at the London Science Museum, it combines the study of material culture with ideas around object interpretation and the Social Construction of Technology. This chapter considers how material and supporting textual evidence can provide new insights into the process of historical skill development. It differentiates between mediate auscultation as a diagnostic method and the stethoscope as a physical object in order to explore actor motivations and tool use as historical phenomena.

This thesis approaches the puzzle of the British uptake of mediate auscultation and the stethoscope and discovered layers of complexity surrounding knowledge and skill acquisition. In addressing these complexities, I hope that this work both solves the puzzle put in front of it and acts as a guide to others with similar questions.

Chapter 1 – Learning the Stethoscope: The Motivations and Methods of Early Stethoscope Adopters in Britain

"An English Physician to whom I gave a sthenoscope [sic] *which I brought from Paris with me, informs me that he has already found it useful in the diagnosis of some of the diseases of the heart."*

– James Clark, Medical Notes on Climate, 1820.

1.1 – Introduction

In 1821 John Forbes embarked on his trial of the new diagnostic technique of mediate auscultation. He started examining his patients with the stethoscope, recording the sounds he heard and attempting to relate what he heard to the descriptions in Rene Laennec's book *Traité* (1819). Forbes seemed initially disheartened; he had heard high praise of the stethoscope but struggled to even verify his diagnoses, let alone know if he had formed one correctly. Early in this process he moved from Penzance to Chichester and began working in a different institution (a dispensary, rather than private practice), where he gained the ability to practice anatomico-clinical correlation; he could also examine living patients and then, if their illness proved fatal, dissect those same patients in order to verify his diagnoses. Over the next few years Forbes built his skill with the stethoscope, correlating the various sounds that he heard in his patients with the morbid anatomy he saw at dissection. He had not initially shown much interest in the stethoscope or mediate auscultation, preferring the pathological anatomy which came with news of the stethoscope. How did he become aware of the instrument? Beyond that, how did he eventually come to use it and praise the technique of mediate auscultation? Forbes was neither the first nor the only British practitioner who adopted the stethoscope, nor was he the only practitioner who was initially drawn to Laennec's pathological anatomy rather than the diagnostic method.

This chapter begins to answer both of the two thesis questions: why did British practitioners take interest in mediate auscultation and how did they develop their skills with the stethoscope? This chapter focuses primarily on the first 10 years following the invention of the stethoscope (1816-1826) as a means of understanding how practitioners first interacted with the concept of mediate auscultation and adopted the stethoscope. It will become apparent in that British practitioners were open to the concept of mediate auscultation and the stethoscope. However, they approached it with their own personal motivations, being initially unsure of its diagnostic utility until after they had begun using the instrument. Furthermore, this chapter emphasises that the process of developing skill in the practice of mediate auscultation and using the stethoscope was a lengthy process with a number of difficult steps. The structure of the French medical system enabled the practices which encouraged skill development, whereas Britain's did not; nevertheless, British practitioners were able to develop the same skills through their own personal investigations.

British practitioners first encountered mediate auscultation and the stethoscope fortuitously through visits to Paris undertaken for their own personal reasons rather that any wish to explore new medical instruments and techniques. These practitioners brought home examples of the stethoscope and published articles about Laennec's new diagnostic method, while other journals also carried reports on foreign medicine through which many British practitioners learnt about mediate auscultation and the stethoscope.

The process of learning about and adopting the stethoscope therefore occurred in two distinct ways: within the Parisian context in which Laennec invented it, and within the British context which differed greatly to its Parisian counterpart. The aim of this chapter is to understand those differences in medical context and examine how information passed between France and Britain, as well as how practitioners acted upon their new knowledge, which ultimately led to the adoption of mediate auscultation and the stethoscope in the British Isles.

There are five sections in this chapter, each with an explanation or partial answer to the overall questions the chapter addresses.

The second section (1.2) provides an overview of the Parisian medical system and how it differed from the British structures. It outlines the specific and significant changes which occurred in France over the years of the French Revolution, and the impact that change had on the structure of Parisian medicine. It emphasises some of the unique features of medicine in Paris; ones which, incidentally, encouraged the practice of anatomico-clinical correlation: that is, a post-mortem method of verifying the accuracy, or inaccuracy, of a diagnosis through observing the dissection of the same patients examined when they were living. It culminates in the story Laennec provided of his invention of the stethoscope and discusses the importance of the Parisian system in enabling that invention. It sets the scene for the thesis questions: given the unique elements of Parisian medical institutions which led to the invention of the stethoscope, how did those outside these institutions learn of and take interest in the instrument and its associated diagnostic method?

Section 1.3 begins to answer these questions by looking at the motivations of the first British practitioners known to have experienced the stethoscope in Paris. It focusses on three different practitioners: Augustus Bozzi Granville, James Clark, and Charles Thomas Haden. Previous narratives around stethoscope uptake have linked these three with the early years of the stethoscope, especially Granville and Clark who wrote of their experiences in Paris.[126] When looking at their reported motivations it quickly becomes apparent that each had his own unique motivations for visiting Paris, rather than a knowledge of the stethoscope and a burning desire to see it. It was these individual motives, in combination with observing French practitioners using mediate auscultation with the stethoscope, which both brought the

[126] For a more complete view of the previous discussion on the earliest adopters of the stethoscope, see: Agnew 2008, Duffin 1998, Nicolson 1993, and Blaufox 2002.

instrument to their attention and piqued their curiosity in its use. Additionally, it is clear that even with their new-found interest in mediate auscultation and the stethoscope, they did not necessarily immediately develop any particular skill with either the technique or the instrument.

Some early stethoscope adopters specifically learnt how to use it within the Parisian medical system. Section 1.4 considers how the Parisian hospital structures appealed to British medical students, initially due to the increased access to bodies for dissection and anatomical study rather than because of a distinct interest in the stethoscope. However, in the early 1820s, as the number of books and journal articles with information on the diagnostic method of mediate auscultation with the stethoscope increased, so did the corresponding number of students who made the study of auscultation a key part of their education in Paris. In Paris students had access to trained stethoscopists as teachers, as well as the benefits of working within the system that enabled Laennec to invent the instrument in the first place. This section uses the work of Charles Scudamore to explore how British practitioners visiting Paris learnt and developed skill with the stethoscope.

The next section (1.5) explores how those who went to Paris advocated the stethoscope in journal articles and books. Section 1.5 examines the role of James Clark as one of the most influential advocates for the stethoscope, emphasising his role both in introducing at least one journal editor to the instrument and in encouraging his friend John Forbes to translate Laennec's work into English. Historians have, rightly, paid a lot of attention to John Forbes' 1821 *Treatise*, the first English translation of Laennec's book on mediate auscultation.[127] Many of those who visited Paris and specifically sought out Laennec's teaching at the Necker Hospital were familiar with Forbes' highly praised work. This section furthers their discussions of *Treatise,* considering the factors which led to Forbes writing the translation and how he

[127] For the purposes of this thesis, I will refer to Laennec's French versions of the book as *Traité* and Forbes' English translations as *Treatise.*

initially interacted with Laennec's work. It demonstrates how James Clark played an essential part in ensuring Forbes produced a translation of Laennec's work, a translation which propelled knowledge of Laennec's pathological anatomy and diagnostic methods into the British medical consciousness. In this section it becomes even more apparent that knowledge of the method of auscultation and the stethoscope did not automatically lead to skill with the instrument.

The final section (1.6) then addresses how British practitioners who did not visit Paris developed skill with mediate auscultation and the stethoscope. As previous sections in this chapter will have made clear, learning *about* the stethoscope was not the same as learning *how* to use one. However, once British practitioners became interested in the stethoscope through the advocacy of others and through publications which praised the new method as well as Laennec's pathological anatomy, some practitioners began to conduct their own personal trials of the instrument. Two of the most well-known stethoscope trials came from Andrew Duncan Jr., in Edinburgh, and John Forbes in Chichester. The section starts by briefly looking at Duncan's trial, indicating how he approached testing mediate auscultation and the stethoscope, i.e. observation and examination of the patient with the stethoscope, forming a diagnosis, and then verifying that diagnosis in some way, usually dissection. That is the practice of anatomico-clinical correlation. It then moves on to closely examine John Forbes' trial of the stethoscope which he conducted for several years following the publication of his translation. The section focuses on Forbes due to the meticulously documented trials which he went on to publish. Forbes' personal trials included the observation of the patient, including examination with the stethoscope, making a diagnosis, followed by some form of diagnostic verification (often, but not always, dissection). Through Forbes' work it is possible to understand how he trialled the instrument, to see how that paralleled Duncan's trials, and to begin to form a picture of how the early adopters of the stethoscope managed to develop their skill with the instrument.

The chapter concludes by revisiting the two questions of the thesis – how did British practitioners come to take interest in the stethoscope and how did they develop their skill with the instrument? – and reiterates how the discussions in this chapter answer those questions. The motivations of the first British practitioners who took notice of the stethoscope varied greatly; often they saw some benefit in the Parisian system or simply happened to be visiting, yet seeing the stethoscope within its original context brought about at least some level of interest in the instrument. Following this, news of mediate auscultation spread amongst British practitioners through the publication of the experiences of some of the earliest adopters, as well as general interest from the medical press of any international developments. Some medical students, often young and wealthy, visited Paris to take advantage of the unrivalled access to cadavers for anatomical study and then, spurred on by their awareness of mediate auscultation and the pathological anatomy of Laennec, sought out training with the stethoscope. These students developed skill with the stethoscope within the Parisian setting; one which had teachers already skilled in its use and which allowed the practice of anatomico-clinical correlation as a means of observing and diagnosing patients and then verifying those diagnoses, specifically at autopsy. British practitioners who could not visit Paris, or simply did not want to, developed their skill with the stethoscope in a range of ways. Encouraged by the same publications, and occasionally by the advocacy and support of friends who had visited Paris and experienced the stethoscope there, British practitioners began to conduct their own personal trials of the instrument. These personal investigations included practicing anatomico-clinical correlation, thus emphasising that whilst the Parisian hospital structure enabled the invention of the stethoscope and aided its uptake, practitioners in the British Isles could still develop an interest in mediate auscultation and develop skill with the stethoscope.

1.2 – The Parisian Context in Detail

Before discussing the motivations and practices of early adopters of the stethoscope in the British Isles, it is necessary to explain the particular nature of Parisian medical institutions. Hospitals in Paris functioned with a different organisational structure compared to most of the major medical centres in Europe, including those in Britain and Ireland. The French structure gave rise to the specific circumstances in which Laennec invented and investigated mediate auscultation. This section first gives a brief overview of the state of medical practice in Europe before the French Revolution; it then shows how the Revolution caused the destruction of the French medical structures, and the important changes which occurred when those institutions reopened. The new, centrally organised hospital structures brought about hospital-based and bedside teaching, increased access to cadavers for anatomical study, and unified the teaching of medicine and surgery – all of which led to a quite new approach to medicine. While some aspects of the new French system may have made their way eventually to other European hospitals and medical institutions, such large-scale change only occurred in France and meant that the hospitals of Paris had their own unique medical structure and context.

Medical students in the 18th century memorised the classifications of disease based on their symptoms; anatomical information was irrelevant to the diagnosis of a disease.[128] Teaching did happen at the patient's bedside, but it was not what we might consider a 'clinic' in any real sense; the bedside sessions were intended for the 'masters' to demonstrate their knowledge rather than research.[129] When dissections did take place, an infrequent occurrence, it was rare for the body the doctors dissected to be from a patient they had seen in life. Most bodies came from executed criminals, which meant they were generally 'healthy' before

[128] Duffin 1998, 27.
[129] Foucault 1963, 72.

death.[130] Morbid anatomy was of interest to the profession, but it was not important to diagnosing or treating diseases and medical schools across Europe rarely formally taught it to their students.[131]

There were, of course, some notable exceptions to this. Most important for this section are the works of Giambattista Morgagni in Padua and Leopold Auenbrugger in Vienna. Morgagni's extensive tome, *De Sedibus,* was one of the first to systematically link the symptoms of the living patient with the anatomy found at autopsy.[132] The books were very popular, with multiple reprints and translations within the first ten years of its publication.[133] This popularity was mostly due to interest in pathological anatomy as a science rather than encouraging other practitioners to practice 'clinicopathological correlation' in the same way as Morgagni.[134] Auenbrugger worked in Vienna and suggested the diagnostic method of percussion. The hospitals in Vienna had strong centralised control and some specialised 'clinics' in which doctors could observe living patients and then conduct dissections on the same patients following death. Auenbrugger worked within this system, allowing him to develop and verify this new diagnostic method. He outlined the method of percussion as follows:

> This consists of the Percussion of the human thorax, whereby, according to the character of the particular sounds thence elicited, an opinion is formed of the internal state of that cavity.[135]

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130 Richardson 2000, 248. 'Healthy' is not quite the right word. More accurately, whatever illnesses these people may have had, the doctors were not able to investigate their symptoms during life. Additionally, Richardson suggested that executed criminals were often younger and less worn down than bodies of paupers, which meant anatomists preferred them precisely because they were 'good' specimens. For more on this, see Richardson 2000, 248.
131 Duffin 1998, 28.
132 De Sedibus; Jarcho 1968, 95.
133 Encyclopaedia Britannica 1911 s.v. Giovanni Battista Morgagni.
134 Encyclopaedia Britannica 1911 s.v. Giovanni Battista Morgagni; Jarcho 1968, 95.
135 Auenbrugger 1761, trans. Forbes 1824, 3. French physician Corvisart translated Auenbrugger's work into French in 1808, Forbes' 1824 translation was of the French, not Auenbrugger's original text.

Auenbrugger's work made 'but a slight impression' (as Forbes later observed) on both his audience in Vienna at the time and further abroad.[136] The lack of uptake of percussion may have been because Auenbrugger did not teach so could not pass on the technique, and none of the other European medical centres had a hospital structure comparable to Vienna's. Teaching within hospital structures was one of the most important and effective ways for practitioners, especially students, to become familiar with a new medical technology.[137] As this section will demonstrate, until the French Revolution the medical structures in France were similar to the majority of European institutions, and it was only with the complete restructure of French medical care and teaching that percussion and mediate percussion gained traction amongst practitioners.

The Revolution began in 1789 and was a period of immense political and civil turmoil in France. In an attempt to remove the higher social classes, the revolutionary government suppressed universities and then academies, attempting to abolish hospitals in around 1793 by advocating for home care rather than hospitals.[138] This did not mean that all medical practice instantly stopped; indeed, many hospitals kept functioning in semi-secrecy.[139] The continued medical care took the form of a hasty return to bedside teaching, and the abolition of the existing structures gave rise to a new kind of bedside teaching; a kind in which there was space for innovation as well as instruction.[140] Only in the abolition of the old hospital structures could any new form of medical knowledge and teaching appear; in trying to abolish the hospitals the Revolution ended up strengthening them.[141]

[136] Forbes 1824, xi.
[137] Reinarz 2006, 48.
[138] Foucault 1963, 80.
[139] Foucault 1963, 83.
[140] Foucault 1963, 82.
[141] Ackernecht 1967, 17.

The Parisian medical school and hospitals reopened in 1794, under the new (short-lived) name of the École de Santé, with an emphasis on maintaining health rather than treating disease.[142] There were no existing structures, so the newly reopened hospitals could create a medical practice from the ground up. The government which oversaw the reopening of the hospitals held ownership of these institutions.[143] State ownership of medical institutions meant that the government could control and regulate the hospitals from a centralised point.[144] This centralisation brought Paris to the forefront as the undisputed centre of France, both politically and medically; this in turn meant that many of the major events and discoveries occurred specifically in Paris, hence this thesis focuses particularly on the city rather than on France as a whole.[145] Paris had increased hospital capacity and a centralised system which could move patients between hospitals, granting practitioners much greater access to a range of patients and the ability to tailor their uptake of patients to fit a specific research or teaching purpose.[146] A practitioner who wished to study and teach on diseases of the chest, for example, could formally request that their ward only accept patients suspected of suffering from those conditions, and that other hospitals send them any patients who had particularly noteworthy cases. Never before had medical practice and teaching been so based within the hospital structure; the hospitals of Vienna came close but had the handicap of drawing on a smaller city population and having a much stronger traditionalist movement in medical teaching, especially compared to post-Revolution Paris.[147]

In 1798 the French government changed the laws in a way which dramatically increased the legal availability of cadavers for medical teaching. These new laws made it legal for practitioners to use the bodies of any patients who died in hospital as anatomical subjects, a

[142] Duffin 1998, 24-25.
[143] Ackernecht 1967, 17.
[144] Ackernecht 1967, 17.
[145] Ackernecht 1967, xii.
[146] Ackernecht 1967, 17.
[147] Ackernecht 1967, 15.

change which made between 300 and 500 cadavers available to Parisian students per year.[148] The Parisian hospitals became the first in Europe to have a steady stream of cadavers with which medical students could study anatomy.[149] France's new laws made bodies available for general anatomy; however, the responsible governmental authorities did not intend this to be a means of increasing the practice of pathological or morbid anatomy as a distinct method of study. Indicated by the fact that they included both anatomy and physiology in their curriculum but *not* pathological anatomy.[150]

The new system of the Parisian hospitals combined the teaching of surgery and physic.[151] This combination was in no small part because France was continuously at war from 1792 to 1815.[152] Many of the most influential practitioners in French medicine had served in the military and had initially trained as surgeons.[153] With an ongoing military need for more trained surgeons, and with many of those in charge coming from a similar background, it is perhaps unsurprising that surgical instruction gained such a prominent position in the new French system. In addition to the desire for more trained surgeons in general, French surgical practitioners often held the title of 'surgeon-anatomist'; this meant that they took particular interest in anatomical investigations, a function further enabled by the increased availability of bodies after 1798.[154] The unification of surgery and physic caused yet more revision of French medical instruction: medical education promoted practical medical experience through anatomical dissection and clinical experience as a means of combining surgical and medical skills.[155] Elsewhere in Europe, including in the British Isles, surgery and physic remained distinct, and often competing, disciplines within institutions; some practitioners managed to

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[148] Duffin 1998, 28; Richardson 2000, 102.
[149] Ackernecht 1967, 33.
[150] Duffin 1998, 30.
[151] Ackernecht 1967, 25; Duffin 1998, 25.
[152] Ackernecht 1967, 25; Duffin 1998, 25.
[153] Ackernecht 1967, 25.
[154] Ackernecht 1967, 25.
[155] Duffin 1998, 25.

combine the two through their own lives and practice, but not through any official teaching structures.

As an unintended consequence of this new hospital system – hospital-based teaching and practice, availability of the bodies, combination of surgery and physic – the French medical system itself enabled the practice of anatomico-clinical correlation,.[156] That is, the practice of relating the findings in the dead body to the symptoms seen in living patients. There were (as Laennec himself pointed out) several prerequisites for the practice of anatomico-clinical correlation: the living patient must be observed and have all symptoms recorded, the *same* patient must then die, and there must be an opportunity to dissect the body.[157] Furthermore, those three events must happen multiple times for any results to be verified and there must be a way of collating all the findings. The structure of the Parisian hospital system allowed for practitioners to see the living patients during their hospital rounds and record their symptoms, and then see the same bodies in the anatomy theatre following their death. Furthermore, the vastness of the Parisian hospitals meant this occurred regularly, and practitioners could request patients with similar symptoms come under their care in order to follow the progress of specific illnesses. French practitioners could, therefore, observe a living patient, make a diagnosis, and then follow that patient's progress through to their death and dissection, or until the patient returned to a healthy state and left the hospital.

By 1803, practitioners who had outlasted the institutional turmoil began teaching again within this new system and with a new curriculum.[158] These teachers now had a much larger exposure to anatomy and bedside teaching than those who had taught before.[159] They became critics of the old nosology (classification of disease), advocating instead for an approach which

[156] Wilson 2007, 29.
[157] Laennec 1827, 34 (Trans. Forbes).
[158] Duffin 1998, 32.
[159] Duffin 1998, 29.

viewed disease as disordered internal function, anatomical and physiological in nature.[160] This went against the classical nosology seen in the early 18th century where practitioners based their diagnoses purely on signs and symptoms. Instead, their new nosology was based on an understanding of the internal working of the body, as verified through the practice of anatomico-clinical correlation. The emphasis on bedside teaching and anatomy, combined with increased access to cadavers from the same hospital wards where teaching took place, encouraged – if not caused – a drastic change in nosology in the Parisian hospitals.

Within this new structure and nosology, physician Jean-Nicolas Corvisart took a particular interest in diseases of the heart.[161] His interest in the heart led him to the work of Leopold Auenbrugger and, in the new Parisian system, Corvisart could now teach the method of percussion to his students.[162] In 1808 Corvisart published a book on diseases of the heart which contained a translation of Auenbrugger's *Inventum Novum* on his invention of percussion.[163] Accompanying his translation, Corvisart wrote a detailed commentary on Auenbrugger's work, so much so that the commentary was longer than the translation of the original text.[164] The new structure allowed consistent practice of anatomico-clinical correlation as a means of testing percussion: practitioners could practice percussion on their patients, then if a patient died and went to autopsy the practitioners could verify (by confirmation or refutation) the accuracy of their diagnoses based on the percussive sounds. Corvisart's teaching, empowered by the structure of the Parisian hospitals, revitalised the technique of percussion and encouraged the use of diagnostic techniques through which practitioners inferred the state of the internal viscera in the still living patient.

[160] Duffin 1998, 29.
[161] Ackernecht 1967, 84.
[162] Forbes 1824, xii; Ackernecht 1967, 84.
[163] Forbes 1824, xii; Ackernecht 1967, 84.
[164] Ackernecht 1967, 84.

Rene Laennec, the future inventor of the stethoscope, was a student of Corvisart.[165] Laennec was thus in a doubly special cohort of students; a cohort which studied in the new Parisian system and learnt, through Corvisart, a technique for interpreting the internal state of the living patient. Moreover, Laennec learnt this technique in an environment that enabled the practice of anatomico-clinical correlation as a means of verifying these diagnostic investigations. Indeed, the practice of percussion and the recognition of the need to understand the internal anatomy of the living patient played a pivotal role in Laennec's invention of the stethoscope. As Laennec later wrote:

> In 1816, I was consulted by a young woman labouring under general symptoms of diseased heart, and in whose case percussion and the application of the hand were of little avail on account of the great degree of fatness. The other method just mentioned [immediate application of the ear] being rendered inadmissible by the age and sex of the patient, I happened to recollect a simple and well-known fact in acoustics, and fancied, at the same time, that it might be turned into some use on the present occasion. The fact I allude to is the augmented impression of sound when conveyed through certain solid bodies,– as when we hear the scratch of a pin at the end of a piece of wood, on applying our ear to the other. Immediately, on this suggestion, I rolled up a quire of paper into a kind of cylinder and applied one end of it to the region of the heart and the other to my ear, and was not a little surprised and pleased, to find that I could thereby perceive the action of the heart in a manner much more clear and distinct than I had ever been able to do by the immediate application of the ear.[166]

Laennec's invention occurred in late 1816 with a patient who had (he suspected) a faulty heart, but his enthusiasm for the technique of mediate auscultation only really ignited a few months later, at the start of 1817, when he began working with phthisis (now known as

[165] Forbes 1824, xii.
[166] Laennec 1827, 4-5. (Trans. Forbes) Most sources suggest that this event occurred in late 1816, most likely sometime between September and November. Text given in square brackets in the quote added by me.

tuberculosis) patients at the Necker hospital. Through investigating the ‘differences which the sound of the voice within the chest might occasion’ Laennec discovered the phenomenon which he came to call ‘pectoriloquism’, where over a localised part of the chest the patient’s voice seemed to come directly through the stethoscope, bypassing the throat and mouth.[167] He suspected that tuberculous excavations in the lungs were the cause of this phenomenon.[168] The death of a number of patients in whom Laennec had recorded the phenomenon enabled him to ascertain if his suspicions were correct: in every case the dissection showed that the patients who exhibited pectoriloquism in life did indeed have tubercles in their lungs.[169] With this verification Laennec became convinced of the utility of the stethoscope and excited by the new diagnostic findings he could gain through its use; he had demonstrated that pectoriloquy was a sure sign of the presence of tubercles, and that it could occur even in patients who had no other symptoms of phthisis.[170] This regular means of examining living patients and then dissecting the same patients after their death could only have occurred to such a degree within the Parisian hospital system. Laennec’s invention of the stethoscope and the extensive research he undertook with the instrument seem only to have been possible within this very specific Parisian context, one which encouraged an anatomical view of disease and enabled the dissection of the same patients seen in clinics.

Practitioners could practice either mediate ausucltation (with the stethoscope) or immediate auscultation (applying the ear directly to the chest). Laennec himself appeared to practice immediate auscultation at least occasionally, since he stated in his account of inventing the stethoscope that immediate auscultation was ‘inadmissible’ due to the age and sex of the patient.[171] This suggests that had he been dealing with an elderly male patient (for example) he

[167] Laennec 1819, 36.
[168] Laennec 1819, 36.
[169] Laennec 1819, 37.
[170] Laennec 1819, 37.
[171] Laennec 1827, 4-5. (Trans. Forbes)

would have placed his ear directly onto their chest; indeed, it was only circumstance which prevented him from doing so this time. François Double, a French physician and contemporary of Laennec, recommended the practice of immediate auscultation as early as 1817, and generally seemed to prefer the direct use of the ear over any mediate form.[172] Moreover, even Laennec noted that some practitioners preferred to practice immediate auscultation as it saved them the 'trouble of carrying an instrument' and they found it easier to apply their ear to the chest than to correctly apply the stethoscope.[173] Laennec disagreed, claiming that immediate auscultation was more cumbersome for practitioners: they needed to hold more difficult positions and immediate ausucltation made it difficult for them to access certain parts of the chest (such as the lower sternum); and in female patients he frowned upon it for reasons of decorum.[174] Most important to Laennec was the fact that immediate auscultation removed the possibility of the practitioner detecting pectoriloquy, and for that reason he '[did] not hesitate to affirm, that the physicians who shall confine themselves to immediate auscultation, will never acquire great certainty in diagnosis'.[175] As will become apparent in later chapters, Laennec's disapproval of the practice of immediate auscultation did not necessarily dissuade all practitioners from preferring it over the use of the stethoscope.

This Parisian context had no direct British counterpart. Hospitals in the British Isles had a much stricter distinction between physic and surgery and, above all, no regular or sustained legal access to cadavers. Outside of the Parisian context medical practitioners had little access to the type of organisational systems which enabled the practice of anatomico-clinical correlation; something which appeared necessary for at least the invention of the stethoscope. Furthermore, institutional changes on such a national scale seemed unlikely,

[172] Duffin 1998, 124.
[173] Laennec 1826, 24. (Trans. Forbes)
[174] Laennec 1826, 24. (Trans. Forbes)
[175] Laennec 1826, 25. (Trans. Forbes)

especially without the impetus of a societal revolution. How, then, did British medical practitioners begin to approach the stethoscope and mediate auscultation given that they functioned in such a different environment? The rest of this chapter examines how British medical practitioners first encountered the stethoscope and how they went about developing skill with the instrument within a British rather than Parisian context.

1.3 – Early Advocates and the Stethoscope in Paris

The previous section established the unique medical environment in which Laennec invented the stethoscope. This section moves on to discuss the first British practitioners to learn of and interact with the stethoscope. It focusses on three practitioners – Granville, Clark, and Haden – who all wrote some account of their time in Paris over the period of the stethoscopes' invention and early years of its uptake. The section considers their motivations for going to Paris and how they first encountered mediate auscultation once there. It becomes apparent that these practitioners rarely went specifically for the unique medical context, instead they had their own motivations relating to their specific practices, health, and circumstances. Despite this over their time in France all three became familiar with the use of the stethoscope and became convinced of its utility, although only one (Clark) truly acted on this conviction. Their experiences in France, within the specific institutional structures and with French advocates for mediate auscultation, sparked their interest in the stethoscope and encouraged them to adopt the technique.

Augustus Bozzi was born in Italy in 1783, taking the additional surname Granville (honouring his English maternal great-grandfather, Bevil Granville) following his mother's death.[176] In 1799 he entered the University of Pavia to study medicine, graduating in 1802; this followed a short, somewhat unintentional, break due to his arrest following involvement in

[176] ODNB s.v. Augustus Bozzi Granville.

campaigns for an Italian Republic.[177] After graduation Granville travelled around the Mediterranean, becoming second physician to the Turkish fleet.[178] In 1806, after settling for a short time in Portugal, Granville became an assistant surgeon to the British Navy, a position he stayed in until 1811 when ill health and a wish to remain with his wife and child prevented him from sailing with the fleet.[179] He remained in the Navy but took up a role as envoy between London and Italy.[180]

In 1813, Granville left the Navy on half-pay and settled in London. He attempted to become a general practitioner, becoming a member at the Royal College of Surgeons and taking up a position lecturing in Chemistry at the Great Windmill Street school.[181] He permanently lost his sense of smell following an accident with chlorine gas during one of his lectures.[182] Granville found himself surrounded by many influential physicians, politicians, and royals due to the legacy of his grandfather and his own travels; he kept up his activities supporting the creation an Italian Republic and engaged regularly with the trade of art, chemistry, anatomy and other interests.[183] On the advice of Sir Walter Farquhar, an eminent Scottish physician, Granville decided to give up on general practice and instead focus on the discipline of obstetrics.[184] Farquhar suggested Granville go to Paris and study at La Maternité (the large Parisian maternity hospital) to qualify as an accoucheur (male midwife), which Granville immediately set out to do.[185]

At the time of his move to Paris (and for several years before) Granville had been quite unwell with an unknown ailment that he, and 'many professors of medicine' in England,

[177] ODNB s.v. Augustus Bozzi Granville.
[178] ODNB s.v. Augustus Bozzi Granville.
[179] ODNB s.v. Augustus Bozzi Granville.
[180] ODNB s.v. Augustus Bozzi Granville.
[181] Granville 1874, 15.
[182] Granville 1874, 18.
[183] ODNB s.v. Augustus Bozzi Granville.
[184] Granville 1874, 51.
[185] Granville 1874, 51; 56.

believed related to his heart.[186] Whilst in Paris he requested the opinion of French physicians but found little comfort in those opinions and their suggested remedies.[187] Despite this illness, Granville threw himself into life in Paris, with daily visits to La Maternité starting at 6am as well as multiple daily visits to Hôpital des Enfants and Hôpital des Femmes to examine the cases related to obstetrics.[188] Alongside these hospital visits Granville attended courses in Chemistry, Minerology, Medical Jurisprudence, and occasional anatomical demonstrations, whilst keeping himself open to further opportunities to expand his medical knowledge.[189]

One such opportunity presented itself when Granville was able to look around La Charité, particularly at patients who had symptoms similar to his relating to a diseased heart. He reflected on these cases and insisted that he observed a difference in the patient's symptoms and outcomes when compared to his own.[190] It was at this time that he first took notice of Laennec's work around diseases of the chest.[191] Granville wished to study under him and observe whether dissections verified Laennec's diagnoses before presenting him with his own medical grievances for assessment.[192]

Granville took pleasure in learning for the sake of learning, expanding his own knowledge and being involved in a range of intellectual activities. However, in the case of investigating Laennec's work, his motivations seemed to stem from a personal desire to understand his own condition. Granville was certainly intrigued by the practice of mediate auscultation, stating that it 'brought to light the extraordinary accuracy in the diagnoses'.[193] It soon became apparent in Granville's account that the stethoscope enabled Laennec to make

[186] Granville 1874, 57.
[187] Granville 1854, 16.
[188] Granville 1874, 61
[189] Granville 1874, 61; 64.
[190] Granville 1854, 19.
[191] Granville 1854, 19.
[192] Granville 1854, 20.
[193] Granville 1854, 24.

accurate diagnoses; however, it is not clear whether Granville could do so or how regularly he personally used the instrument.[194] He did eventually submit his own case to Laennec, spending three days with Laennec conducting stethoscopic examinations of his heart and lungs in a range of times and circumstances.[195] Laennec decided that Granville suffered with an issue of circulation, not a direct disease of the heart, encouraging Granville to continue examining any cases he found which were similar to his own in order to verify the diagnosis for himself.[196] In the rest of his time on the wards of La Charité and the Necker, Granville 'perfectly satisfied' to himself the truth of Laennec's diagnosis and overall doctrine.[197]

In his 1854 book *Sudden Death*, published 38 years after the event, Granville claimed to have been present at the very point when Laennec invented the stethoscope; the 13th of September 1816, according to his notes.[198] Duffin has pointed out that there were a number of errors in Granville's account, the most striking of which being that Laennec himself suggested the invention occurred in October or November, not September as Granville claimed. In the same book he expressed confusion at the fact Laennec disagreed with him about the specific date of the discovery.[199] Further errors included claiming that Laennec had been employed at the Necker hospital since 1815 when most other records state that, if Granville had seen Laennec at the Necker it would have been perhaps his very first week there in 1816.[200] Another incorrect assertion from Granville was that Laennec first named the instrument 'pectoriloque', which was actually a term Laennec used to describe a particular sound and investigative method with the stethoscope.[201] Granville did not keep a contemporaneous record of his time

194 Granville 1854, 24.
195 Granville 1854, 24.
196 Granville 1854, 24-25.
197 Granville 1854, 26.
198 Granville 1854, 20.
199 Granville 1854, 22; Duffin 1998, 360n11.
200 Granville 1854, 19; Duffin 1998, 360n11.
201 Granville 1854, 22; Forbes 1827.

in Paris, reflecting on it only many years afterwards and making a misguided attempt in 1854 to link himself to the now well-known and respected medical instrument.

Indeed, much of Granville's history and motives come from his later works, in this case *Sudden Death* (1854) and his *Autobiography* (1874). As sources both are very useful in that they are the direct reports from Granville himself, but they are not without their limitations. He wrote both accounts of his time in Paris well after his time there; 38 and 58 years respectively. Unsurprisingly, within that time the details of his account seem to differ, sometimes drastically so. Most notably, it was in his earlier work that he made his claim of being present at the invention of the stethoscope; in his later autobiography he made no such claim. Similarly, his motivations for visiting Paris changed slightly between versions; in *Sudden Death* he claimed to see Laennec invent the stethoscope and put a much greater emphasis on being in Paris due to concerns about his own health, whereas in his autobiography his health was only a minor factor in his decision to study in France.[202] Despite the inconsistencies in his accounts, some factors remain the same; Granville did have an illness he thought related to his heart, he was in Paris over the appropriate times and spent much of his time there pursuing a range of medical study, and his primary purpose for being in Paris was the study of obstetrics.

Granville returned to London in November 1817 and established himself as the physician-accoucheur at the Westminster Hospital; following Sir Farquhar's suggestion had been a success in terms of establishing Granville as a practitioner in the city.[203] He brought a stethoscope back to England with him and kept it on show in his home, available for anyone who wished to examine it, and reported that other British practitioners mocked the idea of using the instrument.[204] In November 1818, a year after Granville's return, the *London Medical and*

[202] Granville 1854, 23.
[203] ODNB s.v. Augustus Bozzi Granville.
[204] Granville 1854, 23.

Physical Journal – of which Granville was editor – published a small but favourable section on Laennec's new instrument, describing it as 'somewhat more than a chimerical improvement'.[205] In the same month the *Edinburgh Medical and Surgical Journal* also published a short piece introducing Laennec's invention which contained practical information about uses for the stethoscope.[206] These journal articles likely introduced a much wider audience of British practitioners to the concept of mediate auscultation and the stethoscope, despite both being very short.

There are two important things to note in Granville's story of the stethoscope in England. First, and most important, is that Granville *kept the stethoscope in his home*: he did not take it out into his practice. Despite his reported 'daily' use of the instrument in Paris, and his apparent acceptance of the general utility of the instrument, there is no indication that he continued to use the stethoscope once he returned to London.[207] It may be that British practice did not provide the same opportunities to use it, though following over a year of (alleged) daily use – under the direct tutelage of the creator himself – it would be surprising for him to simply exclude such a useful instrument from his practice. Granville was an obstetrician, so it is possible that the stethoscope did not fit into his daily practice, but as we shall see in Chapter 3, obstetrics offered ample opportunity for stethoscope use. Granville's sudden lack of interest in using the instrument further suggests that his motivations for studying it were purely personal, relating to his own illness and intellectual curiosity rather than an acceptance of the instrument as *useful* in his own practice.

The second important aspect to note is Granville's claim that his British contemporaries mocked him, and the French, for use of the stethoscope. He did not name which of his

[205] *The London Medical and Physical Journal*. November 1818, 451. 'Chimerical' can mean existing as an unchecked fantasy or simply being improbable.
[206] *Edinburgh Medical and Surgical Journal*. November 1818, 656.
[207] Granville 1854, 24.

contemporaries were against his use of the instrument; furthermore, although a range of other sources also mentioned 'resistance' to the stethoscope, he did not name any particular individuals or groups.[208] The lack of named opposition may indicate that in some cases, though clearly not all, the 'opposition' was in fact fictitious. The fact that the *Edinburgh Medical and Surgical Journal* published an article in favour of the instrument at the same time as Granville's journal suggests that, at the very least, some British practitioners were not against the new instrument.

Granville, was one of the earliest British practitioners to gain experience with the stethoscope, but he was not inclined to actively promote the use of the instrument in Britain. He took note of the instrument not as a new method of diagnosis for medical practitioners as a whole, but as another means to manage his own fears surrounding his health and as an object of curiosity. Once he returned to London, more confident in the knowledge he was not suffering from a form of heart disease, and with the ability to establish himself in an unrelated aspect of medicine, he seemingly abandoned the stethoscope except to show it off as a novelty and give it a short article in his journal. Granville did bring the instrument to the attention of some practitioners through displaying it in his home and writing the piece in the journal, but he did not continue to use the instrument nor publicly to advocate for its adoption.

Granville may have been one of the earliest British practitioners to experience the stethoscope in France and write about it in Britain, but his motivations showed little interest in the instrument as a means of improving British medicine. Two other early stethoscope advocates, James Clark and Charles Thomas Haden, interacted with Laennec's new methods in quite a different way.

[208] *The London Medical and Physical Journal*, November 1818, 451.

After graduating from Edinburgh in 1817, Scottish-born physician James Clark accompanied a wealthy phthisis patient on a tour of France, Lausanne and Florence in search of the best treatment.[209] He recorded his observations of the impact of different climates on the treatment of consumption, noting that the disease seemed exceedingly prevalent in many areas of Britain and the continent.[210] In late 1818, on his arrival in Paris, Clark decided to spend time at the Necker hospital, despite it being a relatively small hospital by Parisian standards (only 130 beds).[211] He visited the Necker frequently because it was the site of Laennec's experiments around diagnosing diseases of the thorax, and Clark wished to ascertain the utility of these new methods.[212] His motivation for investigating and subsequently adopting the stethoscope stemmed from his already established research into diseases of the chest, particularly phthisis. The stethoscope provided a new avenue of investigation and diagnosis which appealed to Clark in a way it had not to Granville: the former wished to help all patients; the latter wished primarily to help himself.

Clark noted that several French practitioners, even those working at other hospitals, spoke highly of percussion and auscultation, and used the stethoscope in their wards.[213] He attempted to learn how to use the stethoscope during his time at the Necker, however he found that his travel itinerary did not allow for as much time as he needed.[214] Due to only being able to spend a few months in Paris, Clark found it would require more time than he had to bestow on it to become fully acquainted with the stethoscope.[215] This was despite his receiving tutelage from Jean-Bruno Cayol, one of Laennec's colleagues at the La Charité Hospital who had

[209] Bishop 1961, 255.
[210] Clark 1820, viii.
[211] Clark 1820, 153.
[212] Clark 1820, 153.
[213] Clark 1820, 154.
[214] Clark 1820, 153.
[215] Clark 1820, 153.

readily adopted the instrument and used it regularly.[216] Nevertheless, in his time there Clark observed enough to be convinced of the useful information that the stethoscope could offer.[217]

He understood that by using the stethoscope a practitioner could accurately discover the extent and seat of most lung diseases.[218] This information strengthened his opinion that the instrument was vital to medical practitioners, as it allowed for more accurate diagnosis and thus more accurate treatment.[219] He acknowledged that it did not provide a *cure* for these diseases, but insisted that knowing the nature and extent of each disease was 'surely the first step' towards the discovery of a cure.[220] Even without the potential possibility of cures, Clark argued it was still useful to know the progress of any given disease, even if it were terminal, as the information allowed for greater understanding of the stages of care.[221] His interest in the stethoscope stemmed from his desire to better treat patients with phthisis, which extended to helping the entire medical profession better understand the disease. His work on understanding the anatomical seat and the treatment of phthisis continued for the rest of his life. Due to this conviction he began to investigate the stethoscope and, once convinced of its utility, he began to advocate its use. This chapter will examine the impact of Clark's advocacy in Section 1.3.

Clark lauded the organisation of Parisian hospitals which allowed for dissections to regularly be performed on the same patients seen on wards.[222] He similarly noted that the Parisian system gave practitioners the ability to observe a large number of cases of the same disease, the 'object of his particular enquiry', and that this was of 'no small importance'.[223] He praised and acknowledged the Parisian system as possessing the necessary structure for

216 Clark 1820, 153.
217 Clark 1820, 153.
218 Clark 1820, 154.
219 Clark 1820, 154.
220 Clark 1820, 155.
221 Clark 1820, 155.
222 Clark 1820, 127.
223 Clark 1820, 128.

students to learn how to use auscultation as a diagnostic means. These benefits – increased opportunities to dissect, extensive clinical practice, and the possibility of observing a large number of cases – drew many British practitioners to Paris.[224] These opportunities, combined with the teaching of French practitioners who were familiar with the Parisian systems, made many British students and practitioners consider spending at least a season in the city.

Physician Charles Thomas Haden was one such practitioner. He succeeded Granville as editor of the *Medical Intelligencer* in 1821 and went to Paris in the summer of 1822 for the purpose of experiencing the French system.[225] According to Haden's friend, Thomas Alcock, Haden had a keen interest in the structure of French practice.[226] Indeed, Haden's contemporaries reportedly viewed his enthusiasm for the French anatomico-clinical tradition as being 'overzealous'.[227] On his arrival in Paris, he immediately took up study under Laennec.[228] He reportedly worked with Laennec on the design of the stethoscope, though Laennec never mentioned Haden in any of his publications.[229] Haden's interest in the stethoscope appeared to stem from a desire to improve diagnostic measures and bring aspects of French practice into the British medical system. Unfortunately, he died in 1824, before he could return to Britain, so his fascination with the French medical structure and his knowledge of the stethoscope did not make it back to British practitioners. Haden's motivations seemed to suggest he would have been a strong advocate for medical reform in Britain, including introducing the stethoscope. However, owing to his early death and a lack of his own writings, this will forever remain speculation.

[224] Richardson 2000, 102
[225] Alcock 1827, ix; Williams 1884, 417; Maulitz 1987, 163.
[226] Alcock 1827, ix; Williams 1884, 417
[227] Maulitz 1987, 168.
[228] Alcock 1827, ix; Williams 1884, 417; Maulitz 1987, 166.
[229] Blaufox 2002, 28; Williams 1884, 417.

The experiences and motivations of these three practitioners – Granville, Clark and Haden – indicate that there was no one factor which drew the practitioners to Paris. Practitioners were aware that the Parisian system differed from their own, but that did not necessarily entice them to visit without the addition of other motivations. What does become apparent is that, once in Paris, each practitioner encountered mediate auscultation and took an interest in it as a diagnostic method, although the level of their interest varied depending on their individual motivations for visiting Paris and their general medical interests. The fact of being in Paris and working within the hospitals there introduced them to the practice of mediate auscultation and convinced them of the utility of the stethoscope as a means of diagnosis. The question remains, however, how did other practitioners become aware of the stethoscope and how did they develop their skill with the instrument?

1.4 – Early Adopters Learning the Stethoscope in Paris

This section provides at least the first part of an answer to the question above by looking at how information on the stethoscope and mediate auscultation arrived in the British Isles and how some practitioners responded to it. Firstly, this section looks at the first journals to report on the stethoscope and Laennec's work. Secondly, it looks at the work of Charles Scudamore, a practitioner who visited Paris specifically to learn in the Parisian medical context. Using a close reading of Scudamore's work as emblematic of the broader trend of British practitioners going to study in Paris and how they developed skill in mediate auscultation and the stethoscope once there. This section emphasises that for some British practitioners their interest in the stethoscope came from reading articles about mediate auscultation and that they then chose to learn more by visiting Paris. Furthermore, this section gives an explanation of *how* the French context encouraged the development of skill with the technique.

In August 1819, Laennec published *Traité*, a detailed account of mediate auscultation in practice along with the relevant anatomical information. Reviews of *Traité* in British journals were undoubtedly one of the main ways British practitioners learnt about mediate auscultation and the stethoscope. The *Quarterly Journal of Foreign Medicine and Surgery* was the first to publish a review of Laennec's book in November 1819. The review focused on Laennec's 'new system of diagnosis' rather than on his work in pathological anatomy.[230] This was one of the few discussions of Laennec's work which puts its primary focus on mediate auscultation as a diagnostic method; most responses emphasised the pathological anatomy. The stethoscope was praised as a mode of precise diagnosis, from which practitioners could better tailor their treatments; it was acknowledged that the stethoscope required a lot of practice, best achieved through use in a hospital, and that there were many diagnostic advantages to be gained through its use.[231] In the last paragraph the reviewer urged readers to obtain a stethoscope from a Mr Weiss on the Strand and to 'convince themselves' of the merits of the stethoscope.[232] From this it is feasible to infer that it was possible to buy a stethoscope in London by November 1819. British practitioners, at least those in London, heard about the stethoscope and could buy one, only a month after Laennec published his *Traité*.

The *London Medical and Physical Journal*, with Granville still in his position as editor, published a four-part review of Laennec's book over the course of four months (February – May 1820). Unlike the *Quarterly Journal*, Granville's review focused on Laennec's pathological anatomy, with the new means of diagnosis being treated in a 'secondary way'.[233] Granville, though intellectually interested in the stethoscope, did not view the mediate auscultation as the main attraction of Laennec's work, nor did he bring the diagnostic method

[230] *The Quarterly Journal of Foreign Medicine and Surgery*, November 1819, 51.
[231] *The Quarterly Journal of Foreign Medicine and Surgery*, November 1819, 58.
[232] *The Quarterly Journal of Foreign Medicine and Surgery*, November 1819, 68.
[233] *London Medical and Physical Journal*, February 1820, 166.

to the fore in his publication. When he did discuss the mediate auscultation as a diagnostic method, the review was favourable; not just as a diagnostic method but also as a way of observing the recovery process: 'When the disease terminates favourably, the cylinder becomes a sure means of appreciating the progress of the cure'.[234] The long review ends in May 1820, with Granville commenting that he would have liked more time to further discuss this 'original work' and recommending Laennec's work to 'all those who have a due love for medical science'.[235]

Following discussion of the stethoscope and Laennec's work in these journals, other British practitioners began making the journey to Paris for the purpose of studying within the French system and learning how to use the stethoscope. They recognised that the Parisian system offered many opportunities they could not access in Britain: most notably increased access to bodies and the practice of pathological anatomy.[236] Practitioners at the time estimated that between 150 and 200 British students per year travelled to Paris for at least part of their education.[237] Between 1825 and 1826, Charles Scudamore, an Edinburgh educated physician and prolific medical writer, spent a year studying with French physicians at La Charité. Using evidence from Scudamore's 1826 book, *Observations on M. Laennec's Method*, this section will demonstrate how practitioners who visited Paris learnt to use the stethoscope, including how the Parisian teaching methods made this process easier for students, reflecting the unique Parisian clinical context. The benefits of studying in Paris included trained stethoscopists as teachers, increased clinical teaching, and greater access to cadavers for dissection. By the mid-1820s many students went to study under Laennec for the explicit purpose of learning how to

[234] *London Medical and Physical Journal*, March 1820, 249.
[235] *London Medical and Physical Journal*, May 1820, 428.
[236] Bonner 1995, 147.
[237] Grainger 1828, 108.

use the stethoscope.[238] These practitioners included Charles James Blasius Williams and James Hope, who would both go on to become famous for their stethoscopic endeavours.[239]

Due to the Parisian hospitals' close control over immense numbers of patients, often in specialised wards allowing each practitioner to examine a certain set of diseases, the medical practitioners – including those visiting from elsewhere – who worked there, could more easily focus their studies.[240] A practitioner wishing to study only diseases of the abdomen, for example, could request that hospitals admitting patients with relevant symptoms sent them to their hospital and ward. This patient exchange could occur between any of the main Parisian hospitals. This system stimulated the systematic and specialised study of diseases in the living patient, which practitioners could further examine after death.[241] The ability to observe the same patients during both life and death brought out a new form of pathological examination in Paris.[242] British students entered into this system, experiencing the new Parisian methods which were unavailable in their home countries. For many British students it was the access to bodies and anatomical teaching which primarily motivated their decision to study in Paris rather than any specific interest in mediate auscultation and the stethoscope. It was only as British practitioners, at home or on returning from their own visits to Paris, increasingly wrote of the use of the stethoscope and as Laennec's work became better known, that students began seeking out Laennec or other stethoscopists.

French practitioners provided private tutelage to British students, including the process of correlating the internal signs with the post-mortem findings necessary for understanding how the stethoscope functioned.[243] Scudamore noted that 'in a late visit to Paris' (likely 1825)

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238 Maulitz 1987, 157. For a more thorough list of British practitioners who studied under Laennec or who corresponded with Laennec in some way, see P. Huard's 'Les élèves étrangers de Laennec' (in bibliography).
239 Morris 2004, 140; 144.
240 Bonner 1995, 143.
241 Bonner 1995, 143.
242 Maulitz 1987, 61-62.
243 Bonner 1995, 136.

he received personal attention from Laennec himself.[244] On his return to Britain he wrote a short book advocating Laennec's method of diagnosing disease of the chest in which he suggested that all students ought to study the stethoscope themselves.[245] He reassured his readers that for the first few days of his own stethoscopic education he was completely unable to recognise any distinct sounds, but with practice and instruction he improved and now understood the full value of the instrument.[246] He explained Laennec's process of observing patients and pronouncing a diagnosis, then verifying his opinions at autopsy if the patient died.[247] Here Scudamore's notes provide clear evidence that Laennec practiced anatomic-clinical correlation by means of observing the patient, forming a diagnosis, and then having that diagnosis verified by autopsy.

French practitioners had greater opportunities to conduct autopsies than practitioners in Britain because cadavers were much cheaper and more readily available in Paris.[248] The government in France introduced legislation which allowed hospitals and anatomy theatres to obtain any unclaimed bodies from around the city.[249] The large hospitals and legal availability of unclaimed bodies from them created opportunities for anatomical investigation on a scale not seen before in Europe.[250] The regulation and control of the cadaver market in France made it much easier for French practitioners to dissect patients.[251] Scudamore noted that these dissections, happening on a much larger scale than those in Britain, provided Laennec with 'proofs of sure diagnosis'.[252] Increased access to dissections led to an increase in the ability to conduct post-mortems in general, for all practitioners working in Paris.

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244 Scudamore 1826, 1.
245 Scudamore 1826, x.
246 Scudamore 1826, 9.
247 Scudamore 1826, 10-11.
248 Bonner 1995, 81.
249 Bonner 1995, 87.
250 Bonner 1995, 136.
251 Maulitz 1987, 141.
252 Scudamore 1826, 10.

This did not mean Laennec and other Parisian practitioners relied solely on dissection to verify their diagnoses. Scudamore related a case in which Laennec confirmed a diagnosis by means of a successful operation.[253] Previous diagnoses suggested that the patient suffered from consumption yet, when Laennec examined him with a stethoscope, he claimed that diagnosis was incorrect.[254] Laennec recommended the patient for surgery and his recommendation (and diagnosis) proved correct when the surgeon removed a large amount of pus from the patient's chest and they recovered completely.[255] This shows that practitioners in Paris had access to several means of verifying their diagnoses, though the regulation of the cadaver markets greatly differentiated the Parisian medical context from that of Britain.[256] The process through which practitioners obtained diagnostic verification without the need for dissection is the one I have termed symptomatic-pathological verification; a practice which occurred regularly in Britain and which I will discuss further in Chapter 2.

The routine of the clinic was another significant way that the Parisian hospitals differed from British ones.[257] The French government officially promoted clinical teaching in Paris by converting the hospitals into major centres of medical teaching, rather than splitting the education between universities and hospitals.[258] Nowhere in Britain were hospitals organised for clinical teaching on the same scale as they were in France, and British students who travelled to Paris were able to gain experiences that were unheard of in British practice.[259] For many visiting students their time in Paris was their first experience using anatomical knowledge to inform discussion of a living patient.[260]

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[253] Scudamore 1826, 14.
[254] Scudamore 1826, 14.
[255] Scudamore 1826, 14.
[256] Maulitz 1987, 141.
[257] Maulitz 1987, 141.
[258] Bonner 1995, 98.
[259] Bonner 1995, 132.
[260] Bonner 1995, 136.

The dual French system of the regulation of cadavers and the emphasis on clinical teaching allowed students to observe patients on the wards and form diagnoses. When those same patients died, the practitioners and students who saw them in life were able to verify their diagnoses by dissection. In this way, the French system provided many opportunities for students and established practitioners alike to practice anatomico-clinical correlation. This extended to developing skill with the stethoscope: students could examine a patient with the stethoscope, make a diagnosis, and then have that diagnosis verified (usually by dissection) in a system which better allowed for practitioners to examine the morbid anatomy of the same patients they saw in life. Within the French system even those practitioners who went to Paris without knowledge of the stethoscope likely encountered it and could be easily convinced of its utility.

The previous section established the role of British journals in introducing mediate auscultation and the stethoscope to Britain; providing positive reports which encouraged practitioners to take interest in Laennec's work. It further demonstrated how some British practitioners travelled to Paris, in part to learn the practice of mediate auscultation, and developed their skill with the stethoscope within the Parisian context. These practitioners benefitted from the same structures in which Laennec invented the stethoscope: one which enabled the practice of anatomico-clinical correlation. Obviously, only a small percentage of British practitioners and medical students were able travel to Paris. How, then, did practitioners who did *not* visit Paris and learn in that unique context develop their skill with the stethoscope?

1.5 – The Advocacy of James Clark and the Introduction of the Stethoscope to Britain

This section examines the important, and historically under-appreciated, role of James Clark in advocating for stethoscope adoption and the role of John Forbes' translation of Laennec in promoting the practice of mediate auscultation. Clark's advocacy is one that historians of the stethoscope routinely downplay, choosing to focus instead on its outcome: Forbes' translation of Laennec's work.[261] The first part of this section examines Clark's advocacy; the role it played in promoting the stethoscope and its influence on John Forbes. Historians of the stethoscope primarily focus on Forbes' translation of Laennec's work, *Treatise*, only briefly noting that Clark encouraged it. The role of James Clark provides a clear example of how advocacy for mediate auscultation and the stethoscope impacted others, but it is important to note that Clark is one well-known, if under-appreciated, example rather than a unique case. This section shows that the impact of Clark's advocacy was pivotal in furthering the knowledge of mediate auscultation within the British Isles. The second part of this section then considers how, following Clark's encouragement, Forbes approached the translation and mediate auscultation. It looks at Forbes' process of writing the translation, his opinion of mediate auscultation and the stethoscope, and the reception of his work in the broader medical press.

Clark and Forbes grew up together in Fordyce, Scotland; they walked to school together and socialised outside of the classroom, forming a lifelong friendship which also extended to their professional interactions later in life.[262] Following on from apprenticeships, both Clark and Forbes practised as a surgeons in the Navy during the Wars, often writing to each other when on different ships.[263] When the Napoleonic Wars finally ended in 1815, Clark and Forbes were put on half-pay, at which point they chose to leave the Navy and return to Edinburgh to study medicine – although it is not clear whether they made this decision independently of each other or not.[264] Clark and Forbes graduated with MDs from Edinburgh on the same day in August 1817.[265] After graduation Clark travelled across Europe with a wealthy private patient,

[261] Advocacy, especially from practitioners in teaching roles, has been given some attention by historians of medicine and medical technology, for more on this see Blume 1992 and Reinarz 2006.
[262] Agnew 2002, 23.
[263] Bishop 1961, 255; ODNB s.v. Sir James Clark.
[264] ODNB s.v. Sir James Clark.
[265] Bishop 1961, 255.

eventually settling in Italy while Forbes remained in Britain, taking up a position at the Penzance dispensary.[266] The two men maintained regular written correspondence.

As seen in 1.2, James Clark recorded information about his travel on the continent, particularly in relation to the climate for the treatment of phthisis and the structure of hospitals in different countries. His 1820 book, *Medical Notes on Climate*, outlined these observations for British practitioners, primarily as an aid for the understanding and treatment of consumption.[267] Clark originally communicated much of the contents of *Medical Notes* in his regular letters to John Forbes, and also collected his own notes which he presented for Forbes 'and other friends' during a brief return to Britain in September 1819.[268] Forbes and these other friends encouraged Clark to publish his notes, and it was Forbes who edited and oversaw their publication in Britain while Clark travelled to Italy.[269] Clark even joked in the letter published as a preface to the book that, as Forbes was responsible for Clark publishing his observations, Forbes should also take some responsibility if people did not like the book![270] It was yet another testament to their close friendship that Forbes superintended the publication of Clark's work, a task which likely involved a large amount of work.

In *Medical Notes* Clark mentioned that he had given a stethoscope to an English physician.[271] Given their close relationship and Forbes' prominence in the historical narrative of the stethoscope, many historians have assumed that Forbes was the recipient of this instrument.[272] Forbes openly admitted to not starting to use the stethoscope until late 1820, making it unlikely that he was the unnamed practitioner to whom Clark gifted the instrument

[266] Agnew 2002, 28.
[267] Clark 1820, viii.
[268] Clark 1820, vii-x.
[269] Clark 1820, x.
[270] Clark 1820, vii.
[271] Clark 1820, 158.
[272] Agnew 2002, 29.

in 1819.[273] Instead, I suggest James Johnson, London physician and editor of the *Medico-Chirurgical Review*, as the more likely recipient of Clark's gift. The footnote in which Clark stated he had given the instrument to a British practitioner went on to note that they had 'already found it useful in the diagnosis of some diseases of the heart'.[274] The footnote was attached to the comment that Johnson had an 'upcoming' review of Laennec's *Traité*; Johnson's review appeared only a month after the publication of *Medical Notes*. In this review Johnson praised the stethoscope, stating he had put the diagnostics 'to the test of experience' by examining diseases of the heart in two patients.[275] Despite reporting only a small number of cases in which he used the stethoscope, he claimed he could vouch for the 'general accuracy' of the instrument.[276] Therefore, unlike Forbes, Johnson had not only used the stethoscope but had done so whilst investigating the heart, fitting with Clark's footnote and indicating that he was one of the earliest stethoscope users in Britain.

Johnson claimed to have 'procured some [stethoscopes] from Paris' despite not having travelled there himself, further suggesting that someone else had given him the instrument.[277] His experience with the stethoscope, though brief, thoroughly convinced him of its utility and he began to encourage other practitioners to test it themselves.[278] To this end, Johnson 'engaged' Allnutt of Piccadilly, a wood turner, to produce stethoscopes at 4 shillings each for 'any gentlemen … who may wish to have one'.[279] Similar to Granville, Johnson had models of the stethoscope in his house which were available to practitioners 'at any time', but unlike Granville there is clear evidence that Johnson also used the instrument in his practice.[280] These were the first stethoscopes produced in Britain, and they came about as a result of Clark gifting

[273] Forbes 1821, xxvi.
[274] Forbes 1821, 158.
[275] Johnson 1820, 480.
[276] Johnson 1820, 480.
[277] Johnson 1820, 494.
[278] Johnson 1820, 494.
[279] Johnson 1820, 494.
[280] Johnson 1820, 494.

the instrument to his friend. Clark's advocacy and passion for the instrument introduced it to Johnson, the editor of a widely read and respected journal. Johnson's experience and advocacy led to the start of easily available, British-made, stethoscopes. Johnson became a very early adopter of the stethoscope in no small part due to his friendship with Clark; the sharing of instruments and information between friends brought about efforts to move the stethoscope into general medical knowledge.

In contrast, there is little to suggest that Forbes – Clark's closest friend – attempted to use the stethoscope until August or September 1820. Clark's impact on Forbes was simultaneously less immediate (Forbes did not use a stethoscope until late 1820) and more profound. Over the course of several letters, Clark convinced Forbes to translate Laennec's *Traité* for an English-speaking audience; he claimed he would have translated the work himself, but he had just taken a position in Italy, which made the process of publishing the work in Britain more difficult.[281] Forbes, who was staying in Britain, was the better option. It is impossible to give a history of the stethoscope without discussing John Forbes and his translation, yet this translation may well not have come about without the encouragement from Clark.

Forbes began work on the translation whilst holding a position at the Penzance Dispensary.[282] The position was likely unpaid; it is probable that Forbes also established a private practice in order to earn a living.[283] Dispensaries constituted a distinctive medical environment, different both from hospitals and private practice. The original dispensaries were driven by the Quaker belief that people should not be unnecessarily confined, especially in places such as prisons, asylums, and hospitals; dispensaries provided medical assistance on an

[281] Forbes 1827, vi.
[282] Agnew 2008, 28.
[283] Agnew 2008, 28.

out-patient basis, seeing many patients in their own homes.[284] By the time Forbes was practicing, dispensaries were no longer a solely Quaker endeavour, however, they were still seen as institutions which supported civic and religious duty.[285] Not restricted by bed places, as hospitals often were, dispensaries were able to serve as many patients as could be afforded.[286] Dispensaries were funded entirely by voluntary philanthropic subscriptions; in order to see a physician or surgeon, patients were required to provide a letter of recommendation from a financial contributor.[287] Patients who relied on dispensaries were often poor and many suffered from conditions which were excluded from hospital admission, such as illnesses which fell under the general category of 'fever'.[288] Some hospitals would only take patients who they believed were curable, so the dissection rate in hospitals was not as high as one might imagine. This was not the case for dispensaries, where no board selected patients based on their chances of survival. Physicians in dispensaries therefore saw a relatively large number of patients and, though the number was still not particularly high, they were able to conduct more post-mortems. It was in this environment that Forbes did much of his work as a physician.

Forbes began working on the translation in early 1820. He had a great interest in the pathological aspect of Laennec's work and stated that British practitioners ought to regard the original French *Traité* as having great value.[289] Forbes acknowledged that French hospitals were better equipped for the study of pathology due to increased access to cadavers, and commented that it was impressive that English practitioners were not further behind their continental colleagues.[290] To support his claim about the superior French systems which

[284] Kilpatrick 1990, 263; 257.
[285] Hurren 2016, 188.
[286] Kilpatrick 1990, 256.
[287] Kilpatrick 1990, 256.
[288] Kilpatrick 1990, 257.
[289] Forbes 1821, viii.
[290] Forbes 1821, viii.

allowed for a greater study of pathology, Forbes included an extract of Clark's *Medical Notes.*[291] The original arrangement of *Traité* had each disease organised under four different headings, each a form of diagnostic exploration with the stethoscope: voice, respiration, rattle, and circulation.[292] Forbes noted that Laennec based the original arrangement on the new principle of diagnosis and, because of this, Laennec regularly made pathology subservient to diagnosis.[293] Forbes saw this arrangement as having many disadvantages as it made the pathology more difficult to understand for a reader who was not familiar with the stethoscope, so he rearranged the work to prevent the anatomical information being 'hidden' by the diagnostic method.[294] This rearrangement resulted in the translation being separated into what was essentially two different treatises, one on pathology and the other on Laennec's new diagnostic method.[295] By separating the work, Forbes made the pathology more understandable to the reader whether or not they adopted mediate auscultation as a diagnostic method.[296] Forbes stated that this arrangement was how he thought the work always ought to have been organised, and that both its English readers and Laennec himself were obliged to him for improving it in this way.[297]

Forbes was not entirely against the concept of auscultation, he agreed with the idea that more accurate diagnosis leads to better treatment.[298] He stated that until the publication of Laennec's *Traité,* English practitioners had paid too much attention to the external symptoms without paying proper attention to the internal conditions the symptoms indicated.[299] While he conceded that some pathological signs may never come to light, he maintained that with proper

[291] Forbes 1821, viii.
[292] Forbes 1821, ix.
[293] Forbes 1821, ix.
[294] Forbes 1821, ix.
[295] Forbes 1821, ix.
[296] Forbes 1821, x.
[297] Forbes 1821, ix-x.
[298] Forbes 1821, xv.
[299] Forbes 1821, xi.

investigation the state of the internal organs would become known.[300] Forbes argued that knowledge of anatomical forms was an essential part of knowledge of disease, so a diagnostic method founded on knowledge of the internal pathological anatomy was pre-eminently valuable.[301] Laennec's diagnostic method linked the signs afforded by the stethoscope immediately to the individual 'derangements' of internal organs, and Forbes stated that if 'the experience of others' proved this method to be accurate then Laennec had conferred on medicine 'one of the greatest benefits with which it has ever been enriched'.[302] Evidently, despite being primarily focused on Laennec's work in pathology, Forbes understood the implications of the use of the stethoscope and supported investigations into the diagnostic method that used the instrument. At the time of writing the translation, however, Forbes' own investigations had only just started, hence his reliance on the experience of others in determining if Laennec's diagnostic method would prove to be accurate enough for general uptake.

At the time of writing the preface Forbes had only conducted a stethoscopic examination on a few patients, of which only one had been dissected.[303] These cases marked the very start of his stethoscope trials, and though even in this early stage he had come to appreciate the instrument and diagnostic method that came with it, it was too late for the translation to see the benefit of his changed opinions. Forbes admitted in his preface that when he started the translation he was 'too little impressed with the diagnostic methods recommended in the work'.[304] Furthermore, he acknowledged that removing and abridging the cases had been an error, mostly due to his lack of interest in the stethoscope at the start of the translation; he stated that if he could start again he would handle the cases differently.[305] To try

[300] Forbes 1821, xi.
[301] Forbes 1821, xiii.
[302] Forbes 1821, xiii.
[303] Forbes 1821, xviii.
[304] Forbes 1821, xxvi.
[305] Forbes 1821, xxvi.

and compensate for his earlier mistakes he included an appendix to the translation which contained some of the formerly abridged cases in their entirety. He also considered that it may have been even better to split the work into three separate treatises on pathology, diagnostics, and detailed cases.[306] Even with this concession, he still argued that his arrangement was superior to Laennec's original.[307]

Forbes published his translation in the last quarter of 1821.[308] Therefore the majority of the discourse around the stethoscope in 1821 likely occurred without influence from Forbes' translation. Reviewers responded very positively to Forbes' translation and the book sold very well, suggesting that many British practitioners were interested in Laennec's work: either the morbid anatomy, the diagnostic method, or both. Johnson's *Medico-Chirurgical Review* highly praised both Laennec and Forbes; of Forbes especially the reviewer stated that 'the public has a physician of native genius and acquired knowledge – the profession a member of zeal, honour, and integrity'.[309] The *London Medical and Physical Journal*, still edited by Granville, similarly responded very positively to Forbes' translation and praised many aspects of the work, including its general revision and reordering.[310] However, the reviewer criticised Forbes for significantly revising, or simply removing, Laennec's case reports: they argued that the original French work was akin to the work of the 'illustrious Italian pathologist' Morgagni.[311] The work of Morgagni included long and detailed case notes on the symptoms of many diseases and could be consulted in difficult cases. The reviewer suggested that practitioners could use

[306] Forbes 1821, xxviii.
[307] Forbes 1821, xxvii.
[308] *Medico-Chirurgical Review*, December 1821, 289. Forbes' translation listed in 'Books published and received for review since the last quarter'.
[309] *Medico-Chirurgical Review*, March 1822, 808.
[310] *London Medical and Physical Journal*, February 1822, 140.
[311] *London Medical and Physical Journal*, February 1822, 141.

Laennec's *Traité* in a similar manner, but the abridged version of his cases given by Forbes would be of little use.[312]

In addition, the review in *London Medical and Physical Journal* alluded to resistance towards the use of stethoscope in British practice; it stated that the instrument was 'despised and laughed at', though no individuals were named.[313] The reviewer was 'anxious to see Laennec's practice more generally adopted among the British profession'.[314] In July 1822, Scottish physician Roderick MacLeod became the editor of the *London Medical and Physical Journal*; he was described as 'eminently conservative in his professional convictions and habits', and the journal took a more sceptical stance towards the stethoscope from this date due to MacLeod's appointment.[315]

The *Edinburgh Medical and Surgical Journal* did not publish a review of Laennec or Forbes until 1822, when the reviewer (likely Andrew Duncan Jr.) published a joint review of both Laennec's *Traité* and Forbes' *Treatise*.[316] Duncan explained that he withheld his review until he had completed his own trials with the stethoscope, so as to give the most informed commentary possible.[317] He praised Laennec's *Traité* as a valuable contribution to *both* pathology and diagnosis and argued that whatever his readers thought of the stethoscope – Duncan admitted to liking it – no one could deny Laennec's great contributions to pathology.[318] Duncan disapproved of Laennec's arrangement of *Traité*.[319] Similar to Forbes, he argued that Laennec's arrangement made the pathology secondary to the stethoscope whilst he felt that the pathology ought to be the most important factor.[320] He noted that Forbes was 'wise' to separate

[312] *London Medical and Physical Journal*, February 1822, 141.
[313] *London Medical and Physical Journal*, February 1822, 142.
[314] *London Medical and Physical Journal*, February 1822, 143.
[315] *Medical Times and Gazette*, December 1852, 625.
[316] Duncan, *Edinburgh Medical and Surgical Journal*, July 1822.
[317] Nicolson 1993, 143.
[318] Duncan 1822, 447.
[319] Duncan 1822, 450.
[320] Duncan 1822, 450.

the two aspects of Laennec's work.[321] Despite his complaints about the arrangement of Laennec's work, Duncan still advocated for practitioners to study – either in French or English – these new findings in pathology and diagnosis.[322] Although the reviewer had more practice with the stethoscope and thus, presumably, was more familiar with the practical application of Laennec's work, they were in favour of Forbes' decision to split Laennec's work into two sections: pathology and diagnosis.[323]

Forbes' *Treatise* increased the accessibility of Laennec's work to the general British medical profession. Historians have, rightly, paid a great deal of attention to Forbes' translation and its reception by British practitioners. The translation made knowledge of Laennec's pathology and diagnostic methods available to all practitioners, even those who could not speak French. But it was Clark's advocacy which led to this point. Without the constant encouragement from Clark to engage both with Laennec's work in general and with the stethoscope itself, Forbes would not have started the translation. Undoubtedly other practitioners would have created their own translations, but the translation that did appear came from Forbes and owed its creation to the enthusiastic efforts of James Clark. Despite the generally positive reception of Forbes' *Treatise* in the journals and in book sales, it is apparent that at the time of writing the translation, Forbes was not skilled with the stethoscope. He focussed on the anatomical aspects of Laennec's work and did not adopt stethoscope use himself during his work on the translation. Forbes practiced outside of the Parisian context, how then did he come to develop skill with mediate auscultation? The next section uses Forbes' work with the stethoscope as an example of how British practitioners approached learning to use the stethoscope.

[321] Duncan 1822, 450.
[322] Duncan 1822, 474.
[323] Duncan 1822, 447.

1.6 – Personal Trials as a Means of Gaining Stethoscopic Skill Without Visiting Paris

Clark's advocacy and Forbes' translation allowed British practitioners to know about Laennec's work, but it did not immediately provide them with the skills to use the stethoscope. Not all British practitioners could travel to Paris, so they needed to develop a method of learning how to use the instrument that did not rely on a very specific environment. The personal trials conducted by Duncan Jr of Edinburgh and John Forbes provide evidence that British practitioners succeeded, with relative ease, in observing patients and stethoscopic signs, forming diagnoses, and having those diagnoses verified (often by means of dissection). The example of John Forbes' work demonstrates that the Parisian context offered many advantages, but it was not necessary for gaining skill with the stethoscope. Instead, early adopters in Britain managed their own process of investigation which included some practice of anatomico-clinical correlation.

We need first to specify what exactly is meant by 'trial' in this regard. In the context of 19th-century practitioners, a trial was the process of 'testing' a new technique or instrument. It was not a 'clinical trial' as we know them today with features such as 'control' groups; rather, these practitioners tested the stethoscope through practicing with it and observing whether they could make accurate diagnoses. What is it that makes something a trial of the stethoscope and not simply 'use'? One example is that of Johnson, who had attempted to use the stethoscope at least twice in 1819, well before the first review of Laennec's *Traité* even appeared in any British publication. Clark's preface, written in November 1819, indicated that he had also made some attempts with the stethoscope by then; furthermore, Forbes included Clark in a list of practitioners he knew had conducted some 'trials' of the instrument, though Clark was in Italy at the time.[324] Is it reasonable to claim that Johnson 'trialled' the stethoscope given that the

[324] Clark 1820, x; Forbes 1824, 66.

records of only two of his cases have survived? Certainly, practitioners at the time credited Johnson as conducting one of the earliest stethoscopic investigations, alongside Duncan Jr and Forbes.[325] For the purposes of this section I suggest that Johnson was indeed trialling, although unlike Duncan Jr. and Forbes he did not *claim* to be. However, I have chosen not to include him in this section as he did not keep a clear record of his work with the stethoscope; he both used a stethoscope and wrote about it but there are few records of his work with mediate auscultation. The discussion in this section centres on the work of Andrew Duncan Jr. and John Forbes, as they were explicit in their exploration of auscultation as a diagnostic method.

Edinburgh physician Andrew Duncan Jr. claimed to be – and likely was – one of the first practitioners to trial the stethoscope in Britain.[326] Duncan and his assistant John Lane began to trial the stethoscope in an attempt to fully assess the instrument before reviewing Laennec's work. They were employing the stethoscope on the wards of the Edinburgh Infirmary by November 1820.[327] Duncan understood the importance of connecting the signs of disease with the changes in the tissue of the internal organs.[328] Similarly, he noted that relying on symptoms alone to form a diagnosis could be misleading: practitioners could not recognise many diseases by the presence or absence of any one symptom, or group of symptoms.[329] The only way for medical practitioners to satisfactorily understand disease was to acquire a conviction of the dependence of symptoms upon the organic causes existing in the body.[330] Here he noted that the manner of organisation in the Parisian hospitals gave them a decided advantage over the British ones.[331]

[325] Scudamore 1826, 4.
[326] Duncan 1827, 302; Nicolson 1993, 147.
[327] Duncan 1827, 307.
[328] Duncan 1822, 448.
[329] Duncan 1822, 449.
[330] Duncan 1822, 449; Duncan 1827, 314.
[331] Duncan 1822, 452.

Duncan expressed the belief that the best place to trial the instrument was in a hospital as that working environment provided ‘many opportunities to apply the instrument’ and see numerous cases of the same illness.[332] He argued that an advantage of the stethoscope as a mode of investigation was that it neither fatigued not offended the patient.[333] In most of these cases his assistant Lane recorded a detailed account of the history, symptoms, and observations made with the stethoscope, after which Duncan noted the patient’s diagnosis.[334] Duncan, or another practitioner from the hospital, would dissect the patients after death and report the findings; they would then describe what they had expected to find given the symptoms and stethoscopic signs, and whether the actual morbid appearances met those expectations.[335] Whilst his interest lay primarily in the morbid sounds, Duncan did provide information on the healthy sounds of the chest in order to emphasise the change in sounds which indicated the presence of disease.[336] The stethoscope trials included careful observation, the formation of a diagnosis and then the verification of that diagnosis.

Duncan stated that the general application of the stethoscope was simple, but it took a large amount of experience for any practitioner to develop the ability both to distinguish the range of sounds and the skill to draw inferences from them.[337] Despite the need for experience to gain skill with the instrument, Duncan maintained that practitioners only needed to listen to around half a dozen chests to understand the wide array of diagnostic possibilities the instrument offered.[338] The observations Duncan and Lane made convinced them of the correctness of Laennec’s work, even in the areas where they had not yet acquired enough skill to achieve the same results described in *Traité*.[339] Duncan acknowledged that a deficiency of

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[332] Duncan 1822, 452.
[333] Duncan 1822, 450.
[334] Duncan 1827, 307.
[335] Duncan 1827, 307.
[336] Duncan 1822, 453.
[337] Duncan 1822, 450.
[338] Duncan 1822, 457.
[339] Duncan 1822, 457.

skill and knowledge meant that he made mistakes in some diagnoses, but the same is true for all other methods of making a diagnosis and was not a reason to disregard the stethoscope.[340]

Duncan and Lane managed to trial the stethoscope over two years through means of observing patients (their symptoms and the stethoscopic signs), forming a diagnosis, and then verifying their diagnosis – often, but not always, by means of dissection.[341] This did not require Duncan and Lane to conduct each stage themselves. In one of their earliest cases the patient died in the family home in Hull; practitioners in Hull dissected the patient and sent information from their findings back to Edinburgh, allowing Duncan and Lane to verify their diagnosis despite not observing the dissection themselves.[342] Furthermore, not all cases required a post-mortem examination for verification. Duncan reported a case from 1822 where successful surgery on a young girl verified the diagnosis gained by the stethoscope.[343] This means of verification, which did not rely on dissection, is but one example of symptomatic-pathological correlation: i.e. where the practitioner verified their diagnosis through means other than that of dissection – in this case, through successful surgery. Duncan's trials meant he could bear 'ample testimony' to the accuracy of Laennec's work and the intelligence and skill of Forbes's abridgment.[344]

Duncan never published anything which outlined the process of his trial, seemingly satisfied to only bring out the work when he could use the cases to provide more information on a larger matter relating to diseases of the chest. The only evidence of Duncan's trials come from his letters to Forbes, the 1822 review of Laennec and Forbes' work, and some brief recollections about them in his 1827 article on empyema.[345] While it is certain that he did

[340] Duncan 1822, 457.
[341] Duncan 1827, 307; Duncan 1827, 319.
[342] Duncan 1827, 317.
[343] Duncan 1827, 318. At the time of publication, Duncan described the patient as 'now a stout young woman'.
[344] Duncan 1822, 474.
[345] I was hoping to find more evidence through visiting the Edinburgh archives where there are documents which apparently contain Duncan's original notes, but due to Covid-19 that is no longer possible.

indeed conduct these trials, and it is possible to understand some of his methods, the evidence does not create a clear picture of the way in which he learnt to use the stethoscope.

In 1824, John Forbes published a short book, *Original Cases*, in which he outlined in great detail his experiences conducting a trial with the stethoscope. Whilst writing his translation of Laennec's work, Forbes stated that he was interested in seeing if the 'experience of others' proved the utility of the stethoscope.[346] With that in mind, Forbes contacted Duncan Jr. before he began his own stethoscope trials in order to discuss the best way to carry out these investigations.[347] In the preface to *Original Cases* Forbes recounted a letter from Duncan confirming that he had made great use of the instrument on the wards of the Edinburgh Infirmary and was satisfied with its use in diagnostics.[348] Forbes claimed that Duncan Jr. had considerable experience of seeing connections between symptoms, including signs afforded by the stethoscope, and the body at morbid dissection.[349] Forbes undertook a trial of the stethoscope following Duncan's advice; he published this trial in *Original Cases* and outlined exactly how he carried out the investigations.

Between 1821 and 1824 Forbes examined at least 39 patients with the stethoscope, with varying levels of success. Forbes' trial began a few months before he completed the translation; the earliest recorded case which he regarded as part of the trial is from Penzance Dispensary in November 1820, and he released the translation of Laennec's work in December that year.[350] Despite having only just started his trial he stated that he was now 'convinced of its value'.[351] Forbes acknowledged that his earliest trials were unsatisfactory; a result of his inexperience and lack of attention to the general instructions for using the instrument.[352] All uncertainty and

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[346] Forbes 1821, xiii.
[347] Forbes 1821, xx. It has not yet been possible to find any evidence of this correspondence.
[348] Forbes 1821, xx.
[349] Forbes 1821, xiii.
[350] Forbes 1824, 102.
[351] Forbes 1821, xviii.
[352] Forbes 1821, xiii.

apparent difficulty lifted after practice, and Forbes speedily became convinced that the stethoscope's results were advantageous.[353]

The cases in his book indicated that during the trial he began to systematically record his use of the stethoscope, along with the general symptoms of the patient and his diagnosis; if the patient died, he would then dissect the body. Forbes meticulously recorded his observations of the symptoms in the living patient, including the signs afforded by stethoscope, noted his diagnosis, and then sought some means of verifying his diagnosis. In most cases this verification took the form of dissection. Forbes occasionally read aloud his notes on the stethoscopic signs and his diagnosis to those accompanying him before the dissection began.[354] Clear evidence that Forbes practiced anatomico-clinical correlation: observing the living patient and forming a diagnosis before using the morbid appearances at autopsy to verify his diagnosis.

Of the 39 cases Forbes presented in *Original Cases*, he only managed to observe 13 of them himself, form a diagnosis, and dissect them after death. There were 2 cases where practitioners other than Forbes carried out the dissection and sent their findings to him, and one case where Forbes did not examine the patient with the stethoscope before death (he included the case for other reasons). A further five patients died, but their families denied Forbes the permission to carry out a dissection. It is unclear how many other patients Forbes saw and examined with the stethoscope in this time, but it is unlikely that these 39 cases were the only ones he observed. He included one case in order to demonstrate a specific pathological point, rather than demonstrate his practice with the stethoscope. He stated that *had* he examined the

[353] Forbes 1821, xxi.
[354] Forbes 1824, 115.

patient with a stethoscope he believed he could have formed a correct opinion on the case; the fact he did not actually use a stethoscope in that case was, apparently, irrelevant.[355]

Only one case in Forbes' book came from his time in Penzance: in September 1821 Forbes used the stethoscope to examine a female patient who he then diagnosed with hypertrophia (an abnormally large heart), which, by his own admission, was done 'very imperfectly'.[356] He re-examined her in October, again using the stethoscope only 'briefly', and restated his diagnosis of hypertrophia, the prognosis of which was death.[357] Forbes examined her once more in February 1822, though there was no mention of whether the stethoscope was employed on this occasion.[358] When the patient died in 1823, Forbes was not able to perform the autopsy himself but another practitioner in Penzance, Dr Barham, did examine the body and wrote a letter to Forbes detailing the findings.[359] Forbes had been mostly incorrect in his diagnosis but explained he was unsurprised by his failure as it was one of his 'very first cases'.[360] Forbes indicated that he did examine other patients with the stethoscope while in Penzance, but he did not include them in *Original Cases* and it is likely that his early uses of the instrument were all 'imperfect'. He had not yet examined enough patients and had his diagnoses verified (either by confirmation or refutation) to develop consistent skill with the instrument.

In March 1822, roughly six months into his trials, Forbes moved to Chichester to replace naval physician and Edinburgh graduate William Burnett, who was leaving his position at the Chichester Public Dispensary to take up a position on the victualling board of the Navy.[361] Here Forbes ran a successful private practice as well as working at the dispensary,

[355] Forbes 1824, 268.
[356] Forbes 1824, 104.
[357] Forbes 1824, 105.
[358] Forbes 1824, 105.
[359] Forbes 1824, 105.
[360] Forbes 1824, 108.
[361] ODNB s.v. Sir William Burnett.

which gave him greater opportunities to trial the stethoscope as he had two sources of patients.[362] Forbes continued his practice of recording stethoscopic signs and other symptoms, as he had done in Penzance, but once in Chichester he was better able to follow up his findings with dissections. Forbes stated that practitioners would find it easier to learn how to use the stethoscope through hospital practice, rather than in dispensary or private employment.[363] Despite dispensaries generally accepting patients who were more likely to die, for reasons that I will further explore in Chapter 2, practitioners argued that hospitals were the best place for students to learn new diagnostic skills.

Forbes saw most of the cases reported in *Original Cases* during 1823: he reported 21 cases in that year. By this time Forbes found his diagnoses from stethoscopic signs tended to be successful, having moved from 'imperfect' application of the stethoscope in his early cases to increased reports of his diagnoses being 'perfectly accurate'.[364] The trials increased Forbes' appreciation of Laennec's diagnostic methods and developed his skill with the stethoscope. He developed his ability through careful observation of the symptoms and stethoscopic signs of the patient, forming a diagnosis, and then having that diagnosis verified in some way. In cases where the patient did not die, or where he could not dissect the patient after death, Forbes' diagnoses were less certain. Forbes recorded 11 cases as 'supposed' or 'suspected' diagnoses; in all of them the patient either survived or he could not conduct a post-mortem.[365] It is worthy of note that he did not refer to all cases where dissection was not possible as 'suspected'. In some instances, he understood successful treatment as proof of the correctness of his diagnostic assessment.[366] In gaining skill with the stethoscope, Forbes became entirely convinced of its utility. In late 1823 he wrote a letter to Laennec apologising for the 'great liberties' he had

[362] ODNB s.v. Sir John Forbes.
[363] Forbes 1824, xxv.
[364] Forbes 1824, 267.
[365] Forbes 1824, xxxiii-xxxv. Cases: V, XI, XII, XIII, XVI, XVII, XVIII, XIX, XXV, XXXIV and XXXVIII.
[366] Forbes 1824, 170; 178; 210.

taken in the first translation, although he also maintained that a British audience would not have read a translation that was as long as the original French work.[367]

In the preface of *Original Cases* Forbes stated that his primary motivation for writing and publishing the book was the worry that British practitioners were not using the stethoscope.[368] He claimed that despite his translation being popular, there was little evidence to suggest that the auscultation was being regularly used by physicians either in private practice or in hospitals.[369] The *Lancet* responded positively to Forbes' *Original Cases* and the review covered two issues, published on 30th October and 6th November 1824. The reviewer emphasised that the stethoscope was *known* to be a valuable instrument for diagnosing diseases of the chest.[370] This suggests that Forbes' impression of British practitioners not taking up the stethoscope was incorrect. The reviewer did note that the stethoscope required the 'utmost attention' and that a 'beginner will be frequently deceived'.[371] However, the author of the review remained supportive of the stethoscope and indicated that they too had spent time on its study and practice in order to determine if it was they or the instrument that was at fault; they concluded that it was their own lack of skill.[372]

Shortly after Forbes published *Original Cases* in 1824 he received a letter from Sir James McGrigor, the Director-General of the Army Medical Services, informing him that the stethoscope had been ordered for general use and study by all army physicians and surgeons.[373] The order was not just that these practitioners should use the stethoscope, but also that all their

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[367] Sakula 1981, 763; Duffin 1998, 213. The Musée Laennec, Nantes, holds this letter. I have not been able to visit. Duffin gives the most detailed discussion of the letter in secondary literature. Sakula gives a small except in his 1981 article.
[368] Forbes 1824, viii.
[369] Forbes 1824, viii.
[370] *Lancet*, 30 October 1824, 145.
[371] *Lancet*, 6 November 1824, 174.
[372] *Lancet*, 6 November 1824, 174.
[373] Forbes 1834, xi. Preface from 1829; Sakula 1981, 559. Sakula claimed that McGrigor (Army) and Burnett (Navy) both went to visit Laennec in Paris. I have not been able to confirm this, it may be written in the original French version of the 2nd Edition of *Traité*, but the only English notices do not mention either men visiting Laennec in France.

findings should be recorded so that understanding of auscultation and percussion, and the diseases they were used for, could be improved.[374] This order is the first clear evidence of widespread learning of the stethoscope, moving away from the personal trials carried out by individual practitioners. Both Duncan and Forbes succeeded in practicing anatomico-clinical correlation: observing patients, forming a diagnosis, and verifying those diagnoses through dissection. These men practiced outside of the Parisian context, which would have provided them greater opportunities for conducting dissection of the same patients observed in life. It is clear that even outside of Paris, British practitioners were capable, on an individual basis, of practicing anatomico-clinical correlation and developing skill with the stethoscope and the method of mediate auscultation.

1.7 – Conclusion

The aim of this chapter was to begin to answer the two main questions of the thesis: why did British practitioners take an interest in mediate auscultation and the stethoscope, and how did they develop skill with the instrument? Focusing on the first ten years following Laennec's invention of the instrument (1816-1826), the chapter has asked what first drew British practitioners to the practice of mediate auscultation and how early adopters developed skill with the stethoscope.

It became apparent through this chapter that all three British practitioners who first experienced the stethoscope in Paris – Granville, Clark, and Haden – had their own motivations for being in France which were not to do with mediate auscultation. The earliest encounters with the instrument occurred by chance, with practitioners who had some interest in new diagnostic approaches happening to be in Paris in 1816-18 for other reasons. Through observing Laennec or other Parisian stethoscope users, each practitioner became convinced of

[374] *Lancet*, 6 August 1826, 567. Misspelled as MacGregor.

the utility of mediate auscultation and the stethoscope in forming accurate diagnoses. Granville wrote favourably about Laennec's work in the *London Medical and Physical Journal* on his return to London, though there is no indication he personally adopted the use of the stethoscope in his own practice, and he often emphasised Laennec's pathological anatomy rather than diagnostic method. Haden died soon after his time in Paris, limiting his ability to advocate for the technique or instrument in print or in person. Of the three, it was only Clark who was able to encourage his friends and colleagues to take an interest in and adopt mediate auscultation and the stethoscope. Clark's advocacy directly encouraged James Johnson, editor of the *Medico-Chirurgical Review*, to trial the instrument and publish work promoting the method of mediate auscultation in his journal. In addition, Johnson's interest in the stethoscope increased the commercial availability of the stethoscope for practitioners in London. All this happened within the first few months following Laennec's formal publication of his work on mediate auscultation and the stethoscope.

The main impact of James Clark's advocacy was his encouragement of John Forbes in translating Laennec's work into English. Forbes was initially uninterested in the practice of mediate auscultation and the stethoscope, focussing instead on Laennec's work in pathological anatomy. Nevertheless, the British medical community received his *Treatise* with enthusiasm and many journals wrote long and positive reviews of his work. Forbes' book (which came about in no small part due to Clark's advocacy and encouragement) and the reactions to it dramatically increased awareness of, and interest in, mediate auscultation and the stethoscope in the British Isles.

Once practitioners were aware of mediate auscultation and the stethoscope, this chapter begins to answer how they went about developing skill with the instrument. In the first ten years following Laennec's invention of the stethoscope there were two distinct approaches to developing this skill: learning in Paris or trialling in Britain. Many who encountered the stethoscope in Paris began studying the method of mediate auscultation there, which gave them access to all of the benefits of the Parisian system. These benefits included increased access to cadavers for post-mortem examinations and systematic clinical teaching, enabling them to routinely practice anatomico-clinical correlation which aided their ability to understand the utility of the stethoscope. Additionally, those learning in Paris studied under the direct tutelage of teachers who were skilled in mediate auscultation and stethoscope use, could accurately and appropriately guide their study and effectively demonstrate the instrument. Those practitioners attempting to develop skill with the stethoscope in Britain had none of these advantages.

Practitioners in the British Isles who would not or could not visit Paris instead developed their skill in mediate auscultation through conducting personal trials with the stethoscope. Through looking at the trials Forbes published in his book *Original Cases* it becomes apparent that these personal trials followed the same basic structure as Parisian practice: observing the living patient, forming a diagnosis, and then verifying the diagnosis at dissection should the patient die. The practice of anatomico-clinical correlation was not restricted to the Parisian hospital structures and, although practitioners there may have been able to practice it more routinely, the few cases British practitioners were able to follow thoroughly convinced them of the diagnostic utility of mediate auscultation and the stethoscope.

This chapter, therefore, provides an answer to both thesis questions. Practitioners took an interest in mediate auscultation and the stethoscope, in part through directly experiencing the instrument in Paris or through exposure to the concept of mediate auscultation in print media such as journals and books, as well as through the advocacy of those with direct experience. They then developed skill with the instrument through direct experience with trained teachers in Paris, including the practice of anatomico-clinical correlation, or through personal trials in Britain. These personal trials similarly involved the practice of anatomico-clinical correlation, but the distinct structural differences between the Parisian and British medical institutions made their practice much less routine and with far fewer cases. It is important to note, however, that these limitations on the practice of anatomico-clinical correlation in Britain did not prevent the British practitioners conducting these trials from becoming fully convinced of the diagnostic accuracy of the instrument and technique.

While the reasons for interest in the stethoscope stayed much the same for most practitioners in the British Isles – they became aware of the positive applications of the instrument in forming accurate diagnoses – the method of skill development continued to evolve. This chapter looked at skill development on an individual level, considering only the personal trials of the earliest adopters of the instrument. As this chapter demonstrated, the structure of the French medical system encouraged widespread reforms to medical education and the routine practice of anatomico-clinical correlation. The next chapter looks at how British practitioners developed skill with the stethoscope on a broader scale than the individual trials discussed here. How did British medical students develop skill in using the stethoscope within a medical and educational structure which did not encourage or enable the practice of anatomico-clinical correlation?

Chapter 2 – Teaching the stethoscope: British medical education and the promotion of stethoscopic skill.

"My plan has always been, to spend two or three hours at the visit; to converse familiarly with the pupils on the cases; to request everyone to observe the countenance of the patient … to present each with my stethoscope who has not one, and stand patiently at the bedside while he is listening; in short, to act the part of a private tutor in the wards to each, just as the demonstrator does in the dissecting-room."

– John Elliotson, Introductory Address to the Winter Session, University of London, 1832.

2.1 – Introduction

In the previous chapter I established that in forming any diagnosis with certainty a practitioner needed to observe the patient, make a diagnosis, and then have some sort of verification. The early adopters of the stethoscope developed their skill through personal trials of the instrument following the practice of anatomico-clinical correlation. That is: observing the symptoms in the living patient, making a diagnosis, and having that diagnosis verified (by confirmation or refutation) by the morbid anatomy seen at dissection. This chapter will demonstrate how, between 1825 and 1835, practitioners and medical students learnt to use the stethoscope outside of these independent trials. It emphasises the British practice of what I shall call *symptomatic-pathological correlation*; observing the symptoms of the living patient, making a diagnosis, and having that diagnosis verified through some means often *relating* directly to pathological anatomy, but not necessarily requiring it. Similarly, it brings in the concept of Observation, making a Diagnosis, and Verifying that diagnosis (ODV), a larger category, of which both anatomico-clinical correlation and symptomatic-pathological correlation are instances, but which need not take the form of either named practice.

For practitioners to learn how to use the stethoscope they needed to be able to *confidently and accurately* infer the state of the morbid internal changes with the sounds they heard through it. A confident and skilled stethoscope user was one who felt that they could regularly and accurately infer internal changes from the sounds they heard, regardless of whether dissection later showed that diagnosis to be accurate. At the stage where a practitioner became skilful in using the stethoscope, they would be confident enough in their knowledge and ability to correlate the signs to no longer need verification by dissection. Practitioners could only acquire such adeptness through a great deal of practice.[375] The difficulties surrounding the development of stethoscopic skill were well known to practitioners at the time. Some suggested that the care and attention necessary for understanding how to use the stethoscope was the greatest hindrance to its general adoption.[376] Learning how to use the stethoscope took a lot of time and patience; it was not enough to put it down after a few unsuccessful attempts, skilful employment relied on continuous practice.[377] Practitioners seemed to note a particular difficulty in learning the sounds relating to the heart. Indeed, in 1830 well-known physician James Hope, who historians link to the founding of cardiology, stated:

> We have not unfrequently had occasion, during a series of years, to witness the early attempts of individuals commencing the study of auscultation; and we cannot recollect an instance in which one, unaccustomed to the stethoscope, could satisfactorily distinguish the two sounds of the heart on the first application of the stethoscope.[378]

As I have already shown, the French medical context in which Laennec invented the stethoscope differed greatly from the British one, which saw far fewer opportunities to dissect and had no centrally organised hospitals.[379] Medical practitioners in Paris worked within a

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[375] Collins trans. Ryland 1825, x.
[376] Collins trans. Ryland 1825, xiii; Forbes 1827, vii.
[377] Scudamore 1826, x; Spittal 1830, 13; Mackintosh 1837, 452.
[378] Hope August 1830, 783.
[379] Connolly 1828.

system that allowed for regular observations of patients followed by verification of their diagnoses through post-mortems. Each time a French practitioner reached a diagnosis using stethoscopic signs and the post-mortem proved those signs to be correct, they gained more confidence in their future ability to diagnose based on those same stethoscopic sounds. Eventually they would be able to accurately diagnose a patient by combining their new-found knowledge of the sounds of the stethoscope with both their knowledge of the morbid anatomy *and* with past diagnoses which had proven correct. The British early adopters, such as Forbes and Johnson, similarly relied primarily on their individual access to dissections, and the indications seen there, as verification of diagnosis.

The work of Malcom Nicolson previously assumed that the English medical environment (hospital and teaching structures), in conjunction with reduced opportunity for dissection, limited the ability of British practitioners to adopt the stethoscope.[380] In contrast, he argued that practitioners in Scottish medical institutions were more likely to respond positively to the instrument, as they had closer ties to French practice (having been less affected by the Napoleonic Wars) and as such Scottish physicians adopted the stethoscope earlier and with less conflict.[381] But as we are about to see, evidence from journals and books around Britain suggest that (a) dissection had less impact on stethoscope uptake than might first be imagined, and that (b) the Scottish medical schools did not have any particular advantage, in respect of readiness to embrace the stethoscope, over those in London.

To understand how this is the case it is first necessary to understand both the process by which ODV functions and its component parts. The first stage is observation of patients: recording their symptoms in life and noting any changes during the progress of disease. It is in this first stage that, in the examples relevant to this thesis, the practitioner would carry out a

[380] Nicolson 1993, 151.
[381] Nicolson 1993, 151-152.

stethoscopic examination. The second stage would see the practitioner form and ideally record a diagnosis based on this observation and examination. The final stage of the process is that of verification: there must be some method of verifying the diagnosis, by confirmation or refutation. Verification aided the practitioner in understanding where they succeeded or failed in their diagnostic methods, so that they may correct it in future or gain confidence in their skills.

Historians have generally understood this verification to mean 'dissection', which did take place in British practice. In section 2.2 I outline the ways in which British practitioners did have access to cadavers and could verify their diagnoses through the practice of anatomico-clinical correlation, as well as two alternative modes of verification which rely on anatomy (specimen use and animal experiments) but which did not require the practitioner to conduct a dissection. These alternative forms of verification constitute the practice of symptomatic-pathological correlation; that is, the observation of the living patient, making a diagnosis or (in experimentation on animals) making a claim regarding the internal organs, and then verifying the diagnosis by relating the symptoms to *some form* of anatomical information.

As implied by the works of Morgagni, Auenbrugger, and Laennec, who all had access to a large number of cases and post-mortem indications, the practice of anatomico-clinical correlation necessitated a high volume of cases. British practitioners spoke against such requirements for understanding auscultation; some indications were so clear it was sufficient to hear them only once to recognise them again ever after, and many illnesses were distinct enough that a practitioner only needed to see them in two or three patients to know them with certainty.[382] Diagnostic verification did not necessarily rely on a large number of cases and could come from a range of sources, both anatomical and not. Sections 2.3 and 2.4 offer two

[382] Forbes 1828, 8; Forbes 1830, 7.

distinct verification methods (treatment and expert guidance) which are entirely separate from any practice of dissection or anatomical study. Both these alternatives were available to British practitioners as a means of verifying their diagnoses without access to cadavers nor any means of understanding the internal anatomy of the patient. These methods allowed for the practice of ODV without either sub-practices of symptomatic-pathological correlation or anatomico-clinical correlation.

Section 2.5 more closely examines teaching practices related to the stethoscope through the published lectures of John Elliotson, a well-known stethoscope advocate who studied in Paris under Laennec before returning to London in 1826 and practising in St Thomas's Hospital. Through Elliotson's lectures it is possible to see the different methods of verification as they functioned within an educational medical context, moving from general theory and discussion into concrete examples of teaching. It will become apparent that teachers expected their students to have a high level of anatomical knowledge, which likely supported their ability to correlate the symptoms in the living patient with the known pathological signs.

The assumption of anatomical knowledge brings in an additional question about the general expectations around medical education. Section 2.6 will outline the apparent expectations of medical education in the 1820s and then move towards the more formalised medical curriculum which developed in the late 1820s to early 1830s, including a discussion of the 1832 Anatomy Act. It will become clear that these codified expectations of medical education enabled the forms of verification which supported students to develop skill with the stethoscope. It will come as no surprise that prominent stethoscope advocates such as James Clark, James Johnson, and John Elliotson were involved in the formalisation of British medical education. These reforms and teaching methods came from practitioners who had carried out their own individual trials and then, most notably in the case of Elliotson, went on to teach incoming medical students, passing on their knowledge of auscultation in the process. I have not always been able to demonstrate skill development for any particular individual, but this chapter identifies general patterns into which these historical agents fit.

This chapter primarily aims to explain how British medical students developed skill with the stethoscope despite the relatively low level of post-mortems compared to other countries. Dissection still played a key role in British medical practice and education, but with fewer cadavers available the learning environment differed greatly from that in France, where Laennec invented the stethoscope. This chapter asks: how did British medical teachers and students manage these differences in medical context to develop their stethoscopic skills?

2.2 – Methods of Verification

Anatomical Pedagogy

As demonstrated in the previous chapter, the opportunity for practitioners to carry out dissections was a fundamental requirement if they were to develop skill in mediate auscultation and stethoscope use. Dissection as a form of verification appeared to be a key part of developing diagnostic skill, similarly it was the form of verification that the practitioners themselves were the most cognisant of. Most practitioners appeared to use the words 'dissection' and 'post-mortem' interchangeably, despite there being a supposed distinction: dissection involved unclaimed bodies from workhouses and prisons, post-mortems involved hospital patients.[383] In this section I follow most practitioners in using the word dissection without any particular reference to this official distinction.

Practitioners at the time were certainly aware that there were, on average, fewer opportunities to dissect bodies in Britain than there were abroad.[384] They understood that, even as the possibility for dissections increased, compared to the hospitals on the continent there

[383] Richardson 2000, 110.
[384] Connolly 1828; Richardson 2000, 102.

was still a scarcity of bodies.[385] This comparative lack was not necessarily viewed as a large hindrance to British practice, indeed some practitioners suggested that dissections in Britain were better than those in France, as the scarcity encouraged careful and thorough work (as opposed to hasty and messy dissections in Paris, where bodies were so easily available).[386]

British anatomists disagreed regarding how many dissections students needed to attend in order to achieve an appropriate level of understanding; some argued that students needed to dissect at least three corpses, whilst others suggested that students need only examine parts of a body as long as these parts added up to a full body.[387] Even within these debates no group disputed that there existed no 'adequate' substitution for dissecting a human body when it came to the study of anatomy.[388] Bodies became increasingly difficult for practitioners to obtain as cities and towns increasingly enforced the laws against grave robbing.[389] Other, often illicit, means of appropriating bodies began to occur, with many hospital porters selling the bodies of paupers who died in hospitals to the anatomy schools for substantial fees.[390] Hospitals tended to have a higher mortality rate inside their institutions and their own cemeteries for unclaimed bodies; an easy place to obtain bodies with few people noticing.[391] These illicit methods of obtaining bodies incurred a high price and still had a relatively low yield; as the laws tightened on practices such as grave robbing the price of bodies increased due to reduced availability.[392]

Despite British practitioners having fewer opportunities for dissection than their Continental neighbours, this did not mean they had no opportunities at all, or even an insufficient amount of such opportunities. Forbes stated in 1824 that it was much less difficult

385 Lee 1835; 7.
386 Lee 1835, 7; Craig 1833, 15.
387 Richardson 2000, 54.
388 Richardson 2000, 104.
389 Richardson 2000, 101.
390 Richard 2000, 104.
391 Richardson 2000, 104; 105.
392 Richardson 2000, 106.

to get permission to dissect than the general public imagined.[393] Additionally, Ryland noted that patients in hospitals rarely opposed the application of the stethoscope, seeming to appreciate the (appearance of) extra attention.[394] This meant that practitioners had a greater ability to examine patients with the stethoscope and then dissect. As we saw in Chapter 1 from Forbes' *Original Cases*, he was able to access a not insignificant number of bodies for autopsy. From these discussions it appeared both that patients often submitted easily to examination with the stethoscope, and that practitioners often had access to a reasonably large number of patients and could gain permission to dissect without much opposition. Practitioners were able to observe the patient, to examine with the stethoscope, to make a diagnosis and finally to verify their diagnosis through dissections, thereby meeting the necessary criteria to develop skill in forming diagnosis with the instrument. Whilst British practitioners undoubtedly had *fewer* opportunities to dissect, this was not necessarily *insufficient* access. By the early 1830s practitioners acknowledged that the system seen in Paris – stethoscope used in all cases and predicting signs which were confirmed at dissection – now occurred in most British hospitals and that practitioners 'dissect with great accuracy'.[395]

These opportunities for dissection served to emphasise the importance of hospital practice in learning how to use the stethoscope; it facilitated the teaching and learning of the stethoscope, above and beyond private practice and personal trials.[396] Practitioners acknowledged that, particularly for students, it was best to learn the stethoscope and other medical skills in a hospital setting.[397] Only in a hospital could students 'completely and certainly' acquire the habit and ability of the new art of observation offered by the stethoscope.[398] Practitioners viewed dispensary practice, in which Forbes carried out his trials,

[393] Forbes 1824, xxvi.
[394] Ryland 1825, xii.
[395] Craig 1833, 15.
[396] Forbes 1824, xxv.
[397] Norris 1825, 17.
[398] Laennec trans. Forbes 1828, 8.

as inadequate for students.[399] Dispensary patients were generally in their own homes, which limited the practitioner's ability to examine them and to access their bodies after death.[400] The ability to link symptoms with the morbid signs of disease was not something students could learn from dispensary practice, nor could they acquire it from simply attending lectures; they required frequent visits to hospitals and sick chambers to observe the diseases in person.[401] Students could derive benefit from clinical lectures, but practitioners were aware that these lectures could not supersede the necessity of clinical instruction on the wards.[402] One of the most important aspects of hospital practice was that 'no time [was] wasted' in practitioners being able to examine a patient's body after death.[403] Practitioners, therefore, were aware of the importance of dissection in medical education and encouraged hospital practice in order to facilitate access to post-mortems.

British medical practitioners understood dissection as being important for two reasons: developing pathological knowledge and verifying diagnostics through examining the morbid anatomy. In the rest of this section I will outline these two uses for dissection. It will become apparent that practitioners assumed their students would have a certain level of pathological knowledge, gained through anatomical study and dissection, which informed any diagnostic decisions. This expectation of pathological knowledge from dissection further suggests that British practitioners at least had sufficient access to dissections to prevent their medical education suffering from a lack of anatomical knowledge. The second – and for the purpose of understanding stethoscope uptake, more important – use of dissection was the verification of diagnosis. I will show that British practitioners used dissection to verify their diagnostic claims

[399] Billing Nov 1831, 235; Elliotson 1832c, 36.
[400] Elliotson Oct 1832, 37.
[401] Lawrence 1832, 14.
[402] Lawrence 1832, 15.
[403] Elliotson 1832c, 37. Quote altered to change tense from present to past.

in much the same way as those in Paris, the comparative lack of bodies having little impact on the effectiveness of this practice in aiding skill development.

In respect of the first of these uses of anatomy, practitioners teaching students anatomy considered dissection a tool for learning the 'Science of Organisation' which constituted a healthy body – that is, normal anatomy.[404] Beyond the healthy signs, practitioners were also aware that dissection was necessary for the acquisition of pathological knowledge.[405] Advice to students encouraged them to take all (favourable) opportunities to examine dead bodies so that they could develop their understanding of the morbid pathological signs.[406] Those practitioners involved in teaching students expected their students to be familiar with these pathological indications; to have knowledge of anatomical structure both in general and for specific diseases.[407] Development of this knowledge – acquaintance with all the different morbid states and their corresponding signs – required students to undertake a 'significant' amount of study, yet by 1833 William Craig, who taught at the University of Glasgow, as well as stethoscope advocates William Stokes and Charles Scudamore, stated that this study 'may be easily done'.[408] Practitioners acknowledged, therefore, the importance of dissection in developing knowledge of both healthy and morbid anatomy, and their expectation regarding levels of student knowledge suggests that dissections were not as uncommon as historians had previously assumed.

As for anatomy's second and more important use, practitioners were aware that the 'unerring testimony' of dissection could confirm or refute their diagnoses.[409] Indeed, Forbes advised those learning how to use the stethoscope to be cautious of using the information they

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[404] Turner 1824, 3.
[405] Collin trans. Ryland 1825, 45; Norris 1825, 19.
[406] Norris 1825, 18. Norris did not specify what was meant by 'favourable' but one would assume that included in that was the caveat of 'legal' or 'legally sourced'.
[407] Scudamore 1826, 28; Stokes 1828, 41.
[408] Craig 1833, 20.
[409] Forbes 1824, xxix.

gained through auscultation to inform the treatment of patients until experience and dissection convinced them of the general correctness of their observations.[410] Victor Collin, a French practitioner, stethoscope advocate and contemporary of Laennec, wrote that distinguishing signs of some illnesses could only become known to the practitioner after death; certain diagnosis of such diseases would always be difficult but was only possible in the first instance from knowledge of these morbid signs.[411] Diagnoses of disease could be 'perfectly verified' by dissection of the patient after death, allowing the practitioner to gain confidence in their diagnostic skills (or, where necessary, to correct their methods).[412] Indeed, there was widespread agreement on this matter, particularly between 1824-1827, starting with Laennec and Forbes, but spreading to other stethoscope users and advocates such as Stokes (in Ireland), Scudamore (in Europe and then London), and Craig (in Edinburgh). Practitioners could use dissection to verify their diagnostic decisions.[413] This appeared to be the case for all diseases and diagnostic methods, not only for the stethoscope but also for practitioners interested in percussion, to whom the importance of verification was similarly well known.

Scudamore stated in his 1826 book on the instrument that dissection offered 'proofs of sure diagnosis'.[414] The diseases of the lungs and heart allowed for frequent opportunities to examine bodies and 'test of the physician's judgement', as they appeared regularly in hospitals and were often the cause of the patient's death.[415] Laennec endorsed this opinion in the second edition of *Traité*: in order for a practitioner to acquire confidence with the instrument it was necessary to use dissection to verify the diagnostic signs established by the stethoscope.[416] Laennec, and thus Forbes in the translation, stated that dissection offered practitioners who

[410] Forbes 1824, xxix.
[411] Collin trans. Ryland 1825, 46.
[412] Stokes 1825, 75; 100.
[413] Stokes 1828, 327.
[414] Scudamore 1826, 10.
[415] Scudamore 1826, 10.
[416] Laennec trans. Forbes 1827, 8.

were learning the diagnostic method of auscultation further evidence of the correctness (or otherwise) of the indications obtained by the stethoscope and their own observations.[417] Irish practitioner and stethoscope advocate William Stokes argued that, in learning about diseases, it was the combination of mediate auscultation and pathological anatomy that offered a route to 'facts': practitioners needed to use the stethoscope and dissections to fully understand the nature of some diseases.[418] Dissection formed a clear part of British medical practitioners' methods in terms of teaching and learning the stethoscope.

Surgeon and vocal medical reform advocate William Lawrence made it clear that students should examine and closely watch the patient, observe the origin and progress of altered function in life, and then investigate the changes produced after death.[419] This outlines what I have described in the thesis as the practice of anatomico-clinical correlation; observing the living patient, forming a diagnosis, and having that diagnosis verified in some way. As I established earlier in this chapter, cases where dissection was possible were sufficiently common that practitioners could verify their diagnoses from the stethoscope.[420] Charles Turner Thackrah in Leeds stated that 'From stethoscope examinations we were able to prognosticate with precision the appearance found after death, the kind, the stage, and the seat of several diseases';[421] indicating that British medical practitioners had opportunities to link the indications of the stethoscope (symptoms) with the morbid (pathologic) signs found at dissection.

Furthermore, as with Forbes, many practitioners had access to a number of cadavers which they were able to dissect.[422] One such practitioner was Scottish physician Robert Spittal,

[417] Laennec trans. Forbes 1827, 8.
[418] Stokes 1828, 44.
[419] Lawrence 1832, 14.
[420] Craig 1833, 14.
[421] Thackrah 1834, 211.
[422] See Duncan Jr, Johnson, and Stokes, for just a small set of practitioners regularly carrying out dissections during their stethoscopic trials.

who saw 44 cases of heart or lung disease (or both) between 1828 and 1830, of which he was able to dissect 41.[423] This is particularly impressive as Spittal was based in Edinburgh, where there were fewer cadavers than London due to its smaller population.[424] Spittal seemingly had a similar number of cases to Forbes during his earlier private trials of the stethoscope, suggesting that the Parisian system of obtaining bodies was not *required*; regular access to bodies simply increased the rate of learning, while any access at all enabled the development of the skill.

Dissection was clearly a fundamental part of British medical practice, with practitioners at the time acknowledging both its importance for understanding the body and the necessity of post-mortems in the development of diagnostic skill, especially with the stethoscope. Dissection was probably one of the most common forms of anatomical investigation that Continental practitioners had at their disposal, especially those in Paris, and historians have devoted much of their attention to this method.[425] However, the act of dissection as outlined above, of a whole body examined after death, forms only a narrow view of how practitioners could use morbid anatomy to educate students and aid the development of diagnostic skill. I have identified two alternative methods – that still used anatomical investigation – which practitioners employed to aid student understanding of morbid anatomy and to form the connection between the symptoms and the corresponding pathology: the use of specimens and the practice of animal experimentation. These practices were important tools for students gaining knowledge of morbid anatomy and developing skills in correlating the symptoms with the pathological state of the body, useful for general skilful diagnosis and diagnosis with the stethoscope.

[423] Spittal 1830, 155.
[424] Spittal 1830; Nicolson 1993, 151; Richardson 2000, 101.
[425] For more on dissection in France and Britain, see particularly Maulitz 1987 and Richardson 2000.

Anatomical Preparations

Rather than using dissection of a whole body, practitioners could use anatomical preparations of the relevant organ as a means of encouraging their students to correlate the sounds they heard with the stethoscope to the internal pathological anatomy. An anatomical preparation was a part of the body – tissue, bones, an organ or system (such as nervous, lymphatic) – removed from the body and preserved using wax, oil, or other embalming fluids, and displayed. Practitioners used preparations to preserve physical evidence found at dissection.[426] I categorise anatomical preparations as distinct from dissection of the whole body because, once made, the preparation existed in preserved state which demonstrated the morbid pathological anatomy separate from the specific body it came from – it became a general demonstration, rather than specific. Preparations, therefore, were parts of dissected bodies which practitioners preserved as pieces of evidence for further study or demonstration.[427] Medical practitioners and educators could use preparations to serve the same ends as dissection; that is, to encourage the development of anatomical knowledge and to provide verification of a diagnosis.

Anatomical preparations as a method for developing anatomical knowledge stemmed from the 18th century, with private medical schools teaching the art of making preparations as part of anatomy courses.[428] Anatomists made preparations of both healthy and diseased parts of the body, preserving evidence for general and pathological anatomy, respectively. By the 1825, medical educators such as William Norris, during a speech to the Royal College of Surgeons in London, encouraged students to cultivate their knowledge of anatomy through creating anatomical preparations in their leisure time, alongside their studies.[429] Practitioners

[426] Chaplin 2009, 95.
[427] Chaplin 2009, 35.
[428] Chaplin 2009, 105.
[429] Norris 1825, 13.

such as William Greville Jones, whose 1828 book *A Statement Explaining the Course of Instruction* contained advice for medical students, still considered dissection to be the best method of developing anatomical knowledge but preparations were very useful, as were written descriptions of the dissection or preparation.[430] Teachers of anatomy passed preparations around during their lectures, providing information about the function of the internal part displayed and, in cases of pathological anatomy, details of the case from which the preparation originated.[431] Using preparations, students could become familiar with the morbid appearances of many diseases, without ever having met a patient with that affliction or having dissected the body of one who had died from it. Preparations, then, play a part in explaining why, when there were comparatively so few dissections in British medical practice, medical educators expected their students to be familiar with morbid anatomy.

Medical educators could further use preparations as a form of diagnostic verification, as well as developing a student's general knowledge of both healthy and pathological anatomy. Those practitioners involved in teaching medical students could carry preparations between the clinical wards, dissection rooms, and lecture theatres, allowing the students to have a close look at the morbid anatomy in a variety of contexts.[432] In the first two places, the clinical ward and the dissection room, students benefited from preparations as a heuristic tool. A student could examine a patient, form a diagnosis, and be handed a preparation showing the morbid anatomy that practitioners would expect to see at dissection to confirm that diagnosis. In dissection rooms, rather than needing to be close up to the body, students could circulate preparations so that they might look more closely at the anatomy even if they were in a large class.

[430] Jones 1828, 31.
[431] Davies 1835, 411; 476. This occurred multiple times.
[432] Chaplin 2009, 113.

In the third setting, clinical lectures, the preparations took on the role of verifying a diagnosis in front of a large audience. Students saw patients on the wards, examined them, and formed a diagnosis. If the patient died, then a group of practitioners at the hospital could dissect the body and create preparations of any parts they deemed useful or interesting. The lecturer could then present these preparations during the clinical lecture, confirming or refuting the diagnosis made by the students without each student needing to be present at, or personally carry out, the dissection. On occasions when dissections took several days, or the parts practitioners needed to examine were particularly difficult to observe, preparations offered a much clearer and more easily accessible example to students than crowding them into a dissection room.[433] Students could therefore verify their diagnoses and gain confidence in their diagnostic skill without the need for a particularly high number of dissections to occur.

The same was also true for diagnoses made by use of the stethoscope. John Elliotson, a physician at St Thomas's whose teaching we will examine more closely later in this chapter, took his students around the wards with him so that they could examine patients under his tutelage. In his clinical lecture from November 1827 he circulated a preparation taken from one of the ward patients who had died that week.[434] Students saw the patient and, *using the stethoscope*, made a diagnosis. They then had that diagnosis verified using the morbid anatomy of the *same* patient, with no need for each individual student to be involved in the act of dissection. Elliotson was not the only lecturer to use preparations in this way: stethoscope advocate Archibald Billing used a preparation of a diseased heart, taken from a patient seen on his clinical wards. Billing's students were aware of the stethoscopic signs seen in this patient and then had those signs directly correlated with a preparation of the morbid anatomy taken from that same patient.[435] Dissections still needed to take place but on a much less frequent

[433] 'Notes of Joseph Else's lectures' (Wellcome MS.2292), 13-14, in Chaplin 2009, 118.
[434] Elliotson 1827, 367.
[435] Billing November 1831, 236.

basis, with only a few practitioners needing to be present at each one. The use of preparations enabled students to examine living patients with a stethoscope to make a diagnosis and then have that diagnosis verified, the necessary factors for developing skill with the instrument, *without* necessitating individual presence at multiple dissections.

Experiments on Animals

Practitioners could further attempt to explore subjects relating to auscultation through 'experiments on animals'.[436] They attempted to understand the function of the heart and lungs through opening the chests of living animals.[437] Practitioners viewed these experiments with some distaste, describing themselves performing the vivisections 'with reluctance' and 'not being happy with these experiments'.[438] It is important to note that these experiments were always vivisections; opening up a living animal in order for practitioners to observe the motion of the internal organs before the animal died. Practitioners could use a range of animals to examine the motions of the lungs and heart, conducting vivisections in order to observe the normal function of various organs.[439] Practitioners used these experiments to develop their skill with auscultation, listening to the internal organs of the live animal before opening the (still living) creature to verify if the sounds they identified had been correct. Animal experimentation did not appear to be very common amongst students, but some practitioners who either were teachers or went on to become teachers were involved in these experiments as part of their efforts to understand stethoscope use.

Many of these animal experiments focussed on the sounds of the heart as, compared to the sounds of the lungs, practitioners often had more difficulty identifying the heart sounds in

[436] Raciborski 1835, 68.
[437] Davies 1835, 242.
[438] Davies 1835, 242.
[439] Davies 1835, 242.

human patients.[440] Horses and donkeys were the animal used most often for these stethoscopic heart experiments, though other practitioners also trialled the instrument on rabbits and cats.[441] During one experiment in Ireland, aimed at discovering some sounds of the heart, physician and stethoscope advocate John Creery Ferguson identified the sound of a foetal heartbeat in a donkey where presence of pregnancy had previously been unknown.[442] The two practitioners running the experiment, Ferguson's friends Corrigan and Hunt, confirmed the existence of a donkey foetus soon afterwards during a full dissection of the animal.[443] Corrigan used this experiment to investigate the motions of the heart in relation to the sounds he heard through the stethoscope.[444]

James Hope, commonly regarded by historians as the 'first' cardiologist, conducted a number of experiments on animals as a part of his investigations. Hope designed many of his experiments with the direct intent of disproving Corrigan's claims through repetition of the same process on the same breed of animal.[445] Hope similarly reported on some of Corrigan's previous animal-based experiments, particularly a case in which Corrigan conducted a vivisection on a rabbit; Hope repeated the experiment and argued that rabbit heartbeats were too fast for anyone to reach a satisfactory conclusion from them.[446] Hope accepted that 'experiments on small animals' could benefit practitioners when judiciously combined with knowledge of human pathology, but he preferred to work with larger animals.[447] He mostly commonly used horses or donkeys as the animals for his experiments.[448]

[440] Barry 1827, 651.
[441] Barry 1827, 651; Ferguson 1829, 71; Raciborski 1835, 115.
[442] Ferguson 1830b, 71; O'Brien 1983, 71.
[443] Ferguson 1830b, 71; O'Brien 1983, 71.
[444] Ferguson 1830b, 71; O'Brien 1983, 71.
[445] Hope July 1830, 648.
[446] Hope July 1830, 648.
[447] Hope 1839, 10.
[448] Hope 1839, 291; Hope July 1830, 684.

Hope found that larger animals were particularly useful for understanding the motion of the heart. In July 1830 he conducted two public vivisections on donkeys.[449] In each case he opened the animals' pericardium and applied the stethoscope to the outside of the chest; observing the motion of the heart at the same time as listening to it.[450] Due to the nature of vivisections, human subjects were of course unavailable and even with animal subjects practitioners found them difficult. Hope conducted the second experiment immediately after the first to make sure he could replicate his findings.[451] These vivisections provided vital information about the function of heart valves whilst the heart was in motion as well as increasing Hope, and other practitioners', understanding of the causes of different heart sounds they heard through the stethoscope. They provided a form of verification of the previously only surmised actions of the heart in motion and its related sounds.

This section emphasised that understanding of morbid anatomy played a key part in medical education and the development of diagnostic skill with the stethoscope. Despite British medical practitioners having comparatively less access to dissection than their colleagues in Continental Europe, they could still gain anatomical knowledge and connecting the stethoscopic signs with morbid anatomy. They did this through work with anatomical preparations and conducting animal experiments, which enabled students to develop diagnostic skill by presenting verification of diagnoses without the need for each student to personally attend a large number of dissections. Practitioners acknowledged dissection, and alternatives to it, as an important part of medical education which allowed students and qualified practitioners to develop the necessary skills to confidently and accurately correlate the symptoms with the pathological evidence. It is clear that an empirically grounded understanding of morbid anatomy formed a key part of British medical understanding and, for

[449] Hope August 1830 786; 788. He termed these 'Experiment I' and 'Experiment II' in his report.
[450] Hope August 1830, 788.
[451] Hope August 1830, 788.

the stethoscope, an important role in verifying diagnoses, but it was not always widely available. The next sections go on to discuss methods of verification which acted as alternatives to dissection: verification by treatment and verification by expert guidance.

2.3 – Treatment

An alternative verification method, which did not rely on dissection, anatomical preparations, or vivisection, was for practitioners to infer correct (or incorrect) diagnosis from the success (or failure) of treatments. Dissections had to occur once a patient died, an undesirable outcome in the medical profession, and many patients *did* live, so practitioners had to rely on other methods of verifying their diagnoses. Practitioners built on the anatomical knowledge learnt through dissection, correlated with symptoms, and on this basis made diagnoses and formed treatment plans for their patients. If the patient's symptoms reduced, the practitioner could assume they had ordered the correct treatment as a result of forming the correct diagnosis. This section explores treatment as a form of verification by first looking at the importance of learning healthy stethoscopic sounds, secondly at evidence of practitioners asserting the correctness of their diagnosis when the patient lived, and thirdly at the unique opportunities which arouse from certain surgical treatments.

First, for the purpose of learning how to use the stethoscope, medical educators encouraged their students to practice with the instrument by becoming familiar with the healthy sounds of the chest, often by using the instrument on patients with no signs of disease in the chest.[452] For students to be able to appropriately identify alterations in the normal sounds of the chest they needed to know, by continual examinations of patients without a diseased chest or on each other, the sounds made by a healthy body.[453] This knowledge of healthy sounds worked as a standard of comparison when examining patients, allowing students to recognise

[452] Ryland 1825, x; Stokes 1828, 13; Lawrence 1832, 5; Semple 1858, 90.
[453] Ryland 1825, xii.

when the sounds were unhealthy and how severe that disease was.[454] To be able to understand pathology it was first necessary to understand physiology, which was true for all forms of disease and methods of diagnosis, as much as for auscultation.[455] This emphasis meant that students were able to differentiate between healthy and unhealthy sounds in order to form a diagnosis, a process that could then be reversed in order to ascertain the effectiveness of a treatment.

Secondly, just as students could recognise when the healthy sounds became disordered, similarly they could recognise when previously disordered sounds were returning to being healthy ones. The return of healthy sounds acted as verification that the practitioner's prescribed treatment was having the desired effect. As practitioners derived the treatment from the diagnosis, a treatment which practitioners could evidence to be working also verified the correctness of the original diagnosis. French physician Collin, a keen stethoscope user, stated that it was in treating diseases that practitioners found the true differences which distinguish between each disease.[456] British stethoscope advocates regularly presented cases in which the patient lived due to an effective treatment as evidence for the utility of auscultation.[457] This implies that they saw successful treatment as evidence of a successful diagnosis with the stethoscope. Irish stethoscope advocate William Stokes presented several cases where use of the stethoscope altered the diagnosis, and therefore the treatment, and the patient then recovered, thus confirming the correctness of the diagnosis formed with the stethoscope.[458] Practitioners could use the stethoscope to tell 'with accuracy' the effect of remedies in treating specific diseases of the chest.[459] In cases where Stokes' patients did die he conducted dissections to act as further evidence of his ability to correctly diagnose patients; in some

[454] Stokes 1828, 13.
[455] Lawrence 1832, 5.
[456] Collin trans. Ryland 1825, 44.
[457] Scudamore 1826; Elliotson 1827, 464.
[458] Stokes 1828, 28.
[459] Stokes 1828, 16.

instances he insisted that had the stethoscope been employed earlier and he been able to make a more accurate diagnosis, then a different treatment would have allowed the patient to live.[460] As well as using stethoscopic signs to form a diagnosis, practitioners could use evidence from the instrument as proof that the treatment (therefore, the diagnosis) was correct.[461]

Practitioners assumed that the success of a treatment reflected the accuracy of the diagnosis on which the treatment had been based. When the patient improved practitioners took that as proof that the diagnosis was correct. This proof relied on the practitioner already having knowledge of the correlations between the symptoms in the living patient and the pathological anatomy of the internal organs. Verification by dissection enabled this later form of verification by treatment, but once a practitioner was comfortable with their pathological knowledge, they no longer *needed* dissections, primarily relying on treatments as their form of verification. They still used dissections when possible, but it was not their primary form of verifying their diagnoses. This form of verification was particularly noticeable within surgical practice, where treatment often involved direct interaction with the pathological anatomy.

Thirdly, stethoscopic indications in surgery allowed practitioners to more accurately form a diagnosis and work out where the disease originated.[462] For surgeries such as paracentesis (the removal of liquid from the lungs) a practitioner could use the stethoscope to better locate the fluid and remove it with less damage to the surrounding tissue.[463] In these cases the treatment directly verified the diagnosis; either the practitioner could locate and remove the fluid (confirmation of the diagnosis) or they would carry out the operation and find that there was no liquid (refutation of the diagnosis). Unlike in the study of just physic, where successful treatment led the practitioner to infer the state of the internal structures, surgeons

[460] Stokes 1828, 42.
[461] Elliotson 1827, 464.
[462] Spittal 1827, 25.
[463] Spittal 1827, 25; Craig 1833, 26-27. Craig outlined three cases in which using the stethoscope enabled successful paracentesis.

could access more direct evidence through interacting with the body. Practitioners understood successful operations as confirmation of their diagnoses; successful operations based on stethoscopic signs similarly encouraged practitioners to have confidence in their diagnostic abilities with the instrument.[464] Use of the stethoscope and the use of treatment as verification of diagnosis brought physic and surgery closer together in the minds of many practitioners, as surgery could bring about important knowledge about the state of the internal parts.[465]

Once a practitioner had a level of confidence in their diagnostic abilities and their skill with understanding stethoscopic signs, treatments became a viable form of verification for their diagnoses. A practitioner's correct diagnosis brought about correct treatment, which medical practitioners expected to bring about improvement in the patient. They could therefore use improvement in the patient as evidence of correct diagnosis, reinforcing belief in their abilities and confidence in making a diagnosis when presented with the same set of symptoms and stethoscopic signs in the future. The method of verification by treatment was only possible for practitioners who already had some level of confidence in their diagnostic abilities and who had power over the treatments given to patients. Students who were still early in their medical education needed another method of diagnostic verification in order to develop their general and stethoscopic skills.

2.4 – Expert Guidance

Practitioners who were less confident in the diagnostic or stethoscopic skills often relied on the testimony of others to verify their conclusions. Use of the word 'expert' as a noun first occurred in an Act from King George IV in 1825, though it did not see regular use as a noun until later in the 19th century.[466] Prior to 1825 historical actors understood the term 'expert'

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464 Wardrop 1828, 93.
465 Lawrence 1832, 6.
466 Oxford English Dictionary, 'Expert, (n).'

only as an adjective: in use since c.1374 the adjectival form of expert meant ‘trained by experience or practice, skilled’.[467] Due to the relatively new nature of the term ‘expert’ as a noun, this section will use the term ‘expert guidance’ as one which practitioners at the time would have been more familiar with. Where access to material from dissection was not possible and they had not yet developed the necessary skills for verification by treatment, new stethoscope users who lacked access to material from dissection could rely on the expert guidance of a teacher or colleague with greater stethoscopic skill to verify their diagnosis. Those offering expert guidance did so either in books or in person; students benefited more from the in-person guidance rather than the written, as without both parties examining the patient the advisor could not be tailor their suggestions to the student and situation.

In the case of expert guidance though books, early adopters tended to present their guidance in written works, such as in the case of the popular works of both John Forbes and Irish practitioner and stethoscope advocate William Stokes. Forbes suggested in his 1824 book *Original Cases* that the evidence he provided could lead readers to the same conclusions he reached ‘just as well as if they had done the actual exploration on a living subject’.[468] Here Forbes presented his testimony as a form of expert guidance, suggesting that readers could use his work to understand the diagnostic method of auscultation. At the same time, Forbes relied on the suggestion ‘any competent judge’ could verify his (written) diagnoses from the case summary he provided even when he could not provide information from dissection.[469] Here the notion of expert guidance applies two-fold: Forbes’ experience with the stethoscope suggested to readers that he could offer expert guidance, whilst simultaneously he relied on the skill of his readers to enable them to verify some of his diagnoses. William Stokes advocated students develop the ability to ‘properly connect’ the signs from the stethoscope to the pathological state

[467] Oxford English Dictionary, ‘Expert, (adj. 2).’
[468] Forbes 1824, xxvii.
[469] Forbes 1824, 243.

of the viscera.[470] In an effort to encourage students to form these connections Stokes presented an outline both of the stethoscopic phenomena and the corresponding morbid conditions (ascertained by dissection).[471] If students turned to Stokes as a reference for stethoscopic signs, they could 'be at once led' to an overview of the expected morbid anatomy.[472] As seen in these two examples, those with more experience with the stethoscope presented their work as a method for students to verify their understanding of stethoscopic signs: they offered expert guidance.

Similarly, the *Lancet* ran two articles in 1826 in which they provided 'Directions for the Use of the Stethoscope'. The articles contained practical instructions such as how to hold the instrument and which positions the patients and practitioners should adopt during an examination.[473] They further explained some of the most common sounds of respiration and the voice; the author claimed that sounds of the heart would require a separate set of articles which never appeared.[474] Subscribers seemed to have requested the second part of the article, demonstrating a desire to have further information on how to use the instrument, although the article itself suggests that they read Laennec's latest edition of *Traité* for the most recent guidance.[475] The article makes a distinction between immediate and mediate auscultation, claiming that it was only when Laennec could not practice immediate auscultation that he invented the stethoscope.[476] The article does not mention the possibility of practicing immediate auscultation rather than mediate, instead it assumes that practitioners will be using the instrument. It cited other written works, most notably Forbes' *Original Cases*, as another source of guidance for practitioners to learn about the stethoscope.[477] There was clearly a

[470] Stokes 1825, 6.
[471] Stokes 1825, 7.
[472] Stokes 1825, 7.
[473] *Lancet* August 1826, 669.
[474] *Lancet* August 1826, 668; *Lancet* December 1826, 313.
[475] *Lancet* December 1826, 312.
[476] *Lancet* August 1826, 668.
[477] *Lancet* August 1826, 668.

market for written guides on how to use the stethoscope and interpret the sounds heard through mediate auscultation.

Although practitioners widely acknowledge that the stethoscope was a difficult instrument for anyone to learn 'by aid of an instructor', they also routinely asserted that students could easily overcome this difficulty.[478] An instructor who already had practical skill with the instrument, could help a student navigate the task of learning how to use a stethoscope without the intense labour that early adopters had needed to achieve the same result. The student examined the patient and reported the stethoscopic signs, then an instructor – presumed to be skilled in use of the stethoscope – similarly examined the patient and gave their opinion on the sounds identified. In this way students had their opinions verified or corrected by a more skilled practitioner. Over time the student's verdicts increasingly overlapped with those of the skilled practitioner, building their confidence and ability to accurately diagnose a patient with the aid of auscultation. Hope claimed to have taught four students how to adequately diagnose various diseases of the heart within only 10 minutes, under his guidance and with patients on whom he had already conducted stethoscopic examinations.[479] When 'efficiently taught' medical students could develop diagnostic skill with the stethoscope in very little time at all, although there was no note on how well the students continued to use the instrument following this instruction.[480]

Practitioners offered 'practical instruction in the use of the stethoscope' as part of their medical courses.[481] Many of these courses further entitled students to access the hospital wards and clinical lectures, the prime setting for developing stethoscopic skill.[482] Lecturer Archibald Billing noted that within hospital practice there was 'not a moment in the day' where trained

[478] Kay 1828, 757.
[479] Pocock 1838, 741.
[480] Pocock 1838, 741.
[481] Corrigan 1831, 1; Riadore 1830, 17.
[482] Corrigan 1831, 1.

medical officers were not at the student's disposal.[483] Billing himself used a stethoscope as a part of his teaching; however, he seemingly also practiced immediate auscultation on occasion, and gave descriptions of the sounds and sensations practitioners could expect from placing their ear directly onto the patient's chest.[484] His uses of immediate auscultation appeared rare, likely influenced by Laennec's disapproval of the practice and Billing's own interest in the stethoscope. Trained practitioners offered their skill and expert guidance as part of the process of educating medical students. Furthermore, practitioners offered this expert guidance within *paid* medical courses, suggesting that there was student demand for such guidance as they deemed it worth paying for. Few individuals could fully acquire stethoscopic skill from books alone, they required assistance from 'one already instructed in it'.[485] Practitioners appeared to understand that expert guidance was a necessary part of developing skill in mediate auscultation, acting as a form of diagnostic verification that allowed students to build confidence in their abilities.

Practitioners used expert guidance to verify their own diagnoses as well as for guiding the education of students. In uncertain cases practitioners could request that another person skilled in the stethoscope listened to the patient to test whether the two agreed on the sounds present.[486] When a practitioner was unsure of their abilities, they sought the opinions of those with 'superior knowledge of diseases of the chest and stethoscopic tact' to verify their opinions.[487] Occasionally the patient later died, and the practitioners could conduct a post-mortem to further verify their opinions, often revealing the expert guidance to have been correct.[488] The practitioners who offered expert guidance had often developed their skills through extensive personal trials where dissection played a key part in their verification

[483] Billing November 1831, 236.
[484] Billing May 1832, 200.
[485] Mackintosh 1837, 452.
[486] Craig 1833, 30.
[487] Mackintosh 1837, 450.
[488] Mackintosh 1837, 451.

method, but once they had achieved their skill level they could pass on this knowledge without relying on dissections.

Dissection retained its central role as the best method of verifying a diagnosis, a necessary part of developing skill with the stethoscope and diagnosis in general. This central role did not necessitate that practitioners personally attend hundreds of dissections. Practitioners such as Forbes, Scudamore and Craig developed their skill with the instrument with fewer than fifty reported dissections to verify their diagnoses. British practitioners had comparatively fewer opportunities to conduct dissections than their colleagues in Continental Europe, but this did not mean that the number of opportunities that were available were insufficient. Practitioners used other methods of verifying their diagnoses. The practice of symptomatic-pathological correlation, verified through anatomical preparations and anatomical knowledge gained through animal experiments, enabled mass verification for lecture theatres full of students without requiring each student be actively present at the dissection. Furthermore, they understood the success of a treatment to imply a successful diagnosis and relied on the expert guidance of others who they recognised as having more skill than themselves. These alternatives, though still based in part on past dissection, allowed British practitioners to gain confidence with their stethoscopic skills without requiring the high volume of dissections seen in places like Paris.

In the next section, using the example of John Elliotson, I will outline teaching practices which encouraged and utilised the practice of symptomatic-pathological correlation as well as more general ODV to develop stethoscopic skills. Elliotson’s teaching employed, to varying degrees, each aspect of verification discussed above.

2.5 – John Elliotson's Teaching

John Elliotson received an MD from Edinburgh in 1810.[489] Following his time there he moved to London and, in 1817, became an assistant physician to St Thomas's Hospital. The senior physicians refused to allow him to deliver lectures (something he regularly requested), and in response he began to lecture privately at the Webb-Street medical school alongside his work at St Thomas's. In the early 1820s he travelled to Paris to study auscultation under the tutelage of Laennec; he developed skill with the stethoscope in the Necker Hospital, but Laennec was not present, being too unwell to take students at the time.[490] In 1823, despite some outrage caused by his offering private teaching, the board at St Thomas's appointed Elliotson to the position of full physician and he immediately became involved in clinical teaching. In 1832 he took up a further teaching role at the newly created University College, and two years later he resigned from St Thomas's in order to take up a position as Senior Physician at University College Hospital. At the height of his career, in the mid-to-late-1830s, Elliotson was the Lecturer of Principles and Practice of Medicine at the London University.[491] He had the largest classes of any teacher in London, with a strong reputation as a lecturer and clinical teacher. He resigned from the position in 1838, after his series of public experiments around the new science of mesmerism ostracised him from the medical community at University College, and irrevocably damaged his reputation.[492]

Until his fall from academic grace, Elliotson held a position of great respect amongst his colleagues and students. He seemed to enjoy teaching, putting a great amount of energy into his lectures and clinical teaching; he aimed to provide a systematic course of lectures which

[489] Munk's Roll, Vol III, 258. I have taken all subsequent biographical information for Elliotson, where not otherwise cited, from Munk's Roll.
[490] Elliotson 1829b, 402.
[491] Bellot 1929, Table 6.
[492] Winter 1998, 35.

laid the practices of medicine and surgery before the student.[493] He acknowledged the importance of hospital practice and dissection in the education of medical students, emphasising the necessity of students experiencing actual disease in the living patient 'where the individual characteristics affect the disease, presentation, and treatments'.[494] The students could then follow up the impact these diseases had on the structure of the internal organs, ideally in dissections they conducted very soon after death.[495]

Elliotson was a dedicated stethoscope advocate, having studied in Paris and brought the instrument back to London. He encouraged students not to think less of the stethoscope because it was hard to learn, arguing that many useful aspects of medicine took a large amount of effort to study.[496] Even in cases of chest disease where the symptoms were so clear as to not need the aid of the stethoscope, Elliotson made a point of still examining the patient with the stethoscope; he suggested that practitioners ought to record the symptoms from the stethoscope anyway, as those indications could support the diagnosis.[497] Elliotson further argued that no practitioner was truly familiar with the diseases of the chest without knowing with certainty how the diseased sounds differed from the healthy ones.[498]

Elliotson was a prominent teacher and stethoscope advocate. The *Lancet* published the majority of his clinical lectures, allowing us a glimpse into his teaching practice and how he encouraged students to develop skill with the stethoscope. The extensive records of his lectures mean that it is possible to follow his teaching practice over ten years, drawing out his methods of verification and skill development. A close reading of Elliotson's practises, understood at the time as being some of the most optimal, provides an overview of the 'best' teaching

[493] Elliotson 1832c, 36.
[494] Elliotson 1832c, 56.
[495] Elliotson 1832c, 56.
[496] Elliotson 1829b, 402.
[497] Elliotson 1830a, 408.
[498] Elliotson 1830b, 156.

methods at the time. In the following section it will become clear that dissection – including the use of preparations and animal experiments – as well as treatments and expert guidance, all played a part in his teaching.

Dissection played a large part in Elliotson's personal ability with the stethoscope, and in many of the cases he presented in his lectures. He used dissection to verify his diagnoses and bring authority to his ability with the stethoscope.[499] He employed the stethoscope in his general and teaching practices from at least 1825, and in 1826 he noted that the 'utility of the stethoscope is now well established'.[500] He presented his opinions on stethoscopic signs alongside post-mortem evidence which 'fully confirmed' the accuracy of his diagnoses.[501] Similar to Forbes, Elliotson made a point of announcing his diagnosis and inferences from the stethoscope to the other physicians and students present so they could also verify his claims.[502] In one such case the patient spent several months in hospital before dying, meaning the other practitioners and students were able to examine them, both with and without the stethoscope, before their death. It appears that Elliotson led by example when it came to use of the stethoscope and verifying his diagnoses by dissection.

This did not mean that Elliotson had an unusually high number of opportunities to conduct dissections; he noted in a lecture from December 1829 that the case contained his third post-mortem from that lecture season (starting in October).[503] This suggests that Elliotson was conducting post-mortems at a rate of roughly one a month, far fewer than his contemporaries in Paris and a rate which historians may previously have been considered insufficient for the development of stethoscopic skill. Rare or difficult chest diseases still caused him some uncertainty, particularly in cases of aortic aneurisms where stethoscopic signs were often vague

[499] Elliotson 1825, 493.
[500] Elliotson 1826a, 158.
[501] Elliotson 1826a, 158.
[502] Elliotson 1826a, 159.
[503] Elliotson 1829b, 400.

and the cause of death generally only became known at dissection.[504] Nonetheless, Elliotson relied heavily on dissection to verify his diagnoses in the cases he presented during clinical lectures. In developing his own skill, he used dissections as his primary means of verification; a method which served him well despite not having a large volume of bodies to work with.

Despite his own reliance on complete dissections, Elliotson argued that preparations were the best way to teach morbid anatomy, especially when he could use preparations taken from the same cases observed on the wards.[505] Here we see preparations as a form of verification in full practice. Elliotson's students observed patients on the wards, recording the symptoms and making note of (or forming) diagnoses. If the patient died Elliotson or another practitioner at St Thomas's would conduct a post-mortem, verifying the previous diagnoses by confirmation or refutation. Practitioners then turned the parts of the morbid anatomy which verified the diagnosis into preparations which Elliotson used in his lectures. By this method, students were enabled to see a living patient, make a diagnosis, and receive verification from the morbid anatomy – all the stages necessary to develop diagnostic skill – even though they did not attend the dissection.

Elliotson's use of preparations extended to his teaching of stethoscopic signs. During a lecture on hypertrophy of the heart he presented and passed around two heart specimens – one diseased, one healthy – whilst explaining the indications of hypertrophy from percussion and using the stethoscope.[506] This practice encouraged students to form a correlation between the sounds heard via the stethoscope and the internal pathology, despite them not necessarily being able to observe the signs in a living patient and follow it up with a dissection. Displaying preparations in his teaching allowed Elliotson to educate his students on the difference between

[504] Elliotson 1832a, 920-921.
[505] Elliotson 1829a, 142; 1835, 199.
[506] Elliotson 1829a, 142.

healthy and unhealthy organs; furthermore, he could compare stages of disease and provide information on the corresponding changes in symptoms.[507] Elliotson continued to use preparations in his lectures and regularly presented heart preparations, as the stethoscopic signs from heart disease were often more complex than those from the lungs. Occasionally Elliotson presented an anatomical preparation taken from a patient he had not seen, or had only seen briefly, with notes on the symptoms and treatments provided by the attending practitioner.[508] From this use of preparations, it is clear that Elliotson and his students were able to form a correlation between the reported symptoms of a patient, the related stethoscopic signs, and the morbid anatomy. All without needing to actually see the patient or attend the dissection.

Works on anatomy often included sketches that artists produced from observing dissections or preparations, one of the most famous being the work of Matthew Baillie. Elliotson appeared to use prints from Baillie's work alongside the preparations to emphasise the importance of anatomical knowledge to his students.[509] He advocated for museums and collections of preparations as means of instruction for students and general education for the public.[510] In his teaching practice, Elliotson emphasised the importance of students becoming familiar with anatomy and of the correlations between symptoms in the living patients and the morbid anatomy seen at dissection. He used preparations as a means of teaching these correlations to a large number of students without requiring a high volume of dissections.

Animal experiments formed a small part of Elliotson's practice. In 1832 a difficult case of heart disease presented in the hospital and he found the stethoscopic sounds confusing as they were inconsistent. To remedy his lack of understanding, he examined the sounds of the heart in a donkey in order to work on his familiarity with the bellows sound from the auricles.[511]

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[507] Elliotson 1831a, 489.
[508] Elliotson 1831a, 487.
[509] Elliotson 1832a, 924.
[510] Elliotson 1832c, 37.
[511] Elliotson 1832b, 68.

Elliotson's use of animal experimentation here emphasised how practitioners benefited from such activities. Animals allowed practitioners to become familiar with the healthy sounds of an organ and examine the anatomy almost immediately afterwards. Familiarity with the healthy sounds in general enabled practitioners to better identify the sounds in the body and their unhealthy alterations, building up their knowledge base of stethoscopic sounds to aid forming diagnoses.

In addition to the forms of verification which stemmed directly from dissection, verification by treatment and verification by expert guidance appeared in Elliotson's teaching practice. Elliotson saw multiple patients over the course of his clinical teaching where, by use of the stethoscope, he determined that the first diagnosis was incorrect. He verified these diagnoses as incorrect by means of stethoscopic examinations when the patients were either not improving or becoming more unwell due to the ineffectiveness of their treatment.[512] Once he formed the new diagnosis, as informed by auscultation, and altered the treatments the patients improved, eventually leaving the hospital 'completely well'.[513] The altered diagnosis combined with the improvements following a change of treatment verified the correctness of Elliotson's new diagnosis, building his confidence and skill with the stethoscope.

In order to teach students about stethoscopic signs, Elliotson occasionally brought patients into the lecture for students to examine there and then.[514] He encouraged them to listen for the healthy sounds which now replaced the pathological ones heard during earlier examinations on the wards. In many cases of heart disease he was clear that the sounds heard by the stethoscope indicated an improvement in the patient's condition but not a cure; he acknowledged that practitioners could not cure inflammation of the heart, they could only

[512] Elliotson 1826b, 440; 1830a, 412.
[513] Elliotson 1830a, 412.
[514] Elliotson 1831c, 773.

monitor the stage of the disease and treat the acute symptoms.[515] As a further example he cited a patient who received repeated treatment, whose signs of disease shown via stethoscopic examination reduced but did not disappear, and who lived for many years before dying from an unrelated illness; he dissected the patient and reported to his students that the heart disease was as he had suspected.[516] A return of the natural sounds of the chest, indicated by the stethoscope, proved a successful treatment and, thus, a successful diagnosis.[517] He used the stethoscope and a return to the natural sounds to infer that a treatment was successful, and that success confirmed that his diagnosis, also formed with the stethoscope, had been successful. This practice informed not only Elliotson's practice but also the practice and understanding of those who studied under him.

Using the stethoscope allowed students to diagnose diseases from negative evidence: they could identify diseases of the chest by a process of elimination based on which stethoscopic signs were, or were not, present.[518] This was particularly useful when diseases of the heart and lungs were simultaneously present; as, the morbid sounds from the lung could mask the quieter and less distinct morbid sounds of the heart.[519] Elliotson championed the formation of correct diagnoses of heart diseases, encouraging his students to pay particular attention to the signs heard from the stethoscope and providing multiple cases and forms of verification to enable that knowledge. He stated that correct diagnoses for diseases of the heart were 'exceedingly serviceable' for the purposes of treatment;[520] a correct diagnosis allowed for correct treatment, which in turn verified the correctness of the diagnosis. By encouraging his

[515] Elliotson 1831c, 774.
[516] Elliotson 1831c, 776.
[517] Elliotson 1830b, 156; 1831b, 686; 1835, 196.
[518] Elliotson 1831b, 683.
[519] Elliotson 1831d, 196.
[520] Elliotson 1831d, 198.

students to view successful treatment as an indication of successful diagnosis, Elliotson increased their confidence in both their general diagnostic and specific stethoscope skill.

Elliotson 'rejoiced' in giving clinical instruction, stating it was impossible to teach symptoms and history well without the aid of living illustrations.[521] He praised the organisation of St Thomas's Hospital; the high number of beds allowed for careful selection of patients to study, and they would often see several rare cases over the course of a year.[522] Despite praising the high number of cases to select from, Elliotson also noted that for the purposes of education it was better for students to have a few, well observed, cases than a large number with only superficial examinations.[523] Elliotson endeavoured to make every clinical visit an important part of student education; he explained everything possible at the patient's bedside, then devoted the clinical lecture to the morbid anatomy of those same patients seen in the clinic.[524] He visited the wards for 'two or three' hours every day, bringing his students with him, he and the students examining the patients and taking reports on their progress.[525] He used this time to lend his stethoscope to students who did not own one themselves and to stand 'patiently at the bedside' while the student conducted a stethoscopic exam, with Elliotson intended to 'act as a private tutor'.[526] Here is clear evidence of him providing expert guidance as a means of educating students in stethoscope use.

Elliotson included the views of others, whose stethoscopic opinions he trusted, in his private and teaching practices. He referred to the opinion of others when he was unsure of a sound heard with the instrument.[527] When practitioners made new claims about a cure or treatment based on stethoscopic indications he stated that he would be sceptical of the findings

[521] Elliotson 1829a, 141.
[522] Elliotson 1829a, 141.
[523] Elliotson 1829a, 141.
[524] Elliotson 1829a, 141.
[525] Elliotson 1832c, 39.
[526] Elliotson 1832c, 39.
[527] Elliotson 1829b, 401.

until he and ‘several friends’ had verified the results.[528] However, he did also defer to an opinion that several practitioners whom he knew to be ‘excellent stethoscopists’ reported to have verified, even without his own personal evidence.[529] Elliotson offered his own expert guidance as a form of verifying stethoscopic sounds to his students, but he similarly relied on the opinions of others – especially those whom he acknowledged to have more stethoscopic skill – when he was unsure of a diagnosis or simply desired another form of verification.

Further to his encouragement and tutoring of students in stethoscopic signs at the patient’s bedside, providing his expert guidance as a form of verification, and his reliance on expert guidance in his own work, Elliotson criticised the teaching practices in other locations. He lamented that students in Edinburgh may not become well acquainted with the stethoscope because their teachers did not direct attention towards the instrument.[530] Whether his complaint was well founded is unclear, but it serves to emphasise the importance Elliotson placed on educating students in stethoscopic examinations. Similarly, his complaint was, specifically, that Edinburgh practitioners did not offer expert guidance to their students; he claimed they did not act as tutors during ward rounds, nor direct their students to pay attention to the development of stethoscopic skill.[531] In London, he stated, medical teachers taught students to hear the stethoscopic signs which accompanied any given disease, so that they may recognise it again in the future.[532] Through the above examination of Elliotson’s teaching we can observe that he taught stethoscopic skill through providing opportunities to examine living patients and then used preparations and his own expert guidance as key forms of verifying the diagnoses for the students.

[528] Elliotson 1831d, 199.
[529] Elliotson 1831d, 199.
[530] Elliotson 1832c, 40.
[531] Elliotson 1832c, 40.
[532] Elliotson 1832c, 40.

As a known proponent of the stethoscope, Elliotson was sure to include stethoscopic examinations in his teaching practices. Through the detailed accounts of his lectures and educational speeches it is possible to observe his teaching methods, which give an insight into how established practitioners taught new medical students. This is particularly relevant in cases of stethoscopic teaching, where practitioners who had first developed skill with the instrument through experience in Paris or through personal trials attempted to pass on stethoscopic skill within the established context of medical education. Development of stethoscopic skill was not easy, even with skilled practitioners as teachers; Elliotson acknowledged that there would be times when the stethoscope misled users, but this was true of any sign or symptom.[533] His teaching practices provide a glimpse into the methods of diagnostic verification teachers provided to medical students. These forms of verification allowed students to develop stethoscopic and general diagnostic skills without the need for the same high volume of dissections seen in Paris and other continental medical schools.

In this section I outlined the evidence of alternative verification methods in medical teaching. These forms of verification all relied on some knowledge of the morbid signs seen at dissection but did not require a high volume of post-mortems. However, while the examples taken from Elliotson's teaching are useful they only provide a narrow glimpse of medical education. The next section examines the broader context of medical education, looking at how teaching reforms in the late 1820s and 1830s solidified some of the methods seen in Elliotson's practice. This allowed for a more consistent method of teaching which encouraged the development of stethoscopic and diagnostic skill.

[533] Elliotson 1832a, 927.

2.6 – The State of Medical Education and Attempts at Reformation

The late 1820s into the early 1830s saw the first attempts at creating a general medical curriculum in Britain. This section provides an overview of this process and examines where the practice of ODV fitted into these new structures. It will become apparent that practitioners primarily wanted to address lack of cadavers available for dissection; the method they generally considered best for students learning anatomy. Many stethoscope advocates were involved both in the creation of these new educational guidelines and in the agitation that led to the 1832 Anatomy Act, which increased access to cadavers for teaching purposes. Whilst not necessarily intended to encourage the practice of symptomatic-pathological correlation, the standardisation of aspects of medical education, combined with increased access to cadavers, resulted in a medical environment in which students could develop skill with the stethoscope.

Practitioners acknowledged the importance of students having a thorough knowledge of anatomy in which to ground their medical practice.[534] The best way for students to develop this skill was through dissection. In the absence of a high number of dissections, students found other ways gain knowledge of anatomical structures: studying books (especially those with plates) and hearing descriptions, viewing pictures, casts and models, and viewing preparations.[535] Medical practitioners understood the necessity of anatomical study, ideally by dissection, as a part of medical education. Within hospital and private practise, it appears that practitioners could attempt to obtain permission to perform dissections from the families of deceased patients, with varying degrees of success. However, accessing bodies through hospital and private practise required practitioners to already be qualified and practicing in those areas, whereas students needed other methods of accessing information to develop anatomical knowledge. Dedicated schools of anatomy appeared in the major cities as a means

[534] Jones 1828, 31-32.
[535] Jones 1828, 31-32.

to provide students with this education, but the problem of there being only a small number of bodies for dissection and study remained.

Bodies of executed criminals remained the only truly legal means for anatomy schools to obtain corpses for dissection.[536] This severely limited the number of bodies any anatomy school could (legally) access, as there were only twelve executions per year across the whole of Britain and hundreds of anatomy schools.[537] An illegal body trade arose as a response to this demand for bodies, usually consisting of illegal grave robbing by 'resurrection-men', though in some gruesome incidents the groups who provided bodies to anatomy schools committed murder in order to provide 'fresh' corpses for the dissection room.[538] In 1828, as a response to the outrage caused by the occurrence of grave robbing and murder for the sake of anatomy, Parliament ordered the creation of a Select Committee to look into possible regulations which would enable anatomy schools to access bodies but end the unlawful practices surrounding the acquisition of subjects. Henry Warburton chaired this committee and presented a *Bill for the Prevention of Unlawful Disinterment of Human Bodies* in the August 1829.

The Bill outlined the committee's suggestion that anatomy schools may have free access to 'unclaimed bodies' from workhouses and prisons.[539] If no family member came forward to claim a body in the first seventy-two hours after death, a *licensed* anatomy school could claim the body for the purposes of dissection.[540] Anatomy schools would need to apply to a special board in order to gain a license and would need to renew that license yearly.[541] The House of Lords did not pass the 1829 Bill, even though it passed through the Commons.[542]

[536] The *London Quarterly Review* 1830, 3.
[537] The *London Quarterly Review* 1830, 3.
[538] The *London Quarterly Review* 1830, 4. One of the most well-known cases of people committing murder to receive payment for supplying bodies to anatomy schools was the 1828 Burke and Hare murders in Edinburgh, which causes a large public outcry when it came to light.
[539] Bill 1829, Paper 200, 5.
[540] Bill 1829, Paper 200, 5.
[541] Bill 1829, Paper 200, 6. Warburton suggested the board could issue a fine of £100 for any place found to be dissecting without a license, but special licenses could be granted for one-off dissections, at the cost of £2.
[542] The *London Quarterly Review* 1830, 12.

Practitioners appeared to be generally in favour of the Bill despite having some reservations about certain aspects. Practitioners supported an act of Parliament which would allow greater access to bodies for use in dissections, a necessary tool for teaching students anatomy.[543] Furthermore, the notion of using unclaimed bodies – where there were no family members to be upset by the dissections – met with a great deal of approval.[544]

The *Edinburgh Medical Journal* objected to the Bill, as they argued it would give an unfair advantage to the anatomy schools of London and Dublin schools (where there were higher numbers of unclaimed bodies).[545] Furthermore, the Bill contained a stipulation that the anatomy schools needed to respectfully bury the bodies (at their own cost) after the dissection.[546] This stipulation caused concern, as practitioners frequently removed and preserved parts of the body as preparations and it was unclear whether the burial clause would prevent this.[547] Curiously, Warburton did not intend this Bill to extend to Irish practice, which raised the possibility amongst practitioners that the change in English, Scottish and Welsh laws would increase the traffic of cheap bodies from that country.[548] Once the Bill failed, in the summer of 1829, Parliament did not revisit the ideas contained within the motion for another three years.

In September of the same year, the *Lancet* published an account of the requirements for surgical students wishing to take their examinations in the upcoming session (October 1830 to May 1831). The Royal College of Surgeons presented strict regulations around the medical education a student must have completed before they could register to enter the exams. These included six years of surgical study, during which the student must produce evidence of

[543] Guthrie, *Medico-Chirurgical Review* 1829, 355; The *London Quarterly Review* 1830, 6.
[544] The *London Quarterly Review* 1830, 10; Goodman, 1944, 808
[545] *Edinburgh Medical Journal* 1829, 212; The *London Quarterly Review* 1830, 12.
[546] Bill 1829, Paper 200, 6.
[547] The *London Quarterly Review* 1830, 13.
[548] Bill 1829, Paper 200, 10; Goodman 1944, 808.

completing at least three courses in anatomy and two courses in dissection.[549] It is interesting that, despite the insistence that students needed dissection to learn anatomy, there were separate courses on anatomy and dissection, suggesting that dissection held meaning outside of anatomical knowledge. This outline of student expectations applied specifically to surgeons; it is unclear if the Royal College of Physicians had a similar list for their examinations in 1830. For all students, hospital attendance over the course of their study was essential. The Royal College of Surgeons required students to have at least twelve months of hospital practice at a recognised hospital (more than 100 beds), or an 'extended period of time' in a smaller provincial hospital as well as six months in a hospital in London, Edinburgh, Glasgow or Dublin.[550] The emphasis on hospital practice encouraged students to form a link between the symptoms of living patients and the changes to internal viscera studied during the anatomy and dissection courses. Similarly, it may have increased the number of dissections students were able to perform; however, that number remained very low.

Parliament introduced the Anatomy Act in August 1832 in an attempt to solve the issues surrounding provision of a sufficient number of bodies for dissection. Identical in many ways to the 1829 Bill, the Act acknowledged the necessity of anatomical examination in the acquisition of knowledge about disease, and that the current laws meant anatomy schools had access to an insufficient number of bodies.[551] The aim of the Anatomy Act was to provide protections and regulations to the study and practice of anatomy, allowing practitioners the means to develop necessary skills whilst preventing the likelihood of 'grievous crimes and murder' for that cause.[552] The Act brought in a need for schools of anatomy to obtain a licence in order to legally accept the bodies of unclaimed persons from workhouses and prisons.[553]

[549] *Lancet* 1830, 5.
[550] *Lancet* 1830, 5.
[551] Anatomy Act 1832, n.p.
[552] Anatomy Act 1832, n.p.
[553] Anatomy Act 1832, n.p.

Indeed, the fundamental difference between this Act and the 1829 Bill was simply the inclusion of Ireland in the reach of the legislation.[554] With the introduction of the Act, the number of bodies used in London anatomy schools increased from roughly three hundred per annum to around six hundred.[555] London students at the very least had much greater access to dissections as a means of gaining anatomical knowledge and verifying certain diagnoses. There is, however, little indication that anatomy schools functioned to emphasise the correlations between symptoms and morbid appearances – that may have relied more on hospital practice.

In 1833 Parliament formed another select committee to inquire into the regulations and laws surrounding British medical education and practice.[556] The committee interviewed a range of medical practitioners – physicians, surgeons, and apothecaries – as part of their investigation. They looked to establish the 'current state of medical education' as taught by the universities and schools of medical practice.[557] The Report, published in 1834, came in three parts – one for each branch of medicine; physicians, surgeons, and apothecaries – and offered no suggestions or conclusions based on this research; instead, those on the committee requested another year to understand the implications of their findings.[558] The witnesses interviewed included many prominent physicians and vocal stethoscope advocates: James Clark, James Johnson and John Elliotson, to name but three.[559] These stethoscope advocates played a key role in providing evidence and insight to the committee regarding the factors they considered necessary in medical education. As supporters of auscultation, it is likely that the systems of medical education for which they advocated included appropriate means of learning the

[554] Anatomy Act 1832, n.p.
[555] Goodman 1944, 808.
[556] Report 1824, iii.
[557] Report 1834, iii.
[558] Report 1834, iii. If they were granted this extension, they did not report again in 1835. Very little official medical reform occurred until the mid-1840s.
[559] Report 1834, Index. Other names of known stethoscope advocates in the index: A. Billing, G. Burrows, A. Cooper, A. Tweedie, J. Wardrop.

stethoscope: opportunities for patient examination, formation of diagnoses, and verification of those diagnoses.

Notes from these interviews show most, if not all, of the witnesses promoted increased opportunities for students to complete their own dissections.[560] The board of examinations required physicians to prove at least five years of study, including at least one year of anatomical study and six months of 'dissection and demonstration'.[561] Furthermore, students of physic needed to complete three years in attendance at a General Hospital with at least 100 in-patient beds and attend at least one course (usually three months) on surgical practices.[562] The regulations outlined in the Report stated that students who attended foreign medical schools needed testimonials proving they had completed the equivalent of these tasks and to complete a further six months in a British or Irish hospital (meeting the 100-bed requirement) before they could enter for examination.[563] In 1834 students intending to become physicians needed to have at least three years of hospital practice before they could apply for their exams. The emphasis on hospital practice indicates an understanding that these students needed to see patients on the wards and have clinical lectures on the morbid anatomy of those same patients in order to qualify. The criteria necessary for the development of stethoscopic skill became ingrained in the criteria necessary to qualify as a physician.

The same was also true for qualification as a surgeon. Compared to the expectations outlined by the *Lancet* in 1830, the testimonies in the Report provided a much more detailed list of the necessary aspects of surgical education. The practitioners interviewed made it clear that students of surgery needed to spend at least one hundred hours working with dissection and demonstrations.[564] Surgical teachers 'positively required' their students to have practice in

[560] Report 1834, 263.
[561] Report 1834, 24.
[562] Report 1834, 24.
[563] Report 1834, 24.
[564] Report 1834, 19.

dissection: they must have conducted at least part of the dissection themselves; it was not enough to have simply watched one.[565] Whilst practitioners did not consider watching dissections to be sufficient for surgical students, they did encourage anatomical demonstrations.[566] Demonstrators could show preparations of the parts of the body they considered most important until they had 'beaten knowledge of them into the student's heads'.[567] Surgical practitioners hoped that the Anatomy Act would facilitate an increase in dissections, bringing British practice closer to that seen in Continental Europe, although they noted that even with the Anatomy Act dissection would still only be possible in large cities.[568] Students needed to have a specific certificate proving their attendance at these dissection courses, separate from all other forms of evidence.[569] Surgeons in particular pushed for access to dissection and other parts of morbid anatomy as a part of their medical education, all of which would aid any student attempts to learn the diagnostic method of auscultation.

The hope these surgeons expressed for the impact of the Anatomy Act suggests that by 1834, two years after its enactment, they still perceived that students had insufficient access to bodies for dissection. Despite this, or perhaps because of this, for students to enter into the surgical examinations many medical schools required the candidates to have at least two courses of dissection (at least a year of study) and a further twelve months in a recognised hospital.[570] Similar to the rules for physicians, those in charge of the examinations required surgeons at provincial hospitals to attend those for a year and then, in addition, spend at least another six months in one of the larger hospitals.[571] As with the physicians, the surgeons outlining the necessary requirements of an adequate surgical education emphasised the

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[565] Report 1834, 20.
[566] Report 1834, 20.
[567] Report 1834, 20.
[568] Cooper, Report 1834, 87; 135.
[569] Appendix 23, Report 1834, 26.
[570] Appendix 23, Report 1834, 24-26.
[571] Appendix 23, Report 1834, 26.

importance of hospital practice alongside the need for anatomical knowledge. Again, it was probably the case that only through practice in a hospital – ideally a large one – students could interact with patients, make diagnoses, and receive verification of their diagnostic opinions. These were the criteria necessary for surgical practice *and* for enabling the development of skill with the stethoscope.

Practitioners in 1834 seemed to be aware of the importance of this correlation between the living signs and the morbid anatomy. Symptoms alone were useless unless practitioners considered them as a sign of the internal disease.[572] Morbid anatomy was ineffective in understanding a disease unless the practitioner could accurately use symptoms to ascertain their presence in a living body.[573] The value of medical practice arose from the ability to correctly form associations between these two areas.[574] To achieve this correlation practitioners required their students to study, minutely, the morbid anatomy and understand the common symptoms of a disease.

They could only fully correlate the two through examining living patients and seeing the morbid anatomy of that same patient, verifying their diagnosis and enabling more confident and skilful diagnoses in future practice. This was only possible through hospital practice. The stethoscope further enabled this practice, more firmly connecting the signs of internal disease with the symptoms of a living patient; indeed, for general medicine, practitioners could only usefully employ the stethoscope while the person was living![575]

Students developed an understanding of this correlation through the required aspects of their education, and this correlation enabled them to learn how to use the stethoscope. In turn,

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[572] Hall 1834, 6.
[573] Hall 1834, 6.
[574] Hall 1834, 6.
[575] Within medical jurisprudence practitioners did occasionally use the stethoscope to confirm death by lack of heartbeat and breathing sounds, but this was uncommon and does not reflect much on the general practice of most medical practitioners.

ability with the stethoscope further encouraged the understanding of this correlation. The expectations and regulations for medical education reinforced the necessary factors which allowed the practitioners' development of stethoscopic skill.

2.7 – Conclusion

The primary question addressed by this chapter concerned the ways in which students developed skill with the stethoscope, especially in a medical context which had comparatively few opportunities to conduct dissections. Developing stethoscopic diagnostic skill entailed examining a patient, making a diagnosis, and having that diagnosis verified. Such verification, I have argued, took two distinct forms. (a) *Anatomico-clinical correlation* involved verification through dissection, the method which in Paris had enabled Laennec to invent the stethoscope. (b) *Symptomatic-pathological correlation* rested on other methods of verification, of which I have distinguished three: the use of anatomical preparations, the interpretation of treatment-efficacy, and the exercise of expert guidance. In addition, a few individuals enhanced their stethoscopic skills using a different approach altogether, namely (c) animal experiments.

Anatomical preparations (the first of these three) made from the cadaver of a deceased patient acted as verification when presented in lectures. Students could examine a living patient with the stethoscope on the clinical wards and form a diagnosis; if the patient died, and the appointed hospital practitioners dissected the body, those practitioners could also create an anatomical preparation of the important viscera. Then in the clinical lectures the lecturer could present the preparation to serve as verification of the diagnosis that the students had formerly made of the patient from whose body the preparation had come. This set of procedures enabled students to develop stethoscopic skill without requiring the high volume of dissections seen in Paris and other continental schools.

Secondly, practitioners could verify their diagnoses through the successes, or failures, of certain treatments. This method of verification did not require the patient to die and so low rates of dissection did not impact its value. Certain diseases required certain treatments. A correct diagnosis, therefore, directly influenced the type of treatment a patient received. If the practitioner's diagnosis was correct then the treatment ought to be successful, and when the patient did not appear to be making progress or was getting worse, the first assumption was that the initial diagnosis may have been incorrect. Stethoscopic signs allowed practitioners more scope to understand and properly diagnose an illness; practitioners could understand any successful treatment following a stethoscopic diagnosis to be proof that they had correctly interpreted the indications from the instrument. This was crucial in building their confidence and skill in making diagnoses using the stethoscope.

The third form of verification was that of expert guidance from those already skilled with the stethoscope. Students new to using the stethoscope listened to the patient and pronounced their judgements, and the skilled stethoscopist could then verify and guide the ear of the untrained student. Practitioners often stated that for a student to properly acquire stethoscopic skill they needed to have a personal tutor – already skilled with the instrument – to aid their learning. The role of this tutor was to provide expert guidance, that is, to use their trained ears to verify the sounds and meanings heard by the learner. Expert guidance was yet another form of verification which did not rely on dissection, and so British practitioners could use it without needing to be concerned by the low rates of dissection in British medical practice.

A supplementary way of developing skill with the stethoscope – used by only a few practitioners and only for self-education, not for instruction – was animal experimentation. Its chief purpose was to develop an understanding of healthy sounds and their corresponding healthy anatomy. Animal experiments enabled practitioners to listen to the sounds of the animal body, to observe the beating heart directly, and finally to kill and dissect the creature. This allowed practitioners to correlate the sounds heard by the stethoscope and the internal actions of the body in a way that was not possible with human patients.

Section 2.4 used the extensively documented teaching practice of John Elliotson to illustrate the pedagogic use of the three distinct forms of verification. Elliotson employed each method of verification to varying degrees. These alternative modes in British medical education made it possible to provide stethoscopic instruction, and to correlate symptoms and morbid anatomy, *without* the high volume of dissections seen in Paris. At the height of his teaching career many established practitioners, as well as students, held Elliotson in high regard and considered his teaching practices to be some of the most excellent available.

The final section of this chapter looked more closely at the formalised outlines of expectations within medical education. Stethoscope advocates were heavily involved in the formation of these codified regulations for medical students, and the aspects of medical education which took precedence reflected the methods which allowed students to develop stethoscopic skill. They emphasised the importance of students having firm anatomical knowledge and extensive hospital practice. Teachers required their students to practice dissections and become familiar with a range of anatomical preparations. The examination bodies would not allow anyone with too little hospital experience to qualify. The modes of verification necessary for students to develop skill with the stethoscope existed and flourished within the formalised requirements of medical education; embedding the necessary requirements for students to develop skill with the stethoscope within the structure of medical education.

The next chapter examines the unique relationship between mediate auscultation, the stethoscope and obstetric practice. Obstetricians often had different motivations for their interest in the stethoscope (reducing opportunities for infanticide, use of intervention tools) when compared with other areas of medicine. In relation to the first thesis question – why did British practitioners take an interest in the stethoscope? – obstetrics therefore provides its own unique answers to the questions which this thesis must address. Additionally, obstetric diagnoses had their own means of verification which were distinct from those in other areas of medicine: a diagnosis of a pregnancy has a very specific and time-limited window for verification. The thesis, then, needs to consider the methods of developing skill with the stethoscope in an obstetric setting as providing additional information for answering the second thesis question: how did British practitioners develop skill with the stethoscope? In answering the thesis question regarding the motivations and methods of British practitioners, obstetrics had its own unique forms of both; the next chapter will address these.

Chapter 3 – Stretching the Stethoscope: The Unique Position of Obstetric Practice in Learning and Using Auscultation.

"An accouchement has fully confirmed your diagnosis, which I confess has contributed to raise in my esteem not merely the discriminating qualities of the stethoscope, but also your tact in using it"

– An 'eminent and intelligent practitioner' in a letter to Dr J.C. Ferguson, December 1828.

3.1 – Introduction

The role of auscultation and the stethoscope in obstetric practice is an area which historians have greatly neglected. A few articles have been published regarding the first practitioners to suggest the use of the stethoscope in pregnancy and childbirth, but little in-depth research has been devoted to the question of why or how obstetric practitioners adopted the instrument.[576] This chapter considers the unique motivations obstetric practitioners had for introducing mediate auscultation and the stethoscope into their practice. Obstetric practitioners held their own debates and had concerns which differed from those in other branches of medicine. Pregnancy was not a disease or illness, although there were associated risks and dangers, and practitioners needed to balance the life of the mother and at least one child. Their concerns related to the proper diagnosis and management of pregnancy as well as dealing with issues that arose in childbirth. Mediate auscultation elicited new information and offered a new means of understanding the process and management of childbirth. It fundamentally altered approaches to diagnosing pregnancy and contributed to other, wider, debates within obstetric medicine.

In the previous chapters this thesis has demonstrated the role of the practice of anatomico-clinical correlation and symptomatic-pathological correlation in aiding British

[576] J.H. Pinkerton published two articles on the matter, in 1969 and 1980. See the bibliography for more details.

practitioners to understand and adopt mediate auscultation and the stethoscope. This chapter introduces the unique methods in the practice of obstetric medicine and suggests that the key practice of observation, making a diagnosis, and verifying that diagnosis (ODV) could happen without the practice of anatomico-clinical or symptomatic-pathological correlation. In obstetric practice the verification aspect of ODV had its own, unique, form as the diagnosis of pregnancy had very clear means of verification: the birth, or not, of a child. Unlike many other conditions, the end point of pregnancy was not death or the simple remission of symptoms; instead, there was a clearly defined end point at which practitioners were able to assess the accuracy of their diagnoses. Obstetric practitioners, then, had a distinct means of verifying their diagnoses and developing their skill with mediate auscultation and the practice of mediate auscultation.

This chapter as a whole introduces some of the earliest adopters of mediate auscultation in obstetric practice in the British Isles, including three Irishmen: John Creery Ferguson, Robert Collins, and Evory Kennedy. Ferguson in particular was a vocal proponent of the use of mediate auscultation and the stethoscope in obstetric practice, despite not being an obstetrician himself, having studied and adopted the instrument in Paris. Although he plays only a small part in the discussion between obstetric practitioners using the stethoscope, his role is important and sets the stage for further discussion of his work in Chapter 4.

The first section, 3.2, gives a brief summary of the discovery of the uses of auscultation in obstetric practice following Laennec's invention of the stethoscope. This section looks at the first known practitioner to hear the foetal heartbeat, François Mayor of Geneva, and the much more comprehensive work of Jacques Alexandre Kergaradec. Practitioners in the British Isles took little notice of the discovery; section 3.3 provides an overview of the landscape of obstetric practice in the British Isles in the lead up to the introduction of auscultation. It will become apparent that the provision of maternity care differed between Dublin, Edinburgh and London, which may well have contributed to their differing approaches to the uptake of the instrument.

Section 3.4 considers the debate regarding instrumental intervention in childbirth as forming the wider political environment in obstetric practice, into which this chapter situates the practice of mediate auscultation. It outlines the intervention debate as it stood before Kergaradec introduced the concept of using mediate auscultation in childbirth.

The next three sections, 3.5, 3.6 and 3.7, look at the ways in which practitioners could use the stethoscope in their obstetric practice and the debates and disagreements amongst the profession regarding those uses.

The first way in which practitioners could use mediate auscultation and the stethoscope was as a means of more accurately diagnosing pregnancy (section 3.5). Additionally, practitioners could make these diagnoses earlier in the pregnancy. Individual practitioners seemingly had their own motivations for wishing to diagnose pregnancies earlier and with more accuracy. Even amongst practitioners who readily adopted the practice of mediate auscultation for this purpose, there remained debates and disagreements regarding the accuracy of the sounds they heard with the stethoscope. Of the two main sounds, the heartbeat and the placental souffle (the sound of the blood moving through the placenta), many practitioners considered only the former to be a sure sign of pregnancy. Furthermore, some practitioners – notably, Hamilton in Edinburgh – rejected the stethoscopic indications entirely. In each case the practitioners relied on the method of ODV to develop their skill and understanding of mediate auscultation and the stethoscope; observing patients and employing the stethoscope, diagnosing the patient as pregnant (or not), and then having their diagnosis verified, often only a few months later, through the birth (or not) of a child.

Following on from diagnosing pregnancy, the second way in which practitioners could use indications from mediate auscultation and the stethoscope was to determine certain facts about the position of the placenta and foetus, as well as the number of children in utero (section

3.6). This information aided practitioners (and, occasionally, mothers) in preparing for potentially difficult births, especially those where there were multiple foetuses and different presentations. Knowledge of the placement of the placenta similarly aided practitioners interested in the practice of caesarean sections. These occurred rarely during the 1820s-1840s, the period this chapter covers, but placement was still a vital piece of information for the practitioners who later conducted such surgeries. Concern for their patients motivated practitioners to develop their skills in mediate auscultation and the stethoscope as a means of preparing for possible difficulties during pregnancy and labour. As with the diagnosis of pregnancy, practitioners were able to verify any diagnosis of the number or presentation of foetuses at birth, rather than relying on dissection or the practice of symptomatic-pathological correlation.

The third, and final, way in which practitioners could use the stethoscope was to determine the life or death of the foetus in utero. Knowledge of, and the ability to detect, the foetal heartbeat and the placental souffle allowed practitioners to ascertain the status of the foetus while it was yet undelivered. Again, the uniqueness of obstetric practice meant that should a practitioner diagnose the death of the foetus, or assert that it was living, the subsequent birth of a living or dead child would provide the necessary verification of their diagnoses. Such ready availability of verification enabled practitioners to develop their diagnostic skill with mediate auscultation and the stethoscope. The debates surrounding instrumental intervention in difficult labours motivated practitioners to develop their ability to accurately diagnose the life or death of the foetus as a means of more appropriately treating their patients.

Over the course of the chapter it will become apparent that the practice of mediate auscultation and the stethoscope needed to fit into the established debates surrounding instrumental intervention in labour. Section 3.8 reconsiders the debate surrounding instrumental intervention with reference to the new information practitioners could gain from stethoscopic examinations. I suggest that the introduction of mediate auscultation to obstetric practice ultimately impacted how practitioners understood and practiced within those wider debates. Practitioners chose to develop skill with the stethoscope or reject its use, which in turn impacted their opinions and approaches to the use of instruments to intervene during a labour. Previous historians, such as Wilson and Jenkins, have produced excellent work on the debates and divisions regarding the use of instruments such as the forceps and vectis (another tool used to extract a living child), yet neither have considered the role of practitioners using mediate auscultation and the stethoscope within these discussions.[577] This chapter provides the first known attempt to combine discussion of both instruments in relation to childbirth.

This chapter has three main aims. Firstly, it aims to demonstrate the wide array of motivations for adopting the practice of mediate auscultation in obstetric practice, with particular emphasis on the range of uses for the stethoscope. Secondly, through examining the uniqueness of obstetric practice, this chapter further expands on different methods of developing diagnostic skill with the stethoscope. Through observation, making a diagnosis, and having that diagnosis verified through the birth (or not) of a child, obstetric practice had its own form of building diagnostic skill and practitioners' understanding of the sounds heard through the stethoscope. Thirdly, this chapter situates the adoption of the stethoscope in the practice of obstetrics within the wider debate surrounding the interventional uses of instruments in labour. It will become clear over the course of this chapter that practitioners had a range of motivations, benefited from this unique method of verification, and that the adoption of the stethoscope signified an important change in the debates between instrumentalist and anti-instrumentalist approaches to labour.

[577] For more on this see Wilson 2007 and Jenkins 2019.

3.2 – The Introduction of Auscultation into Obstetric Practice

Many people now take knowledge of the foetal heartbeat for granted; it is something that is a familiar aspect of maternity care and often appears in television, film, and even songs. This section looks at the first uses of auscultation in the detection of pregnancy and determining the life or death of the foetus in utero. This discovery remained mostly unacknowledged in the British Isles for several years after Kergaradec published his treatise on it in 1822.

In 1818, François Mayor, a surgeon in Geneva, reported that he had heard the foetal heartbeat.[578] This was the first recorded instance of the sounds of the foetal heart and of a medical practitioner using auscultation to examine a pregnant patient. He applied his ear directly (immediate auscultation) to the abdomen of a pregnant woman, who was only a few days from her due date, and declared that he could hear quite distinctly the sound of the foetal heart.[579] Mayor noted that the foetal heartbeat was usually between 100 and 120 beats per minute, much faster than the maternal heartbeat.[580] The editor of the Swiss publication *Bibliothéque Universelle* wrote a note on his discovery, stating:

> [Mayor] has discovered that one can recognize, *with certainty* whether a child very near to term is living or not, by applying the ear to the mother's belly; if the child is living, one hears the beats of its heart very well, and one can distinguish them easily from the mother's pulse.[581]

The editor described Mayor as 'skilful surgeon' and noted that this discovery seemed relevant to 'the art of delivery and to legal medicine', which may have sparked interest in the use of mediate auscultation for these purposes.[582] Similarly, Mayor carried out the first

[578] Laennec 1826, 702 (*Trans*. Forbes 1827); Bibliothéque Universelle, 249 (*Trans.* Wilson 2020). Private translation.
[579] Laennec 1826, 702 (*Trans*. Forbes 1827).
[580] Laennec 1826, 702 (*Trans*. Forbes 1827).
[581] Bibliothéque Universelle 1818, 250. (Trans. Wilson). Italics in the original. Belly translated from the French 'ventre'.
[582] Bibliothéque Universelle 1818, 249-250. (*Trans.* Wilson 2020).

caesarean section in Geneva, so it would be reasonable to assume that other surgeons dealing with obstetric patients may have been interested in this method.[583] Yet, despite the apparent novelty of the discovery, Mayor did not follow up his findings nor did he ever publish any further information on the subject.[584]

Instead it was French physician Jean-Alexandre Le Jumaeu de Kergaradec, friend of Laennec and a fellow Breton, who publicised this obstetric use of auscultation and the stethoscope. Kergaradec acknowledged that Mayor had priority on the discovery of the foetal heartbeat, a fact which did not concern him as his main priority was simply to spread knowledge of the utility of mediate auscultation for obstetric use.[585] He was not an obstetrician and he made his discovery of the use of auscultation in pregnancy during his trials for a planned, though never fully completed, long review of Laennec's 1819 *Traité* which initially focussed on diseases of the thorax.[586] Once he made his discovery he began to investigate it more thoroughly and, like many other French practitioners, Kergaradec benefitted from being in Paris. The Hôtel-Dieu in Paris had a number of *salle de accouchements* (delivery rooms) while many British hospitals, especially those in London, had no such thing.[587] As mentioned in Chapter 1, Granville attended the large Lying-In Hospital there (formerly known as La Maternité) during his two years in Paris training to be an obstetrician; in that time practitioners there delivered 5622 women, a rough average of 2800 per year.[588] The facilities and high number of births gave Kergaradec a great number of patients to observe and practice auscultation on.

[583] Société Médicale de Géneve 2019.
[584] Laennec 1826, 702 (*Trans*. Forbes 1827); Kennedy 1833, 59.
[585] Pinkerton 1968, 483.
[586] Pinkerton 1968, 482.
[587] Wilson 1995, 145.
[588] Granville 1819, 17.

In 1822, Kergaradec published a short treatise *(Memoir sur l'Auscultation)* on the use of the auscultation and the stethoscope for obstetric purposes; the first publication which addressed obstetric auscultation.[589] Kergaradec outlined two sounds which indicated the presence of a foetus; the foetal heartbeat and the *bruit de souffle*, a rushing sound produced by the placenta (termed the 'placental souffle' in English).[590] Practitioners could interpret these two sounds together as a positive indication of pregnancy. According to Kergaradec the foetal heartbeat became audible from around the 6th month of pregnancy and provided a conclusive sign of pregnancy.[591] The placental sounds became audible at around the 4th month, but alone they provided strong evidence of pregnancy, but not definitively as diseases of the abdomen could give rise to similar sounds.[592] These discoveries led Kergaradec to extol the virtue of auscultation, and the stethoscope, for diagnosing pregnancy and for detecting cases of multiple foetuses.[593] His work appeared to make little impact on the medical profession, however; most French obstetricians seemed uninterested in the discovery.[594]

Indeed, only two known French practitioners replied to Kergaradec's work. One practitioner, Jean-Baptist Forestier, was an old and conservative obstetrician working at the Hôtel-Dieu in Paris.[595] Following Kergaradec's publication of *Memoir* in 1822, Forestier wrote to him and advised that he stop using the stethoscope – which he described as a 'new-fangled and ridiculous plaything' – as it interfered with the training and 'sacred' role of the accoucheur.[596] The other practitioner, Michel Fodera, agreed with Kergaradec regarding the utility of ausucltation in obstetric practice, but argued that an obstetrician could hear more

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589 Kergaradec 1822. There is no English translation of this book, I am using Forbes' translation of Laennec's 1826 edition of *Traité* to establish what Kergaradec discovered and claimed about the obstetric use of the stethoscope.
590 Laennec 1826, 703 (*Trans*. Forbes 1827).
591 Laennec 1826, 701 (*Trans.* Forbes 1827).
592 Laennec 1826, 703 (*Trans.* Forbes 1827).
593 Laennec 1826, 704 (*Trans*. Forbes 1827).
594 Duffin 1998, 211.
595 Quérard 1829, 162.
596 Pinkerton 1869, 483; Duffin 1998, 211.

clearly through immediate auscultation.[597] Fodera suggested that practitioners use the stethoscope only for the purposes of delicacy but give preference to the immediate application of the ear in all other cases.[598] Kergaradec seemingly agreed that, for obstetric purposes, both mediate and immediate offered similar advantages, but perhaps unsurprisingly given his close friendship with Laennec, he preferred to use the stethoscope in both obstetric and in general practice.[599]

Both the *Quarterly Journal of Foreign and British Medicine* and the *Medico-Chirurgical Review* wrote short articles acknowledging the publication in 1822, but British publications said little else about it; there was no effort to publish an English translation.[600] Laennec included a small summary of Kergaradec's findings in an appendix to the 1826 edition of the *Traité*. Forbes subsequently translated the appendix as part of his work on the second edition (1827); this was the first time any of Kergaradec's work was available in English.[601] Laennec stated in this appendix that, until Kergaradec's work, it had not occurred to him to use the stethoscope for obstetric purposes.[602] With so little published on the stethoscope before 1826, it is unsurprising that British practitioners did not hit upon the idea of obstetric auscultation.

3.3 – The Landscape of Lying-In Hospitals in the British Isles

Before we consider how the practice developed in the British Isles, it is important to understand the layout of obstetric and maternity care in the British Isles, focusing on London, Edinburgh and Dublin. During the 1820s there existed one Lying-In Hospital in Dublin, one in

[597] *Medico-Chirurgical Review* 1822, 662.
[598] *Medico-Chirurgical Review* 1822, 662.
[599] *Medico-Chirurgical Review* 1822, 662.
[600] The *Medico-Chirurgical Review* 1822, 661-662; The Quarterly Journal of Foreign and British Medicine and Surgery 1822, 371-375.
[601] Laennec 1826 (*Trans*. Forbes 1827).
[602] Laennec 1826, 701 (*Trans*. Forbes 1827).

Edinburgh, and four in London. The number of patients seen at each institution varied between the cities, with the large hospital in Dublin enabling practitioners to observe a much higher number of births. There was no requirement for the hospitals to produce reports on the number of patients they saw; information regarding the number of patients seen in each place is, therefore, spread across a forty-year period from 1793 to 1833. It is nearly impossible to claim that there was a specific number of cases which practitioners would find most beneficial, let alone what that number may be, but certainly a higher volume of cases provided practitioners with greater scope for observation.

Dublin

The Dublin Lying-In Hospital was founded in 1745, and later renamed the Rotunda, which is how I will refer to it.[603] Between 1826 and 1833, practitioners at the Rotunda recorded 16,645 deliveries.[604] This meant that the Rotunda saw a rough average of 2,300 cases per year. Robert Collins, Master of the Rotunda during this time, noted that this high volume of patients provided him with 'abundant means' of testing the ideas which he later presented in his 1835 book *A Practical Treatise on Midwifery*.[605] Until Collins' time as master, the Rotunda was the only lying-in hospital in Dublin; however in 1826 Irish doctors Kirby and Daniell established the Coombe Maternity Hospital, which may have decreased the number of patients seen at the Rotunda.[606] Collins had two assistants during his time as master, William O'Brien Adams and Evory Kennedy.[607] These three men were some of the earliest adopters of the stethoscope in obstetric practice, and they had access to a significant amount of clinical material to test this new means of examination and enable the development of skill with the instrument.[608]

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603 Browne 1947, 4.
604 Collins 1835, ii.
605 Collins 1835, ii.
606 Browne 1947, 40; 176.
607 Browne 1947, 267.
608 Browne 1947, 178.

Fellow Dubliner John Creery Ferguson, Professor of the Practice of Medicine to the Apothecaries' Hall, published the first description of auscultation of the foetal heart in 1830 in *Dublin Medical Transactions*, the first of its kind in the British Isles.[609] Despite evidence that Ferguson, Collins and Kennedy moved in similar social circles – Ferguson was good friends with William Stokes, who also regularly wrote to Kennedy regarding the obstetric use of the stethoscope – there is no evidence that they ever interacted with each other.[610] The small amount of secondary literature looking at the first use of obstetric auscultation in the British Isles has suggested, without supporting evidence, that Ferguson must have passed on information about the stethoscope to Collins and others at the Rotunda.[611] This is speculation, and while I am inclined to suspect that it was in fact the case there is, as yet, no evidence to support this claim.

Edinburgh

The Edinburgh General Lying-In Hospital was established in 1793, superseding a six-bed maternity ward in the Edinburgh Royal Infirmary.[612] At its opening, the Edinburgh General Lying-In Hospital had only eighteen beds: twelve reserved for married patients, with a further six for those who were unmarried.[613] Between 1793 and 1801 the Hospital records claimed to have treated 'above 1,400 women' giving them an average of roughly 150 births per year.[614] James Hamilton held the position of Professor of Midwifery and Ordinary Physician to the hospital until his retirement in 1839, with ex-naval surgeon James Moir as his assistant.[615]

Like Dublin, Edinburgh had only one dedicated lying-in hospital but seemingly far fewer births per year. This necessarily reduced the opportunities for students to learn obstetric

[609] Ferguson 1830b; Browne 1947, 177.
[610] Kennedy 1833, 225.
[611] Pinkerton 1980, 258.
[612] Sturrock 1958, 113.
[613] Edinburgh General Lying-In Hospital 1793, 9.
[614] Fettes 1801, 9.
[615] Sturrock 1958, 124.

practice, but this may not have mattered for the uptake of mediate auscultation; while cases were comparatively low, there was no set number of practitioners needed to see in order to develop skill. Hamilton and Moir had differing opinions on the use of auscultation in obstetric practice, something that this chapter will further explore in later sections, but both men had ample opportunities to test the method and develop skill with the instrument.

London

London lying-in hospitals began in the 1740s; by 1753 there were three of them. These were high-profile institutions, but as they were voluntary hospitals which relied on donations, they were small in scale; all of them together delivered only around 5% of the births in London in 1760.[616] Around 1820, practitioners in these three hospitals delivered about 1,400 women per year, probably representing less than 3% of the births in the capital.[617]

Over the next fifty years even more voluntary institutions appeared, and by 1816 there were twenty-three dispensaries spread across London, of which eight could boast an appointed practitioner of midwifery.[618] In addition to these institutions, London had the Royal Maternity Charity, established as a service to attend married women in deliveries at home.[619] By 1820 the charity, along with other services which delivered women at home, delivered a large proportion of London's births: far more than the combined numbers from all the dedicated lying-in hospitals. It was midwives who attended the majority of these births, with male practitioners only attending if some difficulty arose and the charity forbade male practitioners from using patients for teaching purposes.[620] London then had a wide range of provision for lying-in women, although each institution saw only a small number of patients and the Royal Maternity

[616] Wilson 1995, 146.
[617] Granville 1819, 16; 18.
[618] Granville 1819, 3.
[619] Seligman 1980, 404.
[620] Seligman 1980, 404; 406.

Charity, which attended around 4,250 births in 1828, primarily employed midwives – there is no indication that midwives were using stethoscopes in this period.[621] Despite their small numbers, these institutions offered attractive opportunities for students wishing to develop skills in obstetrics and midwifery, which would have extended to any investigations with mediate auscultation and the stethoscope.[622]

3.4 – Debates around Instrumental Intervention in Labour before Auscultation

Throughout this chapter it will become apparent that much of the discussion practitioners had around the use of the stethoscope in obstetric practice related to the use of other instruments such as the forceps and crotchet. With that in mind it is important to frame obstetric practitioners' adoption of mediate auscultation within the much wider and protracted debates surrounding instrumental intervention in labour. From the early 1700s there existed a debate amongst obstetric practitioners: was the practitioner ever justified in using instruments to interfere in long or difficult labours and if so, when and with which instruments? Instrumental interference took four main forms: use of the vectis, use of the short forceps, use of the long forceps, and use of the crotchet or perforator. Practitioners could employ the vectis and forceps to remove the complete child, often to produce a living child but occasionally to remove a stillborn infant. In contrast, the instrument known as the crotchet or perforator destroyed the child, breaking the skull in order to lessen the size and enable its removal – an operation known as a craniotomy. In a seemingly paradoxical sense, those who I characterise as 'anti-intervention' were those who favoured the use of the crotchet or perforator, the means of removal which was likely to cause less harm to the mother, whilst those who favoured intervention often most firmly advocated for the forceps, which they argued would not cause harm to the mother if employed correctly.

[621] Seligman 1980, 413.
[622] Wilson 1995, 147.

Many anti-forceps practitioners followed the writing of Dutch obstetrician Hendrick van Deventer, who advocated for an approach to birth which emphasised the whole of the body (posture, pelvis, and powers of the uterus) in the process of labour.[623] An aspect of Deventer's work, particularly in relation to posture and the pelvis, made craniotomy more permissible as it suggested that there were some cases where women were simply incapable of delivering naturally.[624] Deventer's ideas caused a split between practitioners who were anti-intervention and those who argued that instruments were better suited to the task of removing the foetus.[625] Renowned obstetric practitioners William Smellie and William Hunter both used the forceps but advocated for great caution; they put a lot of trust in the 'powers of nature'.[626] Similarly, Thomas Denman, Hunter's successor in terms of being a well-known male midwife, had an aversion to using instruments, instead advocating for obstetric practitioners to trust the natural powers of the woman's body.[627]

In the early 1800s, just before the introduction of the stethoscope, the consensus amongst medical men was that they should only use instruments with extreme caution.[628] London practitioners did not deny the danger which arose from unskilled and hasty practitioners using instruments – the forceps in particular – without proper forethought, but where practitioners properly understood the instrument then using them ought not to cause any serious harm to the mother.[629] Indeed, many male practitioners working in the lying-in institutions, at least to start with, were anti-forceps.[630] They drew a distinction between the short and long forceps, Denman preferring the former and Hunter considering the long forceps

[623] Wilson 1995, 81.
[624] Wilson 1995, 85-86.
[625] Wilson 1995, 82.
[626] Jenkins 2019, 110.
[627] Jenkins 2019, 110.
[628] Jenkins 2019, 114.
[629] Ashwell 1828, 35.
[630] Wilson 1995, 148.

to be dangerous.[631] John Burns, Denman's contemporary, considered the long forceps to be an alternative to craniotomy when the child's head was too high in the birth canal for the use of the more common, short, forceps.[632] He admitted that the use of the forceps became both easier for the practitioner and safer for the woman and child the lower the head descended into the birth canal.[633]

Irish practitioners tended to lean more heavily on the teachings of Denman, which caused them to hold similar anti-intervention (especially anti-forceps) beliefs. The long forceps were not, and never had been, in regular use in Dublin, where practitioners preferred Denman's short, straight forceps or the crotchet.[634] In contrast, James Hamilton in Edinburgh strongly advocated for the use of the long forceps and intervention as soon as possible after identifying an obstructed labour. London practitioners held the middle ground, generally following Denman but occasionally admitting the use of the long forceps when the child's head was too high for the usual ones to be applicable.[635] Granville reported that, particularly amongst the lower classes in London, the patients also held an aversion to the practitioner employing 'even the most harmless' of instruments during labour.[636]

The debates around intervention similarly emphasised a difference in approaches to the life of the foetus: Irish practitioners preferred to delay intervention until they could be certain of the child's death, then using the crochet to remove the dead foetus.[637] In contrast, those in Edinburgh argued that the life of the mother superseded that of the foetus during labour; if the mother's health was in danger then, regardless of the status of the child, they should

[631] Jenkins 2019, 123.
[632] Jenkins 2019, 123.
[633] Burns 1832, 440.
[634] Browne 1947, 179.
[635] Burns 1832, 454.
[636] Granville 1819, 23.
[637] Collins 1835, 18.

intervene.[638] Opinions in London remained more divided, though it tended towards the Edinburgh approach with John Burns, a London based practitioner, stating 'whilst I endeavour to prevent the unnecessary loss of the child, I cannot place out of consideration, the danger if not destruction, of the mother, which may follow from improper and injudicious delay'.[639]

In 1817, following a long labour, Princess Charlotte, daughter of George, Prince of Wales, died in childbirth.[640] Her death stunned the nation and the practitioners who attended her labour, many of whom were close to Denman or studied under him, faced severe criticism from the public.[641] Debate surrounding the use of instruments, which may or may not have saved Princess Charlotte, increased within obstetric circles.[642] This shift in opinions occurred only a few years before Kergaradec suggested the use of auscultation in obstetric practice. As we will see, in sections 3.5 and 3.6, the introduction of obstetric auscultation and stethoscope use greatly impacted the nature of this debate.

3.5 – Auscultation as a means of Diagnosing Pregnancy

This section considers one of the main uses of auscultation and the stethoscope in obstetric practice; practitioners could use the sounds from the stethoscope as a means of more accurately diagnosing pregnancy. It examines why some practitioners desired a more accurate means of diagnosis, and how the use of auscultation and the stethoscope aided them for this purpose. Other practitioners argued that there was no such need for a more accurate method and that introducing mediate auscultation and the stethoscope only added unnecessary complications to the practice of midwifery. This section considers what motivated practitioners to adopt or reject mediate auscultation and the stethoscope in this area, as well as exploring

[638] Hamilton 1837, 34.
[639] Burns 1832, 462.
[640] Jenkins 2019, 115.
[641] Jenkins 2019, 115.
[642] Jenkins 2019, 116.

how practitioners developed their skills with this method of diagnosis. It will become clear that mediate auscultation and the stethoscope did offer a new means of diagnosing pregnancy. Furthermore, practitioners dealing with pregnancy and childbirth had a distinct method of verifying their diagnoses; observation, forming a diagnosis, and having their diagnosis verified by childbirth rather than any reliance on morbid anatomy or potentially misleading 'cures'.

Obstetric practitioners continuously discussed the potential signs and symptoms of pregnancy, often discussing how unreliable such signs were. The most common symptoms on which practitioners based their diagnosis of pregnancy were the cessation of periods, the onset of sickness, and the swelling of the abdomen. These signs were regularly misleading, however, as many other conditions could supress periods, cause regular sickness, and even cause abdominal distention.[643] Similarly, even the more specific signs, such as the production of milk, were not unequivocal signs of pregnancy as practitioners noted that lactation could occur in elderly or male patients; without any other symptoms, they could not take it as a sure sign.[644] Indeed, while some practitioners had signs they trusted above others, when taken on their own none of the traditional symptoms offered practitioners the means of diagnosing a pregnancy with complete confidence.[645]

In November 1827, only a few months after Forbes published the second edition of *Treatise* containing a translation of Kergaradec's ideas, there occurred – in Dublin – the first reported obstetric use of the stethoscope in the British Isles.[646] This report came from John Creery Ferguson, who was the Professor of the Practice of Medicine at the Apothecaries' Hall

[643] Kennedy 1833, 9-43. Kennedy goes into much more detail regarding what other illnesses or conditions may cause symptoms often associated with pregnancy.
[644] Kennedy 1833, 53.
[645] Kennedy 1833, 58.
[646] Ferguson 1830b, 71. It is likely, based on the work of other practitioners, that there were other instances of practitioners using the stethoscope in obstetric practice, but Ferguson's use is the earliest reported with a specific date.

of Ireland at the time.[647] Ferguson was a close friend of stethoscope advocates William Stokes and Dominic Corrigan, having accompanied them to Edinburgh in 1823.[648] He disliked Edinburgh and, soon after arriving with Stokes and Corrigan, he left to spend two years in Paris where he met and studied under Laennec and Kergaradec.[649]

Ferguson was a devoutly religious man; his grandfather was incumbent of the Church of Ireland parish of St Mark, where he grew up, and he practiced his Protestantism even when visiting Edinburgh and Paris.[650] Perhaps as a result of his religious convictions the practice of infanticide concerned him greatly; referring to it as a 'frightful evil' he appeared to have a much deeper preoccupation with it than his contemporaries.[651] He argued that discovering and announcing a pregnancy greatly reduced the chances that the mother would, or could, resort to infanticide.[652] The stethoscope greatly appealed to Ferguson, as it furnished unequivocal signs of pregnancy which occurred independent to the mother's testimony. He claimed to have discovered around one hundred cases of concealed pregnancy, in all of which the stethoscope enabled him to discover the pulsations of the foetal heart and the sounds of the placenta, thus revealing the condition of the woman.[653] Ferguson noted that all other signs of pregnancy were fallible, equivocal and deceptive; a range of other health conditions could simulate any of the generally relied upon signs of pregnancy.[654] He suggested that practitioners could consider the audible heartbeat or placental bruit de souffle to be infallible evidences of pregnancy, with the lack of those sounds being 'at least presumptive' proof of the contrary.[655]

[647] Browne 1947, 177.
[648] Browne 1947, 177.
[649] Ferguson 1830b, 69.
[650] Pinkerton 1980 258; McDonell 2012, 36.
[651] Ferguson brought up infanticide as an issue much more often than any other practitioner I have read.
[652] Ferguson 1830b, 87.
[653] Ferguson 1830b, 65; Ryan 1831, 124.
[654] Ferguson 1830b, 66.
[655] Ferguson 1830b, 81.

Ferguson's first recorded use of the stethoscope for obstetric purposes, in November 1827, was to examine a young woman who claimed not to be pregnant; by use of the stethoscope, he determined that she was in fact around the fifth month of pregnancy.[656] He announced this finding to the patient's sister, making her promise to still support the sister despite having a child out of wedlock.[657] Ferguson stated in his report that the woman did deliver a healthy child some months later, which confirmed his diagnosis, but he felt that this confirmation was unnecessary; a report of hearing the heartbeat and placental souffle should suffice as evidence.[658] He saw another patient in March 1828 and detected the heartbeat 'almost instantly', upon re-examining the patient he was further able to discover the sounds of the placenta: the woman delivered a healthy child two months later, thus confirming his diagnosis.[659] Ferguson lamented that he had not yet seen even those who more generally studied midwifery discuss the use of auscultation in obstetric practice.[660]

In December 1828 Ferguson attended a case and forgot to bring his stethoscope with him.[661] In a testament to the value Ferguson placed on auscultation with the stethoscope, he rolled up a sheet of paper – similar to Laennec's original instrument – in order to still be able to use the instrument. Additionally, this decision demonstrates Ferguson's initiative and ability in the act of *creating* a stethoscope to remedy a situation. He stated that the paper version was not as good as his usual stethoscope, but it did enable him to find the foetal heartbeat.[662] The paper version meant that Ferguson could not easily demonstrate the foetal sounds to the (unnamed) colleague who was also in attendance.[663] Indeed, he reported that the friend was sceptical of his diagnosis until the patient gave birth, after which he wrote to Ferguson stating

656 Ferguson 1830b, 71-72.
657 Ferguson 1830b, 72.
658 Ferguson 1830b, 72.
659 Ferguson 1830b, 73-74.
660 Ferguson 1830b, 65.
661 Ferguson 1830b, 74-75.
662 Ferguson 1830b, 75.
663 Ferguson 1830b, 76.

that “an accouchement has finally confirmed your diagnosis”.[664] Unlike practitioners such as Forbes and Elliotson, Ferguson could verify his diagnoses without relying on any form of dissection or morbid anatomy. Delivery, or lack thereof, acted as the method of verification for any stethoscopic diagnosis of pregnancy and this was something that practitioners at the time were sensible of.[665]

Ferguson published two papers on his work on auscultation in the *Dublin Medical Transactions* (1830). In the first paper Ferguson extolled the virtue of mediate auscultation and the stethoscope in the diagnosis of diseases of the thorax, indicating that obstetrics was not the only area in which he used the stethoscope.[666] He stated that his examples, two cases of pulmonary apoplexy, clearly demonstrated the ‘value, nay, the necessity of a stethoscopic examination, to the formulation of an accurate diagnosis.’[667] In matters of the thorax, Ferguson practiced anatomico-clinical correlation and symptomatic-pathological correlation, verifying his diagnoses through dissections and the success of treatments.[668] He acknowledged that many of his fellow practitioners were already investigating ‘zealously and successfully’ the applications of mediate auscultation in relation to diseases of the thorax.[669] However, he expressed his disappointment that many of those who ‘dedicated themselves’ to the practice of midwifery had not shown the same interest in the instrument, especially when they ‘must, by necessity, have a much more extended field of observation’ than he did.[670] Ferguson acknowledged that a large number of cases aided the process of learning the technique of mediate auscultation and using the stethoscope; increased observation of pregnant patients

[664] Ferguson 1830b, 76.
[665] Ferguson 1830b, 79.
[666] Ferguson 1830a, 18.
[667] Ferguson 1830a, 18.
[668] Ferguson 1830a, 13; 18.
[669] Ferguson 1830b, 64.
[670] Ferguson 1830b, 65.

allowed for increased opportunities to both try the stethoscope and see (by birth, or not) the verification of the diagnosis.

Ferguson was the first practitioner to publish his investigations into Kergaradec's work in the British Isles, but he was by no means the last. Assistant and then Master of the Rotunda, Evory Kennedy bemoaned the difficulties practitioners faced in diagnosing pregnancy from the well-known symptoms and criticised the lack of discussion around obstetric auscultation, despite practitioners in other areas of physiological and pathological investigation reporting good results with the stethoscope.[671] Kennedy stated that every medical man 'knows how often he is required to give an opinion in cases of doubtful pregnancy' and the ability to do so with confidence increased the practitioner's reputation.[672] Before his adoption of auscultation, Kennedy claimed to have previously been in the practice of placing his cheek (not his ear) on to the abdomen of pregnant women, as recommended – Kennedy claimed – by German practitioner Heinrich Wrisberg, in an attempt to detect foetal movement to confirm pregnancy.[673] It is important to recognise that this was *not* auscultation nor an attempt at it; the point of this form of examination was to use the sensitivity of the cheek to *feel* for foetal movement, not to listen to any part of the abdomen.

Kennedy could only attempt this form of examination after the mother claimed to have felt the child quicken (foetal movements only noticeable to the woman carrying the child). He claimed that some practitioners did not approve of this form of examination for reasons of delicacy, nor did they approve of auscultation, although he never named these supposed anti-auscultation practitioners.[674] He argued that any practitioner who supported the practice of vaginal examination to diagnose pregnancy could not disagree with the more convincing

[671] Kennedy 1833, 3.
[672] Kennedy 1833, 1.
[673] Kennedy 1833, 63.
[674] Kennedy 1833, 63.

evidence the more delicate act of auscultation provided.[675] Kennedy advocated for both the foetal heartbeat and the placental souffle as strong evidence for the diagnosis of pregnancy. In cases where all normal signs of pregnancy were inconclusive, and all other means of examination failed to determine the matter, Kennedy stated that the 'simple application of the stethoscope' would immediately decide the diagnosis and allow for appropriate treatment of the patient, pregnant or otherwise.[676]

In January 1830 Kennedy used the stethoscope to measure the impact on the foetus which came from treating an ailment in the mother through the process of bleeding, suggesting he was already adept at identifying the foetal heartbeat with the instrument.[677] He stated that the position of the foetus had a significant impact on the volume of the foetal heartbeat. When a practitioner had previously been able to discover the heartbeat and then found they no longer could Kennedy urged them to repeat the examination multiple times over the next few days: the child may simply have moved inside the uterus making the heart more difficult to detect.[678] Well-trained stethoscopists could sometimes identify the foetal heartbeat before the fourth month of pregnancy, but this was rare and required the practitioner to have a high level of skill.[679] From the moment of quickening the foetal heartbeat became increasingly easy to detect. This detection provided a very convincing sign of pregnancy, putting to rest any notion that the mother may have misinterpreted, or lied about, a feeling in her abdomen for that of quickening.[680] Kennedy accepted that, generally, by the fourth or fifth month the usual signs of pregnancy would be clear enough to leave practitioners in little doubt of the state of the woman. He claimed, however, that there were, and always would be, a few cases where even the most experienced practitioners could only verify their diagnostic suspicions by the birth (or

[675] Kennedy 1833, 63; 102.
[676] Kennedy 1833, 106.
[677] Kennedy 1833, 92.
[678] Kennedy 1833, 98.
[679] Kennedy 1833, 101.
[680] Kennedy 1833, 102.

not) of a child.[681] This claim indicates once again that the verification of diagnoses within obstetric practice relied on the birth, or not, of a child rather than on dissection or its subsidiaries. Obstetric practitioners did not practice symptomatic-pathological correlation, as they did not rely on pathology. Instead these practitioners carried out the process of observation, making a diagnosis, and having that diagnosis verified through different means.

Kennedy devoted a lot of attention to the sounds of the placental souffle as a means of diagnosing pregnancy. He argued that it was only present in women where there was uterine circulation: if a practitioner listened to the abdomen during labour, and then again after cutting the umbilical cord, he would notice the sound stopping in between these times as the circulation ceased.[682] Practitioners who were unacquainted with the stethoscope could easily confuse the placental sounds for those from the thorax; Kennedy stated that the best way to discriminate between the sounds was to work out if the sounds were in line with the mother's breathing or her pulse.[683] The sound of the placental souffle would correlate to that of the mother's pulse, therefore by applying the stethoscope to the woman's abdomen for a few minutes whilst simultaneously taking their pulse, the placental souffle would become apparent to the practitioner.[684] Obstetric practice was not wholly different to other areas of medicine; Kennedy conducted an experiment on a cow in order to practice detecting the placental souffle just as other practitioners used experiments on animals to better understand the normal internal functions of their patients.[685]

Fellow Irish physician David Nagle fundamentally disagreed with Kergaradec, Ferguson and Kennedy that any practitioner could or should rely on the placental souffle as a

[681] Kennedy 1833, 109.
[682] Kennedy 1833, 70.
[683] Kennedy 1833, 76.
[684] Kennedy 1833, 77.
[685] Kennedy 1833, 71.

sign of pregnancy.[686] He did not consider the placental souffle to exist, suggesting that it did not come from the placenta at all but rather from the large veins *around*, but not related to, the uterus.[687] Nagle further argued that a tumour could easily mimic the sound commonly thought of as the placental souffle and presented a case from 1830 in which that had been the case.[688] He stated that neither the presence of multiple placentas nor the placenta being an unusual size seemed to alter the supposed souffle sound, when one would expect that to be the case, and from that he concluded that the sounds did not originate in the placenta at all.[689] Nagle stated that the use of the souffle as a test of pregnancy, as suggested by Ferguson and Kennedy, was a 'dangerous theory'.[690] The existence of the sound thought to be the souffle in conjunction with other signs *and* the patient history could lead to a 'strong suspicion of impregnation', but practitioners should not view it as an infallible sign.[691]

Nagle further claimed that Ferguson 'was not much acquainted' with midwifery, which was likely true as Ferguson was a professor for the Apothecaries' Hall, not a dedicated obstetrician.[692] Despite Nagle suggesting that Ferguson was unqualified to comment on matters of midwifery, he stated his agreement with Ferguson's claim that auscultation could furnish the only *true* sign of pregnancy: the heartbeat.[693] He claimed that those who did not have experience using the stethoscope, in obstetric practice and in general, had no place questioning the ability or findings of those who had.[694] This suggests that practitioners at the time were aware that there was a unique aspect to the information gained through auscultation and the

[686] Nagle 1830b, 396.
[687] Nagle 1830b, 396.
[688] Nagle 1830b, 399.
[689] Nagle 1830b, 399.
[690] Nagle 1830b, 399.
[691] Nagle 1831a, 500.
[692] Nagle 1830b, 396.
[693] Nagle 1831a, 501.
[694] Nagle 1831a, 502.

stethoscope and that experience was a necessary part of understanding and being able to discuss this method of practice.

Even after practitioners began investigating the utility of auscultation in obstetric practice, there were still questions as to the *purpose* of diagnosing a pregnancy before the 'obvious' signs appeared around the fifth month.[695] There were certainly at least three important medico-legal reasons for determining pregnancy: a woman could feign pregnancy in order to get money on charges of bastardy; if widowed, to avoid losing an estate to the presumptive heir; and, the most commonly discussed reason, to get a stay on an order of execution.[696] If a doctor and jury concluded that a woman was pregnant then a judge would delay her sentence until the child was born; it is unknown how often female prisoners bound for the gallows made such a claim. Beyond the medico-legal reasons, Kennedy suggested that 'every medical man… knows how often he is required to give an opinion in cases of doubtful pregnancy', which indicates that it was not so rare an occurrence as other practitioners claimed.[697]

London practitioners appear to have been more sceptical of the use of the stethoscope in obstetrics, for diagnosing pregnancy and for the other uses discussed later in this chapter. In a lecture on medical jurisprudence in 1834, five years after Ferguson first published his work on auscultation as a diagnostic method for pregnancy and 12 years after Kergaradec published his *Memoir* on the topic, London practitioner Thomson claimed that it 'would take time' to determine if the stethoscope could produce useful information in these cases.[698] The stethoscope 'promised' beneficial results in identifying the foetal heartbeat and the sound of the placenta, but confirmation of the statements made by auscultators would take 'time and

[695] Thomson 1834, 678; Hamilton 1837, 49.
[696] Thomson 1834, 673-674.
[697] Kennedy 1833, 1.
[698] Thomson 1834, 677.

experience'.[699] This further supports the idea that practitioners required experience with the instrument in order to develop diagnostic skill, but also suggests that London-based obstetricians were not using the stethoscope in the same way as their peers in Ireland. In the same lecture Thomson stated that by the time auscultation furnished useful sounds there was little difficulty in determining pregnancy through the other symptoms.[700] Auscultation in obstetric practice in London, therefore, was not taken up with the same level of enthusiasm as in Ireland, potentially due to the differences in the structure of maternity care outlined in the section 3.2.

The sceptical approach in London was comparatively tame next to the response of the renowned Edinburgh obstetrician James Hamilton, who was firmly against the use of the stethoscope as a means of diagnosing pregnancy. In his 1837 book *Practical Observations on Various Subjects Relating to Midwifery* he acknowledged the 'new test' of auscultation which had appeared within the last few years.[701] He similarly noted that he had not been able to verify the 'allegations' made by Kergaradec and he had never met a case after the fifth month where he could not diagnose a pregnancy on the regular symptoms.[702] He never adopted new methods of practice when he already found, by experience, that the established methods were successful; he was confident in the established methods of diagnosing pregnancy, so he did not need to take interest in auscultation.[703] From the accounts of others, Hamilton established that the ability to distinguish between the various stethoscopic signs required a great deal of experience, and as he was confident in the pre-established symptoms of pregnancy, he felt no need to develop this skill.[704]

[699] Thomson 1834, 677; 678.
[700] Thomson 1834, 678.
[701] Hamilton 1837, 49.
[702] Hamilton 1837, 49.
[703] Hamilton 1837, 49.
[704] Hamilton 1837, 49.

Hamilton stated that he felt a deep conviction that there must be some fallacy in the observations of those who claimed to be able to use the stethoscope to detect the foetal heartbeat.[705] He argued that there was such a discrepancy in the experiences reported by stethoscope users that he could not help but be sceptical of their claims.[706] The very public disagreement between Kennedy and Nagle likely did not help soothe Hamilton's misgivings about auscultation.

As a way to explore the validity of these claims Hamilton asked his friend and fellow Edinburgh obstetrician, John Moir, to repeat Kennedy's experiments using ten cases between August and September 1833 at the Edinburgh Lying-In Hospital.[707] Moir noted that sometimes he found it difficult to locate the heartbeat, but that in each case the patient delivered a living child soon after his stethoscopic examinations revealed either the placental souffle or the foetal heartbeat, or both.[708] These findings verified the diagnoses he made with the stethoscope, and from this Moir became confident that there was an audible foetal heartbeat which practitioners could use, by means of the stethoscope, to determine in uncertain cases if a pregnancy existed.[709] He did clarify that he did not consider the signs from the stethoscope to be infallible, but they were strong indicators of pregnancy.[710] After conducting the trial of the instrument for Hamilton, Moir continued to use the stethoscope on other patients at the Edinburgh General Lying-In Hospital and reported that he had similar results for all of them; Moir and his attending students were all able to identify the foetal heartbeat and the placental souffle during a labour.[711] In one case Moir reported that he had initially heard the foetal heartbeat and then been unsuccessful at doing so in future examinations, he had his findings both confirmed and

[705] Hamilton 1837, 49.
[706] Hamilton 1837, 49.
[707] Hamilton 1837, 50-51.
[708] Moir 1837, 97.
[709] Moir 1837, 100.
[710] Moir 1837, 100.
[711] Moir 1837, 99.

refuted when the woman delivered twins a few months later; one living, the other stillborn.[712] The birth of the infants acted as verification for Moir's diagnostic investigations and this method of verification did not require access to morbid anatomy in the same way other, non-obstetric, medical investigations did.

Moir's confirmations of Kennedy's findings made Hamilton's observations all the more confusing.[713] Even in accepting the findings of Moir – and in consequence the work of Kergaradec, Ferguson and Kennedy – Hamilton still queried the general application of auscultation in obstetric practice.[714] Hamilton argued that the use of the stethoscope to diagnose pregnancy had limited use, except in criminal cases, as there was seldom a need for practitioners to pronounce a certain diagnosis of pregnancy before the fifth month, by which point there should be sufficient, non-auscultatory, evidence.[715] In Hamilton's opinion there were only two instances when patients required practitioners to make a declaration earlier: either when the woman is desperate to be pregnant or desperate not to be.[716] In the former instance, Hamilton claimed, the patient would readily submit to stethoscopic examination, while in the latter they would not.[717] Hamilton stated that readers ought not to interpret his opinions as opposition to general improved methods of diagnosing pregnancy; just that he wished to record his opinion that even if these supposed sounds could be heard, he felt there were few cases where the test could be required or applied.[718]

Despite Hamilton's outspoken scepticism of obstetric auscultation, much of the debate around the use of the stethoscope in pregnancy related to *which ways* practitioners could use auscultation, not if it was generally useful. Kennedy even wrote that it was a 'shame' that

[712] Moir 1837, 101.
[713] Hamilton 1837, 51.
[714] Hamilton 1837, 51-52.
[715] Hamilton 1837, 52.
[716] Hamilton 1837, 52.
[717] Hamilton 1837, 53.
[718] Hamilton 1837, 53.

auscultation in obstetric practice had not met with more opposition, as it might, ironically, have brought greater attention to the method.[719] He argued that vocal opposition may have encouraged obstetricians practitioners to take an interest in trialling the instrument, and it was simply a 'matter of fact' that anyone who took the time to practice with the stethoscope would satisfy themselves of its utility for diagnosing pregnancy.[720]

It is evident that there was a split between practitioners regarding the use of mediate auscultation and the stethoscope in diagnosing pregnancy. Those who disagreed with the practice argued that the traditional signs were accurate enough or that some of the stethoscopic signs were fallacious. Practitioners who advocated for the use of the stethoscope in diagnosing pregnancy did so because they felt the instrument allowed practitioners to make their diagnoses earlier and more accurately. They had a range of motives for wanting these earlier and more accurate diagnoses: Ferguson wished to reveal pregnancies and thus reduce the rates of infanticide; Kennedy suggested that, especially in doubtful cases, the ability to accurately and confidently diagnose increased the practitioner's reputation. This was in addition to times when there was a medico-legal reason for diagnosis, such as in cases where a woman requested a stay of execution on the grounds of pregnancy, where accurate and early diagnosis was invaluable. In all cases, regardless of the motivations for adoption of mediate auscultation and the stethoscope, practitioners received verification of their diagnosis through the birth, or not, of a child, which meant they could develop skill with the stethoscope without any reference to the morbid anatomy of the patient.

3.6 - Auscultation as a means of Gaining Evidence about the Foetus and Placenta in Utero

Diagnosing a pregnancy was not the only use of the stethoscope in obstetric practice. Once a practitioner had established that a woman was pregnant, they could use the stethoscope

[719] Kennedy 1833, 90.
[720] Kennedy 1833, 112.

to determine other aspects of the pregnancy. These included: the number of foetuses, the position of the child (or children) in utero, and the position of the placenta for the purpose of diagnosing possible placental previas (when the placenta forms over the cervix) and guidance in caesarean operations. These all held the potential for a difficult or dangerous birth, so the desire to have forewarning of complications motivated obstetric practitioners to use and develop their skill with mediate auscultation and the stethoscope. In each of these cases the eventual labour and birth served as verification (by confirmation or refutation) of the practitioners' diagnoses. This section looks at these uses of auscultation in detail, evidencing the obstetric practitioners carrying out observations, forming diagnoses, and having their diagnoses verified by the birth of one or more children. Furthermore, the presence of the stethoscope at the time of birth allowed practitioners to save the lives of children that otherwise would have been stillborn. The final part of this section examines the role of dissection in lying-in hospitals, indicating that the practice of symptomatic-pathological correlation did occur in obstetric practice, but it was not the sole, or even main, method of confirming diagnoses.

French obstetricians distinguished between Simple (one foetus) and Compound (two or more foetuses) pregnancies; often only being able to distinguish between the two during the delivery.[721] In 1830 Nagle and Collins encountered a case where examination with the stethoscope during labour convinced them of the presence of twins.[722] Their conviction was correct, but due to a long and difficult labour both were stillborn.[723] In this instance the fact the infants were not born living held no relevance to the verification of the diagnosis: the presence of two foetuses at birth was enough to confirm Nagle and Collins' stethoscopic diagnosis. Collins later encountered another case where he ascertained the presences of twins 96 hours

[721] Kennedy 1833, 5.
[722] Nagle 1830a, 232-233.
[723] Nagle 1830a, 233.

before delivery, in this case both children were born living.[724] In all of these cases, it was the birth of two children (regardless of whether they were living) which verified Nagle and Collins' diagnoses, thus they did not need to rely on either dissections or general morbid anatomy.

In his seven years as Master of the Rotunda Lying-In hospital in Dublin, Collins recorded four cases of triplets.[725] In each case he noted the extremely large abdomen of the expectant mother, and in the first case he discovered three foetal heartbeats to be distinctly audible.[726] In this first case, all three children, two boys and a girl, were born alive and Collins reported that several years later they were all healthy children.[727] In the latter three cases, none of the children were born living but the woman's delivery of three infants still confirmed his diagnosis.[728] Practitioners could observe the patient and, using auscultation, diagnose the presence of multiple foetuses; the number of children delivered at birth would then confirm or refute their diagnosis, building their diagnostic skill. As multiple foetuses increased the danger for both the mother and the children, Collins noted that advanced knowledge of such cases helped both the practitioner and the mother prepare for a difficult labour – although occasionally he argued it was better to keep the woman unaware of the situation in case her anxiety caused more disruption.[729]

Nagle used the stethoscope to determine the presenting position of the child or children during labour.[730] He recommended this use to other practitioners as it provided important information about possible difficult presentations during labour, and could aid practitioners in avoiding prematurely causing the patient's water to break.[731] The attending practitioner could

[724] Collins 1835, 133.
[725] Collins 1835, 340.
[726] Collins 1835, 340.
[727] Collins 1835, 341.
[728] Collins 1835, 341.
[729] Collins 1835, 341.
[730] Nagle 1830a, 233.
[731] Nagle 1831c, 449.

more easily manoeuvre the foetus into a better presentation for delivery with the amniotic fluid still in place; they could also avoid the complications which came with unfavourable presentations such as breech, which often ended in the death of both mother and child.[732] Nagle suggested this use of auscultation in Dublin in 1831, whilst it was over 10 years later that London obstetrician Francis Ramsbotham stated that with a 'correct hand' and the advantage of auscultation a practitioner might 'possibly' detect the position of the foetus in utero.[733] This once again emphasises how practitioners in Dublin accepted the use of the stethoscope for obstetric purposes much more readily than those in London.

William Dawson, the Lecturer on Midwifery at the Newcastle-upon-Tyne School of Medicine and Surgery, recommended the use of the stethoscope before conducting caesarean operations.[734] In the case he reported in the *Lancet* in 1837, where he performed a caesarean after the death of the mother, he did not employ the stethoscope due to the urgency of the case.[735] He argued that the application of the stethoscope was generally invaluable for ascertaining the vitality of the child before intervening.[736] Dawson's statements indicate that the obstetric use of the stethoscope spread further than just three cities of Dublin, Edinburgh and London: provincial practitioners used the instrument as well. In living patients, surgeons could use the stethoscope to determine the placement of the placenta, so as to avoid cutting into it during the caesarean operation.[737]

Kennedy suggested that, beyond the two main uses, practitioners could use the stethoscope on stillborn infants that appeared to have only recently died.[738] On some occasions this practice allowed them to detect a slight heartbeat in the child, so they could attempt to

[732] Nagle 1831c, 449.
[733] Ramsbotham 1841, 215.
[734] Dawson 1837, 28.
[735] Dawson 1837, 28.
[736] Dawson 1837, 28.
[737] Ryan 1831, 596.
[738] Kennedy 1833, 258.

resuscitate the infant.[739] This use of the stethoscope related to obstetric practice but was not directly related to auscultation of the pregnant abdomen. Instead, in this instance, the stethoscope returned to its more common use of listening to functions of the thorax. The practitioners 'diagnosed' life in the infant, attempted a 'treatment' of resuscitation and, if it was successful, they could deem their diagnosis correct; if it was unsuccessful then the child may have become the subject of a post-mortem examination. In this case obstetric practitioners performed a type of symptomatic-pathological correlation, but of a slightly different form from that of their non-obstetric contemporaries. They observed a body which may or may not be living, and they took verification from a successful resuscitation rather than relying on the morbid anatomy discovered at post-mortem.

A similar practice occurred if a woman died in childbirth – obstetric practitioners did conduct post-mortems, often finding disease of the uterus or bladder.[740] These dissections took the form of 'true' post-mortems: examinations taken to ascertain the cause of death. Practitioners in these scenarios rarely diagnosed the patient with some particular disease for which they wished to gain diagnostic verification. Midwifery lectures certainly made use of anatomical preparations as teaching tools for demonstrating conditions which could interfere with pregnancy and specimens likely came from post-mortems such as these.[741] Collins reported two cases of maternal mortality where he conducted a post-mortem to discover the cause of the complication.[742] He did not record an observation of these women's symptoms, pronounce a diagnosis, and conduct the dissection in order to verify his claims; in other words, he was not practicing anatomico-clinical correlation. Rather he and his assistants understood that some complication had occurred in the patient and wished to understand what it was;

[739] Kennedy 1833, 258.
[740] Collins 1835, 24-25.
[741] Chaplin 2009, 118.
[742] Collins 1835, 135; 300.

whether they could have successfully diagnosed or treated that complication was not something they addressed.

This section examined the other benefits of using the stethoscope in obstetric practice, as additional points to the use of the stethoscope in diagnosing pregnancy. In all of these instances, practitioners employed the stethoscope not only to diagnose pregnancy but to ascertain certain aspects of that pregnancy. These uses did not directly relate to the method of ascertaining the life or death of the foetus in utero, which I will further discuss in section 3.7. This section additionally examined the fact that obstetric practice, especially in teaching, did employ some form of symptomatic-pathological correlation; using anatomical preparations as a means of aiding practitioners to understand diseases which could complicate pregnancy and birth. Obstetric practitioners, however, rarely seemed to practice anatomico-clinical correlation as a means of diagnosing and verifying these conditions. They diagnosed the pregnancy and, if the patient died, they examined the morbid anatomy as an intellectual exercise to discover the other illness; they did not seem concerned with detecting or treating such things during pregnancy or labour unless they saw obvious signs of illness. The practice of ODV occurred regularly in obstetric practice and helped them develop their skill in the practice of mediate auscultation. While they did practice some symptomatic-pathological correlation and anatomico-clinical correlation, such occasions were very rare and unlikely to play a key role in their skill development.

3.7 – Auscultation as a means of Ascertaining the Life or Death of the Foetus in Utero

The application of the stethoscope allowed practitioners to ascertain if the child in utero was living or dead.[743] This gave practitioners the ability to comfort worried patients or prepare them for the worst, and it had further use in cases of medical jurisprudence. As with the

[743] Ramsbotham 1841, 185.

previous obstetric uses of mediate auscultation and the stethoscope, practitioners developed their skill in this practice by observing the patient and employing the instrument, making a diagnosis, and then having their diagnosis verified by the birth of a child – the life or death of the infant confirming or refuting their diagnosis. Obstetrics continued to provide a specific means of verifying diagnoses and thus offering a unique means of developing diagnostic skill. As will become apparent in this section, and in section 3.8, the ability to accurately diagnose the life or death of the foetus in utero impacted the debates surrounding instrumental intervention in childbirth.

In December 1828 Kennedy examined a patient during labour and determined that the child was still alive; the birth of a live child verified his diagnosis and made Kennedy more confident in his ability to identify the foetal heartbeat.[744] In 1830 he examined a mother who had been through six previous pregnancies, all of which culminated in a stillborn child; Kennedy applied the stethoscope and determined that the in utero child was still living, the woman went on to deliver a live infant and Kennedy reported that at the time of publication the child was now a healthy three-year-old.[745] Regardless of the status of the child at birth, it acted as verification of the practitioners' diagnosis; either by confirmation or refutation. Kennedy reported cases where he heard the heartbeat and the woman delivered a viable child, while others reported being unable to find the heartbeat followed by the birth of a living child.[746] Practitioners observed the patients and examined them with the stethoscope, made a diagnosis, and then waited for birth to verify their claims.

Further to this, Kennedy noted that the practitioner's ability to declare with certainty that the child was alive meant they could reassure anxious mothers who were worried, with no

[744] Kennedy 1833, 217. The child died soon after birth but was living at delivery.
[745] Kennedy 1833, 218.
[746] M'Keever August 1833, 716.

good reason, that the child had died.[747] He was confident in his ability to identify the foetal heartbeat and of recognising the diagnostic implications of the sound. He noted that sometimes women did seem to know, despite the lack of evidence, that the child had died, but that many more women were convinced the child was living when it was not.[748] Women often cited a lack of foetal movement as their reason for fearing the child was dead, but Kennedy assured them (and his readers) that a decrease in movement was not an unequivocal sign of death.[749] Kennedy mentioned times where movement appeared to continue despite the child being stillborn, and other instances of movement ceasing yet the child being born alive and healthy.[750] He suggested that the ability to determine if the child was still alive aided practitioners in cases of jurisprudence; for example, if the courts called medical practitioners to determine the validity of the complaint in cases where a pregnant woman claimed injury to the unborn child following a fight.[751] In July 1830 Kennedy was consulted by a woman who feared that her child was dead, he examined her with the stethoscope and assured her that the stethoscopic signs of the placental souffle and the foetal heartbeat were still clearly audible; the woman delivered a healthy infant six weeks later, verifying Kennedy's diagnosis.[752] This verification did not rely on the correlation of the symptoms of the patient with pathological signs seen after death; childbirth acted as verification of these diagnoses outside of the classic view of relating symptoms with morbid anatomy. These cases evidenced the use of the practitioner knowing with certainty that the child was still alive, but what about certain knowledge that the child was dead?

Knowledge concerning whether the child was living or dead allowed the practitioner to direct the course of treatment for pregnant women who were not yet in labour: certainty of

[747] Kennedy 1833, 207.
[748] Kennedy 1833, 209-210.
[749] Kennedy 1833, 213.
[750] Kennedy 1833, 213.
[751] Kennedy 1833, 208. How common such an occurrence was, I cannot say.
[752] Kennedy 1833, 214-215.

foetal death could prevent the mother going through a range of harmful treatments in the vain hope of producing a living child.[753] In his book, Kennedy requested that those practitioners who had never managed to find a heartbeat did not use the method of auscultation to determine the life or death of the foetus; it would only cause confusion and upset.[754] He even urged those practitioners who could identify the sounds of the foetus to not pronounce certainty of either life or death after only one examination.[755] The practitioner needed to treat any and all signs of foetal death with caution, always taking into consideration a range of information in addition to information regarding the pulse.[756] The cessation of the foetal heartbeat *and* the placental souffle offered clear indication of the death of the foetus in utero.[757] If a practitioner had previously been able to find the foetal heartbeat with the stethoscope, and now on multiple attempts in a variety of positions on the abdomen they cannot locate it, then they may with relative certainly conclude that the vitality of the infant had ceased.[758] Kennedy stated, however, that if the placental souffle ceased but the heartbeat continued, then practitioners could consider that as evidence that the child was still alive.[759] The cessation of the placental souffle further indicated the death of the foetus, but it did not always happen when the heartbeat ceased; the cessation of souffle sounds was not a sure indication of death nor was its presence a sure indication of life.[760]

In keeping with their ongoing disputes, Nagle ardently disagreed with Kennedy regarding whether practitioners should – or could, as Nagle was not convinced that the phenomenon existed – use the placental sounds as any form of evidence to indicate the life or

[753] Kennedy 1833, 207.
[754] Kennedy 1833, 219.
[755] Kennedy 1833, 220.
[756] Kennedy 1833, 223.
[757] Kennedy 1833, 216.
[758] Ingleby 1836, 248.
[759] Kennedy 1833, 216.
[760] Kennedy 1833, 220.

death of the foetus.[761] If they existed, Nagle argued, it was fallacious to think the character of the sounds could indicate the vitality of the infant.[762] He claimed to have had enough experience in obstetric auscultation to be able to confidently disagree with Kennedy's suggestion.[763] The quote Nagle provided as a means of outlining Kennedy's approach to using the placental sounds as a means of determining foetal death, read as follows:

> The placental sound, either by ceasing altogether after having previously been heard, or having its character altered, from the continuous murmur with its lengthy sibilous [sic] termination, to an abrupt, defined, and much shorter sound.[764]

Kennedy responded by accusing Nagle of purposefully misrepresenting his work; Nagle cut off Kennedy's quote to leave out his statements regarding the necessity of information about the foetal heartbeat in making such decisions.[765] Kennedy pointed out that in the original passage he never claimed that practitioners could use the cessation of the souffle alone to indicate the death of the foetus. The full quotation, as Kennedy argued, should have read:

> The placental sound, either by ceasing altogether after having previously been heard, or having its character altered, from the continuous murmur with its lengthy sibilous [sic] termination, to an abrupt, defined, and much shorter sound *together with the impossibility of detecting the foetal heart's action, particularly if such has been before observed, places the child's death beyond doubt*.[766]

Furthermore, Kennedy argued, Nagle raised other points against the placental souffle which he had already acknowledged and addressed, but Nagle simply left these reasons out of

[761] Nagle1830b, 398.
[762] Nagle 1831a, 500.
[763] Nagle 1831a, 500.
[764] Nagle 1831a, 501.
[765] Kennedy Jan 1831, 496.
[766] Kennedy Jan 1831, 496. Italics in the original text.

his published critique.[767] He suggested that Nagle's claims about not being able to fully distinguish the sounds of the placenta said more about Nagle's skill level than about the utility of that mode of examination.[768] Nagle did not dispute that practitioners could use auscultation to determine the life or death of the foetus, only the use of the sounds of the placenta in making such determinations. Nagle considered Kennedy's reply to be exceedingly rude, stating that if 'Dr Kennedy had confined himself to facts and arguments, instead of resorting to intemperate and uncourteous declamation, he would have acted better for his own respectability at least'.[769] The two never reconciled over the disagreement.

Many illnesses and events could cause the death of the child in utero, including illnesses such as smallpox, but what were the general signs that the foetus had died?[770] In most cases, practitioners ascertained the death of the foetus during labour when, often after a long labour, the uterus began to expel putrid matter. Once this symptom occurred, practitioners assumed that the child had been dead for some time; the death of the child took place well before the practitioner became sensible of that fact.[771] Kennedy suggested that if the mother's health appeared to be declining, along with the cessation of some of the other signs or symptoms of pregnancy, and the foetal movements had stopped, then these were strong indications, before labour, that the child had died.[772] Collins claimed that a practitioner could ascertain the life or death of the foetus 'beyond all doubt' by use of the stethoscope, stating:

> I know of no case where the advantage of the stethoscope is more fully demonstrated than in the information it enables us to arrive at with regard to the life or death of the foetus, in the progress of tedious and difficult labours.[773]

[767] Kennedy Jan 1831, 496.
[768] Kennedy Jan 1831, 496.
[769] Nagle 1831b, 622.
[770] Kennedy 1833, 204.
[771] Collins 1835, 16.
[772] Kennedy 1833, 206.
[773] Collins 1835, 16; 18.

Collins argued that a lack of satisfactory evidence of death led the practitioner to delay to interfering until the mother was in great danger.[774] If the practitioner could be certain that the child was dead, he could deliver before the mother's life became endangered, saving her from hours or days of pain.[775] He recounted numerous cases where the patient endured urgent and distressing labours for over forty hours only to deliver a child that had evidently been dead for hours; furthermore, the act of waiting often brought about inflammation in the mother, a cause of severe illness if not maternal death.[776] These cases occurred before the invention of the stethoscope, but Collins was certain of the immense value information from auscultation could have given in those circumstances.[777] He went on to state that now he was familiar with the use of auscultation he would be unhappy to attend any instance of a protracted labour without his stethoscope.[778] In enabling practitioners to detect the continuation or cessation of foetal life, Collins argued it was of incalculable benefit.[779]

> I cannot, therefore, too strongly impress on the mind of the junior practitioner, the absolute necessity of making himself acquainted with the stethoscope, considering it, as I do, of the utmost importance in these cases.[780]

Kennedy agreed with Collins that knowledge of the life or death of the foetus aided practitioners in making decisions regarding instrumental intervention in labour.[781] Practitioners having the knowledge that the child was already dead made it more reasonable for them to employ methods of intervention, such as the crochet or perforator, than if they thought the infant were alive. Kennedy did point out that practitioners ought to intervene in a labour when it was necessary to help the mother, not simply because they had evidence that the child was

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[774] Collins 1835, 18.
[775] Collins 1835, 18.
[776] Collins 1835, 19-20.
[777] Collins 1835, 20.
[778] Collins 1835, 21.
[779] Collins 1835, 225.
[780] Collins 1835, 21.
[781] Kennedy 1833, 227.

dead.[782] However, he argued that practitioners could use their knowledge of the vitality of the foetus to help speed up their decision if intervention was necessary, and to a certain extent it helped to prepare the mother for the loss of the child.[783]

In 1829 Kennedy applied the stethoscope to a case where the other attending practitioners had already declared the foetus dead, based on the appearance of fetid matter and meconium (foetal excrement).[784] On applying the stethoscope, Kennedy found a heartbeat and he delivered the child with the aid of the forceps; the child was not breathing at birth, but he was resuscitated and, at the time of Kennedy publishing his book, was a healthy toddler.[785] He made it clear that, had he not applied the stethoscope, the child would surely have died; either before or at the point when the practitioners brought about removal with the crotchet.[786] In light of this, Kennedy worried about how frequently practitioners may have destroyed or mutilated a viable foetus on the assumption that the child was dead, when the forceps or vectis would have been better.[787] When practitioners could still successfully save the child the stethoscope could guide them on both which instrument to use in cases of difficult labours and at what point.

Equally, Kennedy asked, how many times had a practitioner's use of the forceps caused severe damage to the mother when they had incorrectly assumed the child to be alive?[788] Whilst Kennedy argued that the state of the mother should be the foremost guide for the actions of practitioners, he acknowledged that knowing the state of the child could aid the decisions around intervention and result in saving both lives.[789] He cautioned against practitioners aiming

[782] Kennedy 1833, 227.
[783] Kennedy 1833, 227.
[784] Kennedy 1833, 242.
[785] Kennedy 1833, 242.
[786] Kennedy 1833, 242.
[787] Kennedy 1833, 229.
[788] Kennedy 1833, 229.
[789] Kennedy 1833, 230.

too far to preserve the life of both mother and child, and in doing so letting the mother suffer for days in the hopes of delivering a live child; ultimately sacrificing them both in the process.[790] Collins similarly advocated for the use of the crotchet when the practitioner could be certain that the child was dead, before the situation became too dangerous to the mother.[791] In this regard the stethoscope offered both Kennedy and Collins a much surer guide as to when intervention with the crotchet was acceptable, especially as Collins argued that the use of any instrument at all relied *solely* on the necessity of freeing the patient from impending danger and that practitioners really ought not to attempt it unless the child was dead.[792]

London practitioners appeared to be more interested in this aspect of obstetric auscultation; the stethoscope enabled practitioners to acquire the 'most conclusive evidence' of the vitality of the infant during labour.[793] The evidence afforded by the stethoscope regarding the life or death of the child relieved practitioners' minds from painful speculation regarding their actions during the labour and established their prestige amongst patients and their peers.[794] If the attending practitioner could declare the child living and then the mother delivered a living child or, conversely, the practitioner could ascertain the death of the child before the mother produced a still-born infant, then his powers of diagnosis would appear all the more certain. Obstetric practitioners developed these powers of diagnosis not through the practice of symptomatic-pathological correlation, but through observing the patient, making a diagnosis, and having that diagnosis verified by some means. In obstetrics these means did not rely on the death and dissection of the patient, nor on any particular by-products of dissection; verification came from other means. What was necessary for developing diagnostic skill with the stethoscope was observing a patient, creating a diagnosis, and having that diagnosis verified.

[790] Kennedy 1833, 229.
[791] Collins 1835, 16.
[792] Collins 1835, 9; 18.
[793] Ryan 1831, 184.
[794] Ryan 1831, 285.

Hamilton in Edinburgh thoroughly disagreed with the use of the stethoscope for determining the life or death of the foetus; firstly, as we have seen, he doubted that practitioners could use auscultation to identify the heartbeat or placental souffle, which were needed for determining both pregnancy and vitality, and secondly, Hamilton argued the life of the infant was not relevant.[795] Hamilton argued for managing cases of stalled or diminished progression of the foetal head based entirely on the state of the mother, with little or no attention paid to the infant.[796] He acknowledged that many respectable practitioners, 'as well as' Collins, suggested the stethoscope as a safe guide for management of protracted labour.[797] Yet he did not condone this mode of practice, since in his opinion if there was reason to call for immediate delivery for the sake of the mother – by forceps or crotchet – then the living or dead status of the child would not matter.[798]

Practitioners could use the stethoscope to determine the life or death of the foetus in utero. They did this by observing and examining the patient, making a diagnosis, and then waiting for the birth of the child to verify their claims. Verification could take the form of confirmation or refutation, as long as the evidence provided a conclusive proof in regard to the diagnosis. In this way the development of skill in auscultation and using the stethoscope relied not on symptomatic-pathological correlation, but on observation, forming a diagnosis, and receiving verification. It is clear that the use of the stethoscope to determine the life or death of the foetus in utero ultimately lead back to the debates surrounding the use of instruments to aid delivery. Whilst practitioners could use auscultation to reassure nervous mothers about the wellbeing of the child, it was the ability to make decisions regarding intervention in labour which heightened the utility of the stethoscope in this area of obstetric practice. The final

[795] Hamilton 1837, 34.
[796] Hamilton 1837, 33.
[797] Hamilton 1837, 33.
[798] Hamilton 1837, 34.

section of this chapter further examines how the introduction of obstetric auscultation fitted into the debates around instrumental intervention in labour.

3.8 – Auscultation as a Means of Informing Decisions of Instrumental Intervention in Difficult Labours

The ability to determine the life or death of the foetus in utero had a significant impact on the debates surrounding instrumental interventions in labour. Most practitioners accepted that there would always be some cases in which instruments were necessary; with the introduction of mediate auscultation, the discussion developed from *whether* to intervene into a question of *when* and *with which instrument*.[799] Anti-interventionists argued that, while they could confirm that the foetus was still living, it was best not to intervene at all if possible; and then, following confirmation of the child's death, they turned to the crotchet as a method of removal. Pro-interventionists (most often, pro-forceps) practitioners argued that the indications of the stethoscope were irrelevant if the mother was in danger. Fears around the general safety of the forceps persisted in Dublin and London, where even those who used the instrument seemed wary of using it too readily.

In Edinburgh, Hamilton held a firmly interventionist stance; he advocated for the use of the forceps and disagreed on moral grounds with any advice regarding delaying interference until evidence from the stethoscope indicated the death of the child.[800] Hamilton argued that a practitioner ought not to leave a woman in a protracted labour, with no evidence of the child's head advancing, for longer than twelve hours.[801] In any properly attended labour the practitioners should be perfectly able to judge the progress of the child, and if the child's head became stuck but within reach of the long forceps then the attendant ought to employ the

[799] Kennedy 1833, 90.
[800] Hamilton 1837, 33; 51.
[801] Hamilton 1837, 33.

instrument.[802] Hamilton maintained that the forceps, when properly applied, did no harm to the mother; the life of the infant was not relevant to their use.[803] Having read the cases in Collins' *Treatise on Midwifery*, Hamilton was convinced that Collins did not sufficiently value the forceps.[804]

As we have seen, Collins argued that, for the most part, practitioners should not interfere in labour unless they could confirm that the child was dead.[805] Even then, the most satisfactory evidence of the child's death did not warrant immediate intervention; practitioners needed to consider the mother's strength and the state of her physical health.[806] He stated that if natural birth could occur then it would always be preferable to any means of instrumental removal, and if the practitioner judged that intervention was not necessary for the sake of the mother's health then he should avoid interfering.[807] To support his claim, Collins included a case where, by employing the stethoscope, he determined that the child was alive and, in haste, decided to employ the forceps to remove the infant despite the mother not being in immediate distress: the negative impact of the forceps, he claimed, weakened the constitution of the child and it died 28 hours later.[808] Had he and the others in attendance trusted more in the natural powers of the mother's body then a longer-lived child might have been the outcome, so it was their instrumental interference that Collins regretted as the perceived cause of the child's death.[809] Collins displayed a relatively firm anti-intervention stance; as far as possible practitioners should not interfere unless the mother's life was in immediate danger, especially if the stethoscope indicated that the infant still lived.

[802] Hamilton 1837, 33.
[803] Hamilton 1837, 33-34.
[804] Hamilton 1837, 34.
[805] Collins 1835, 18.
[806] Collins 1835, 225.
[807] Collins 1835, 225.
[808] Collins 1835, 507-508.
[809] Collins 1835, 508.

Collins was not entirely opposed to the forceps; indeed, he modified them to create a form of short forceps in 1830, but even then he recommended that practitioners only use them when they could feel the ear of the infant, indicating that the head was sufficiently low in the birth canal for the safe application of the forceps.[810] Hamilton argued that Collins' recommendation would prevent practitioners from using the forceps in many cases where it could successfully aid the delivery.[811] He maintained that the feel of the child's head was distinct enough that any practitioner could develop the skill of understanding the position of the head in the birth canal.[812] Denman similarly advised using the ear of the child as a guide for using the forceps, as did London obstetricians Davis and Ramsbotham, well into the 1840s.[813] This difference in approach likely stemmed from the fact that practitioners in Edinburgh generally used the long forceps, while those in Dublin preferred the short version.[814]

In cases where the head was not accessible to the long forceps, Hamilton suggested that practitioners try to reach the head, but stated that it was likely they would need to use a perforator.[815] Practitioners in London preferred the stethoscope in these situations; the evidence afforded by auscultation not only relieved the practitioner's mind from painful anxiety, but proper diagnosis was a means of establishing himself in the good opinion of others.[816] Hamilton recommended (and practiced) that intervention take place as soon as the practitioner ascertained that it would be necessary.[817] As soon as the practitioner admitted the impossibility of the infant being born alive through the natural passages, he should intervene.[818] Hamilton

[810] Collins 1835, 244; Browne 1947, 167.
[811] Hamilton 1837, 35.
[812] Hamilton 1835, 35.
[813] Jenkins 2019, 122.
[814] Burns 1832, 440; Browne 1947, 167.
[815] Hamilton 1837, 34.
[816] Ryan 1831, 285.
[817] Hamilton 1837, 51.
[818] Hamilton 1837, 51.

claimed that practitioners at the Rotunda allowed women to suffer unnecessarily by letting labour continue when they were aware that the child could not be born living.[819]

At the Rotunda, Kennedy stated that former obstetric opinions suggested that, as soon as the death of the infant could be supposed, the practitioner could take any means necessary to remove it or cause its expulsion.[820] He claimed that previous practitioners held the view that once the child was dead it would necessarily require instrumental assistance for its removal.[821] Kennedy pointed out that this was clearly not the case, as practitioners could confirm foetal death in utero well before *natural* labour began and many had observed women deliver a stillborn child without practitioners needing to aid the delivery.[822] Whilst Hamilton argued that, once practitioners were sure the woman could not deliver a living child they should use instruments, Kennedy suggested that the use of instruments was unnecessary unless there was reason to believe the woman could not deliver the child – living or dead – by natural means.

Thomas M'Keever, the master of the Coombe Lying-In Hospital in Dublin, made it clear that the number of hours a woman was in labour for did not constitute a reason to interfere as long as her health remained stable.[823] Practitioners should only interfere with the distinct view of securing the life of the mother, and in that regard he was 'willing to admit' that other practitioners had laid too much stress on the audibility of the foetal heart as a guide in the employment of instruments.[824] M'Keever further stated that 'Instruments, however ingeniously contrived, however dexterously applied, are still an evil and are only to be thought of with the view of meeting one of still greater magnitude'.[825] Thus M'Keever inidcated that the most

[819] Hamilton 1837, 51.
[820] Kennedy 1833, 205.
[821] Kennedy 1833, 206.
[822] Kennedy 1833, 206.
[823] M'Keever 1833, 715.
[824] M'Keever 1833, 715.
[825] M'Keever 1833, 715.

eminent Irish obstetricians – Master and former Master of the Rotunda, Kennedy and Collins, and himself – still held firm anti-interventionist stances.

The stethoscope added an extra aspect to the debate surrounding intervention: auscultation provided additional information which practitioners could use to decide if they could justify the decision to use instruments to intervene in labour. This seemingly only added further to the debate, rather than bringing it to a close, as depending on their stance practitioners assigned different meanings to the sounds they heard with the stethoscope. Practitioners developed their skills with the stethoscope for a variety of reasons, including knowledge of the life or death of the foetus, which influenced their decisions regarding instrumental interventions in labour. Regardless of which way they chose, they would see the outcome of their diagnosis and decision within a matter of hours or days and without the need for dissection.

3.9 – Conclusion

This chapter has demonstrated the vast array of uses for mediate auscultation and the stethoscope in obstetric practice. It examined in detail the range of applications for the stethoscope, and the motivations of practitioners in adopting the stethoscope for these purposes. Such motivations included a religiously driven desire to reduce infanticide, the wish of practitioners to build up their reputations, general care for their patients, and improvements to multiple areas of medical jurisprudence. Obstetrics as a branch of medicine held its own unique challenges as it involved multiple, interlinked, patients which practitioners needed to treat in a carefully balanced manner, but with an emphasis on saving the one over the other should the need arise. Practitioners' motivations for adopting the stethoscope in obstetric practice therefore show a wide degree of variation, depending on their own personal beliefs, the experiences of their practice, and the institutional landscape in which they practiced.

Their means of developing skill in mediate auscultation and the stethoscope, however, remained the same regardless of their motivations. Obstetric practitioners did not regularly practice anatomico-clinical or anatomico-symptomatic correlation as their means of verification. Pregnancy and childbirth had a clear and distinct end point, which enabled practitioners to assess the accuracy of their predictions, verifying their diagnoses and providing feedback through which they could develop their skill with the stethoscope. While there was no ideal or set number of cases necessary for the development of this skill, practitioners seemed aware that the greater number of pregnancies and births they could observe, the more opportunities they would have for testing and increasing their diagnostic capabilities. Practitioners in Dublin, with access to one, large, lying-in hospital and numerous patients, appeared to adopt the stethoscope much more rapidly than practitioners in Edinburgh or London. Despite this, practitioners such as Moir in Edinburgh found that looking at as few as ten cases was sufficient to convince him of the utility of the stethoscope in obstetric practice.

The process of observing a patient, making a diagnosis, and verifying the diagnosis through confirmation or refutation underpinned the practice of anatomico-clinical correlation as well as the practice of symptomatic-pathological correlation. The fundamental difference between these is the means by which verification occurs; in anatomico-clinical correlation verification is necessarily through direct dissection of the patient, in symptomatic-pathological correlation verification occurs through some reference to the pathological anatomy, though not necessarily though dissection. For obstetric practice, which used the process of ODV without reference to any pathological anatomy – in no small part because pregnancy is not ‘pathological’ – verification occurred through the birth, or not, of at least one child (living or dead). In each form of use, the birth of the child (or not) acted as a means of verifying the diagnosis, the aspect of the process which aids practitioners in developing their diagnostic abilities and building skill with mediate auscultation and the stethoscope.

The practice of mediate auscultation and use of the stethoscope in obstetrics increased the number of diagnostic signs and general information about pregnancy which was available to the practitioner. Practitioners who adopted and advocated for the stethoscope in obstetric practice argued that the instrument enabled them to diagnose pregnancy earlier and with greater accuracy. Admittedly these claims did not go unchallenged and there was debate even amongst stethoscope adopters regarding which indications of pregnancy were 'infallible' and which were not. Similarly, practitioners could use the instrument to diagnose multiple foetuses in utero and prepare for what often turned out to be a more difficult labour as a result. The practice of mediate auscultation enabled practitioners to better prepare for labour and care for their patients by providing knowledge of the number of foetuses, their position, and if they were living or dead. The latter piece of information proved especially vital for practitioners in cases where they determined the necessity of intervention following a long or difficult labour.

This ability to determine which form of intervention, if any, was best links the adoption of mediate auscultation and the stethoscope into wider obstetric debates regarding instrumental intervention in labour. This chapter provides the first account of how the adoption of mediate auscultation interplayed with the changing opinions on, and approaches to the use of the forceps and other interventionist tools. The ability to determine whether the foetus in utero was alive or dead impacted how practitioners argued for and justified their own position on intervening in a labour. Pro-interventionist practitioners often disregarded the information of the stethoscope, while more cautious or anti-interventionist practitioners relied on the sounds and signs from the instrument as a means of making their decisions. These debates situate obstetric practitioner's adoption of the stethoscope not just as an interesting part of the general uptake of the stethoscope in the British Isles, although it does offer significant insight there, but further as an important aspect of understanding the wider history of obstetric practice.

The next chapter builds upon the concept of there being a broader approach to understanding the history and uptake of mediate auscultation and the stethoscope. Taking a step back from specific geographical locations, it examines the stethoscope as a physical object. As we shall see, it was a highly variable object which a person could, on the one hand, fashion out of rolled up paper if necessary, as with John Creery Ferguson, or which, by contrast, could take the form of a complex and ornate model that was used for display in the practitioner's home rather than in clinical practice. The next chapter considers the importance of the stethoscope as an object and approaches the adoption of the stethoscope with this physicality in mind.

<u>Chapter 4 – Developing the Stethoscope: The Importance of the Changes in Monaural Stethoscope Design</u>

"The diagram of the stethoscope, and the accompanying explanation of the best principles of its construction, I have thought worth adding, as workmen have hitherto had little but fancy to guide them."

– C. J. B. Williams, A Rational Exposition of the Physical Signs of Disease, 1828.

4.1 – Introduction

Historians often focus not on the stethoscope itself but on the technique the instrument helped crystallise: Mediate Auscultation.[826] Indeed, the previous chapters in this thesis are primarily concerned with the practice of auscultation, as indicated and aided by the use of the stethoscope, but not the instrument itself. Laennec's innovation was not the instrument of the stethoscope, but the technique of listening to the internal organs to determine their state: the stethoscope was simply an artefact of this technique.[827] This chapter is concerned with when, why, how and by whom the design of the stethoscope was altered. It suggests that changes to stethoscope design, which made the stethoscope lighter, cheaper, and more comfortable, came about due to the wants and needs of the practitioners who regularly used the instrument. It will become apparent that stethoscope design changes over time followed a pattern: little alteration in the first 10 years, followed by a period of intense innovation lasting roughly another 10 years, and finally a stabilisation of the instrument design.

Over the course of this chapter it will become clear that the process of design change necessarily went alongside British (and French) practitioners adopting the stethoscope; only with regular, and ideally widespread, use of the instrument was there innovation in its design.

[826] Sterne 2001, 116.
[827] Sterne 2001, 116-117.

Using both textual evidence and the objects themselves, patterns of change emerge. At first these design changes appeared to come only from France, with large alterations occurring seemingly 'at random' and often entering the British medical context in the translations of foreign books. On further examination, it becomes possible to interpret the design changes which occurred in both France and Britain as resulting from the wants and needs of stethoscope users. Through acknowledging the uptake of the instrument and the desires of these users, it is possible to arrive at a better understanding of at least some of the factors which influenced the design alterations. Use of the stethoscope became a 'performance' of skill, knowledge, and familiarity with the instrument.[828] As such, engaging with the development of the stethoscope as a *physical* object enables us to better understand the role of both the 'actor' and the 'object' in these historical scenarios.

Donald Blaufox, in his 2002 book *An Ear to the Chest*, attempted a similar approach to understanding and interpreting the evolution of stethoscope design. His was the first full work attempting to address this idea, an article by P.J. Bishop being the only example of a similar process before Blaufox's book. Bishop's article, whilst a useful text for understanding how the stethoscope changed, does not attempt to address why these changes occurred. Both the work of Blaufox and the content of this chapter aim to explain not just *how* stethoscope design changed, but also *why* such changed occurred; what motivated practitioners to make changes to the instrument and what can we learn from the surviving historical objects? As will become apparent in section 3.2, Blaufox based his explanation on acoustic reasoning, saying 'a person can understand the evolution of the stethoscope better with a basic knowledge of acoustics'.[829] This chapter argues that acoustic concerns were not a large factor in practitioners' motivations

[828] Rice 2010, 295.
[829] Blaufox 2002, 23.

for changing the design of the stethoscope, rather they were focused more on making the instrument easily transportable, inexpensive to buy, and comfortable to use.

This chapter uses a combination of both physical sources – historical stethoscopes from the Wellcome Collection's large assortment of objects held at the London Science Museum – and written publications from practitioners which range from the creation of the stethoscope in 1816 to its widespread use by the mid-1840s. It examines the physical changes within the object collection and how practitioners at the time justified any design alterations they made. Objects can reveal complexities of change in society, more so than textual analysis alone.[830] Whilst it may be possible to 'read' an artefact without any additional information from textual evidence, this would likely lead to an incomplete story as questions such as 'who' and 'why' would become more like guesswork than investigation.[831] For that reason, this chapter intertwines the evidence from the Wellcome Collection of stethoscopes with evidence from primary textual sources. The collection of stethoscopes at the Science Museum contains more than 150 individual objects related to monaural stethoscopes; section 4.2 provides a more detailed overview of where and how these objects are stored. It will become apparent that these design alterations occurred in a certain kind of pattern: there was little initial change, then a period of intense innovation, and finally a stabilisation of the instrument's form (this is further explored in Appendix 1). For the sake of keeping the discussion within a reasonable scope, this chapter is only concerned with monaural stethoscopes; the most common design until the start of the 1850s.

Stethoscope designs needed to operate within a set of parameters: doctor-patient relationships, the structure of the clinic, and the broader standardisation of medicine occurring

[830] Virdi 2010, 278.
[831] Virdi 2010, 278.

in the mid-1800s.[832] In contrast, stethoscopes which exist within a museum collection are no longer within their intended context; no matter how mundane or uninteresting, they are valuable to the researcher and curator despite no longer serving their original function.[833] Touching and handling the objects are crucial ways to examine and care for them, although with old or delicate objects it is important to handle them carefully.[834] Prolonged contact with a researcher or curator may be harmful to the object or harmful to the person themselves, and training regularly reiterates the potential danger of touching museum objects. With knowledge of the risks and training in appropriate methods, it was possible to handle the stethoscopes in this collection, a vital step in understanding how a historical user may have interacted with the object. By examining the weight and feel of the instruments, as well as trialling a range of them as objects for the *purpose* of auscultation, the stethoscopes provided a great deal of information about themselves. (For more details, see Appendix 1).

As a part of grasping why practitioners made alterations to the design of the stethoscope, it is necessary to understand the notion of 'relevant social groups' who interacted with the instrument. A 'relevant social group' is a term used to describe individuals (organised in institutions or working independently) who have the ability to decide if an artefact has a 'problem' which hinders its utility.[835] It is important to note that there are many relevant social groups for an object, and whilst 'users' are often the most obvious relevant group there is also a range of 'non-users' whose views and opinions may impact the design of an object.[836] In the case of the stethoscope, the relevant social groups are those of adopters and patients (who did not use the instrument, but had it used upon them). The wants, opinions, and concerns of all these relevant social groups could exert pressure on practitioners interested in making

[832] Sterne 2001, 116.
[833] Hess and Geoghegan 2015, 454.
[834] Hess and Geoghegan 2015, 460.
[835] Pinch and Bijker 1984, 414.
[836] Pinch and Bijker 1984, 414.

alterations to the stethoscope's design. As stethoscope uptake and use increased, so the pressures from the relevant social groups changed and increased. Section 4.3 looks at the work of Donald M. Blaufox on stethoscope design changes, which suggested that practitioners primarily noticed 'problems' relating to the acoustic properties of the stethoscope; a claim this chapter argues against, demonstrating that practitioners were seemingly more concerned with practical issues such as portability and comfort.

The chapter follows the chronological progression of the stethoscope in Britain, considering the design changes and discussion of the instrument *as an object* which occurred amongst practitioners. Section 4.4 examines the stethoscope's introduction to the British Isles; looking at how practitioners accessed the instrument and where any design alterations originated in that time. This section further considers how the early adopters, such as those discussed in Chapter 1, came to own a stethoscope, as well as discussing the sale and manufacture of the instrument in Britain. There appeared to be very few changes to stethoscope design in the first 10 years following its invention by Laennec. Moreover, any alterations which did occur came from French practitioners rather than British ones, as the French practitioners were already more familiar with the instrument. It will become apparent that these changes occurred for reasons unrelated to the acoustic capabilities of the instrument – instead, French practitioners focused on ease of manufacture and transportation.

Section 4.5 begins with the first design change which came from a British practitioner and follows the design changes that coincided with the increase in stethoscopic teaching seen in Chapter 2. As use of the instrument increased so did the number of suggested design alterations; widespread use was a necessary factor in innovations in stethoscope design. This widespread use brought about new considerations for the relevant social groups: how affordable was the stethoscope? How comfortable was it as an item for everyday use? These considerations appeared both in the writing of those practitioners suggesting design alterations and in the objects themselves. The stethoscopes became smaller and had fewer parts, reducing the cost of manufacture and lowering the cost for a new medical student buying their first instrument.

Finally, section 4.6 examines the design of the monaural stethoscope which came to be the 'standard'. This is the point at which the design of the artefact is 'fixed' and most, if not all, of the previously perceived 'problems' that the relevant groups had with the instrument are resolved, creating an 'ideal' or 'essential' design.[837] Stabilisation is not necessarily characterised by the disappearance of all of the perceived problems; the relevant social groups may simply accept some problems or think they have solved a problem when they have not.[838] As use of the instrument continues, new problems can occur and practitioners in the relevant social groups then begin a new round of trial and error in an attempt to fix these new issues. In this way we may understand stabilisation of an artefact as a matter of degree, if stabilisation does ever occur, rather than one of finality.[839] This section considers the culmination of design alterations which brought about the model that remained the most common monoaural stethoscope for the rest of the 19th century. It explores the question of who originally created the design which became the 'stable' model, as well as looking at the features of the design and which problems this version of the instrument 'fixed'. It will become clear that, for the relevant social groups, the design which became the most prominent struck a balance between affordability, portability, and comfort.

Regular use was a necessary part of these design changes; as adoption increased and the stethoscope became a standard part of British medical practice, the number of relevant social groups increased, which in turn increased the perceived 'problems' with the initial

[837] Pinch and Bijker 1984, 417.
[838] Pinch and Bijker 1984, 424.
[839] Binnie et al 2020, 2; Pinch and Bijker 1984, 424.

stethoscope design. It was attempts to tackle these problems – affordability, portability, and comfort – which brought about the majority of the design changes to the stethoscope, rather than concerns about the acoustic properties of the instrument. This chapter therefore answers both *how* and *why* practitioners made design changes to the stethoscope and demonstrates how these design changes directly relate to an increase in British practitioners adopting the practice of mediate auscultation with the stethoscope.

Practitioners lacked a standardised nomenclature for the parts of the stethoscope and Blaufox's terms relate too closely to modern stethoscopes to be useful here.[840] This chapter therefore will use the following terms, as seen in the glossary, to describe the parts practitioners referenced most often:

- Monaural Stethoscope – an instrument which the practitioner applies to only one ear. The original form of stethoscope, and the only form until the 1850s.
- Binaural Stethoscope – an instrument which the practitioner applies to both ears. The form most commonly seen today, invented in the 1850s.
- Chest piece – the part of the stethoscope which the practitioner applies to the body of the patient.
- Chest part – if the stethoscope comes in separate pieces, this is the part which has the chest end on it.
- Ear plate – the disk onto which the practitioner places their ear.
- Ear part – if the stethoscope comes in separate pieces, this is the part which has the ear plate on it.
- Obturator – a removable 'stopper' or 'plug' placed into the chest end of the stethoscope as a means of differentiating between the sounds of the lungs and the heart.

[840] Blaufox 2002, 3.

- Mortise and Tenon – a form of joint which typically connects two pieces of wood, the mortise forms a hole and the tenon a 'tongue' cut exactly to fit into the mortise, to hold an object together

4.2 – Wellcome Collection Stethoscopes at the London Science Museum

Tucked away in South London there is a beautiful old building which was once the headquarters for the Post Office Savings Bank. Blythe House has many of the design features necessary for a bank and post office: complete with large basement vaults and thick brick walls to keep the valuables contained in the building safe and sound. In 1979, following the dispersal of the Savings Bank, the building became official storage space for the Science Museum (including items on loan from the Wellcome Collection), the British Museum and the Victoria & Albert Museum. To access the Science Museum objects, it is necessary to get through a series of security measures including a corridor affectionately known as 'the chicken run'. Each floor, connected by grand stone staircases, houses a specific type of object; the stethoscopes were in the basement, behind a heavy metal door almost 25cm thick.

I undertook the greater part of my research at Blythe House during the July and August 2018. The building was always impressive, giving off a feeling of being separate in time, full of wonders, the thick walls blocking out most of the sound from the city outside. The basement rooms were always cold, so despite it being mid-summer I regularly brought several thick jumpers with me to Blythe House, which – as discussed in Appendix 1 – ended up aiding my research. Appendix 1 contains further details of my research with the stethoscopes, including tables of findings and a discussion of my methods. This chapter focuses primarily on using those findings as evidence for a broader historical claim regarding how practitioners developed skill with the instrument and how this knowledge, which was often tacit in nature, became embodied in the very design and body of the stethoscope itself.

In this basement room at least 30 metal cabinets lined the walls, as well as four rows of freestanding wooden shelves, each containing immaculately sorted and labelled historical medical objects. The metal cabinets were roughly 2 metres high and about a metre wide. The Wellcome Collection monaural stethoscopes, which are on long term loan to the Science Museum, took up almost one full storage cabinet. There were 16 drawers per half-cabinet, with each drawer usually holding 10-15 stethoscopes (although this did vary) stored neatly on foam mats. Figure 1 shows an example of one of the drawers from the main cabinet. A researcher never encounters objects in a museum or archive store ‘at random’. In each case, a curator has worked through the objects, recording and cataloguing each one, and placing them in a specific place – down to the specific drawer – so that anyone who wishes to find them on future visits can easily do so. This lay out further means that any researchers can access the majority of the relevant objects all in one place. Blythe House closed at the end of 2018, with each museum moving their collections to new storage facilities – a move that will take several years to complete – so the stethoscopes are now unavailable to researchers and museum staff alike until they are unpacked in the new building.

Figure 1: A drawer with 13 stethoscopes, or stethoscope parts, stored in one of the cabinets in Blythe House. The majority of the stethoscopes seen in this image were made from materials such as plastic and ebonite, which placed their manufacture outside the dates covered in this chapter.

Looking at a group of the same object in one go allows the researcher to notice patterns which may not appear when only observing a few objects or examining only text-based sources. With the physical objects so close to each other, things such as changes in length and the presence (or absence) of certain features become much more immediately apparent. At the start of my research many stethoscopes looked so similar I had assumed they were the same 'design', but seeing the objects together brought out the overarching differences. Careful study of this collection revealed some of the smaller, but no less important, changes and emphasised that there was a high number of particular styles – Laennec, Billing, and Ferguson – which survived. Only through seeing all the objects together was it really possible for me to appreciate the vast range of possible stethoscope designs; this chapter, as well as appendix 1, aims to give at least some indication of the variety of possible stethoscope designs available between 1816 and 1850.[841]

Every object in this large array had catalogue numbers which correlated to an entry in a large database, which in turn contained information on where they were in Blythe House as well as any details on their provenance. As mentioned in the introduction to the thesis, Henry Wellcome acquired 'anything and everything' and he did not hire people to catalogue his collection until 1914, when he had already obtained thousands of objects. The first records of many objects, including a large number of the stethoscopes in the Wellcome Collection, occurred well after Wellcome acquired them, and often contained little-to-no information on where they came from. Additionally, Wellcome collected replicas or copies of objects, as his he wanted to create a 'complete' history even when he could not source the original items;[842] this makes 'dating' objects even more difficult, as they may reflect a style from a much earlier period than when they were made. Many of the dates given to the instruments appeared to be guesses from the person creating the catalogue record, with a number of entries giving potential date of stethoscope manufacture as '1800-1850': an unhelpfully broad date range, which started 16 years before Laennec had even invented the instrument. When the Wellcome Collection transferred the loaned stethoscopes to the Science Museum, the museum staff reviewed each instrument and record and gave them a new catalogue number, thus paralleling the Wellcome catalogue rather than replacing it. In many cases, I was likely the first person to look at these records since the transfer of the long-term loan to the Science Museum.

Some of the instruments did have clear provenance, although the ones with the most notable backgrounds were on display in the Museum, so I was not able to fully examine them. The stethoscope in Figure 2 is one such object; an instrument with a clear label and provenance,

[841] Schaffer 2011, 707.
[842] Larson 2010, 98.

which is regularly on display at the Science Museum and was therefore unavailable for me to examine as a part of this project. It will become apparent, however, that this instrument is very similar to other designs which I was able to interact with at Blythe House. Most objects do not have a clear provenance; either they have so little information attached to them that discovering who they belonged to and when is simply not possible, or the information available may be inaccurate. This discrepancy in both availability and accuracy of information made it difficult to determine precise dates for the stethoscopes in the collection, although the addition of textual sources has aided the formation of a chronology based on a variety of design features present (or absent) in the instruments.

Figure 2: Laennec-style stethoscope, c.1820 on display at the London Science Museum, on loan from the Wellcome Collection (A106078). It has a label on it which reads as follows: "This is one of Laennec's original stethoscopes, and it was presented by him to Dr Bégin a French Army surgeon whose widow gave it to me in 1863."[843]

The objects in the museum store at Blythe House presented both fantastic opportunities and remarkable obstacles. This large, extremely varied collection being kept in one place meant I could observe and examine the instruments in reference to each other, allowing the formation

[843] Monaural stethoscope; Laennec type. Credit: Wellcome Collection. Attribution 4.0 International (CC BY 4.0). I took all of the other pictures in this chapter and in Appendix 1, with permission from the Science Museum and the University of Leeds.

of ideas that would not have arisen without access to the objects. At the same time, the number of objects could be overwhelming, and the mixture of important information with inaccurate details made approaching the instruments a huge task. Time with the objects enabled me to understand them in a way that only reading textual sources, or only *looking* at objects, could not. The stethoscope was an object which practitioners *used*, often on a daily basis, and only through dealing with the objects first-hand was it possible to gain an appreciation of what the objects felt like to carry, manipulate and use. It was only by working with the objects in this way that I came to the argument suggested in this chapter: as practitioners became more accustomed to the stethoscope, they made design changes which altered the portability, cost, and comfort of the instrument, as those were the aspects which most impacted their ability to obtain and use it.

4.3 – Blaufox's Acoustic Account

The work of Donald Blaufox is the first full attempt to look at changes to stethoscope design and explain why practitioners made these alterations. He argued that practitioners made changes to the design of the stethoscope as a means of improving the acoustic qualities of the instrument.[844] He suggested that British practitioners were slower to accept the stethoscope than their French counterparts.[845] As demonstrated in previous chapters, this is not an accurate portrayal of the British response to the stethoscope. He noted that many of the initial design changes came from French practitioners and seemingly concluded that this was due to British practitioners not being interested in the stethoscope.[846] I argue that rather than being uninterested in the stethoscope, British practitioners were still becoming used to the technique

[844] Blaufox 2002, 23.
[845] Blaufox 2002, 15.
[846] Blaufox 2002, 15.

of mediate auscultation and the stethoscope, and as such did not yet have enough skill with the instrument to be able to fully assess what alterations would best benefit them.

Blaufox worked with his own private collection of stethoscopes as well as the additional objects from a deceased physician, Nolie Mumey.[847] He did not note whether the collection came from primarily British or American makers. He already had his own collection of medical objects, consisting primarily of blood pressure apparatus and stethoscopes, to which he added Mumey's collection.[848] Mumey had already written a manuscript for a book on stethoscope design, which Blaufox obtained when he acquired Mumey's object collection, and from this manuscript he decided to finish and publish the work on changes to stethoscope design; he used Mumey's sources, but the majority of the book appears to be Blaufox's original work.[849] He noted that the number and variety of different stethoscopes defied description, something especially true for Blaufox as he looked at both monaural and binaural stethoscopes.[850] In his work he attempted to include examples of some of the 'truly evolutionary' stethoscope designs, although for Blaufox the images were for illustrative purposes only, rather than to demonstrate any particular point.[851]

He began by explaining that the sound conduction of the stethoscope relied on the conduction of both the air in the instrument and the bones in the practitioner's ears.[852] Due to this method of sound conduction, practitioners using monaural stethoscopes had to press very tightly against the patient in order to create a seal of air through which the sound could travel.[853] For Blaufox, this emphasised the acoustic disadvantage of the early monaural stethoscope; the

[847] Blaufox 2002, vii.
[848] Blaufox 2002, vii-viii. Blaufox's collection is now at the Dittrick Museum and has been on display since 2013, for a closer look at his collection see this page: http://www.mohma.org/instruments/category/stethoscope/
[849] Blaufox 2002, viii.
[850] Blaufox 2002, 3.
[851] Blaufox 2002, 3.
[852] Blaufox 2002, 23.
[853] Blaufox 2002, 23.

design of the instrument made it difficult for practitioners to properly apply it and still have a decent audio quality with which to hear the patient's thorax.[854] Indeed practitioners at the time seemed aware that sometimes, especially with particularly emaciated patients (common for late stage phthisis) they needed to 'close the gaps' and give the stethoscope a full seal on the patient's skin.[855] What Blaufox did not consider was the idea that such a level of pressure was also painful both to the physician and to the patient.[856] Such a problem could further motivate practitioners to change the design of the instrument, especially if they are regularly employing the object; practitioners may overlook occasional discomfort during one or two examinations, but if they used the object multiple times a day then the discomfort could become a more crucial concern.

Blaufox discovered that stethoscopes became shorter, compared to Laennec's original, and that that chest pieces appeared to get larger.[857] In keeping with his interpretation, he suggested that the length of a stethoscope was an important factor in the increasing the volume of the sounds it transmitted.[858] Furthermore, a larger chest piece would increase the volume of the transmitted sound, although it would reduce the ability of the practitioner to localise where a sound was coming from.[859] As this chapter will demonstrate, the length of the instrument changed dramatically between models, with the standardised model being significantly longer than some other designs. If practitioners had predominantly acoustic concerns in their design changes, we would expect the shorter (and therefore louder) models to become the standard design, when they did not. Furthermore, it is possible here that Blaufox was not always sure which end of the monaural instrument was the chest piece, as it was the ear plate which dramatically increased in diameter in these models. It is also possible that Blaufox was

[854] Blaufox 2002, 23.
[855] Forbes 1824, 68.
[856] Forbes 1824, 68.
[857] Blaufox 2002, 3.
[858] Blaufox 2002, 3.
[859] Blaufox 2002, 3.

discussing the binaural models in this instance, as he provided no clear distinction in his discussion between the two.

When Blaufox was explicitly discussing the monaural stethoscope, he rightly pointed out the acoustic principles of different materials.[860] Laennec constructed the original stethoscope out of a range of materials as a means of testing which would be the best sound conductor.[861] These materials included hard and soft wood, metal and glass.[862] By 1825 practitioners suggested that fine grained woods such as cedar or maple were the best material for stethoscopes.[863] Practitioners were certainly aware of acoustic principles as they related to the stethoscope, however they seemed content with the acoustic ability of Laennec's original design, often advertising their changes not as improving the sound but simply being 'as good as' the older model.[864]

Additionally, Blaufox accepted that while he championed the acoustic concerns as the primary motivation for practitioners changing the stethoscope, it remained the case that 'many other considerations played a role'.[865] Furthermore, in the writing of practitioners at the time there were claims about designs which were nothing to do with the acoustics of the instrument, instead they were based on more 'complex' considerations.[866] This chapter argues that these more 'complex' concerns were in fact quite simple; practitioners wanted an affordable and portable stethoscope, and both practitioners and patients wanted the instrument to be comfortable for everyday use.

Blaufox discussed experiments with stethoscopes in the 1940s which used microphones to measure the sound transmitted by different styles of stethoscope; these experiments

[860] Blaufox 2002, 27.
[861] Laennec 1827, 6. (Trans. Forbes)
[862] Laennec 1827, 6. (Trans. Forbes)
[863] Collin 1825, xi. (Trans. Ryland)
[864] Comins 1829, 686.
[865] Blaufox 2002, 3.
[866] Blaufox 2002, 3.

measured the sounds the monaural stethoscope transmitted in 'hertz', Hz, a form of sound measurement which the practitioners who made the instruments could not have been aware of as Heinrich Hertz, who gave his name to the measurement, was born in 1857.[867] He is not specific about which styles these experiments examined, but his mention of 'tubing' suggests these were primarily experiments on binaural stethoscopes.[868] His focus on the acoustic characteristics of stethoscopes, and general preference for discussing binaural stethoscopes, led Blaufox to claim that: 'For the most part, until the 20th century, the modifications were truly dependent on trial and error'.[869] The rest of this chapter demonstrates that, at least in relation to monaural stethoscopes, this claim was unfounded. Modifications to the monaural stethoscope made during the 19th century had very specific considerations motivating them: the desire for affordable, portable, and comfortable instruments.

4.4 – French Changes to Stethoscope Design

The first alterations to stethoscope design appeared between 1819 and 1826, all from French practitioners, with the earliest changes originating from Laennec himself. The French practitioners often had greater experience with the instrument; they had access both to its inventor as a teacher and to the environment in which Laennec invented and tested the practice of mediate auscultation and were, therefore, much more able to use the instrument daily. Users and patients had more opportunities to notice problems with the instrument in daily use, and non-users would have much more explicit reasons for not employing it. Increased skill with the stethoscope and more regular use meant that French practitioners were more capable of identifying and making any necessary design changes. In contrast, British practitioners at the time were just beginning to develop an interest in mediate auscultation, with only individual

[867] Blaufox 2002, 25.
[868] Blaufox 2002, 25.
[869] Blaufox 2002, 3.

practitioners attempting to use the instrument as a means of testing the method of mediate auscultation as a whole. This section, therefore, considers the changes French practitioners made to the design of the stethoscope, what their motivations were for making these changes, and how British practitioners obtained such instruments. It will become apparent that the changes from these French practitioners came from a desire to make the manufacture of the stethoscope easier and cheaper, and to make the instrument as a whole more portable.

Chapter 1 contained the story of Laennec's invention of the stethoscope in the autumn of 1816. Confronted with a patient where other diagnostic methods had failed, and where immediate auscultation was either not possible or had not yielded any results, he took a paper workbook, rolled it into a cylinder, and used the object as a tool for auscultation.[870] In that chapter the emphasis was on the creation of a new instrument for the purpose of listening to the chest, indeed that appeared to be Laennec's primary motivation. In Chapter 1, I afforded little attention to the fact that Laennec initially made the stethoscope out of paper; the first tool was an instrument hastily formed in the moment, out of delicate material. Few, if any, 'original' paper models survive due to the degradable nature of the material and Figure 3 shows what is likely a recreation. The accessions ledger from the Wellcome Collection first recorded it in 1914, when museum cataloguing began, and have it down as 'Laennec's first steth [sic]'; there is no information on the instrument's donor or source and Wellcome did not turn down 'well made' replicas.[871] It is more likely that this instrument is a replica as paper instruments were unlikely to survive and any which did would have very notable provenance. By looking at this model it is easy to understand why Laennec first suggested naming the instrument as simply 'the Cylinder'.[872]

[870] Laennec 1827, 5. (Trans. Forbes)
[871] WAHMM/CM/Acc/1; Larson 2010, 98.
[872] Laennec 1827, 5. (Trans. Forbes)

Figure 3: A recreation of Laennec's original stethoscope, held by the Science Museum (A608185).

In the days following the creation of the first stethoscope, Laennec made a stronger version of the instrument, again using paper and then pasting the edges down to create a firm cylinder. Once he had a model to experiment with, he began to explore a range of different materials in an attempt to determine which best carried the thoracic sounds.[873] As a result of this experimentation Laennec settled on wood as the optimal material for the stethoscope. He specified that this wood should be 'of medium density' but did not suggest any one particular wood for this purpose, a point we will return to later in this chapter. Despite the change in material, the overall stethoscope design retained the same dimensions as the paper model in terms of both length and diameter. Laennec considered the acoustic properties of the wood as a part of his design, but it is important to note that when trialled there was no significant difference in sound quality between the replica paper model and the wooden Laennec style object.

Laennec made two major changes to the stethoscope within the first three years of its invention: introducing an obturator (the removable stopper) for the chest end of the stethoscope and splitting the stethoscope in two. With the obturator in place the stethoscope could better transmit the sounds of the heart, with it removed the instrument was better suited to identifying the sounds of the lungs.[874] This is because the sounds made by the heart are lower in pitch to those made by lungs.[875] No records survive of Laennec making this change, nor of his reasons behind it; however, it seems very likely that the change was for these acoustic reasons. His

[873] Laennec 1821. (Trans. Forbes)
[874] Forbes 1824, 71.
[875] Davies and Murray 2016.

second change, splitting the footlong instrument into two parts, appeared to be one of practicality. The divided stethoscope meant that practitioners could more easily carry and store the instrument, furthermore the division held no acoustic benefit.[876] These two changes both occurred between Laennec's invention of the stethoscope in 1816 and the publication of his *Traité* in 1819. In this time Laennec regularly used the instrument and in the later part of that time so did some of his French colleagues, such as Jean-Bruno Cayol who introduced the instrument to James Clark in 1818.[877] Later in 1818 Clark returned to Britain briefly and gifted one of these cylindrical wooden stethoscopes to James Johnson; in the hands of Johnson this instrument became one of the first stethoscopes used in Britain.

Laennec's 1819 book *Traité*, intended to introduce the practice of mediate auscultation to the wider medical community, contained the first printed image of the stethoscope (Figure 4). This first image was of a wooden cylinder roughly a foot in length and an inch and a half in diameter, pierced longitudinally down the middle then divided vertically into two equal parts: a chest part and an ear part, attached by a screw. The ear part had a flat end which acted as an ear plate, and a threaded hole for a screw to go into. The chest part had a removable obturator for use at the chest end. This style of stethoscope was likely the one that Clark presented to Johnson, who described the instrument as:

> [A] cylinder of pretty heavy wood, about a foot in length, and an inch and a half in diameter, pieced longitudinally through its centre by a small hole of a quart of an inch in diameter, and with one end hollowed out in the shape of a small funnel. A piece of the same kind of wood, with a hole in its centre, is made to fill up this funnel, when necessary, like the tompion of a gun, and then the instrument may be considered as a simple tube.[878]

[876] Laennec 1821. (Trans. Forbes)
[877] Clark 1820, 153.
[878] Johnson 1820, 462.

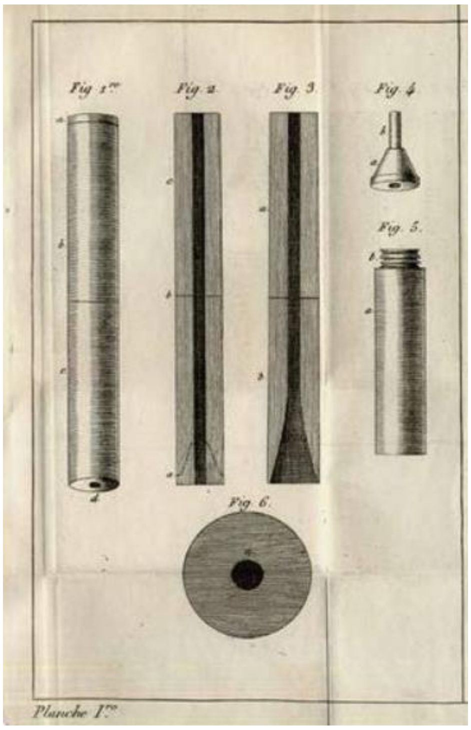


Figure 4: The first published design of the stethoscope, from Laennec's 1819 book *Traité.*

The 1819 book provided the first view of the stethoscope for many British practitioners. Within four months of Laennec publishing *Traité*, British practitioners who did not travel to France themselves could obtain a stethoscope from three places: as gifts from friends or colleagues who had travelled to Paris, buying imported instruments, or having an instrument made to order by a British instrument maker. Truetell and Wurtz, sellers of imported books based in Soho, sold Laennec's book for 13 francs, equivalent to roughly 10 shillings and 5 pence; practitioners could then purchase the stethoscope alongside the book for an additional 2 francs (1 shilling and 7 pence).[879] Famous instrument maker John Weiss similarly imported the instrument, later manufacturing them when his stock ran out.[880] It is probable that practitioners who bought these imported Parisian stethoscopes had models which were closest

[879] Bishop 1980, 452. 10 shillings and 5 pence would be roughly the equivalent of £30 in 2020. Converted prices done by me.
[880] Bishop 1980, 451.

to Laennec's specification, as the sellers likely sourced them from Laennec's preferred manufacturer.[881]

Sellers had a set stock of the imported models, meaning that early buyers of the stethoscope could simply walk into the shop and buy an instrument to take away that day, a pattern of selling which did not last once stocks ran out. James Johnson engaged a woodturner, Allnutt of Piccadilly, to make stethoscopes for 'any gentleman … who may wish to have one'.[882] It is not clear why Johnson chose this manufacturer in particular; compared to Truetell and Wurtz the stethoscope cost significantly more, as Allnutt sold his stethoscopes for the price of 4 shillings each.[883] Weiss's shop was the closest to St Thomas' Hospital and Guy's Hospitals, so he likely received a high footfall from practitioners. Truetell and Wurtz in Soho were close to private medical schools such as Great Windmill Street. Allnutt in Piccadilly, however, was not close to any hospitals or private medical schools so had no proximity to areas of medical practice or study. However, these three sellers accounted for the availability of the stethoscope in London for the first few years following Laennec's publication.[884]

Similar to Allnutt's engagement to create stethoscopes for any who asked for one, the stethoscope seemed to function on a 'made to order' basis. In 1821 Forbes published *Treatise* and the stethoscope design printed within it was the same as the one which had appeared in *Traité* two years earlier (Figure 6). If any practitioners, French or British, had suggested changes to the design then Forbes made no mention of that in the translation. It could be the case that, since this was a translation of Laennec's original work, it would not have been proper for Forbes to put forward a new idea; what seems more probable is that there were simply no

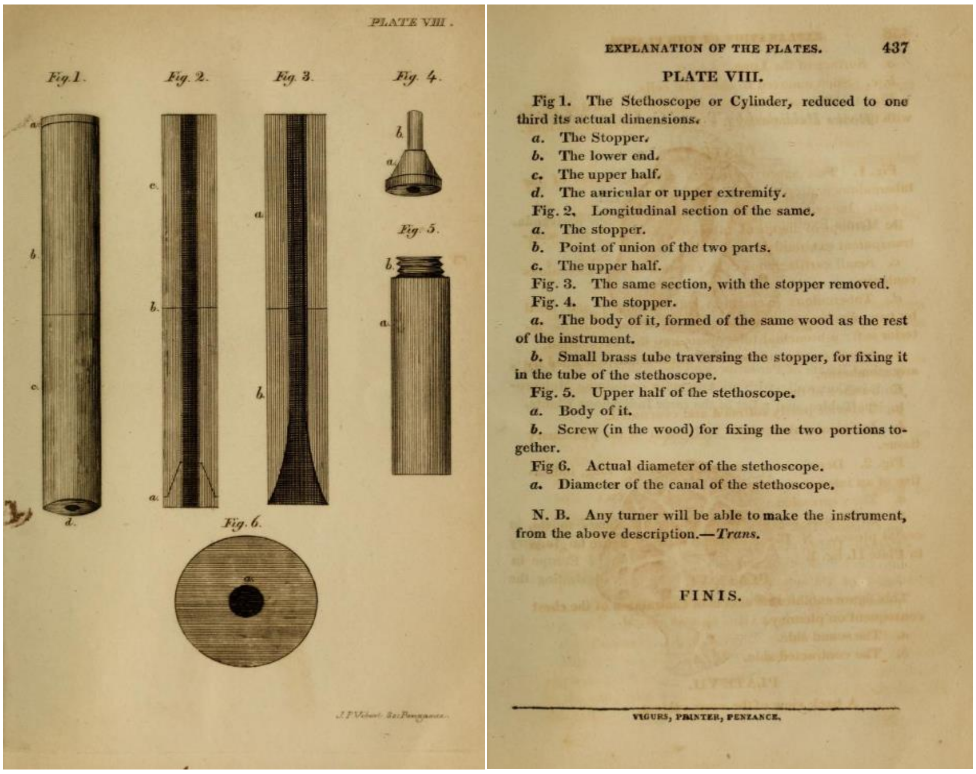
[881] I have been unable to ascertain who Laennec's preferred manufacturer was.
[882] Johnson 1820, 494.
[883] Johnson 1820, 494.
[884] This discussion pertains specifically to London as there I have not been able to find information on when the stethoscope first became commercially available in Edinburgh.

new designs to discuss. The design Forbes published had a note alongside it which read "N.B. Any turner will be able to make the instrument, from the above description".[885]

This further indicates that the stethoscope was a made to order product: practitioners simply approached their preferred maker and requested an instrument based on the printed design in either Laennec or Forbes' books. It is possible that some manufacturers made minor alterations to the design of the stethoscope for their own ease. A range of circumstances could impact the final design of the instrument; local wood availability, a manufacturer's link to metal workers, their general skill level, to list but a few. In smaller towns and cities such as Leeds, Bristol, or Derby, the impact of these factors was likely even more pronounced, as they relied more heavily on reproducing the instrument from print rather than having access to imported models sold in London.

Figure 5: A stethoscope held at the University of Leeds, believed to be an early model belonging to a Dr John Atkinson, dating from around 1826.[886] Edward Atkinson, John's son or grandson, donated the instrument in 1888. The instrument is half the length of a Laennec style model and has a lot of wear. It has not been possible to link the instrument with any particular maker, nor Atkinson's practice with the instrument.

[885] Forbes 1821, 437.
[886] Jones 2013, 721.



EXPLANATION OF THE PLATES. 437

PLATE VIII.

Fig 1. The Stethoscope or Cylinder, reduced to one third its actual dimensions.

a. The Stopper.
b. The lower end.
c. The upper half.
d. The auricular or upper extremity.

Fig. 2. Longitudinal section of the same.

a. The stopper.
b. Point of union of the two parts.
c. The upper half.

Fig. 3. The same section, with the stopper removed.

Fig. 4. The stopper.

a. The body of it, formed of the same wood as the rest of the instrument.
b. Small brass tube traversing the stopper, for fixing it in the tube of the stethoscope.

Fig. 5. Upper half of the stethoscope.

a. Body of it.
b. Screw (in the wood) for fixing the two portions together.

Fig 6. Actual diameter of the stethoscope.

a. Diameter of the canal of the stethoscope.

N. B. Any turner will be able to make the instrument, from the above description.—*Trans.*

FINIS.

VIGURS, PRINTER, PENZANCE.

Figure 6: The stethoscope design and accompanying explanation of the image as printed in Forbes' 1821 translation

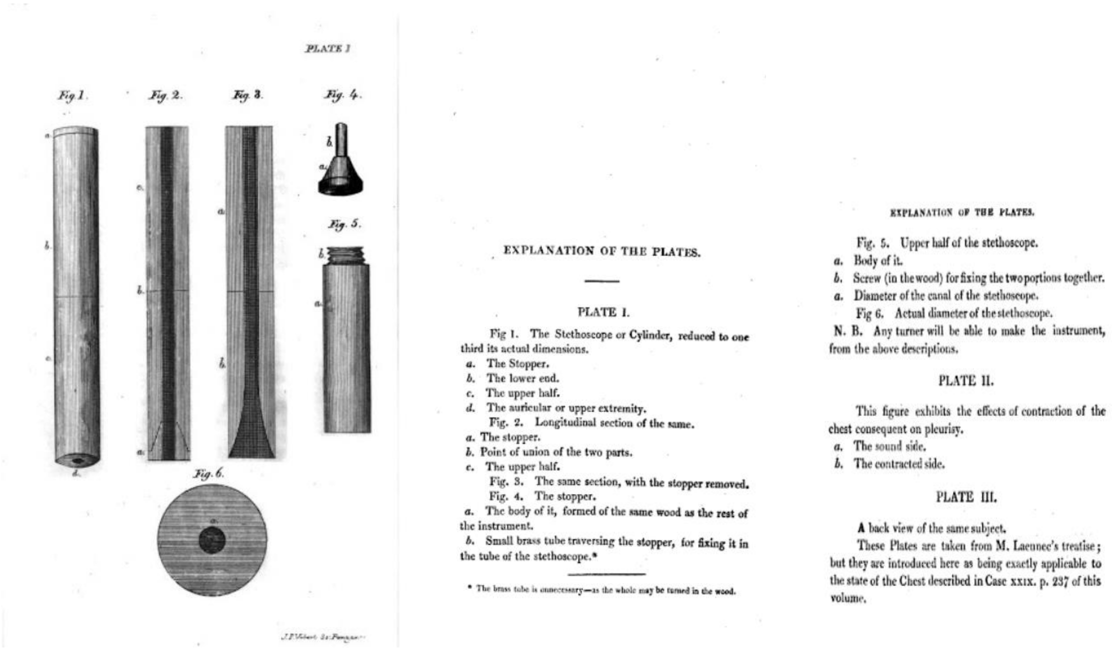
British practitioners could choose which manufacturer they employed to create their stethoscope, based entirely on their own preferences and location. The chosen manufacturer could then alter the instrument based on the individual practitioners' individual criteria, be they a need for cheapness, a desire for comfort, a requirement for portability, or some other unknown want. This led to many stethoscopes which do not exactly fit the pattern as outlined in *Traité* or *Treatise* but which all consistently show many of the features of Laennec's design (Figure 7). These small changes and innovations suggest that practitioners across Britain were interested in procuring one of Laennec's instruments, but did not change the stethoscope in any fundamental way. The instrument was still new, adopters likely employing it cautiously or rarely, using it only as a way of learning the practice of auscultation similar to Forbes' trials: the tool acted as a means to the practice of auscultation rather than being regarded as anything worth improving.[887] They did not have enough experience with the instrument to make informed design choices; it was necessary for them to understand and accept mediate auscultation as a concept before they could try to optimise the stethoscope.

Figure 7: A Laennec style stethoscope, c.1822, held at the Science Museum (A608187). Obturator present with a metal attaching tube. It is a solid piece of wood and does not split into two parts, the indentation around the middle mimics the two-piece style.

Use of the stethoscope was as yet neither standard nor codified in British medical practice and at the same time there was little innovation in stethoscope design. The same, unchanged, stethoscope print appeared again in Forbes' 1824 book *Original Cases*, including the same wording (Figure 8). Forbes intended his book to be a guide for physicians, especially students, who wished to learn how to use the stethoscope; he was still encouraging fellow practitioners to adopt the instrument, suggesting that uptake continued to be low.[888] Nevertheless, by 1824 a few more British practitioners such as John Elliotson at St Thomas' Hospital and surgeon Astley Cooper at Guy's Hospital were regularly trialling the stethoscope.[889] These practitioners still practiced as lone, extraordinary, men trialling the

[887] I have been unable to locate Forbes' own stethoscope. There are several archives which hold some of Forbes' ephemera; Morrab Library, Chichester Archives, University of Edinburgh, Aberdeen University Library, and King's College Library. I managed to visit the King's College Library but did not find anything relating to Forbes' stethoscope and I have had email correspondence with Morrab Library, who similarly do not have any records of his stethoscope. Both Edinburgh and Aberdeen have extensive online archives that do not list the instrument. I was not able to contact or visit the Chichester Archives.
[888] Forbes 1824, viii.
[889] *Lancet*, 3 April 1824, 13; 4 September 1824, 309.

instrument without the educational or institutional framework necessary to make the practice widespread amongst British and Irish medical practitioners.



EXPLANATION OF THE PLATES.

PLATE I.

Fig 1. The Stethoscope or Cylinder, reduced to one third its actual dimensions.
a. The Stopper.
b. The lower end.
c. The upper half.
d. The auricular or upper extremity.
Fig. 2. Longitudinal section of the same.
a. The stopper.
b. Point of union of the two parts.
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Fig. 3. The same section, with the stopper removed.
Fig. 4. The stopper.
a. The body of it, formed of the same wood as the rest of the instrument.
b. Small brass tube traversing the stopper, for fixing it in the tube of the stethoscope.*

* The brass tube is unnecessary—as the whole may be turned in the wood.

EXPLANATION OF THE PLATES.

Fig. 5. Upper half of the stethoscope.
a. Body of it.
b. Screw (in the wood) for fixing the two portions together.
a. Diameter of the canal of the stethoscope.
Fig 6. Actual diameter of the stethoscope.
N. B. Any turner will be able to make the instrument, from the above descriptions.

PLATE II.

This figure exhibits the effects of contraction of the chest consequent on pleurisy.
a. The sound side.
b. The contracted side.

PLATE III.

A back view of the same subject.
These Plates are taken from M. Laennec's treatise; but they are introduced here as being exactly applicable to the state of the Chest described in Case XXIX. p. 237 of this volume.

Figure 8: The stethoscope design and accompanying explanation of the image as printed in Forbes' 1824 book *Original Cases*.

British physician Charles Thomas Haden reportedly worked with Laennec at the lathe, making some of the earliest changes to the stethoscope.[890] Haden's close friend Thomas Alcock, a London-based surgeon, reported that Haden had visited Paris and was one of the first stethoscope adopters in the country.[891] Physician and artist F. Seymour Haden, Charles Haden's son, also stated that Haden Sr. had met with Laennec on a visit to Paris.[892] Blaufox suggested that Haden was responsible for creating a half-length stethoscope, although he also noted that Laennec occasionally recommended only using one half of his longer form stethoscope.[893] If Haden was responsible for these changes, he would be one of the first people other than Laennec to alter the early design of the stethoscope. His work alongside Laennec would have

[890] Blaufox 2002, 28; Williams 1884, 417.
[891] Haden 1827, ix.
[892] Williams 1884, 417.
[893] Blaufox 2002, 28. It certainly did not make it into Forbes' translation if is the case.

exposed him to regular use of the instrument, similar to the practice of French physicians. Haden worked in London before accompanying a patient to Madeira, dying there in 1824, so any interactions between him and Laennec must have been during the early development of the stethoscope.[894] Laennec never mentioned Haden in his work.

Without any direct evidence of Haden's involvement, it appears that Laennec continued to be the only practitioner to purposefully change the stethoscope's design. British physician Charles Scudamore had large ears and struggled to use the stethoscope comfortably, so whilst Scudamore studied in Paris during 1825 Laennec supposedly altered the stethoscope to make it easier for him to use.[895] The exact nature of this change is unclear; Laennec either enlarged or scooped out a small part of the ear plate of the instrument.[896] Physician and stethoscope advocate C.J.B. Williams, who was present at the time, noted that enlarging the ear plate was a change that was 'acceptable to many'.[897] Despite this claim there is no evidence to suggest that a wider ear plate was included in any of Laennec's future published designs.

Later in 1825 French physician Victor Collin, a contemporary of Laennec, published a treatise on auscultation which contained a new stethoscope design, the first published alteration of the instrument. In his book *Different Methods of Investigation* Collin made only one change to Laennec's design: the shape of the mortise and tenon for both the obturator and the main body of the stethoscope (Figure 9). Instead of the conical shape seen in Laennec's obturator, and the screw for connecting the chest and ear parts of the instrument, Collin introduced a dome shaped connection for both the obturator and the main stethoscope. While this design changed only a small aspect of the instrument, the difference in shape makes it much easier to identify stethoscopes manufactured *during or after* 1825, such as the one from the Science Museum

[894] Haden 1827, xii.
[895] Williams 1884.
[896] Williams 1884.
[897] Williams 1884.

seen in Figure 10. Collin was accustomed to using the stethoscope, he employed it regularly in his practise on phthisical patients, working alongside Laennec at the Necker. These alterations were primarily for ease of transport or comfort, not acoustic reasons. Furthermore, the changes to stethoscope design came from those who regularly used the instrument, which in the mid-1820s consisted primarily of French practitioners.

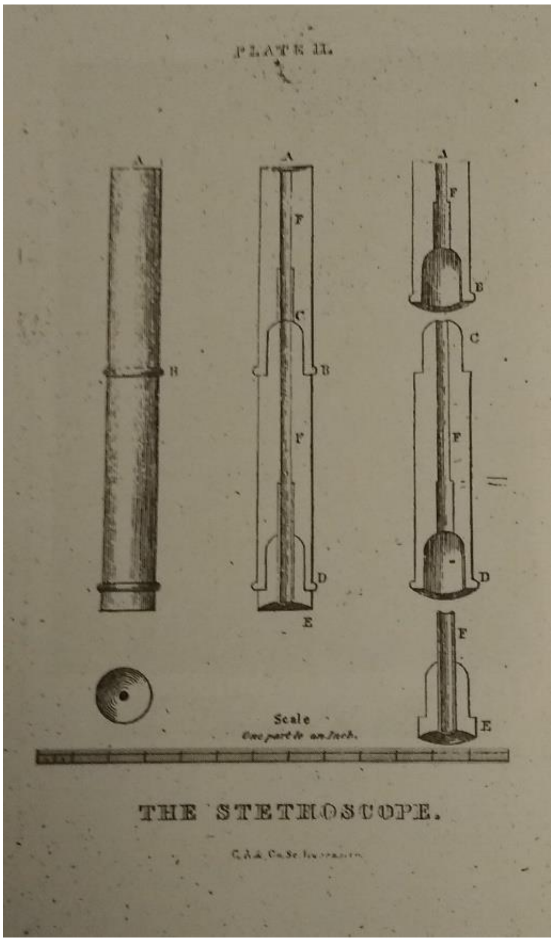

Figure 9: The Collin-style stethoscope published in his 1825 book.

Figure 10: An 1826 Laennec-style stethoscope, metal tube stuck in chest end dome (A608192). This instrument belonged to a Dr Michael Grabham (1840-1935), the model design considerably predates 1861, when Grabham gained his MD. His father was also a physician, so it is likely that the instrument initially belonged to Grabham senior.

Collin designed his stethoscope so that the obturator could fit into both the chest and ear parts of the instrument.[898] This connection, by making the tenon and mortice the same shape in for each piece, allowed Collin to get around his principle complaint about the instrument: that it was too large to conveniently fit into a coat pocket.[899] Since the obturator could fit into both the chest and ear parts, practitioners could choose to simply forgo the chest part of the instrument, instead using the ear part and the obturator as the 'whole' instrument, making it shorter and lighter to carry.[900] Furthermore, the screw shape in Laennec's original model was a difficult and intricate shape to create; by having a mortise and tenon with a metal tube, rather than a screw, Collin's stethoscope took less time and skill to manufacture.[901] The changes were unlikely to have impacted the acoustic ability of the instrument, but Collin's model was easier and cheaper to make.[902]

898 Collin 1825, 135. (Trans. Ryland)
899 Collin 1825, xi. (Trans. Ryland)
900 Collin 1825, 135. (Trans. Ryland)
901 Bishop 1980, 452.
902 Bishop 1980, 452.

It was Collin's design which appeared in the print of Laennec's 1826 edition of *Traité*.[903] Forbes similarly reproduced the image in his translation of the second edition, published in 1827.[904] (Figure 11). Collin and Laennec had a disagreement regarding some uses of mediate auscultation, particularly in relation to the diagnostic phenomena Laennec termed pectoriloque.[905] Neither Laennec nor Forbes acknowledge that the design originally came from Collin. Laennec often avoided citing other practitioners in general, however, he seemed to regard Collin's work as a challenge to his own research.[906] Indeed, Laennec seemed to quietly accept and utilise Collin's work and stethoscope design, but he never cited Collin in his work.[907] If Forbes was aware that the new design came from Collin, he did not rectify Laennec's omission.

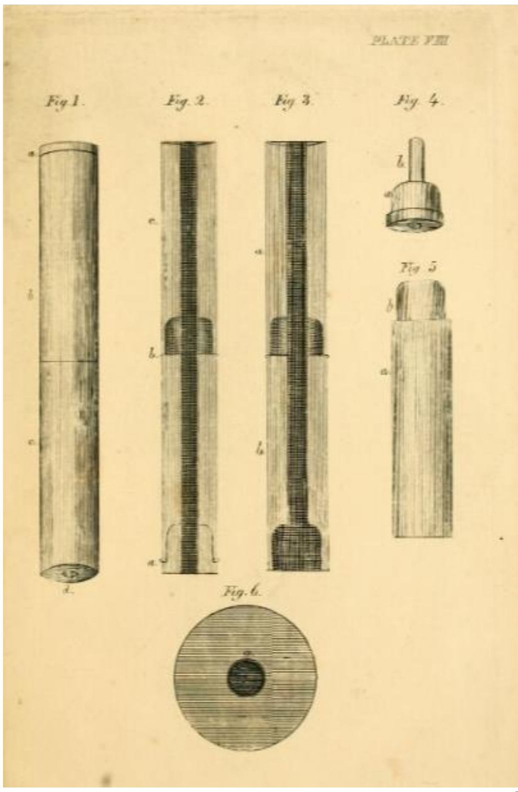

Figure 11: The stethoscope design published in Laennec's 2nd edition of *Traité*.

[903] Laennec 1826.
[904] Forbes 1826.
[905] Duffin 1998, 165.
[906] Duffin 1998, 137.
[907] Duffin 1998, 165-166.

The next design change came from another French physician, Pierre-Adolphe Piorry. Modern historical accounts of Piorry's work link him with Laennec but do not remember him specifically for his connection to the stethoscope, instead he is credited as the father of 'mediate percussion'.[908] Mediate percussion was the practice of percussing a patient without direct contact between the patient and the practitioner. Having also studied under Corvisart, Piorry wanted to do for a method of percussion what Laennec had done for auscultation.[909] Piorry suggested a circular pleximeter made from ivory could be placed between the patient and the practitioner during percussion.[910] The pleximeter was a circle of material, often ivory, which the practitioner could place between the patient's body and their fingers whilst practicing the diagnostic method of percussion. Piorry's aim was to reduce patient pain, improve sound, and create a barrier between the practitioner and any potential skin-based illnesses.[911] His motivations for changing the design of the stethoscope should, therefore, be understood in conjunction with his focus on introducing the pleximeter.

Piorry altered the stethoscope in order to include a pleximeter in the design, linking the two objects together (Figure 12). He considered the stethoscope to be 'indispensable' and considered a combination of the stethoscope and the pleximeter to be a good way to call physicians' attention to his new diagnostic tool.[912] In order to maintain the presence of an obturator the stethoscope had a plug which could be held in place with the ivory cap, or removed, as necessary. [913] Piorry removed the 'two part' aspect of the stethoscope, halving the length of the instrument by having one main body rather than a chest part and an ear part. In some Piorry models the obturator could still be inserted into the main body of the instrument using a metal tenon. In these cases, the patient end of the obturator often had an ivory rim

[908] Sakula 1979, 575; 577.
[909] Sakula 1979, 577.
[910] Piorry 1828, 17.
[911] Piorry 1842, 173.
[912] Piorry 1828, 17.
[913] Piorry 1828, 330.

around it to allow the practitioner to attach the cap, ear plate and pleximeter when transporting the instrument. Piorry's stethoscope was also shorter and thinner than any previous designs, measuring around 8 inches (20cm) rather than 12 inches (30cm) in length, and a half-inch (1cm) in diameter. He described the main body of the stethoscope explicitly as cedar wood but provided no rationale for this specification, and whether this suggestion was followed by other practitioners and manufacturers is unknown.[914] Piorry had no intention of replacing Laennec's 'method' of mediate auscultation with his own ideas, instead he advocated for using both percussion and auscultation together.[915] Piorry's interest in design changes was fundamentally tied to his desire to promote his own instrument through attaching the pleximeter to the stethoscope and encouraging the use of both. The increase in number of parts, as well as the reduction in length and weight, made the Piorry stethoscope, distinct from the previous Laennec-style instruments both in print and as a physical object. Due to the additional parts and the heavy use of finely worked ivory, Piorry's stethoscope was likely more expensive than previous models.

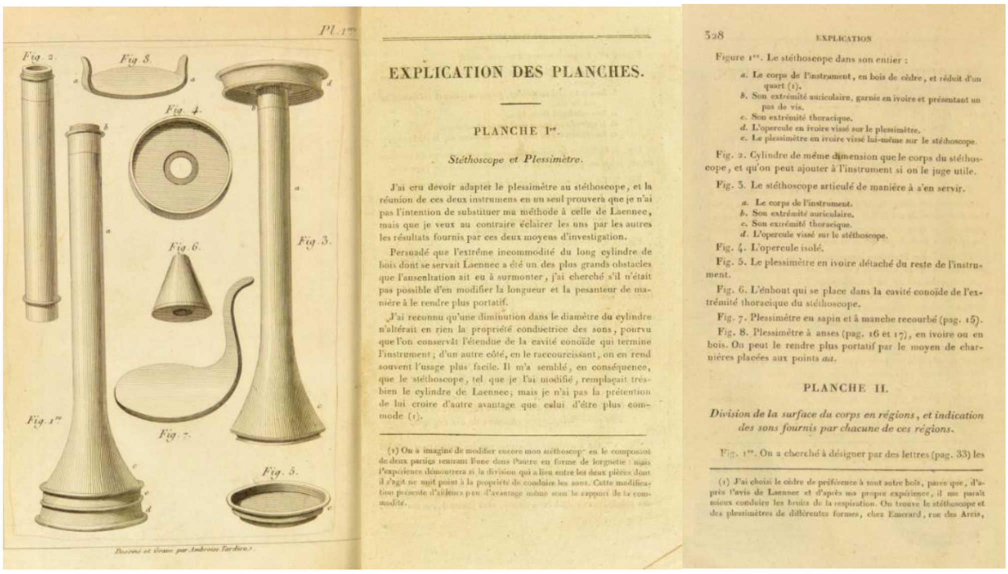
EXPLICATION DES PLANCHES.

PLANCHE Ire.

Stéthoscope et Plessimètre.

J'ai cru devoir adapter le plessimètre au stéthoscope, et la réunion de ces deux instrumens en un seul prouvera que je n'ai pas l'intention de substituer ma méthode à celle de Laennec, mais que je veux au contraire éclairer les uns par les autres les résultats fournis par ces deux moyens d'investigation.

Persuadé que l'extrême incommodité du long cylindre de bois dont se servait Laennec a été un des plus grands obstacles que l'auscultation ait eu à surmonter, j'ai cherché s'il n'était pas possible d'en modifier la longueur et la pesanteur de manière à le rendre plus portatif.

J'ai reconnu qu'une diminution dans le diamètre du cylindre n'altérait en rien la propriété conductrice des sons, pourvu que l'on conservât l'étendue de la cavité conoïde qui termine l'instrument; d'un autre côté, en le raccourcissant, on en rend souvent l'usage plus facile. Il m'a semblé, en conséquence, que le stéthoscope, tel que je l'ai modifié, remplaçait très-bien le cylindre de Laennec; mais je n'ai pas la prétention de lui croire d'autre avantage que celui d'être plus commode (1).

(1) On a imaginé de modifier encore mon stéthoscope en le composant de deux parties rentrant l'une dans l'autre en forme de lorgnette : mais l'expérience démontrera si la division qui a lieu entre les deux pièces dont il s'agit ne nuit point à la propriété de conduire les sons. Cette modification présente d'ailleurs peu d'avantage même sous le rapport de la commodité.

528 EXPLICATION

Figure 1re. Le stéthoscope dans son entier :

a. Le corps de l'instrument, en bois de cèdre, et réduit d'un quart (1).
b. Son extrémité auriculaire, garnie en ivoire et présentant un pas de vis.
c. Son extrémité thoracique.
d. L'opercule en ivoire vissé sur le plessimètre.
e. Le plessimètre en ivoire vissé lui-même sur le stéthoscope.

Fig. 2. Cylindre de même dimension que le corps du stéthoscope, et qu'on peut ajouter à l'instrument si on le juge utile.

Fig. 3. Le stéthoscope articulé de manière à s'en servir.

a. Le corps de l'instrument.
b. Son extrémité auriculaire.
c. Son extrémité thoracique.
d. L'opercule vissé sur le stéthoscope.

Fig. 4. L'opercule isolé.

Fig. 5. Le plessimètre en ivoire détaché du reste de l'instrument.

Fig. 6. L'énbout qui se place dans la cavité conoïde de l'extrémité thoracique du stéthoscope.

Fig. 7. Plessimètre en sapin et à manche recourbé (pag. 15).

Fig. 8. Plessimètre à anses (pag. 16 et 17), en ivoire ou en bois. On peut le rendre plus portatif par le moyen de charnières placées aux points *aa*.

PLANCHE II.

Division de la surface du corps en régions, et indication des sons fournis par chacune de ces régions.

Fig. 1re. On a cherché à désigner par des lettres (pag. 33) les

(1) J'ai choisi le cèdre de préférence à tout autre bois, parce que, d'après l'avis de Laennec et d'après ma propre expérience, il me paraît mieux conduire les bruits de la respiration. On trouve le stéthoscope et des plessimètres de différentes formes, chez Emerard, rue des Arcis,

Figure 12: The Piorry model stethoscope, published in his 1827 book.

[914] Piorry 1828, 330.
[915] Piorry 1828, 329.

Figure 13: A Piorry-style stethoscope from around 1829, held at the Science Museum (A608197).

In his book Piorry indicated that many English and American physicians attended his lessons on the topic of mediate percussion, indicating that practitioners still considered France to be the best place for studying percussion and auscultation.[916] This preference suggests that French practitioners were still ahead of British practitioners in terms of the regularity and skill of their practice of auscultation and percussion. As one of the practitioners championing the general uptake of both percussion and ausucltation, Piorry argued that the fingers were an imperfect tool for percussion for two main reasons.[917] The first reason was acoustic in nature: fingers absorbed the strike and gave less sound, making any sound from percussion harder to distinguish. The second was ergonomic: on a practical level fingers were a more difficult surface to hit precisely.[918] In addition, Piorry was concerned that contact between the practitioner's hand and the patient's body could cause harm, especially in cases of skin disease.[919] He argued that his invention, the 'ordinary' pleximeter, was already so simple that practitioners need not go to the effort of trying to improve his invention.[920] Such was his confidence in his own experience and skill in the practice of percussion and auscultation that he was certain he had come up with the best possible design for both pleximeter and stethoscope.

[916] Piorry 1828, 16.
[917] Piorry 1828, 17.
[918] Piorry 1828, 17.
[919] Piorry 1828, 18.
[920] Piorry 1828, 18.

Like Laennec, Piorry experimented with materials, such as leather, lead and wood, for his pleximeter.[921] He settled on ivory for both acoustic and ergonomic reasons: ivory had the best combination between hardness and sound quality; horn lost its shape too easily and metal altered the sound from percussion which distorted the relevant sounds.[922] Unlike Laennec, Piorry appeared to have done a lot of work with the bowels and abdomen as well as the chest in his exploration of mediate percussion.[923] His explorations with both the practice of auscultation and percussion provided him with the necessary skill to use the instruments and make informed changes. These changes could not occur without familiarity with the physical instrument of the stethoscope.

Piorry supported wider uptake of mediate auscultation, stating that the length of Laennec's model was 'inconvenient' and one of the 'biggest obstacles' to the uptake of auscultation; his own model rectified this problem.[924] Similarly he reduced the width of the instrument, which also reduced its weight, making the stethoscope both more useable and more portable.[925] The ivory pieces of the instrument, such as the pleximeter, ear plate, and cap could all be repositioned around the instrument for ease of storage and transportation.[926] Piorry's changes were predominantly ergonomic in nature, but he was not unaware of acoustic principles. He kept the functionality of the obturator to allow for the sound differences between the heart and the lungs, and argued that reducing the diameter of the cylinder would not alter the sound conducting qualities of the stethoscope as long as the size of the obturator remained the same.[927] He promoted this new stethoscope model as 'very nicely' replacing Laennec's cylinder while also emphasising that his model had no advantages other than being more

[921] Piorry 1828, 16.
[922] Piorry 1828, 16.
[923] Piorry 1828, 17; 133.
[924] Piorry 1828, 329.
[925] Piorry 1828, 329.
[926] Piorry 1828, 330.
[927] Piorry 1828, 329; 330.

convenient *and* coming with his pleximeter.[928] Piorry had a significant amount of experience with the stethoscope and percussion, enabling him to make large changes to the instrument in a way British practitioners, who were still in the process of adopting and learning the instrument, could not. Yet many of his changes were based not on a desire to change the inherent acoustic aspects of the instrument. Instead he focussed on introducing his pleximeter and on his perceived problems with the stethoscope which arose from a lack of portability.

Following further investigations, Piorry envisioned making further modifications to the stethoscope, but at the time of writing his book he had not yet ascertained if those design changes would impact the sound conducting properties of the instrument.[929] He never did publish a second design modification and, despite the popularity of his combined stethoscope-pleximeter, Piorry later gave up on the dual instrument altogether; stating that the combination of the two only reduced their overall effectiveness.[930] It is worth noting that he did not abandon either mediate auscultation or mediate percussion, just the instrument that brought them together. Piorry's extensive practice with both the stethoscope and percussion enabled him to make the first innovative change to stethoscope design, something that was not yet possible for British practitioners.

For the first ten years following Laennec's invention of the stethoscope all the published stethoscope design changes came from French practitioners, or British ones working in France if the story of Haden is accurate. These intentional changes came from practitioners who were familiar with the practice of mediate auscultation and the use of the stethoscope, and so were able to identify various problems with the instrument itself. When they provided reasons for their design changes, they cited problems with the ease of manufacture or portability. They

[928] Piorry 1828, 329.
[929] Piorry 1828, 329.
[930] Piorry 1842, 173.

rarely gave reasons relating to the acoustic characteristics of the instrument, but rather to problems that prevented practitioners from easily obtaining and handling the instrument. Due to the 'made to order' nature of the instrument, it is possible, if not probable, that different British individuals made small adjustments to their stethoscopes based on cost or practicalities such as portability. With regards to design overall, British practitioners were not yet familiar enough with the instrument to become a relevant social group which could identify problems with its design.

4.5 – British Changes to Stethoscope Design

When British practitioners did start to suggest changes to the stethoscope, they did so with the same practical motivations as the French practitioners. In addition to the manufacture and portability of the stethoscope, British practitioners made changes to the instrument in order to make it cheaper (for the practitioner) and more comfortable (for both practitioners and patients). These British design innovations began to appear from around 1827, coinciding with an increase in practitioners such as Elliotson beginning to teach their students how to practice mediate auscultation and use the stethoscope. These teaching practitioners had the level of skill necessary to fully understand the potential flaws with the instrument; using it regularly meant they experienced problems with the stethoscope which may not have been apparent to those who picked up the instrument only occasionally. Additionally, these practitioners were teaching using the instrument, which meant they could observe the barriers which prevented their students from adopting the stethoscope. Similarly, students began to need their own stethoscope in order to actively participate in the study of medicine and the development of their diagnostic skill, meaning that the stethoscope needed to be widely available and ideally inexpensive. This section considers the range of design changes British practitioners suggested between 1828 and around 1835, as well as their reasoning as to *why* they had made these alterations. In each case, it is clear that these practitioners made alterations in order to make the stethoscope affordable, portable, and comfortable; encouraging others to adopt the instrument by 'fixing' their perceived problems with the design.

Welsh-born and Edinburgh educated C.J.B Williams was the first British practitioner to suggest a purposeful change to the overall design of the stethoscope, instead of making personal changes to his own instrument. Williams had studied with Laennec and developed skill with the stethoscope whilst in Paris between 1825 and 1826; his time with the instrument readily convinced him of the utility of mediate auscultation as a diagnostic method. He was one of the few practitioners, French or British, to openly discuss the acoustic properties of the stethoscope when making design changes. In his 1828 book, *Rational Exposition*, he stated that stethoscope design must meet three criteria: it must have a solid conductor (wood), a middle column of air, and an obturator.[931] The design he suggested was similar in design to the original Laennec and Collin models, comprising a thick wooden cylinder, split into three parts (chest, ear, and obturator), and joined together with a conical tenon and carved-out mortise (Figure 12). The split between the chest and ear parts was still ergonomic as Williams admitted it was for ease of transport.[932] In addition to the transportation aspect, Williams added that due to the change in shape of the tenon and mortise the obturator could now be placed into the ear part of the instrument just as well as into the chest part, allowing for 'easier application to some areas of the chest'.[933] He encouraged practitioners to find a model that fitted comfortably to their ears or adapted the practitioner end to have a wider ear plate, both for ease of use and in order to allow sound a more direct course to the ear.[934] Furthermore, once a practitioner found a model that did fit their ear-shape then he encouraged them to use only that model, as it would give them the best chance of using the instrument correctly.[935] This provides further evidence

[931] Williams 1828, 196.
[932] Williams 1828, 198.
[933] Williams 1828, 198.
[934] Williams 1828, 197.
[935] Williams 1828, 197.

that many British practitioners made alterations to the instrument for their own individual needs, rather than solving problems with the design on a broader scale.

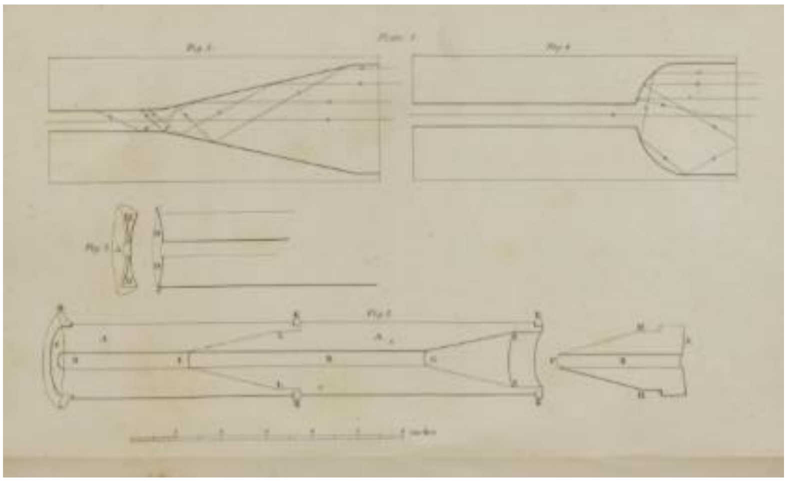

Figure 14: Williams' design published in his 1828 book.

Figure 15: Two parts of a stethoscope, obturator missing, held at the London Science Museum. (A608181) Despite being the same design as the instrument in Williams' 1828 publication, the stethoscope bears the name of Dr Noah Webster, famous American lexicographer, and the year 1826. The Wellcome accession register recorded the instrument as belonging to him.[936] Yet this provenance appears, at best, doubtful; Noah Webster was not a physician and neither did he include the word 'stethoscope' in his 1828 *American Dictionary of the English Language*, making it unlikely that he was the owner of this instrument.

William's instrument was much closer in style to that of Laennec and Collin, rather than Piorry's new model. As the first British alteration the fact it did not differ from the original designs is unsurprising: regular use brought about innovation, but early innovation as seen with

[936] WAHMM/CM/Acc/24

Collin did not need to consist of large changes. It is possible to see in Figure 15 the small chips in the conical tenon; William's design removed the metal tubes which held the parts together, making this model easily breakable and the parts often only loosely joined together. In the description of his model, William's stated that the split between the two parts was in order to 'render the instrument more portable, and to facilitate its application to some parts of the chest'.[937] The conical shape of the obturator and tenon, Williams claimed, increased the 'reflective' acoustic powers of the instrument; the smoother the cone the better the sound quality.[938] His design changes blended concerns with acoustic principles with those of portability and comfort.

William's book appeared a few months after Piorry's, and he acknowledged the new Piorry design in a short note at the end of his work, added after the majority of the book had already been printed.[939] He did not discuss the changes in stethoscope design, only his interest in the concept of mediate percussion.[940] Williams was one of the few British practitioners to make a direct claim about improving the acoustics of the stethoscope, as well as making the ear plate more comfortable for practitioners *and* allowing for a greater seal between the instrument and the practitioner.[941] His alterations may have encouraged more practitioners to adopt the instrument, as it was now more comfortable and potentially had greater acoustic properties. The new design came following Williams' experience learning with Laennec in the mid-1820s and then having a few years to fully develop his skill with the instrument through time and practice. French practitioners, who had developed their skill earlier due to their continuous proximity to Laennec and practice within the Parisian system, suggested many of

937 Williams 1828, 189.
938 Williams 1828, 189.
939 Williams 1828, 190. Williams received Piorry's book from James Clark.
940 Williams 1828, 190.
941 Williams 1828, 189.

the earliest changes, with British practitioners beginning to make suggestions towards the end of the 1820s.

In 1829, Scottish physician Nicholas Comins published his design changes in the *Lancet*, claiming that he had been 'convinced of the practical utility of the stethoscope' before he attempted to alter Laennec's model.[942] This claim further supports the idea that practitioners needed to use and experience the instrument before they could confidently change the design: innovation required use. Comins created the first 'flexible' stethoscope (Figure 16).[943] It is important to note here that there is a significant difference between what Comins meant by 'flexible' and what we as readers imagine as a modern flexible stethoscope. As seen in Figure 16, the Comins model consisted of several thin tubes which the practitioner could fit into a range of joints, allowing for changes to the angle of the instrument without the practitioner or patient needing to change position.[944] Theoretically, a practitioner could add any number of parts, making the instrument as long as they wanted; Comins described this as being a useful feature when examining contagious patients.[945] Comins specified that the ear plate ought to be made from ivory, but gave no specific information regarding the material of the other parts.[946] Comin's familiarity with the stethoscope and, therefore, his understanding of some of the problems practitioners and patients faced when using it, motivated him to change the instrument's design.

[942] Comins 1829, 686.
[943] Comins 1829, 686.
[944] Comins 1829, 686.
[945] Comins 1829, 686.
[946] Comins 1829, 50; 685.

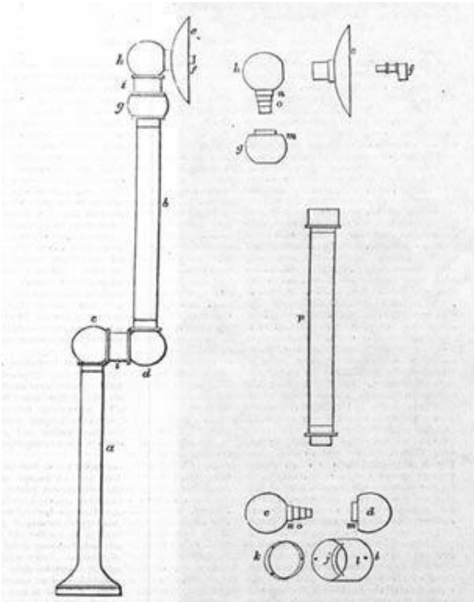

Figure 16: The Comins-style stethoscope published in the *Lancet*. There did not appear to be any Comins-style stethoscopes in the Wellcome collection held at the Science Museum.

Comins commented that the medical students in Edinburgh were often not allowed to practice with the stethoscope as they caused too much pain and inconvenience to the patients through their repeated, poor, examinations.[947] Patients struggled with holding the range of different positions necessary for examination, and from practitioners too firmly applying the instrument.[948] Here it is possible to introduce the concept of 'relevant social groups' seen in the Sociology and History of Technology. Whilst practitioners were the users of the stethoscope, patients equally interacted with the instrument, though of course in a different way. Concern for the discomfort of this social group further motivated Comins to change the design of the instrument. Improper or uncomfortable use of the stethoscope could damage the relationship between practitioners and patients; hence it was in the best interest of all who wished to use the instrument to make it as palatable an experience for the patients as possible. This motivation could only occur once use of the stethoscope became more widespread: as an increased number of students began to use the instrument, so the necessity of making the

[947] Comins 1829, 685.
[948] Comins 1829, 686.

instrument comfortable for both practitioner and patient increased. Once again, we see that increased use brought about a greater necessity for innovation.

Comins' design removed the obturator as a part of the stethoscope, previously a vital aspect of the instrument. He assured anyone interested in his design that it was 'equal' in acoustic ability to Laennec's, and that anyone who was worried it was inferior would soon change their mind after experimenting with his model.[949] He did admit that his model could not hear the lower sounds from the thorax as well as Laennec's, due to the removal of the obturator.[950] He made no attempt to suggest his stethoscope was acoustically superior to Laennec's. This was a wise move on his part as, within a month of introducing his version of the stethoscope he wrote an update to the *Lancet* in which he recommended practitioners use the 'regular' stethoscope except in cases where the patient could not be moved, as the sound in the older models was superior.[951] Comins openly admitted that his stethoscope had acoustic shortcomings in comparison to earlier models of the stethoscope, directly opposing Blaufox's suggestion that practitioners were motivated primarily by improving the acoustic ability of the instrument.

Comins encouraged practitioners to acquire a well-made stethoscope and stated that if the instrument was of good quality then the user could be confident in its ability to accurately relay the sounds of the chest.[952] He provided some advice for manufacturers, such as adding cork to work as a buffer for screws. Similarly, he emphasised the importance of practitioners examining the stethoscope thoroughly whilst in the shop, to ensure that the instruments were good quality.[953] This suggests that toward the end of the 1820s more instrument makers were producing a range of pre-made stethoscopes, moving away from the made-to-order nature of

[949] Comins 1829, 686.
[950] Comins 1829, 49.
[951] Comins 1829, 49.
[952] Comins 1829, 50.
[953] Comins 1829, 50.

the instrument seen earlier in that decade. As use of the stethoscope became more widespread it became more economically viable for instrument makers to produce and stock some models of the instrument, with the knowledge that practitioners would buy them.

The next design change came only a few months later, at the start of 1830, from Derby-based physician Francis Fox, who claimed to have made 'frequent' use of the stethoscope in the Derbyshire General Infirmary between 1825 and 1830.[954] Fox had studied in Paris and seen the stethoscope in use there, claiming to have obtained his first stethoscope from the same (unnamed) maker as Laennec, though it does not seem that Fox ever studied under Laennec himself.[955] Fox suggested a stethoscope which had 'elastic ends'.[956] He criticised Comins' design, stating that he had 'unnecessarily overcomplicated' the instrument.[957] Indeed, Fox warned generally against the overcomplication of stethoscope designs, stating that complex designs were 'extremely ingenious' but 'perfectly useless'.[958] Fox's own variation of the instrument came from a design he devised while struggling to apply the stethoscope to emaciated patients.[959] He added a ring of Indian rubber around the patient end, intending the softer material to be more comfortable for patients.[960] No image accompanied his design recommendation, but he did describe it in some detail: a long, thin instrument with a split in the middle and an elastic collar at the chest end.[961] The pliant substance could counteract any slight alterations in application, rendering it easier for the practitioner to use the instrument quickly, without worrying about exact placement.[962] He noted that the soft rubber could similarly be added to the practitioner end of the instrument to help anyone who struggled to

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[954] Fox 1830, 509.
[955] Fox 1830, 510; Huard 1973, 326.
[956] Fox 1830, 510.
[957] Fox 1830, 510.
[958] Fox 1830, 510.
[959] Fox 1830, 510.
[960] Fox 1830, 510.
[961] Fox 1830, 510.
[962] Fox 1830, 510.

comfortably apply the stethoscope to their ear.[963] Although he criticised Comins' complex stethoscope, he agreed with the general point that stethoscopes were often too uncomfortable for both patients and physicians.[964] Again, the innovation came from a practitioner who had at least five years of experience with the stethoscope – time to build familiarity with it – and motivated by the desire to make the instrument easier to apply and more comfortable for both the practitioner and the patient.

Similar to Comins, Fox was very clear that in his design there was 'no funnel shaped end or plug' (obturator) required.[965] This further suggests that practitioners did not necessarily focus on the acoustic properties of the instrument, instead considering primarily the comfort and ease of use necessary for a regularly employed tool. Regular use increased the practitioner's awareness of the problems with stethoscope design – discomfort, difficulty transporting the instrument, and price – causing them to suggest design changes which addressed these issues. Though the approaches to solving issues with the stethoscope differed greatly, as seen with Piorry, Williams, Comins and Fox, practitioners appeared to generally *agree* regarding what those issues were. This held true not only between Paris, London and Edinburgh but also further across Britain. Stethoscope use became more geographically widespread, as indicated by suggested design changes stemming from locations such as Derby.

Derby was not the only provincial medical centre from which practitioners suggested design changes. In May 1831 Leeds based physician Thomas Dodgson advertised his range of acoustic instruments which he described as 'infinitely superior' to any of the stethoscopes in common use at the time.[966] During the 1820s Dodgson had studied the stethoscope in Paris, under the guidance of Laennec, though little record exists of him.[967] In his advertisement

963 Fox 1830, 510.
964 Fox 1830, 510.
965 Fox 1830, 510.
966 Dodgson 1831, 1.
967 Bishop 1963, 187.

Dodgson described himself as being able to promptly detect diseases in the heart and lungs due to 'habit' with the stethoscope, which suggests he regularly used the instrument in his medical practice.[968] He had experienced the instrument in Paris as well as continuing to employ it in his practice in Leeds: regular use enabled Dodgson to create a new design. There are no surviving drawings or images of Dodgson's designs, if indeed he ever did print them, so it is not possible to directly compare his instrument with other designs. Unlike many other practitioners Dodgson emphasised the acoustic properties, rather than the ergonomic features, of his instruments, but there is little to suggest this approach helped his design gain traction with British practitioners. This lack of interest may be due to the fact that Dodgson only published information on his instruments in his local, non-medical, newspaper – the *Leeds Intelligencer* – limiting the spread of his ideas.[969] He was one of the few practitioners who cited the acoustic properties of the instrument as a motivation for his alterations. Whether acoustic or ergonomic, design innovation required the practitioner to be familiar with the stethoscope; as more practitioners adopted and gained skill with the instrument, so we see the number of suggested design alterations increase.

In 1834 Forbes, in co-operation with Laennec's cousin Meriadec, published a new edition of Treatise, in an attempt to update the text of Laennec's original *Traité* with all the new findings from the range of stethoscopic investigations which had taken place since the first edition.[970] The 1834 edition of *Treatise* contained four stethoscope designs: Laennec's 1819 original; Collin's 1825 model with dome mortise and tenon; the William's design with the conical mortise and tenon; and the Piorry design (Figure 17). Forbes and Meriadec noted that the William's style was the one 'in most common use'.[971] They discussed the Piorry-style

[968] Dodgson1831, 1.
[969] I have examined the *Edinburgh Medical and Surgical Journal*, *The Medical Gazette*, *Lancet*, the *Medico-Chirurgical Review*, and the *London Medical and Surgical Journal*, and there is no mention of Dodgson's book on Consumption nor his changes to the stethoscope.
[970] Forbes 1834.
[971] Forbes 1834, 673.

stethoscope mostly in reference to the pleximeter, though Forbes did note that it was 'conveniently portable', a comment which they did not make about any of the other styles.[972] Forbes gave credit to Piorry for his design, while for the Collin and Williams models he gave no name and referred to them simply as 'alternatives' to Laennec's design.[973]

The text included the point that any wood turner or instrument maker could recreate the designs Forbes and Meriadec printed in this new volume *Treatise,* and it suggested cedar as the best wood type. Forbes cited Williams as recommending Grumbridge of Poland Street, a well-known instrument maker, for this purpose.[974] This suggests that the 'made to order' nature of the stethoscope had not disappeared entirely. Furthermore, as indicated previously by Johnson's choice of Allnutt, and again here by Williams' preference for Grumbridge, there was clearly a relationship between practitioners and certain instrument makers which played a role in who they recommended. It seemed that some practitioners preferred well-known instrument makers, while others had specific wood turners they trusted, even if they were not known for supplying medical instruments. As the number of stethoscope users increased, no doubt bolstered by the increased teaching of auscultation in medical institutions and the 1832 Anatomy Act (as discussed in Chapter 2), these relationships became even more important.

[972] Forbes 1834, 674.
[973] Forbes 1834, 673.
[974] Forbes 1834, 675.

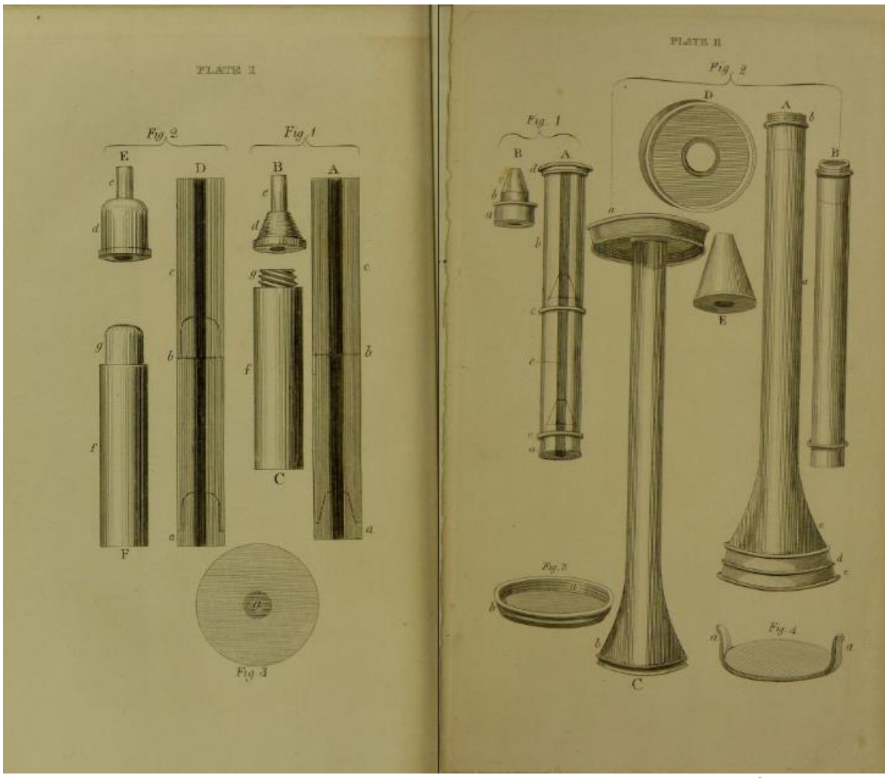

Figure 17: The range of designs of the stethoscope published in Forbes' 4th edition of *Treatise.*

Following the increase in teaching, practitioners became aware of the necessity for medical students to have their own stethoscopes. As seen in Chapter 2, Elliotson would occasionally lend his instrument to students who did not have their own, but as the practice of auscultation became more widespread, so did the number of students interested in learning the method: students borrowing the instrument from their teacher became an increasingly unviable method of practicing. In 1837, as a response to this increasing need for easily available stethoscopes, Archibald Billing – an Irish physician who practiced in London – published a new stethoscope design in his book *First Principles of Medicine*.[975] His design was significantly shorter than all previous models, consisting of one short piece of wood with no additional parts (Figures 18 and 19). He intended the instrument be 'light and convenient' as well as inexpensive, describing it as an 'abridged' version of Laennec's.[976] Billing bemoaned how other 'improvers' were making the stethoscope more complicated, which he stated

975 Billing 1837.
976 Billing 1837, viii.

discouraged students from learning how to use them.[977] Billing was primarily concerned with improving medical education, having been heavily involved with the establishment of the Anatomy Act (see Chapter 2) and a staunch advocate for the use of anatomical preparations in his teaching practices. Billing was very familiar with the use of the stethoscope, and his motivation for changing its design came from a desire to promote its even more widespread use.

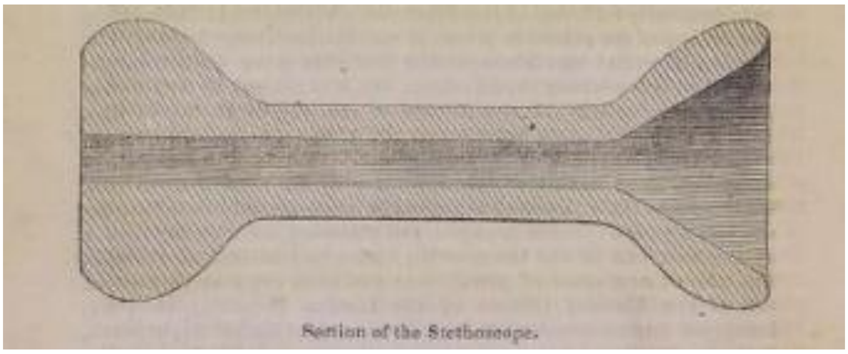

Figure 18: Image printed in Archibald Billing's 1837 book *First Principles of Medicine* in which he described the instrument as 'about 4 inches in length.'[978]

Figure 19: Billing model held at the London Science Museum (A608219).

A practitioner could easily hold the stethoscope in Figure 19 in one hand and fit it into a pocket. The simple design made it both simple and cheap to manufacture. The instrument was sturdy, not liable to breakage, and with no additional parts there was no fundamental element which a student or absent-minded practitioner could easily lose. Billing's instrument was ideal for the student practitioner; cheap, portable, and not easy to break. Billing was heavily

[977] Billing 1837, viii.
[978] Billing 1837, viii.

involved in the teaching of mediate auscultation and in devising the Anatomy Act, it seems likely that he made this design with students in mind.

Billing made no claims about the acoustic properties of his design beyond the instrument being suitable for students to use. Similar to Comins and Fox, Billing removed the obturator from his stethoscope design. He compensated for this removal, however, by making the instrument 'reversable' with one end scooped out and the other shaped in a thick dome; the physician could change the ear and chest ends around as necessary.[979] Billing's stethoscopes were roughly four inches long, as Billing argued that this was an adequate distance to avoid uncleanliness and maintain propriety while still keeping the cost low.[980] Blaufox suggested that shorter instruments were necessarily acoustically better, as the volume of sound from a 3 inch stethoscope was 8 times greater than from a 26 inch one.[981] Billing never mentioned this acoustic improvement as either an intended or unintended (though, presumably, welcome) side effect of his alterations. This suggests that Billing, along with many of the practitioners who came before him, was not primarily interested in altering the acoustic properties of the instrument. These alterations occurred, but they were not the conscious reasons for the practitioner's design decisions. Billing's small stethoscope had two main benefits, as far as he could see: it was portable, and it was cheap.[982] The instrument was small enough that practitioners could easily store it in their pocket and it cost only 'a couple of pennies'.[983] Billing's primary aim in creating his stethoscope was to make one that was affordable, portable, and 'easy' to use; increasing its availability to students so that use of the instrument could become more widespread.

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[979] Billing 1837, viii.
[980] Billing 1837, viii.
[981] Blaufox 2002, 3.
[982] Billing 1837, viii.
[983] Billing 1837, viii.

The drawback of Billing's design was that it was not particularly comfortable.[984] The short design made positioning difficult as practitioners or patients had to bend into awkward positions. Furthermore, the open funnel end was very uncomfortable to place an ear on, especially in cases where the user needed to apply pressure. Billing's design 'solved' some issues with the stethoscope in terms of cost and portability but created new problems for practitioners in terms of comfort. Adaptations to the Billing design attempted to solve some of these uncomfortable aspects. These included creating slightly longer models, with the average length from 1840 onwards becoming 17.5cm, reducing the need for practitioners or patients to hold awkward or painful positions. Other models maintained a short length but did away with the double ended aspect, introducing a more comfortable flat ear plate and doing away entirely with the obturator (Figure 20). These changes did not come from a named practitioner, instead, as with the earliest changes to Laennec's design, practitioners appear to have requested personalised changes from their chosen manufacturer. The flat eat piece made the instrument substantially more comfortable for the practitioner, indicating that even though Billing's original model addressed concerns over price and portability, practitioners still wanted a more comfortable instrument for their everyday use.

Figure 20: Billing model with a flat end held at the London Science Museum (A625008).

There is no evidence to suggest any of these designers patented their work. Laennec did not patent his stethoscope and none of those named above suggested that the practitioners who

[984] As I discovered during my trials of the instruments at the Science Museum, see Appendix 1.

used their designs owed them anything beyond gratitude. Furthermore, new designs often came with a note that the practitioner should take the print to their preferred manufacturer; the 'made to order' nature of the stethoscope prevented market domination from one supplier. Manufacturers such as Weiss and Grumbridge did mark the stethoscopes they produced with their company name, but this was not a widespread practice and it only applied to the makers: the name of the physician who first suggested the design change seemingly never appeared on the instruments themselves, even if the manufacturer's catalogues linked the designer's name to the instrument.

The design changes from British practitioners suggest there was a demand for cheaper instruments which were comfortable to use. This implies that British practitioners were using the stethoscope more regularly and wanted to make alterations that would make everyday use more comfortable: something that would not have been necessary if only a handful of practitioners were sporadically using the instrument. British innovations came from British practitioners becoming more familiar with the instrument as auscultation became more prevalent in medical education. This time the innovations were of British, rather than French, origin as use of the stethoscope became more widespread in Britain. From the range of design changes, it is possible to infer that British practitioners saw a need for their stethoscopes to be inexpensive, easy to carry and comfortable to use for both themselves and their patients.

4.6 – The Standardisation of the Monaural Stethoscope in Britain

Towards the end of the 1830s, following a 10-year period of rapid design alterations, a design of the stethoscope appeared which would go on to become the most common version of the monaural stethoscope; manufacturers continued to sell that design into the early 1900s. The standardisation of an artefact occurs when all of the relevant social groups interacting with an object agree that a particular design fixes all of the perceived problems with it.[985] There could still be some variation within the models but, overall, the design remains relatively static unless one of the relevant social groups identifies another problem.[986] For the stethoscope this standardisation happened with the 'Ferguson' stethoscope; a design which seemed to balance affordability, portability, and comfort.

In 1843, Williams published another new stethoscope design in the journal *Retrospect of Practical Medicine and Surgery* (Figure 21). Unlike his first design change, this model did not include an obturator despite his claim in 1828 that an obturator was a necessary part of the instrument. His new stethoscope was thin, with a trumpet style chest end and a circular detachable ear plate. The following year, in his book *A Rational Treatise on the Diseases of the Respiratory Organs,* Williams reprinted the image of his new stethoscope. He explained that this model was reversible, i.e. practitioners could flip the instrument and place the ear plate in either side; Williams suggested that this reversibility feature allowed him to remove and omit the obturator.[987] He informed readers that his specific model was available from makers Coxeter and Grumbridge in London.[988] Williams acknowledged that the thinness of the wood meant that practitioners could easily crush it if placed in their pocket.[989] As a means of combatting this, he suggested that practitioners place the ear plate into the chest end trumpet when transporting the instrument; it acted as a form of reinforcement for the fragile trumpet part and, Williams boasted, it made the instrument even *more* portable.[990]

[985] Pinch and Bijker 1984, 414.
[986] Pinch and Bijker 1984, 414.
[987] Williams 1844, 81.
[988] Williams 1843, 10.
[989] Williams 1844, 82.
[990] Williams 1844, 82;

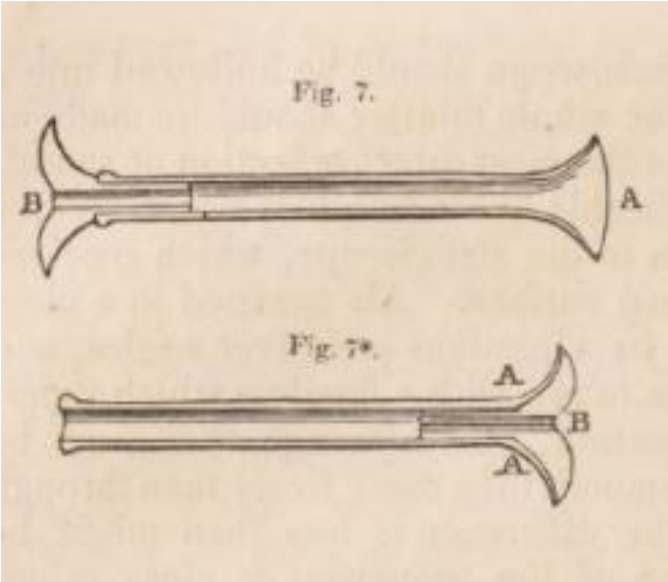


Figure 21: Williams'-style stethoscope published in 1843.

Figure 22: A William's-style stethoscope (with removable ear plate) held at the Science Museum (A625020). The records state that a Dr. D. Manley of Warlingham, Surrey, made this instrument c. 1860.

The producers of the trade catalogues referred to the most common design as the 'Ferguson model' stethoscope. This model appeared to be the most common monaural stethoscope from around 1845, as there were seemingly no further publications of 'new' designs and this model, or slight variations on it, began to appear in makers' catalogues (to the exclusion of other types). It consisted of only one, thin, piece of wood, with a small cone at the patient end and no obturator; the instrument was light, inexpensive and relatively easy to carry (Figure 23). It was roughly 17cm in length and had a large ear plate at the practitioner end, making the instrument comfortable for the practitioner whilst also being long enough to allow for the avoidance of any particularly awkward examination positions for both practitioners and patients. This design was therefore comfortable, easily transportable, and cheap to make, the ideal combination for any practitioner who used the stethoscope regularly.

In terms of acoustic ability, the Ferguson style did not appear to be noticeably better or worse than the Billing or Williams models; though the fact it was not reversible may have limited its acoustic capacity slightly. The most popular stethoscope was one which fitted the criteria demanded by practitioners: cheap, comfortable, portable. Furthermore, the chest end had a small flat rim, which made it more comfortable for the patients. This model was the culmination of the different designs which came before it.

Figure 23: A Ferguson-style stethoscope, c.1840, held in the Science Museum collection (A625023). Listed as 'Fergusson's Style', see discussion below and Appendix 2 for more discussion on who made the Ferguson style instrument.

Though the creator of the Ferguson style stethoscope is unknown, there are three possible candidates: Scottish surgeon William Fergusson, Indian-born physician Robert Ferguson, or Irish physician John Creery Ferguson. It could also have originated with London based instrument makers Ferguson & Co. None of the practitioners nor the company claimed priority over the design and no other contemporary commentators linked them to the design. Furthermore, in both textual sources and prints on objects there was no consistency between the spellings Ferguson and Fergusson. Despite this, both Bishop and the records at the Science

Museum both attribute the design to William Fergusson.[991] From my own research, laid out more thoroughly in Appendix 3, I suggest that John Creery Ferguson was the most likely candidate for the originator of the Ferguson stethoscope. As the Ferguson design did not appear in print it is difficult to date it accurately. By looking at the dates in the Science Museum records as well as using a mixture of late primary and secondary textual sources, I feel confident in suggesting that this model first appeared around 1840.

One of the most compelling reasons to think that John Creery Ferguson was the source of this stethoscope alteration was the sheer amount of time Ferguson spent with the instrument. Ferguson studied in Paris with Laennec and Kergaradec and his exposure to the instrument in the Parisian context was on a par with the early adopters who did the first individual trials. As shown in Chapter 3, Ferguson was not an obstetrician but regularly used the stethoscope on the abdomens of the women he saw in his practice.[992] He was similarly involved with the stethoscope as a means of examining the chest: unlike many other practitioners, Ferguson used the stethoscope to investigate a range of diseases beyond a specific area of the body. These factors make him the most likely candidate to have created a stethoscope which fitted the needs of others who wished to use the instrument often.

Another possibility is that, rather than one person altering the design, the changes came from London-based instrument makers Ferguson & Sons. Makers often stamped or engraved their name onto the instrument, and several Ferguson style stethoscopes at the Science Museum had ‘Ferguson’ printed on them, but this does not prove that they were the originators of the idea. In the catalogue for the Great Exhibition they were not listed as making stethoscopes, only surgical instruments, while other instrument makers such as Matthews and Leard listed

[991] Bishop 1980, 453.
[992] Ferguson 1830b, 65.

the stethoscope specifically.[993] However, stethoscopes seem to have been considered a surgical instrument, as indicated by an advert from the Gutta Percha Company which listed their stethoscopes, along with ear trumpets and bandages, under 'Surgical and Other Applications'.[994] Ferguson & Sons primarily supplied instruments to students and practitioners at St Bartholomew's Hospital, they were a small company that rarely promoted their own work.[995] As we have seen, manufacture of the stethoscope varied between being made-to-order and being a stock item; this makes it difficult to fully grasp the role of instrument makers in the design changes of the instrument.

Figure 24: A version of the Ferguson-style stethoscope held at the London Science Museum, c.1845 (A645167). According to records, this instrument came from the surgery of a Dr Henry Hill Hickman, and 'was probably his'. His granddaughter, Miss B. E. Thompson, donated the instrument in 1926.

[993] Great Exhibition Catalogue 1851, 62; 70.
[994] Great Exhibition Catalogue 1851, 221.
[995] Weston-Davis 1989, 41; Jones 2013, 23; 27.

Figure 25: A version of the Ferguson-style stethoscope held at the London Science Museum , c.1845 (A625031). The body has become slightly curved.

Figure 26: A version of the Ferguson style-stethoscope held at the London Science Museum, c.1898 (A600075). Has a note wrapped around it: "Made of part of the Old Roof of Holyrood Palace, removed Sept. 1898. Above 200 years old."

Figures 24-26 gives just a small example of how prevalent and long lasting the Ferguson-style stethoscope was, with over a quarter of the c.170 monaural stethoscopes in the Science Museum being Ferguson models. This style of instrument balanced the needs of all the relevant social groups. The sound conducted was clear and loud, likely helped by the wide ear plate which allowed for a complete seal between the ear and the instrument. As one piece of wood, with no additional parts nor extra materials, it was cheap to produce and likely cheap to buy. The Ferguson-style stethoscope was light, often weighing less than 20 grams, and not at all cumbersome, making it easy for practitioners who used the instrument in their daily practice to transport it between patients, either in their hand or in a bag. Additionally, the wide ear plate made the instrument comfortable for practitioners to use while the flared trumpet at the chest end meant that the instrument could form a seal on the patient's body without too much pressure or the fear of sharp edges. These design features meant that the Ferguson model stethoscope matched perfectly the wants and needs of practitioners and patients – affordable, portable, and comfortable – making it a desirable item for practitioners who wished to use it every day.

The increase in use amongst British medical practitioners meant that one design which fitted the general criteria eventually appeared, following a period in which a range of 'actors' attempted to solve the perceived issues with the stethoscope. This stabilised instrument took the form of the Ferguson-style stethoscope, and variants of it. The style was inexpensive and portable, appealing to medical students buying their first stethoscope whilst still paying for training. Furthermore, the Ferguson design was comfortable for both practitioners and patients, making it more suitable for regular use. That regular use brought about innovation until the instrument reached a stable point, where the model met all areas of need sufficiently for the relevant social groups which interacted with it to be satisfied with its design. The monaural stethoscope reached this point in the early 1840s, with the introduction of the Williams, Stokes and Ferguson models. It remained mostly unchanged until the introduction of the Pinard foetal stethoscope in the 1870s (for obstetrics) and the eventual abandonment of the monaural stethoscope in favour of a binaural model (for other areas of medicine). This stabilised model continued to meet the needs of those who employed the stethoscope regularly, with no further need for innovation as this design 'solved' all the perceived problems with the instrument.

4.7 – Conclusion

This chapter took a broader look at stethoscope uptake in the British Isles by examining both *how* and *why* the design of the monaural stethoscope changed between its invention in 1816 until the mid-1840s, when the monaural design became standardised. It demonstrated that the motivations for changing these designs often came from the perspective of practitioners wishing to solve problems that arose from regular use. That is, these design changes both came about because of, and themselves encouraged, increased uptake of the stethoscope. Through regular use of the instrument practitioners discovered problems with the design, such as it being inconvenient to transport or often uncomfortable to use, especially on a regular basis. Practitioners made their design changes as a means of combatting these problems, first with French practitioners making alterations, and then as uptake in Britain increased, with British practitioners suggesting their own designs.

In understanding both practitioners and patients as 'relevant social groups' with regards to the stethoscope, it becomes clear that comfort was a large factor in these design changes. Practitioners designed stethoscopes with larger ear plates and a wider chest end, reducing the pressure, and therefore discomfort, in placing the instrument. Similarly, concerns about both cost and portability meant that some stethoscopes became 'pocket-sized' in order for the design to appeal to students. The changes in stethoscope design demonstrate a lot of innovation; becoming smaller, lighter, more complex and then less complex, as the relevant social groups worked out which design features were necessary, and which were not. Through interacting with the objects these changes – weight, length, complexity – take on a new meaning as it is possible to fully imagine how practitioners would have interacted with the instrument and what difficulties they may have faced. The importance of comfort certainly becomes even more evident (see Appendix 1) as discomfort in using the stethoscope surely would have put off some practitioners from attempting to use it.

This chapter rounds off the thesis with a new approach to using material culture in historical research: combining material culture, textual sources, and the social and historical construction of technology. The changes to the design of the stethoscope came from the relevant social groups and help us understand *why* design alterations happened rather than giving a simple description of what changes occurred. These alterations in the stethoscope reflect on the rest of the thesis, as the adoption and uptake of the stethoscope must, necessarily, include the adoption and practice of the diagnostic technique of mediate auscultation. Indeed, only in the regular practice of mediate auscultation could practitioners properly understand the problems present in the earlier stethoscope designs, and devise methods of fixing those problems. British practitioners were interested in the stethoscope as an object as it formed a tool for the practice of mediate auscultation. They developed skill with the instrument through regular use, which in turn uncovered potential design problems and encouraged practitioners to fix those perceived problems. Remedying the problems in design only encouraged greater use, as the new designs removed some of the potential barriers to uptake. The design changes of the stethoscope, therefore, map onto the process of practitioners adopting the use of mediate auscultation and the uptake of the stethoscope in the British Isles.

Chapter 5 – Conclusion: Some Answers and Some Further Questions

5.1 – Introduction and Overview

This thesis set out to provide an answer to two fundamentally linked questions: following the invention of the stethoscope in 1816, why were British practitioners first interested in mediate auscultation and the stethoscope? And, once interested, how did they develop skill with the new technique and instrument? The answers seem, at first, quite simple. Practitioners took an interest because they saw the stethoscope's utility, and they developed skill with the instrument through regular practice. But this does not quite capture the more detailed and complicated process of learning about a new practice and acquiring the ability to implement it. Through close reading of textual sources, combined with a new approach to object study, this thesis provides a deeper explanation of how medical practitioners developed their ability to make accurate diagnoses.

This final section of the thesis provides a brief overview of the original thesis questions and the answers provided in previous chapters. It reflects on the answers presented in this thesis and suggests new avenues of research that arise from them. Section 5.2 looks at the first question of the thesis: why did British practitioners first take an interest in mediate auscultation and the stethoscope? It emphasises the particular aspects which brought knowledge of the technique and stethoscope to British practitioners, as well as bringing out some wider questions regarding the uptake of new techniques and medical instruments. The next section (5.3) revisits the question: how did British practitioners develop skill in the practice mediate auscultation with the stethoscope? This provides a short recap of the methods through which British practitioners developed their diagnostic ability with the stethoscope. This thesis focused on the adoption of the stethoscope in the British Isles, which had its own distinct approach when compared to France, where it was invented. In discussing this aspect of the thesis, I introduce evidence from the German principalities and America which suggests that the story was different again in those places and that practitioners in each country had their own unique motivations and methods for adopting mediate auscultation and the stethoscope. Section 5.4 explores the benefits of examining the stethoscope as a physical object. It provides a short explanation of the new approach I took in investigating the stethoscope, demonstrating how it combines three approaches to form a new, more comprehensive, method of researching objects. Finally, I offer a few concluding remarks.

5.2 – Why Did British Practitioners First Take an Interest in Mediate Auscultation and the Stethoscope?

Laennec invented the stethoscope in the specific context of post-Revolution France, in Parisian hospitals which had a new structure that brought about specific ways of teaching and practicing medicine. The puzzle which presents itself here is why British practitioners, who did not have the same medical context, took an interest in it. The thesis has shown that the three British practitioners who are believed to have been the first to encounter auscultation and the stethoscope – Granville, Clark, and Haden – did so whilst in Paris for other reasons; they had not intended to learn about this new diagnostic technique. It was only when they had observed the practice of mediate auscultation with the stethoscope and become convinced of its utility in making diagnoses that they truly took an interest in the method. When Granville returned to London, he published articles which praised the method of auscultation and the use of the stethoscope, but he did not seem to use it in his obstetric practice nor did he advocate its use to others. Haden died before he could return to Britain. It was Clark, of these known early advocates and adopters, who brought the stethoscope and the practice of mediate auscultation to the attention of his friends and colleagues. He gifted stethoscopes to his medical friends, and convinced Forbes to translate Laennec's work into English. It was through the articles from

Granville and Johnson (a friend of Clark's), and Forbes' translation, that British medical practitioners learnt about this new diagnostic method and its related instrument.

British practitioners seemingly took an interest in mediate auscultation and the stethoscope because it increased their ability to diagnose various diseases of the chest. Laennec himself only became truly invested in the stethoscope once he realised that through its use, he could more accurately diagnose phthisis (TB) through the phenomenon of pectoriloquy. In the case of phthisis, an incurable illness, early and accurate diagnosis did not affect the possible treatment regime beyond allowing practitioners to know with certainty what it was they were attempting to reduce the symptoms of. However, in the case of surgery, accurate diagnoses through the use of mediate auscultation and the stethoscope did have a direct effect on treatment. In operations such as paracentesis, the use of the stethoscope allowed practitioners to more accurately determine the location of the effusion (accumulation of fluid) in the thorax and therefore make more accurate incisions for its removal. The increased diagnostic abilities, at least in surgery, aided the practical treatment of the patient. Mediate auscultation and the use of the stethoscope in the British Isles came to be meaningful in other clinical contexts, all of which required the practitioner to develop diagnostic skill with the instrument through some means, which I will discuss further in section 5.3. In each area, the potential for increased accuracy in diagnosis may have been what advocates suggested when they attempted to draw others to the practice of mediate auscultation. Much of what early advocators actually said in their promotion of the stethoscope, as well as the motivations which drew practitioners towards it apart from that advocacy, went unrecorded. Despite this, it may be possible for future researchers to further examine the writings of these advocates and the testimonies of adopters and attempt to verify the suggestion that increased diagnostic ability was a factor.

In the case of mediate auscultation and stethoscope uptake in obstetric practice, practitioners seemed to link making accurate diagnoses with increasing their professional reputations. It is possible, if not probable, that practitioners in other areas of medicine had a similar idea; a more accurate diagnosis, which presumably led to better care, could bolster the reputation – and, therefore, the number of paying patients – for any given practitioner. The concept of professional reputation in a medical context is not something that historians are unaware of: the work of people such as Clare Jones and Jeanne Peterson provide an interesting discussion of the role of non-self-promotion and professional reputation within the medical profession.[996] There is certainly scope for future research on the role of diagnostic ability in the building of professional reputation, as well as how skill in mediate auscultation and use of the stethoscope fitted into this process.

The process of building professional reputation holds significance outside of the study of mediate auscultation and the stethoscope. The question of what motivates a medical practitioner to adopt a new method of practice and/or instrument is one which applies to *all* new practices and instruments. This thesis examined these motives through personal accounts from practitioners in the process of adopting a new practice (and its associated instrument); other researchers could approach other practices and instruments in the same way. Additionally, the concept of building professional reputation in relation to a practitioner's ability to form accurate diagnoses (or demonstrate skill with a particular method or instrument) is one which applies to many areas of historical medical research. Indeed, general professional reputation in relation to prowess with a particular technique or tool may be a valuable area of research even outside of the history of medicine – doctors are certainly not the only people to use specialist tools in their work.

[996] For more on this see Peterson 1984 and Jones 2013.

5.3 – How Did British Practitioners Develop Skill in the Practice of Mediate Auscultation with the Stethoscope?

In the French hospital structures, there was a clear – if unintentionally formed – method of developing diagnostic skill with mediate auscultation and the stethoscope: the practice of anatomico-clinical correlation where practitioners looked at the symptoms in a living patient, that patient died, and practitioners could then dissect the body, linking the symptoms seen in life with the morbid anatomy at death. British practitioners did not have a means of routinely carrying out this practice.

This thesis offers the new concept of the practice of observing the patient, making a diagnosis, and having that diagnosis verified in some way (ODV) as an explanation of how British practitioners developed skill with the stethoscope despite not practicing in the Parisian context. Observing the living patient allowed practitioners to record the symptoms and physically examine the patient with the stethoscope. From these investigations practitioners could make a diagnosis which they hoped was accurate. Verification of this diagnosis, by confirmation or refutation, then provided the practitioner with information regarding the accuracy of their initial diagnosis. Through this process practitioners developed diagnostic skill: a correct (verified) diagnosis built their confidence in being able to accurately diagnose a condition based on those particular signs and symptoms, an incorrect (verified) diagnosis meant they could go over the case and findings to adjust their process. Repeated practice in diagnosing patients and following this process developed their diagnostic skill. Verification did not need to take the form of post-mortems, therefore despite British practitioners not having regular access to cadavers for dissection they found other means of verification which enhanced their diagnostic abilities with the new method and its associated instrument.

We might wonder whether the Parisian context was necessary for the invention of the stethoscope, but not for its adoption. The routine practice of anatomico-clinical correlation, encouraged by regular access to bodies of the same patients observed in life, meant that Laennec and other French practitioners had ample opportunities for observation, making a diagnosis, and having their diagnoses verified. But, as this thesis has made clear, it was only the routine availability of bodies which enabled the practice of anatomico-clinical correlation which was unique to France, and not ODV itself. This raises an interesting counterfactual question: could the stethoscope have been invented in Britain (or elsewhere)? What other forms of ODV might there be in different countries and contexts, and what impact might they have had on diagnostic skill acquisition? The new notion of ODV introduced in this thesis offers researchers a fresh approach to understanding diagnostic ability and skill acquisition that can be applied to any country or medical context.

The practice of ODV could, though need not necessarily, take the form of distinct practice methods. The two distinct forms of practice discussed in this thesis were anatomico-clinical correlation as presented by Adrian Wilson (and, to a lesser extent, Michel Foucault, although he did not use same terminology) which was common in the Parisian medical context,[997] and symptomatic-pathological correlation, a term of my own invention, through which British practitioners could develop their diagnostic skill without solely relying on dissection. Verification in anatomico-clinical correlation necessarily took the form of dissection, while verification in symptomatic-pathological correlation could use a range of sources, as long as they related in some way to anatomy (pathological or otherwise). In the practice of symptomatic-pathological correlation the practitioner would use anatomical preparations as a means of understanding stethoscopic sounds and verifying their diagnoses,

[997] Foucault 1973, 68, 135; Wilson 2007, 34.

rather than direct dissection as verification as in anatomico-clinical correlation. In Chapter 2 this thesis examined the different means of verification available to British medical students and how they developed their diagnostic skill in mediate auscultation and the stethoscope through these methods. The work of this thesis in identifying and analysing these two forms of ODV does not preclude the possibility that other forms exist; indeed, in formulating the process of ODV this thesis welcomes any further research which expands upon the possible forms the practice could take.

Chapter 3 used the example of obstetric practice to explore the processes of ODV and stethoscopic skill development where practitioners did not practice anatomico-clinical correlation or symptomatic pathological correlation. This further demonstrates that while both practices are forms of ODV, it is the general process of observation, making a diagnosis, and having that diagnosis verified (by confirmation or refutation) which builds diagnostic or stethoscopic skill, rather than any one particular form or method. Until the research in this thesis, the use of mediate auscultation and the stethoscope in obstetric practice is an area to which historians have seemingly paid no attention.[998] Apart from short articles on Kergaradec and Ferguson from Pinkerton – a practicing gynaecologist, rather than historian – much of the research in this thesis covered new or unstudied sources.[999]

The introduction of mediate auscultation and the stethoscope into obstetric practice impacted some of the wider discussions which were already occurring between practitioners; most notably the debates surrounding instrumental interventions in long or difficult labours. The introduction of instruments in labour, as well as the role of the male doctors and man-midwives, is becoming an increasingly studied area for historians of medicine and

[998] Trolle 1975, Wulf 1985 and Loudon 1992 have written a small amount of the monitoring of the foetal heartbeat, but no substantial works. Wilson 1995 similarly focusses on other aspects of obstetric history.
[999] J.H. Pinkerton one article on Kergaradec and another on Ferguson, in 1969 and 1980 respectively. See the bibliography for more details.

childbirth.[1000] The findings of this thesis add to these histories and provide further avenues of research into where these two areas – the history of auscultation and the history of childbirth – overlap.

Despite the apparent early lack of interest in obstetric auscultation from French and British practitioners, there is reason to think that practitioners from elsewhere on the Continent – most notably the German principalities – did appreciate and swiftly adopt the practice. Bavarian obstetrican C. J. Haus published his book *Die Auscultation in Bezug auf Schwangerschaft* (Auscultation in Relation to Pregnancy) in 1823, only a year after Kergaradec first made his investigations public. Other German practitioners such as Anton Hohl in Halle, Hermann Killan in Bonn, and Hermann Naegele in Mainz all published further work on the use of auscultation and the stethoscope in obstetric practice.[1001] The immediate and positive response to obstetric auscultation from these practitioners is in stark contrast to the slow and somewhat reluctant uptake in the British Isles. The uptake of mediate auscultation and the stethoscope clearly differed between countries, and there is ample room for further research into any and all of these distinct international approaches. The novel work in this thesis on ODV, skill acquisition, and object-based research offers concepts and research methods which future researchers can usefully employ in the study of other countries, contexts, and medical tools.

Practitioners in America similarly took an interest in obstetric auscultation, citing the work of Evory Kennedy as introducing them to the approach.[1002] American surgeons and physicians discussed, in detail, many of the stethoscopic signs relating to the diseases of the lungs and heart.[1003] It is currently unclear, based on the research in this thesis, when information

[1000] For more on this, see Wilson 2007 and Jenkins 2019.
[1001] Blaufox 2002, 65-66. Also see Haus 1823, Hohl 1833 and Kilian 1834.
[1002] Jarcho 1964, 809.
[1003] Bigelow 1839; Jarcho 1964.

about mediate auscultation became available to American practitioners, why they took an interest in it, and how they developed skill in the practice. From the sources I have been able to examine, most notably the work of Jacob Bigelow from 1839 and Henry Bowditch from 1846, it is possible they went through the same process as practitioners in Britain, but it is equally possible that they had their own unique approach to the diagnostic practice of ausucltation. Along with the motivations and methods of other European practitioners, the uptake of auscultation and the stethoscope in America is another area of further study which could uncover a rich array of information about auscultation and skill development more broadly.

Another reason the approach to mediate auscultation and the stethoscope by American practitioners warrants its own investigations is their distinct preference for immediate auscultation (placing the ear directly onto the patient). Lecturer of clinical medicine at Massachusetts General Hospital, Jacob Bigelow, advocated the practice of auscultation to American practitioners.[1004] Unlike Laennec, Forbes, and most other European doctors advocating the practice of auscultation, Bigelow argued that immediate auscultation was the best method of practicing auscultation.[1005] This preference for immediate auscultation over mediate auscultation with the stethoscope persisted for at least another seven years, as in 1846, Henry Ingersoll Bowditch – another American stethoscopist – published a guide for American medical students where he suggested that the ear alone was 'perfectly sufficient' for the practice of auscultation.[1006] Bowditch had studied auscultation in Paris during the 1830s and then under the guidance of Bigelow on his return to America; he acknowledged that practitioners in America practiced immediate auscultation more often than their European

[1004] Bigelow 1839, 357.
[1005] Bigelow 1839, 373.
[1006] Jarcho 1964, 812.

colleagues, but he offered no explanation as to why.[1007] This emphasises how practitioners in different countries had different approaches to the practice of auscultation and therefore may have had different methods of uptake and skill acquisition.

5.4 – What Can We Learn From Object Design?

Chapter 4 argued that it was possible to understand skill development with mediate auscultation and the stethoscope through examining the physical object of the instrument and considering its design changes. Changes to stethoscope design came from practitioners using the instrument and figuring out what they wanted from it. Design alterations could only occur when practitioners were regularly and skilfully using the stethoscope. The chapter demonstrated that many practitioners wanted, first and foremost, to have an affordable and comfortable tool for their everyday practice. Looking at the stethoscope as objects and interpreting the information from them involved the new combination of three different disciplines and approaches.

The first was that of material culture. Material culture is an area of study which used the 'material' as a means of understanding the cultures which formed them – material could mean a range of things such as objects, architecture, or constructed spaces. Considering the physicality of an object – i.e. weight, material, complexity – can lead researchers to avenues of study which would not come from textual sources alone.[1008] The ideas in this thesis regarding the portability, affordability, and comfort of the stethoscope would not have formed if I had not had the opportunity to work directly with the objects at the Science Museum. To this approach, however, I added approaches from other disciplines to devise a new method of object

[1007] Jarcho 1964, 808; 812.
[1008] See Fleming 1874 and Prown 1994 and 1996 for more on the methods of studying material culture.

study which had the advantage of combining alterations seen in the physical object with the forces which brought about those changes.

The second discipline is that of the Social Construction of Technology (SCOT). SCOT provides a framework through which researchers can interpret the changes and design features of objects. It considers what external pressures lead to changes in artefact design and the necessity for designers to find a balance to accommodate the wants and needs of those invested in the object. This approach allows for interpreting design changes with reference to the historical actors involved in the process. Researchers using a SCOT approach tended to focus on the conceptual approaches to design, with little to no interaction with the physical objects they discussed. In this thesis the SCOT approach enabled an interpretation of the design changes seen in the stethoscope which incorporated the requirements and desires of the historical actors involved with the instrument. The work of this thesis in combining SCOT with other methods of studying objects opens up a new way for researchers using SCOT to interact with the objects – rather than looking at changes only in an abstract way, the new approach in this thesis encourages a combination of the abstract with the physical which can help ground SCOT ideas in the reality of their studied objects.

The third approach came from areas of history which involved historical re-enactment. Examples of such an approach can be seen in the work of Sibum, in recreating experiments, and Kneebone and Wood in reproducing historical surgical procedures.[1009] Attempting to use the stethoscope forced me to consider the process and the instrument in a more immediate sense. The stethoscope is a practical instrument, intended for use as a tool for a particular diagnostic technique. In recreating some of its use, it was possible to gain insight into the

[1009] For more on history through re-enactment see Sibum 1995 and Kneebone and Wood 2014.

experiences and habits of the historical users.[1010] These insights then feed back into the interpretive method from SCOT as applied to the material objects.

The wealth of information which comes from this approach to object study indicates the scope for future work on the continuing evolution of the stethoscope. This could include further research into the monaural instrument, either in Britain or in other countries, or a move to the study of binaural stethoscopes. Other design changes may have involved changes in practice as much as changes to the physical objects, especially in the case of the binaural model which is still the most common form of stethoscope today. An exception to this is the Pinard monaural obstetric stethoscope, another model which could also benefit from further research using the new approach from this thesis.

My novel combination of these three approaches into one structured method offers an explanation of the role medical practitioners played in the design and promotion of different models of stethoscope, re-emphasising the role of practitioner demands in the innovation of technological artefacts. This new method need not only apply to the study of stethoscopes. Researchers from any discipline can use it to better understand how people used, designed, and otherwise interacted with any objects in their lives. It is a particularly useful approach for any research involving tools or instruments which form part of a technique. The concept of handling the studied objects, having an interpretive framework which considers actors' motivations, and recreating (to varying degrees) the use of the object to uncover potentially unrecorded aspects of its employment sounds quite simple, yet until now it has not appeared as a recorded or codified approach. In outlining the method of this approach, and demonstrating its utility through investigations into the stethoscope, I hope to bring this mode of study to the wider

[1010] Robb 2015, 177.

discipline of history, and other areas of research, so that it might provide a new way to understand abstract ideas such as skill and knowledge acquisition through the study of objects.

There are a vast number of diagnostic processes and instruments which we accept as a part of our medical experiences without much thought as to how they came to be such an integral aspect of medicine. This thesis examined the adoption of the stethoscope, an instrument which is emblematic of medical practice, when it was a simple wooden tube. There are numerous other diagnostic tools which may have started as objects we might struggle to recognise today. These diagnostic processes or tools may seem to be the same in different times and places, as mediate auscultation and the stethoscope do at first glance; but it may also be the case that, once subjected to a similar kind of analysis as the one in this thesis, other seemingly ubiquitous medical processes and tools - and not just mediate auscultation and the stethoscope - may constantly be reviewed and remade in relation to lived experience and changing values.

Appendix 1 – Interacting with the Stethoscope

A1 – Introduction

This appendix details my investigations with the Wellcome Collection stethoscopes held at the London Science Museum, conducted over the summer of 2018. The collection contains over 200 stethoscopes, including monaural and binaural instrument. I excluded binaural stethoscopes from my study as they fell outside the general time period of the thesis (1816-1850). I did, however, look at some monaural instruments which dated later than the 1850s, as a means of gaining a more holistic view of the changes in monaural stethoscope design.

I have organised the appendix into different sections and two tables of data. Section A2 provides a short explanation of what to expect from Table 1 and the table itself. The following section, A3, provides a comparative analysis of the inform provided in Table 1, drawing out any important findings and patterns in the data. Section A4 then outlines my own personal trials with the instruments in the collection, looking at what, why and how I conducted these trials and how they benefited my research. This section also outlines the structure of Table 2, which show the findings of my trial with the instrument. Following Table 2, I provide analysis of the key points I took away from my work directly using the stethoscopes, as well as pointing out areas in which further research or a different trial could add to these investigations. I conclude by emphasising the importance of spending time with the instruments themselves, both for my research and for research in general, and combining a range of approaches to the historical study of objects.

Note on terms:

- Monaural Stethoscope – an instrument which the practitioner applies to only one ear. The original form of stethoscope, and the only form until the 1850s.
- Chest piece – the part of the stethoscope which the practitioner applies to the body of the patient.
- Chest part – if the stethoscope comes in separate pieces, this is the part which has the chest end on it.
- Ear plate – the disk onto which the practitioner places their ear.
- Ear part – if the stethoscope comes in separate pieces, this is the part which has the ear plate on it.
- Obturator – a removable 'obturator' or 'plug' placed into the chest end of the stethoscope as a means of differentiating between the sounds of the lungs and the heart.
- Mortise and Tenon – a form of joint which typically connects two pieces of wood, the mortise forms a hole and the tenon a 'tongue' cut exactly to fit into the mortise, to hold an object together.
- Pleximeter: From the Greek words for 'to strike' and 'to measure'. A Pleximeter is a flat plate of ivory used for mediate percussion. Its inventor, French physician Pierre Adolphe Piorry used the term 'Plessimeter' which translators then termed 'Pleximeter' in English.

A2 – Table 1

The table in this section is intended to show some a cross section of the stethoscopes held at the London Science Museum. Arranged chronologically the table shows a range of stethoscope designs and how they changed between 1816 and 1878. This date range extends further than I discuss in Chapter 4, in part to demonstrate the breadth of stethoscopes at held at the Science Museum, and in part – as becomes apparent in the table – because of the stabilisation of design. The Table has seven columns: Description, Dates, Materials, Number of Parts, Obturator, Length and Weight, and Image.

Description: This column gives a short overview of where the instrument or the image came from. This can include the object number from the Science Museum, as well as a short statement giving the name of a maker or variation, or the image could have been sourced from a primary text, in which case the description will give both the author and the name of the book.

Dates: This column provides the associated dates for each stethoscope design. In some cases, this may be exact, as is the case for books and for some instruments, or it could be a rough estimate founded on the designs at the time and other textual sources. I have organised the table so that the rows are chronological, starting at 1816.

Materials: A short statement about the material composition of each stethoscope, e.g. wood, metal, ivory etc.

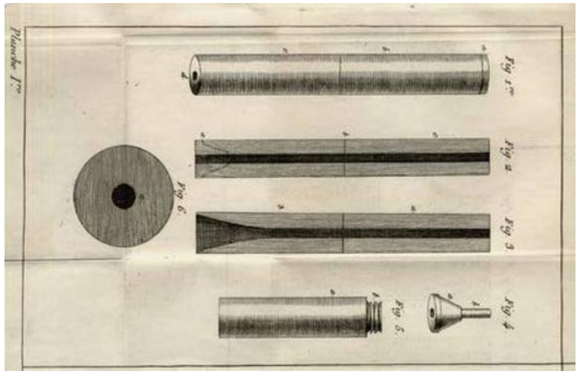
Number of Parts: Information on how many separate or removable parts the instrument has. This can include things like decorative or protective caps as well as obturators, ear plates and if the instrument has chest and ear parts or consists of just one main body.

Obturator: This column looks at whether the stethoscope design has an obturator at as part of the chest piece. The design may or may not include an obturator, hence my inclusion of this part in a separate column to the other parts. Originally, the presence of the obturator in the instrument meant the practitioner could better hear sounds of the heart, while removing the obturator allowed for better transmission of the sounds of the lungs.

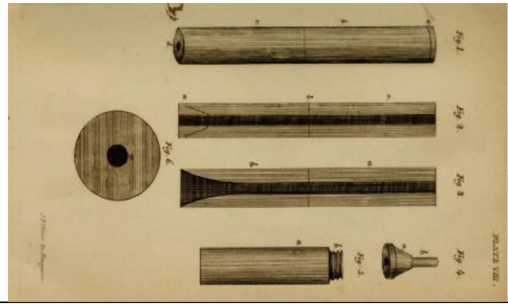
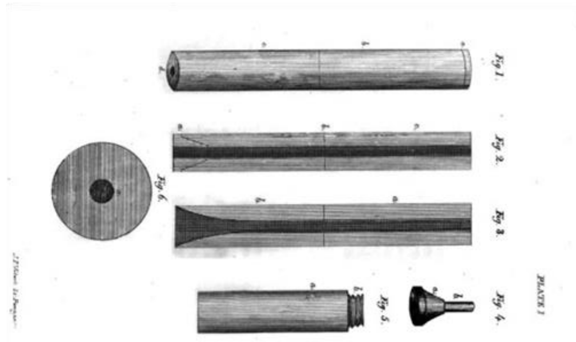
Length and Weight: This column gives information about the length of the instrument and weight of the instrument when fully assembled. The modern stethoscope is commonly thought of as being slung around the neck of a practitioner, however this was not always the case. The weight and length of the stethoscope are features which can change drastically depending on the design of the instrument.

Image: This column has an image of the specific stethoscope or the general design as presented in the primary texts. It allows the reader to observe some of the physical similarities and differences in the stethoscope for themselves, especially those which may be hard to describe in writing, such as the conical or domed shapes of the obturator.

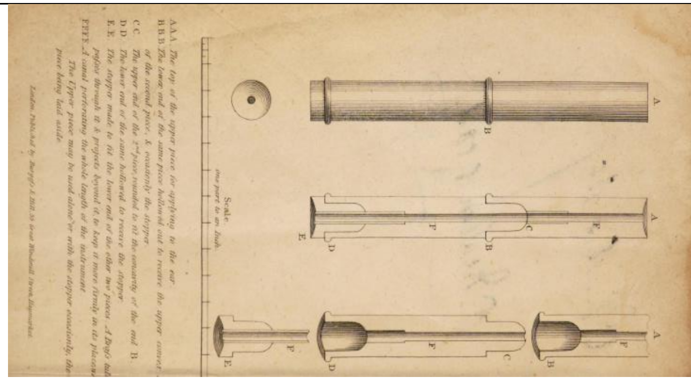
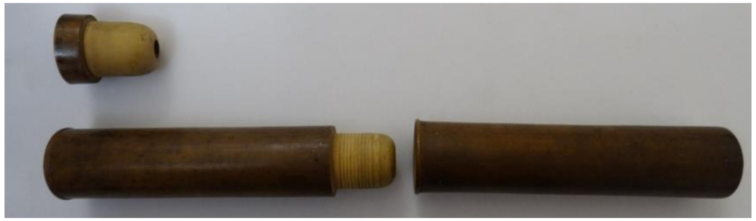
Table 1

Description	Dates	Materials	Number of Parts	Obturator	Length/ Weight	Image
Laennec's first stethoscope[1011] (A608185)	1816	Paper	One	No	31.2cm/ 0.42kg	 
Image printed in Laennec's first edition of *Traité*	1819	Wood and metal	Three	Yes		
Version of the stethoscope seen in Laennec and Forbes' publications[1012] (A79254)	c.1820	Wood (and metal?)	Three	Yes (Missing)	25.6cm/ 0.18kg	 

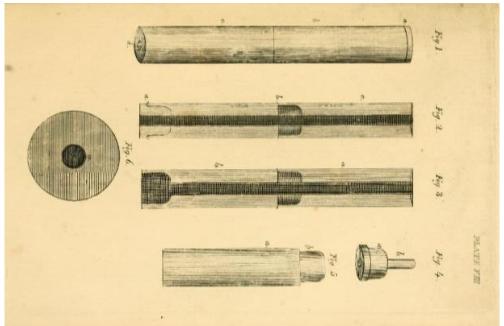
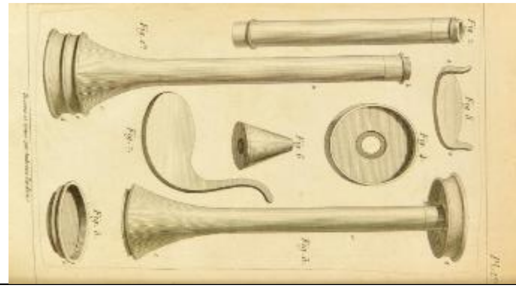
[1011] Listed in the Wellcome Museum Accession Register (entry 2305/1936 in Vol 4: R1971/1936-R2725/1936) as being 'Laennec's first stethoscope'. Based on how well the object has survived, as well as the country it is in and the lack of evidence that Laennec saved any of his original paper models, it is highly unlikely that this is truly Laennec's first stethoscope. Another paper stethoscope is in the collection (A608184) and is listed in the Museum Accessions Register (2543/1940 in Vol 27: 2271/1940-250/1942) as a replica of the first stethoscope, there is no indication if the replica was made for the collection or acquired ready made for another purpose.
[1012] The lack of any scuff marks on the instrument could suggest that it was never used and may be a later replication. Any dates or reasons for replication are unknown. The instrument accurately represents the general style of the original wooden design published by Laennec.

Image printed in Forbes’ first edition of *Treatise*, the translation of Laennec’s work	1821	Wood and metal	Three	Yes		
Laennec style stethoscope (A608187)	c.1822	Wood and metal	Two[1013]	Yes	17cm/ 0.10kg	
An image printed in Forbes’ book *Original Cases*	1824	Wood and metal	Three	Yes		

[1013] Although it looks as though there is a split in the middle, that line appears to be purely decorative or to give the illusion of it splitting into three. It is possible that the instrument was unfinished, however the fact it had been varnished suggests that this is a finished product. It was likely cheaper to produce a stethoscope without adding a split, so the instrument could have been cheaper to acquire or make in only two parts. The groove simply being there to mimic the classic three-part model.

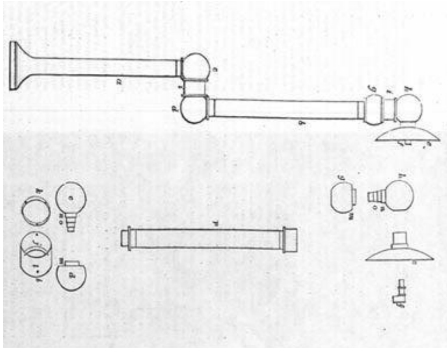
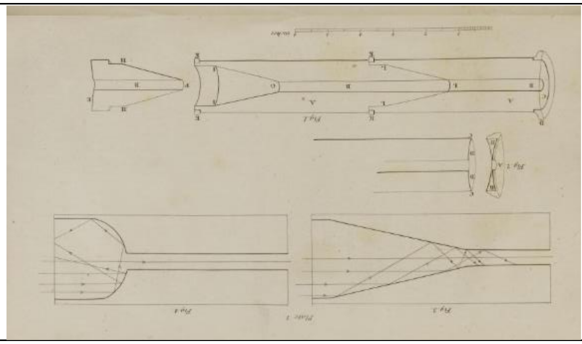
Image printed in W. N. Ryland’s English translation of French M. Collin’s book *Different Methods of Investigation*	1825	Wood and metal	Three	Yes		
Model in a similar style to the one seen in Ryland and Laennec’s books (A608192)	c.1825	Wood and metal[1014]	Three	Yes	30.5cm/ 0.26kg	
A monaural stethoscope with conical wooden attachment ends. ‘Dr Webster, 1826’[1015] written on it (A608181)	c.1826	Wood	Three	Yes (missing)	29.8cm/ 0.14kg	

[1014] For this stethoscope, the metal tube usually seen attached to the obturator has become stuck in the chest end dome.
[1015] See Chapter 4 for a discussion of the supposed identity of Dr Webster.

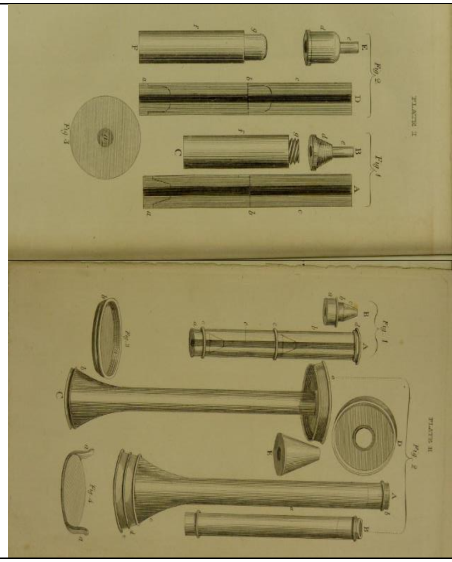
Image printed Laennec's 2nd edition of *Traité* and Forbes' 2nd translation	1826/1827	Wood and metal	Three	Yes		
Image printed in Pierre-Adolphe Piorry's book *De La Percussion Médiate*	1828	Wood and ivory	Six[1016]	Yes		
A Piorry model stethoscope (A608197)	c.1829	Wood, ivory and metal	Five[1017]	Yes	22cm/ 0.06kg	

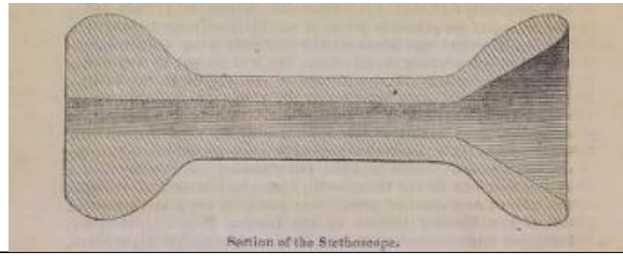
[1016] The model shown in this print has an extra piece of wooden tube to extend the stethoscope if the physician required, but this part was not found in any of the Piorry stethoscopes held at the Science Museum.

[1017] These are: the main body, the obturator, a solid ivory cap, an ivory ring which forms an ear plate, and an ivory cap for the ear plate when the instrument is not in use.

An image of the Comins style stethoscope printed in the *Lancet*	1829	Metal	Three	No		
Fox in Derbyshire made a stethoscope with ‘elastic ends’[1018]	1830	Wood and rubber	Unknown	No	Unknown	None available[1019]
Stethoscope design printed in C.J.B. William’s book *A Rational Exposition of Physical Signs*	1830	Wood, metal and horn or ivory	Four (two main parts, obturator, cap)	Yes		

[1018] Fox 1830.
[1019] Fox published a short description of his stethoscope in the *Lancet* but I have been unable to find any printed designs or verified Fox-style stethoscopes.

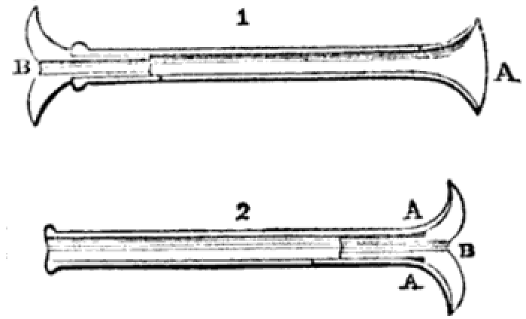
Images of four different design styles printed in Forbes' 3rd edition of *Treatise* Designs (from left to right): - Original design - Design first seen in Ryland/Collins - Model similar to Webster's - Piorry model	1834	Wood, metal and ivory (varies depending on model)	Three – Six (varies depending on model)	Yes (all models)		
Shortened Laennec style stethoscope (A606124)	1834	Wood and metal	Two	Yes	21.6cm/ 0.14kg	

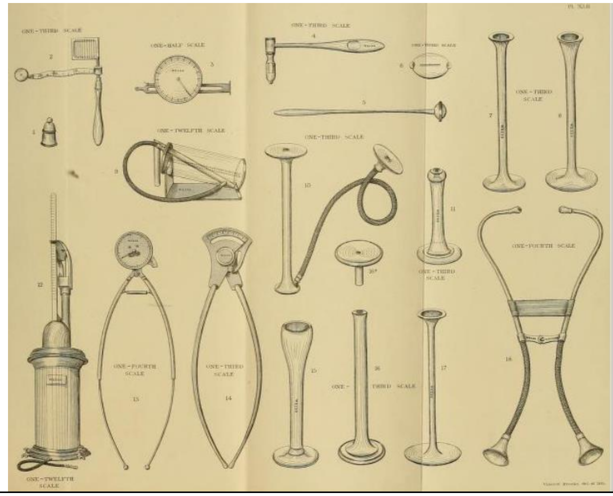
Variation of a monaural stethoscope[1020] (A625006)	c.1835	Wood and ivory	Two	No	18.7cm/ 0.06kg	
Image printed in Archibald Billing's book *First Principles*	1837	Wood	One	No		
A Billing style stethoscope (A608219)	c.1837	Wood	One	No	10cm/ 0.02kg	
A Billing style stethoscope (A608230)	c.1838	Wood	One	No	9.5cm/ 0.02kg	

[1020] This stethoscope had no information on the maker available in the Science Museum records. It is similar to a stethoscope in Bishop's 1980 paper which he attributes to Fox (Bishop 1980, 450). It does not match with the description given by Fox in 1830. In the Wellcome Museum Accessions Register (84/1955 in Vol 30: 41/1950-108/1955) there is a note saying 'Elliotson's', but no further evidence has been found for this.

A variation on the Billing style stethoscope (A625008)	c.1840	Wood	One	No	9.9cm/ >0.02kg	
A variation on the Billing style stethoscope, greatly increasing the length (A608218)	c.1840	Wood	One	No	17.5cm/ 0.04kg	
Ferguson style stethoscope[1021] (A625031)	c.1840	Wood	One	No	17.2cm/ 0.02kg	
Ferguson style stethoscope (A625023)	c. 1840	Wood	On	No	17.2cm/ 0.02kg	

[1021] I have not found any published images of the Fergusson style stethoscope, unlike other models no practitioner claimed priority on this design.

Stethoscope design suggested by C.J.B. Williams. Image printed in *The Retrospect of Practical Medicine and Surgery*	1842	Wood	Two	No		
A Ferguson style stethoscope (A625026)	c.1851	Wood	One	No	17.9cm/ 0.02kg	
William's style stethoscope (A625020)	c.1855	Wood	Two	No	21.2cm/ 0.04kg	
Ferguson style stethoscope (A625027)	c.1860	Wood	One	No	17.7cm/ 0.02kg	

Stethoscopes in John Weiss & Son's Catalogue; containing seven monaural stethoscopes. Four of which were Ferguson style instruments, one Williams style, and one 'teaching' stethoscope.[1022]	1863	Mixed, mostly wood but some flexible materials	One	No		
Fergusson style stethoscope (A625032)	c.1865	Wood	One	No	17.2cm/ 0.02kg	
Fergusson style stethoscope[1023] (A600075)	1878	Wood	One	No	17.4cm/ >0.02kg	

[1022] A teaching stethoscope was a Ferguson style with a flexible part attaching a second ear plate, so teacher and student could listen simultaneously.
[1023] A strip of paper which states "Made of part of the Old Roof of Holyrood Palace, removed Sept. 1898. Above 200 years old" is wrapped around the stem of this stethoscope; it is underneath the varnish so must have been placed during manufacture.

A3 – Analysis of Table 1

This section examines the information in Table 1, drawing out some patterns which appear in the data. Going from left to right, this section describes and compares the changes both within and between the Material, Number of Parts, Obturator, and Length and Weight columns; these comparisons further consider the dates of the instruments. Unlike Chapter 4 it does not attempt to explain why these design alterations happened. These explanations and comparisons work through the table columns from left to right, starting with materials, then number of parts, the presence of an obturator, and finally the weight and length of the instrument. This approach looks at the date of the instrument as well as any variations between each column. In the discussion of Table 1, a particular will become apparent: the design staying much the same for the first 10 years (1816-1826), a marked increase in design variation from 1827-c1835, followed by a return to a more standard form of design.

Starting with the materials used to make the stethoscope, it is clear that very little changed between 1816 and 1878. Laennec made his first stethoscope out of thick paper, but soon afterwards he began experimenting with different materials and eventually settled on medium density wood as the best sound conductor. Wood makes up all but one of the stethoscopes in Table 1. The exception to this is Comin's 1830 'flexible' stethoscope, designed entirely from metal; other designs may have used ivory, metal or rubber, but always alongside wood. Occasionally, designs introduced other materials such as ivory, metal or rubber; earlier models often had a small metal tube for attaching the obturator. Metal appears in many of the stethoscopes from c1822-1824, acting as a tenon with which to attach the obturator. Ivory and rubber became more common, though not prolific, following Piorry in 1828. Practitioners explicitly including a material other than wood in their design seems to reduce after 1835. In the late 1830s designs of stethoscopes in Table 1 return to a fully wooden design. In the case of materials there appears to be a pattern where the instrument started as purely wooden for roughly 10 years (1816-1826), in the following 8 years practitioners used a range of materials in their designs (1827-c1835), the designs returned to using only wood from c.1836 onwards.

Moving onto the number of parts each instrument had, Laennec created the very first stethoscope out of rolled up paper. The very first stethoscope was a single object with no distinct or separate parts, but Laennec's first printed design of the stethoscope shows the instrument consisting of three parts: an obturator, a chest part, and an ear part. The three-part model remained consistent, except in rare cases, for the first 10 years following Laennec's invention of the instrument (1816-1826). In Table 1 the stethoscope from c.1822 did not have three parts, instead it had a main body and an obturator only. In this case the maker appeared to have engraved the instrument to make it seem as though the practitioner could split it into three parts, fitting the design of the other stethoscopes in this period aesthetically if not in actuality. Following Piorry's publication of his stethoscope design in 1827 the stethoscopes in Table 1 show a dramatic increase in the number of distinct parts; detachable pieces made from wood and ivory were common and many Piorry-style stethoscopes had at least 6 distinct parts. While some practitioners still favoured the Laennec-style stethoscope, Forbes and Meriadec acknowledged that the Piorry model was the most popular design in the later 1820s and early 1830s. The number of parts a stethoscope continued to vary between designs from 1828 and 1835; with the Piorry, Laennec, Fox, Comin and Piorry-modified stethoscope styles, stethoscope designs could include anywhere between three and six distinct parts.[1024]

The Billing style stethoscope design, first published in 1837, did not have any removable parts and in Table 1, it is the Billing design which marks a change to stethoscope designs which consist of only one part, or very occasionally two. The William's stethoscope is the only instrument dated after 1835 which has two parts: a main body and a detachable ear

[1024] This is only considering the designs in Table 1, it is possible that other stethoscope designs included more parts than these.

plate. The variations on the Billing style stethoscope and the Ferguson models did not have any removable parts. Similarly, none of the monaural stethoscopes advertised in Weiss & Son's 1863 catalogue consisted of more than one piece with the exception of a teaching stethoscope, where practitioners could attach a second ear plate with a flexible cord so that both student and teacher could listen simultaneously.

As the number of parts decreased, so did the prevalence of the obturator in the stethoscope designs. The decline in stethoscope designs which included an obturator, however, seems to occur in a pattern of steady decline rather than the three stage pattern seen in the different materials practitioners used to make the instrument. Not including the original paper form, all stethoscope models between 1819 and 1826 had an obturator as a part of their design. The first stethoscope design to do away with the obturator entirely was Comin's flexible stethoscope (1829) and Fox's rubber ended stethoscope (1830). In both cases the stethoscope design still included other removable parts. The move away from the obturator was not a unanimous or simultaneous design change, as the stethoscope design published by Williams in 1830, the same year as Fox's stethoscope, had one. Similarly, all of the stethoscope designs Forbes printed in his 1834 edition of *Treatise* contained an obturator present, as did the 1835 Piorry variation.

The 1837 Billing stethoscope did not include a *detachable* obturator. However, the purpose of the obturator was to allow the practitioner to focus more on a specific sound, and Billing designed his instrument so that practitioners could reverse the instrument to use the chest piece or ear plate interchangeably. The Billing stethoscope had one hollowed out end and one full, thick, dome shaped end. These sides, hollow and full, acted as a stethoscope without the obturator out and a stethoscope with the obturator in, respectively. Despite the design not having a detachable obturator the Billing stethoscope maintained the functions related to it, something which the Comins and Fox stethoscope designs did not. In this way, although Billing removed the obturator piece from his design, he did not remove the characteristic. In contrast, the Ferguson style stethoscopes from c.1840, as well as the William's stethoscope (1842), abandoned not only the obturator piece a feature of stethoscope design but also its functionality. While it is possible to observe the decline of the inclusion of a obturator in stethoscope design, this change appears to be much more gradual than many of the others, with some designers attempting to preserve the function of the obturator while removing need for a detachable 'piece', before doing away with it entirely. By 1842 it appears that no stethoscopes have or mimic the use of an obturator and that remains the case for all subsequent models shown in Table 1.

In terms of length, there appears to be a return to the same three-stage pattern. The original Laennec stethoscopes were roughly one foot, or 30cms, in length and between 1816 and 1827 the mean length of the stethoscope was around 26.8cm. The longest stethoscope being the first paper model, at 31.2cm and the shortest before 1827, which also does not have separate ear and chest parts, being 17cm. The printed designs of the stethoscope between 1819 and 1827 did not alter the recommended dimensions and, while the instruments themselves did have variation, the average length remained above 25cm. Then, in 1827, the Piorry design reduced the length of the stethoscope by around 4-8cms, with a mean length of 20.7cm. Other designs from c.1829-1835 also seemed to be shorter than the original Laennec style; for example, the Comins stethoscope consisted of two 7-inch parts.[1025] Billing noted the length of his instrument as being roughly 4 inches (10cm), another drastic reduction in the length of the stethoscope.[1026]

The Billing style did have variations in length, with one version (c.1840) in Table 1 measuring at 17cm, by far the largest version of a Billing model stethoscope. Following from c.1840, the stethoscope models remain at a more static length; the Ferguson models from 1840

[1025] Comins 1829, 685. Fox did not give the dimensions of his stethoscope design.
[1026] Billing 1837, viii.

onwards had varied only slightly between 17.2cm and 17.9cm long. The Williams style stethoscope was the longest model post-1840, with a length of 21.2cm with the ear plate fully extended; it is important to note that the length becomes closer to 20cm with the plate fully inserted. Again, a pattern emerges from Table 1: few changes in the design features of the stethoscope in the first 10 years, followed by a dramatic shift, with a standard appearing around the start of the 1840s.

The final column is that of weight. As with the presence of the obturator, the weight of the instrument does not follow the three-stage trend seen in the other columns, although for weight the change is much less gradual than it had been for the obturators. The original paper stethoscope is the heaviest of the stethoscopes in Table 1 at 0.42kg. This introduces the general principle that the thicker the stethoscope the heavier it is. The stethoscopes which date between 1816 and 1826 are all 0.10kg or heavier. These are also the full cylinder stethoscopes; where there is no change to the diameter across the whole instrument. The most dramatic change in weight came in 1827 with the Piorry style stethoscope which, despite being longer than some of the other full cylinder stethoscopes, weighed only 0.06kg. The Piorry stethoscope has a mainly thin stem, while the shortened Laennec style instrument is a full cylinder. From Piorry to the 1878 Ferguson model, the weight of the stethoscope varies very little, often being between 0.02-0.04kg. For the first 10 years after Laennec invented the stethoscope the weight of the instrument varied but remained above 0.10kg, after the Piorry stethoscope in 1828, which did not have a full cylinder body, the stethoscope became much lighter.

From Table 1 it is possible to observe some trends in stethoscope design changes, such as mild variations in material, large variations in the number of parts and instrument length, the move away from having an obturator, and a drastic decrease in weight. Whilst each feature changed at a slightly different rate, there appears to be some correlation between them, such as the general reduction in distinct stethoscope parts and the decline in the inclusion of an obturator. Additionally, many of these design changes appear to have occurred in a form of pattern, where there was little initial change, followed by a period of intense innovation, with a final stabilisation of the instrument. Chapter 4 discussed the reasons for these changes and how they related to the skill level in the medical population; in the first 10 years practitioners were not familiar with the instrument, as use increased they became more aware of perceived problems with the stethoscope and attempted to change them, and following these innovations came a stable design which solved all of the initial problems around comfort, portability and affordability. In the following sections I outline how I came to the feature of 'comfort' in the stethoscope, and I examine the effect these changes discussed here had on the stethoscope in terms of acoustic abilities and the level of comfort during use.

A4 – My Stethoscope Trials and Table 2

Whilst examining the stethoscopes to gain the information presented in Table 1, I became interested in how practitioners would have actually used the stethoscope. Looking at the stethoscopes from the perspective of their material, length, weight, and number of parts certainly provides interesting and useful information about the development of stethoscope designs. What it does not do is provide information about what these design changes meant for the *functionality* of the stethoscope or how users would have physically interacted with the instrument. As a way of investigating these aspects, I decided to conduct my own trial of the instruments seen in Table 1 whilst measuring the acoustic ability and the comfort of the stethoscopes. The aim of this investigation was simply to experience the objects 'in use'. I wanted to carry out the same actions that the historical users would have, with the possibility that I may discover something in their actions which they did not record in writing, and if nothing new appeared then it at least satisfied my own curiosity.

As I was working on my own, I could not test these stethoscopes on the sounds of the heart and lungs and, as I am not a trained physician, these sounds would likely have been too difficult for me to interpret anyway. I tried to create a standardised means of testing the instruments, so that I would have a constant aspect on which to base my comparisons. To this end, I used my wristwatch, wrapped in several layers of thick clothing so as to muffle the sound to the unaided ear (that was not practicing immediate auscultation!). I placed a sheet of acid-free paper over the top of this bundle as well as over the ear-plate, to protect the stethoscope from any unnecessary exposure to materials or oils which could degrade the old wood or ivory. Using each instrument, with the bundle placed on a regular height table, I attempted to use mediate ausucltation to locate the ticking of the watch through the layers of fabric and paper. The paper increased some of the extra sound from placing the stethoscope onto the proxy-thorax and close to my ear, but this did not cause much difficulty as long as I kept the stethoscope still in one place for a short period of time before trying to listen for the watch. Luckily for me, this was also something that historical practitioners needed to do in order to reduce any rustling from clothing or their own hands; although they would not have had paper in between the ear plate and their ears.[1027] For instruments which had an obturator I attempted to find the ticking both with and without it in place.

This method had three main limitations. Firstly, my hearing is subjective and, while I am unaware of any problems that could cause a definite error, it is still possible that someone could repeat this experiment and get quite different results. This makes these results very subjective and difficult to replicate, but at the same time it emphasised the difficulties practitioners at the time would also have faced; all hearing is subjective. What one practitioner may have heard with ease another may have found impossible to make out. Secondly, the lone

[1027] *Lancet* 1826; 699. Passage on items of clothing best removed ‘on account of the crackling noise produced by their friction on the instrument’.

tick of a watch is much louder and more distinctive than many of the sounds made by the heart and lungs. People can often hear a watch with no aid from an instrument, and there were no other sounds within the bundle competing for my attention. Whether these stethoscopes would have more or less success in transmitting the much quieter and more varied sounds of the chest is still unknown. Thirdly, the room I was working in (a basement room which had previously functioned as a vault) had very little background noise. This would have been ideal for practitioners using a stethoscope but does not accurately represent the sort of situations in which they usually found themselves; general wards, lying-in hospitals, or private residences. Even with these limitations, the trial was still a useful endeavour as it provided information that I could not have obtained through reading or through general physical examination of the instruments.

The two main pieces of information I gained through this trial are thus: that the acoustic ability of the instrument varied only slightly between all the models and that the wider the ear plate the more comfortable the stethoscope was to use. Neither of these pieces of information would have become obvious had I only read publications on the stethoscope or conducted a general physical investigation of the instrument. Only through use was I able to develop certain understandings about the instrument. I recorded the results from this trial and they are presented below in Table 2.

Table 2 consists of one stethoscope per row, organised chronologically, with 8 columns:

1. Object number and if there was an obturator: this column simply gives the object numbers from the Science Museum to allow for accurate records and easy of identifying the same instrument in both Table 1 and Table 2. A subcategory in this column is whether or not the obturator was in the instrument during the test, to allow for an easy dived between these points of information.

2. Volume: how loud were the watch tickets through the stethoscope? I used a scale of ‘Very Loud’, ‘Loud’, ‘Quiet’ and ‘Very Quiet’. Where Very Loud meant the stethoscope was easily audible without much concentration, while Very Quiet means that even in an empty room with few external noises it was still necessary to concentrate to be able to hear the watch ticking.
3. Clarity of sound: did the ticking of the watch sound muffled or fuzzy in some way (Unclear)? Or was the sound was crisp with different tones of sound (Clear)?
4. Proximity: how close did the stethoscope need to be to the watch in order to pick up the sound? ‘Close’ was within a 2-3cm radius of the watch. ‘Reasonable’ was within a radius of about 5-7cm. ‘Low’ was across almost the whole body of the test bundle (roughly 10cm).
5. Comfort of use: how comfortable or uncomfortable was the stethoscope to use? Was there any pain or discomfort when I pressed the stethoscope against my ear
6. Diameter of ear plate: how big was the ear plate of the instrument?
7. Dates of the instrument: the rough date of each stethoscope, allowing me to relate some of the findings in Table 2 to the patterns seen in Table 1.
8. Any further notes: a small section in which I recorded any information I felt was relevant to the investigation, such as the stethoscope being reversable, the obturator being missing, or some part of the instrument being stuck.

Table 2

Object Number and Obturator In/Out		Volume of Sound	Sound Clarity	Required Proximity to Source of Sound	Comfort	Ear plate diameter	Date	Additional Notes
A608184		Quiet	Unclear	Very Close Proximity	Uncomfortable	0.5cm	1816	Paper replica, no obturator. Very loosely rolled.
A608185		Loud	Clear	Reasonable Proximity	Relatively comfortable	4.5cm	1816	Paper replica, no obturator
A79254	In	X	X	X	Uncomfortable	3.9cm	c.1820	Incorrect obturator. The link between the two parts was not very firm, making it hard to place.
	Out	Quiet	Clear	Close Proximity				
A608187	In	Very quiet	Unclear	Close Proximity	Uncomfortable	3.2cm	c.1822	
	Out	Loud	Clear	Close Proximity				
A608192	In	Very quiet	Clear	Close Proximity	Uncomfortable	3.6cm	c.1825	Metal tube from the obturator is stuck inside the conical end.
	Out	Very quiet	Clear	Close Proximity				
A608181	In	X	X	X	Uncomfortable	3.9cm	c.1826	This stethoscope was missing its obturator, very loose attachment.
	Out	Quiet	Unclear	Close Proximity				

A608197	In	Quiet	Clear	Close Proximity	Very uncomfortable	4.4cm	c.1828	
	Out	Quiet	Clear	Close Proximity				
A606124	In	Loud	Clear	Close Proximity	Relatively comfortable	4.0cm	c.1834	
	Out	Loud	Clear	Reasonable Proximity				
A625006		Loud	Mostly Clear	Reasonable Proximity	Relatively comfortable	5.2cm	c.1835	No Obturator
A608219	In	Quiet	Clear	Reasonable Proximity	Very Uncomfortable	4.0cm	c.1837	Double sided, so there is no obturator, just one thick end and one conical end. The instrument is very small
	Out	Very Quiet unless over source	Clear	Very Close Proximity		3.9cm		
A608230	In	Quiet	Unclear	Close Proximity	Both ends very uncomfortable	4.9cm	c.1838	Double sided, so there is no obturator, just one thick end and one conical end
	Out	Quiet	Mostly Clear	Close Proximity		4.9cm		
A625008		Loud	Clear	Close Proximity	Comfortable	5.2cm	c.1840	No Obturator

A608218	In	Loud	Clear	Reasonable Proximity	Comfortable (full end)	5.1cm	c.1840	Double sided, so there is no obturator, just one thick end and one conical end
	Out	Very Loud	Clear	Reasonable Proximity	Uncomfortable (hollow end)	3.5cm		
A625023		Loud	Clear	Reasonable Proximity	Very Comfortable	6.8cm	c.1840	No Obturator
A625031		Loud	Clear	Reasonable Proximity	Very Comfortable	6.7cm	c.1840	No Obturator
A625026		Quiet	Clear	Reasonable Proximity	Comfortable	7.1cm	c.1851	No Obturator
A625020		Loud	Clear	Low Proximity	Very Comfortable	5.3cm	c.1855	No Obturator
A625027		Loud	Clear	Reasonable Proximity	Very Comfortable	6.5cm	c.1860	No Obturator
A625032		Loud	Mostly Clear	Low Proximity	Mostly Comfortable	5.9cm	c.1865	No Obturator
A600075		Loud	Clear	Reasonable Proximity	Comfortable	5.7cm	1878	No Obturator

A5 – Analysis of Table 2

There are four main findings from this trial. First, that the volume of conducted sound appeared to increase over time. Second, that the clarity of conducted sound appeared to increase over time. Third, that the necessity of close proximity to the sound source decreased over time. And fourthly, that the comfort of the instrument increased over time and in relation to the size of the ear plate. This section discusses each of these points in more detail, linking the changes found during the trial with the physical qualities shown in Table 1. That changes in design and shape of the instrument impacted the feel of using it is hardly a controversial claim, instead what this section aims to do is draw out exactly what these changes were and what effect they had. First I will look at the three acoustic properties of volume, clarity, and proximity, then I move on to discuss the comfort of the stethoscope.

The volume of sound conducted by the stethoscope became more consistent as the design changed; instruments from around 1830 onwards generally conducted a loud sound, while the majority of instruments pre-1830 conducted only a quiet sound. In many cases with the older instruments they had a chest part and an ear part which, due to wear, no longer properly fitted together. This likely reduced the instrument’s ability to conduct both loud and clear sounds. As the design of the stethoscope changed, particularly in moving away from having a chest part and an ear part, the volume of the sound conducted by the stethoscope became more consistent.

The clarity of the sound conducted by the stethoscope remained fairly constant across most designs with the majority conducting a clear, unmuffled, sound. Indeed, there were only four instruments where the clarity of sound suffered. The sample size of trialled instruments makes it difficult to determine a reason for this. The first instance came from a paper replica, the poor sound conduction likely came from how loosely rolled the paper was. In the case of instrument A608181 (seen in Table 1), the tenon and mortise were loose, making the instrument difficult to hold together, thus reducing its ability to conduct sound without additional rattling or gaps in the instrument. Finally, in the other two cases the sound became unclear when I used the instrument as though it had the obturator in: one had a separate obturator, the other had one side which functioned as an obturator. Perhaps in these instances there was a flaw in the obturator, or obturator side, although I did not note any flaws in the instruments during examination. It is also possible that having the obturator in, which aided hearing the sounds of the heart, meant the instruments were less suited to hearing the tick of a watch, although if this were the case then we might expect all instruments with the obturators in to conduct unclear sounds, which they did not. The majority of instruments, regardless of their design, conducted a clear sound.

The necessity to have a close proximity to the source of the sound reduced as the design of the stethoscope changed; earlier models required more exact placement, while later versions could pick up the sound from further away. In the case of this trial this meant that I could identify the ticking of the watch across a wider radius. On the chest, this finding may be quite different as there would be a much greater number of competing sounds to mask the one the practitioner needs. The earlier models seemed to require accurate placement to hear any part of the desired sound, while the later models may have required close proximity to make out the exact sound, but perhaps could offer a broader soundscape of the whole chest; especially to the trained ear. This investigation seemingly suffers the most from the lack of an actual chest to examine. Overall, based on the three acoustic aspects of the stethoscope, it is clear that in terms of acoustic ability the stethoscope did improve over the course of the design changes. As demonstrated in Chapter 4, however, this did not seem to be the primary motivation for most practitioners altering the design of the instrument.

A key finding in this trial was my discoveries regarding how comfortable, or not, each instrument design was to use. An area of comfort which I had not initially considered was the process of bending over the table in order to place the instrument onto the bundle. At the start of the process this was not a particularly uncomfortable motion, however as I more regularly trialled the instruments it became less comfortable. Practitioners certainly noted that bending in certain ways was uncomfortable, with some places suggesting how best to position both themselves and the patient in order to reduce this discomfort.[1028] Unfortunately for me, I did not find this guidance until after I had finished my time with the objects. The suggestions from practitioners such as Comins for stethoscope designs where neither the patient not the practitioner had to change or hold difficult positions became much more reasonable after repeatedly bending over the table to examine my 'patient'. Another trial of the different suggested positions would perhaps be an interesting addition to this discussion.

The main area of comfort or discomfort came from the ear plates. Earlier stethoscopes tended to have ear plates with a diameter of less than 4cm, which were often very uncomfortable especially following repeated use. Some instruments became at least 'relatively' comfortable with ear plates that had a diameter over 4cm, although it was certainly "hit or miss" in terms of comfort with an ear plate between 4cm and 5cm. I found that the double-sided stethoscopes, generally Billing models, tended to be more uncomfortable than instruments with a dedicated ear and chest end, regardless of the size of the ear plate; especially when using the hollow end as the ear plate. Looking at both Table 1 and Table 2, there is clear and steady increase in the size of the ear plate with each stethoscope design. Around 1840, particularly with the introduction of the Ferguson style instrument, stethoscopes with ear plates that had a diameter of 5cm or more became increasingly common. These larger ear plates were

[1028] *Lancet* 1826; 699.

much more comfortable than those which came before them.[1029] This may offer some explanation as to why the Ferguson stethoscope became so popular, as it was by far the most comfortable version of the instrument. It was only through my trial of the instrument that I became aware of the importance of comfort for regular stethoscope use.

A6 – Conclusion

This appendix outlined the findings of my investigations with the Wellcome Collection stethoscopes held at the London Science Museum. There were concepts and ideas which became central to the whole thesis which I would not have discovered if not for access to these objects and the ability to trial them. Information regarding the comfort of the stethoscope as well as some of the finer details regarding how to use instrument came solely from approaching the instruments as tools to be used, rather than has historical objects. In Chapter 4 of the thesis I combined this information with my understanding of the Social Construction of Technology (SCOT) to propose a new means of understanding how to understand physical objects as historical evidence and understand how practitioners developed skill.

The role of physical objects in historical research is becoming more important, with other historians as well as myself working with museums and archivists to develop our understanding of material culture. In the case of this thesis I combined the study of material culture with directly trialling the object and an understanding of SCOT to combine the writing of practitioners at the time with the material culture as we see it today. There are a number of ways in which other historians could take this approach further; especially in relation to other historical objects which necessitated skill development and where there are ample records of design changes.

[1029] For a person with ears my size. It should be noted that the main problem with the ear plates when they were uncomfortable was that they were too small, so it is not unreasonable to assume that larger ear plates would be more comfortable in general.

Appendix 2 – Who Designed the Ferguson Stethoscope?

The 'Ferguson' stethoscope became the standard design of the monaural instrument from the mid-1840s until the early 1900s. The work of Bishop as well as the records at the Wellcome Collection and Science Museum attribute this design to William Fergusson. It is likely these claims are interconnected in some way, with one using the other as their source; it is not clear who first suggested this connection. In this Appendix, I suggest that William Fergusson was not the original designer of the Ferguson style stethoscope. I examine the life and work of each potential innovator in an attempt to more clearly determine which of them created the design which would go on to become the standard model. There are four possible candidates: Scottish surgeon William Fergusson, Indian-born physician Robert Ferguson, or Irish physician John Creery Ferguson, or London based instrument makers Ferguson & Son. None of the practitioners nor the company claimed priority over the design and no other contemporary commentators linked them to the design. Furthermore, unlike many design changes which first appeared in print in books by the practitioner responsible design (such as Collin, Piorry, Williams and Billing), the Ferguson style did not; printed images, along with attribution to the name 'Ferguson', occurred for the first time in trade instrument catalogues.[1030] Starting with the Ferguson & Son company, followed by William Fergusson, Robert Ferguson and John Creery Ferguson this appendix will examine each possibility in turn and look at the reasons for and against each may have been the original designer of the Ferguson model. As a result of this discussion I suggest that John Creery Ferguson is the most likely candidate to be the creator of the standard monaural stethoscope design.

Before discussing each possibility in turn, it is important to address the obvious: that there is a difference in spelling between Fergusson and Ferguson, and surely historians could

[1030] Great Exhibition Catalogue 1851.

use this as an easy method of identifying or ruling out at least one possible designer. Alas, it not so simple! The spelling of Fergusson was not consistent for each practitioner, William Fergusson's often, but by no means always, spelled his name with two S's, while Robert Ferguson and John Creery Ferguson commonly, but not always, spelled their names with one S. Similarly, some of these style stethoscopes came with the name engraved on them, but there was no consistency between the spelling of the name: some had 'Ferguson' while others had 'Fergusson'. Historians, therefore, cannot reliably use spelling alone to distinguish which practitioner was responsible for the instrument design.

Firstly, we must consider if, rather than one person making alterations, the 'Ferguson style' changes to monaural stethoscope design came from London-based instrument makers Ferguson & Son. Makers often stamped or engraved their name onto the instrument and some Ferguson style stethoscopes did have a 'Ferguson' or 'Fergusson' print on them. However, as shown in the above paragraph, the inconsistency of spelling variations made it much more difficult for historians to use this information as any positive proof. Furthermore, many makers printed their names onto the instruments to indicate who made them, but not necessarily that they were the original source of the design. For example, instrument makers Grumbridge and Weiss printed their names on to the stethoscopes they produced, even when the design was one with a well-known designer. Catalogues from instrument sellers vary in their use of 'Ferguson' when discussing that stethoscope design as well as with the spelling of the name, making it more difficult to accurately ascertain when the name first became attached to the instrument and just who 'Ferguson' was.[1031]

[1031] Weiss 1863, plate XLII; Maw 1866, 127-128; Arnold and Sons 1873, 74; Down Bros 1885, 1134.

Figure 27: A stethoscope with the imprint of 'Ferguson', held at the Science Museum (A500111). The style of the instrument was in keeping with the Ferguson model.

Ferguson & Son were in the 1851 catalogue for the Great Exhibition but only as surgical instrument makers; unlike other companies which the catalogue listed as specifically making the stethoscope.[1032] The fact the catalogue listed them only as surgical instrument makers does not preclude the possibility that they made stethoscopes, as different companies appeared to class the stethoscope either as its own category or as an additional surgical instrument.[1033] Ferguson & Son did not use the term 'Ferguson stethoscope' in the catalogue. Ferguson & Son certainly made no claim to have originated the design, and as they were a small company that primarily supplied to practitioners at St Bartholomew's Hospital, one may expect them to at least acknowledge a stethoscope design change which could bring in new customers.[1034]

Blaufox suggested that manufacturers applied the names of well-known practitioners to items without there being any real link, in order to boost their sales.[1035] For stethoscopes, however, most key design changes did come from a specific practitioner who publicised the design themselves. The Ferguson style stethoscope is more difficult, as there are no records of a specific practitioner publicising their new version of the instrument. Most stethoscope designs

[1032] Great Exhibition Catalogue 1851, 62, 70.
[1033] Great Exhibition Catalogue 1851, 221. As indicated by an advert from the Gutta Percha Company which listed their stethoscopes, along with ear trumpets and bandages, under 'Surgical and Other Applications'.
[1034] Weston-Davis 1989, 41; Jones 2013, 23, 27. In a footnote.
[1035] Blaufox 2002, 97.

came from practitioners who had a lot of experience with the instrument and wished to promote it to others; they viewed improving the design as another way to encourage other practitioners to adopt the stethoscope. In keeping with the role of individual practitioners as the main force behind new designs, the rest of the appendix examines the three practitioners who are the strongest candidates for the originators of the Ferguson style stethoscope.

The records from the Wellcome Collection and the Science Museum, as well as Bishop in his article on stethoscope design, attribute the new stethoscope design to a practitioner named William Fergusson.[1036] William Fergusson studied in Edinburgh and was well known for his ability with a wide range of medical instruments, of which the stethoscope may well have been one.[1037] He was by far the most famous of the three men being considered here; he was surgeon to Queen Victoria and was knighted for his services, furthermore he was Chair of Surgery at King's College Hospital in 1840.[1038] Extracts from his 1848 book *A System of Practical Surgery* suggest that he had used the stethoscope and recognised its value.[1039] He likely had the necessary ability in wood work and acoustic theory to personally and skilfully adapt the stethoscope's design, due to being a skilled carpenter and musician.[1040] He had been involved with the creation of other, metal, surgical instruments which suggests he was inclined towards creating and adapting tools for practitioners. Fergusson's fame and work with instruments would additionally make him the most likely choice for manufacturers who wished to link the stethoscope with a practitioner even if no such link existed. These points all suggest that Fergusson, a famous practitioner who had a record of creating and altering surgical instruments, would be the most likely candidate for the new stethoscope design. Certainly, both Bishop and the archivist records at the Science Museum have previously assumed this to be the case.

[1036] Bishop 1980, 453.
[1037] ODNB. s.v. William Fergusson.
[1038] ODNB. s.v. William Fergusson.
[1039] *Lancet* 1877, 255; Fergusson 1848.
[1040] ODNB. s.v. William Fergusson.

Yet, despite William Fergusson's skill with creating instruments and his acknowledgement of the stethoscope, his surgical interests were primarily focused on 'conservative' surgery – the prevention of limb loss – and on surgery related to knee-joints.[1041] These areas of surgery rarely if ever required the use of the stethoscope; in *Practical Surgery* he mentioned the stethoscope only twice, once for diagnosing aneurisms and once for use in tracheotomies, neither of which were his main surgical interests.[1042] There is little to suggest William Fergusson used the stethoscope regularly enough to be interested in making the instrument more comfortable and less expensive; he certainly could have afforded an expensive instrument. Furthermore, as Fergusson was such a high-profile practitioner, we would expect his new and innovative stethoscope design to be commented on either by himself or in medical journals and periodicals: he put his name on his other surgical instruments, why would he not publicise his involvement with the stethoscope? William Fergusson rarely used the stethoscope due to his other surgical interests and, unlike his other instruments, he did not claim the design. Furthermore, the spelling of Fergusson changes between catalogues, if manufacturers were making a specific point of linking the instrument with the famous Fergusson, it makes very little sense for them to misspell his name. This leads me to suggest that Bishop, the Wellcome records and the Science Museum records were incorrect in their attribution of the new stethoscope to William Fergusson, misled perhaps by Fergusson's general influence in the British medical sphere.

The second candidate for the creator of the Ferguson stethoscope was Indian born physician Robert Ferguson. He gained his MD from Edinburgh in 1825;[1043] he was likely a contemporary of many other well-known stethoscope adopters. Ferguson was one of the founders of the *London Medical Gazette* in 1827, a publication which was generally favourable

[1041] *Lancet* 1877, 256.
[1042] Fergusson 1848, 138, 441.
[1043] *Lancet* 1865, 25.

towards the stethoscope.[1044] In 1831 he became professor of midwifery and King's College, later taking up the position of professor of midwifery and the diseases of women and children at King's College Hospital in 1839, he was a colleague of William Fergusson.[1045] He became Physician Accoucheur to Queen Victoria but resigned from the position to become a general practitioner in 1857.[1046] He was noted as having anonymously written many articles for the *Quarterly Review* and was a prolific writer despite having a busy practice, none of his identified writings discuss the stethoscope.[1047] Robert Ferguson had the appropriate educational background and moved in social circles which may have encouraged the use of the instrument, but there is little evidence that he took much interest in the stethoscope in his regular practice. He may have used the stethoscope, although obstetric practitioners in London were slower to adopt its use in midwifery than in other places, but he certainly never indicated a particular interest in the instrument himself.

The third, and most likely, candidate for designing the Ferguson stethoscope was Irish obstetric physician John Creery Ferguson. He was friends with William Stokes, a known stethoscope adopter and enthusiast, and Ferguson accompanied Stokes to Edinburgh and Paris between 1824 and 1827.[1048] He is the only one of the possible candidates who visited the medical schools of Paris. Whilst in Paris he was impressed by the work of Kergaradec in applying the stethoscope to the abdomens of pregnant women and, while studying under Laennec, Ferguson claimed to have often seen Laennec 'practically confirm' Kergaradec's claims.[1049] Laennec recorded one practitioner named 'Fergusson' studied under him in 1825, though the spelling of Ferguson is incorrect this person was most likely John Creery Ferguson

[1044] ODNB s.v. Robert Ferguson.
[1045] *Lancet* 1865, 25.
[1046] *Lancet* 1865, 25.
[1047] *The Quarterly Review*.
[1048] Ferguson 1830a, 17.
[1049] Ferguson 1830b, 69.

whose dates in Paris align with Laennec's records.[1050] John Creery Ferguson then experienced the stethoscope in the Parisian context and became a strong advocate for the instrument, unlike William Fergusson and Robert Ferguson who gave mild praise to the instrument or simply never discussed it.

There is evidence that John Creery Ferguson simply spent a very large amount of time with the stethoscope. Ferguson regularly used the stethoscope in his medical practice in Dublin; both in obstetric examinations and for the thorax.[1051] He was comfortably using the instrument from 1827, supporting the idea that he was very comfortable with the stethoscope, employing it regularly.[1052] Ferguson worked with Dominic Corrigan, another Irish stethoscope advocate and friend of William Stokes, on the sounds of the heart and arterial impulses, as well as some small experiments with using the stethoscope on pregnant animals.[1053] John Creery Ferguson, therefore, regularly used the stethoscope, made efforts to teach it to others, and was an active part in on-going research into its use in obstetrics and cardiology. His regular use of, and interest in, the stethoscope makes him the most likely candidate to have created an ergonomically superior stethoscope design as, unlike William Fergusson and Robert Ferguson, he was definitely regularly using the stethoscope and needed it to be comfortable, portable and inexpensive.

The creator of the Ferguson style stethoscope remains unknown; unlike other designs, there is no publication which directly links to a named designer. It is possible that the design came directly from the Ferguson & Son manufacturers and sellers, but this would be an unusual case no other major changes in stethoscope design occurred in this way. Based on knowledge of how most stethoscope design changes came about – the work of individual practitioners – it

[1050] Huard 1973, 325.
[1051] Ferguson 1830b, 65.
[1052] Ferguson 1830b, 71.
[1053] *London Medical Gazette* 1831, 199-200; Ferguson 1830b, 72.

is more likely that the Ferguson design originated in a similar way. The question then becomes: *which* Ferguson? I suggest that Irishman John Creery Ferguson is the most plausible option for the designer of the Ferguson style stethoscope. Compared to the other options, William Fergusson and Robert Ferguson, John Creery spent the most time working with the stethoscope and actively promoted the adoption of the instrument. As shown in Chapter 4, regular use of the stethoscope enabled practitioners to understand what needed changing; use brought about a desire to change the instrument to make it more comfortable, as well as cheaper and more portable. Similarly, those who advocated for stethoscope adoption wanted to encourage others to use the instrument, so made changes to the design in order to remove any potential issues which would put off new users. This, again, took the form of making the instrument more comfortable to use, cheaper to buy, and easier to transport. Of the practitioners discussed here, only John Creery Ferguson demonstrated both that he regularly used the stethoscope and that he wanted to remove obstacles which prevented others from doing the same. Making him the most likely candidate for being the practitioner who created the 'Ferguson' stethoscope; the design which became the standard model in Britain due to its affordability, portability, and high level of comfort.

Bibliography

Archives Visited

King's College Archives

London Science Museum

Royal College of Physicians of England Archive

University of Leeds Special Collections

Wellcome Collection

Journals

Boston Medical and Surgical Journal

Dublin Medical Transactions

Edinburgh Medical and Surgical Journal

Lancet

Leeds Medical Intelligencer

London Medical and Physical Journal

London Medical Times and Gazette

London Quarterly Review

Medico-Chirurgical Review

Retrospect of Practical Medicine and Surgery

Catalogues

Arnold and Sons. 1873. *A Catalogue of Surgical Instruments Manufactured and Sold By Arnold and Sons.* London: Arnold and Sons.

Down Bros. 1885. *A Catalogue of Surgical Instruments and Appliances Manufactured and Sold by Down Bros.* London: Down Brothers.

Great Exhibition London, England. 1851. *Official Catalogue of the Great Exhibition of the Works of Industry of All Nations, 1851.* London: Spicer Brothers.

Maw, S. (and Sons). 1866. *A Catalogue of Surgeons Instruments, Air and Water Beds, Pillows and Cushions, Bandages, Trusses, Elastic Stockings, Inhalers, Galvanic Apparatus and Other Appliances Used by the Medical Profession.* London: Maw & Sons.

Weiss, J. 1863. *A Catalogue of Surgical Instruments, Apparatus, Appliances etc.* London: M.S. Rickerby.

Primary Sources

Anon. 1793. *Laws, Orders and Regulations of the Edinburgh General Lying-In Hospital*. [n.p.: n.p.].

A Bill for Preventing Unlawful Dis-internment of Human Bodies, and for Regulating Schools of Anatomy, 1829. 10 Geo. IV. I.603. https://parlipapers.proquest.com/parlipapers/docview/t70.d75.1829-011388.

Anon. 1818. "Medical Intelligence". *Edinburgh Medical Journal*.14: 655-656.

———. 1818. "Medical and Philosophical Intelligence". *London Medical and Physical Journal.* 40 (238): 451.

———. 1819. “Laennec’s New System of Diagnosis”. *Quarterly Journal of Foreign Medicine and Surgery.* 2: 51-68.

———. 1822. “Dr. Laennec on Diseases of the Chest”. *London Medical and Physical Journal*. 47: 140–146.

———.1822. “M. Kergaradec on Auscultation in Pregnancy”. *Quarterly Journal of Foreign and British Medicine and Surgery*. 4: 371-376.

———.1824. ‘Surgical Lectures”. *Lancet*. 2: 1-17.

———.1824. “Guy’s Hospital”. *Lancet.* 2: 309-310.

———.1824. “Review”. *Lancet.* 3: 144-160.

———.1824. “Review”. *Lancet.* 3: 237-244.

———.1826. “Directions for the Use of the Stethoscope”. *Lancet.* 6: 667-670.

———. 1829. “Anatomical Bill”. *Edinburgh Medical and Surgical Journal*. 32: 211-218.

———.1830. “Accounts of the Medical and Surgical Schools of London, For the Session 1830-1831.” *Lancet*. 15: 5-19.

———. 1852. “Memoir of Dr. MacLeod”. *Medical Times and Gazette.* 5: 625-626.

Ashwell, S.1828. *A Practical Treatise on Parturition, Compromising the Attendant Circumstances and Diseases of the Pregnant and Puerperal States*. London: Thomas Tegg.

Barry, D. 1826. *Experimental Researches on the Influence Exercised by Atmospheric Pressure Upon the Regression of the Blood in the Veins.* London: Thomas and George Underwood.

Bigelow, J. 1839. "Brief Rules for Exploration of the Chest, in Diseases of the Lungs and Heart". Part 1. *Boston Medical Surgical Journal.* 23: 357-360.

———. "Brief Rules for Exploration of the Chest, in Diseases of the Lungs and Heart". Part 2. *Boston Medical Surgical Journal.* 24: 373-378.

———. "Brief Rules for Exploration of the Chest, in Diseases of the Lungs and Heart". Part 3. *Boston Medical Surgical Journal.* 25: 389-394.

Billing, A. 1831. "London Hospital, Introductory Lecture". *Lancet.* 17: 233-239.

———. 1837. *First Principles of Medicine*. 2nd Edition. London: S. Highley.

Bowditch, H. I. 1846. *The Young Stethoscopist, Or the Student's Aid to Auscultation.* New York: J. & H. G. Langley.

Burns, J. 1832. *The Principles of Midwifery; Including the Diseases of Women and Children*. 8th Edition. London: Longman, Rees, Orme, Brown, Green and Longman.

Cameron, C.A. 1886. *History of the Royal College of Surgeons in Ireland, and the Irish Medical Schools: Including numerous Biographical Sketches and a Medical Bibliography.* Dublin: Fannin and Company.

Clark, J. 1820. *Medical Notes on Climate, Diseases, Hospitals, and Medical Schools, in France, Italy, and Switzerland.* (London: T. and G. Underwood).

Collin, V. 1825. *A Treatise on the Different Methods of Investigating the Diseases of the Chest, particularly Percussion, and the Use of the Stethoscope*. Trans. W. N. Ryland. London: Burgess and Hill.

Collins, R. 1835. *A Practical Treatise on Midwifery, Containing the Results of Sixteen Thousand Six Hundred and Fifty-Four Births, Occurring in The Dublin Lying-In*

Hospital, during the Period of Seven Years, Commencing November 1826. London: Longman, Rees, Orme, Browne, Green and Longman.

Comins, N.P. 1829. “Flexible Stethoscope”. *Lancet.* 12: 685-687.

Connolly, J. 1828. *An Introductory Lecture delivered in the University of London on Thursday, October 2, 1828.* London: John Taylor.

Cooper, A. 1835. *Lectures on the Principles and Practice of Surgery.* 8th Edn. London: John Thomas Cox.

Corrigan, D. 1829. “Aneurism of the Aorta: Singular Pulsation of the Arteries – Necessity of the Employment of the Stethoscope”. *Lancet.* 11: 586-590.

———. 1831. “Advertisements & Notices”. *Freeman’s Journal*. 16 November, pp1-3.

Craig, W. 1833. *Observations on the Use of the Stethoscope in the Diagnosis and Treatment of Diseases of the Chest.* Glasgow: G. Brookman.

Craigie, D. 1828. *Elements of General and Pathological Anatomy.* Edinburgh: Adam Black.

Davies, T. 1835. *Lectures on the Diseases of the Lungs and Heart.* London: Longman, Rees, Orme, Brown, Green & Longman.

Dawson, W. 1837. “Caesarean Section After Death of the Mother”. *Lancet*. 29: 28.

Dodgson, T. 1831. “Advertisement”. *Leeds Medical Intelligencer.* 79. 19 May, p1.

Duncan Jr, A. 1822. “Dr Forbes” Translation of Laennec”. *Edinburgh Medical and Surgical Journal.* 18: 447-474.

———.1827. “Contributions to Morbid Anatomy”. *Edinburgh Medical and Surgical Journal.* 28: 302-332.

Elliotson, J. 1825. ‘St Thomas” Hospital”. *Lancet.* 5: 493-494.

———. 1826a. “St Thomas’s Hospital”. *Lancet*. 6: 158-159.

———. 1826b. “St Thomas’s Hospital”. *Lancet*. 6: 440-444.

———. 1827. “St Thomas’s Hospital”. *Lancet*. 9: 365-368.

———. 1829a. “St Thomas’s Hospital: Abstract or A Clinical Lecture”. *Lancet*. 13: 141-144.

———. 1829b. “Clinical Lecture”. *Lancet*. 13: 398-403.

———. 1830a. “Clinical Lecture”. *Lancet*. 14: 408-415.

———. 1830b. “St. Thomas’s Hospital: Clinical Lecture”. *Lancet*. 15: 155-160.

———. 1831a. “St. Thomas’s Hospital: Clinical Lecture”. *Lancet*. 15: 487-493.

———. 1831b. “St. Thomas’s Hospital: Clinical Lecture”. *Lancet.* 15: 682-690.

———. 1831c. “St. Thomas’s Hospital: Clinical Lecture”. *Lancet*. 15: 769-777.

———. 1831d. “St. Thomas’s Hospital: Clinical Lecture”. *Lancet*. 16: 198-205.

———. 1832a. “St. Thomas’s Hospital: C.linical Lecture”. *Lancet*. 17: 923-927.

———. 1832b. “St. Thomas’s Hospital: Clinical Lecture”. *Lancet*. 18: 65-70.

———. 1832c. “University of London: Address Introductory to the Winter Medical Session”. *Lancet*. 19: 33-41.

———. 1835. “North London Hospital: Clinical Lecture on Cases of Acne, Struma, Acute Rheumatism, Catarrhus Bronchitis, Induration of the Uterus, and Disease of the Lungs and Heart”. *Lancet*. 25: 193-199.

Ferguson, J.C. 1830a. “Two Cases of Pulmonary Apoplexy, Illustrative of the Value of Mediate Auscultation”. *Dublin Medical Transactions.* 1: 11-22.

———. 1830b. “Auscultation, the Only Unequivocal Evidence of Pregnancy, with Cases”. *Dublin Medical Transactions.* 1: 64-88.

Fergusson, W. 1845. *A System of Practical Surgery*. Philadelphia: Lea and Blanchard.

———. 1867. *Lectures on the Progress of Anatomy and Surgery during the Present Century.* London: Churchill.

Fettes, W. 1801. *Address to the Public Respecting the Situation of the Poor of Edinburgh during the season of Childbearing and Lying-In*. Edinburgh: Murray and Cochrane.

Forbes, J. 1824. *Original Cases Illustrating the Use of the Stethoscope and Percussion in the Diagnosis of Diseases of the Chest*. London: T. & G. Underwood.

Forbes, J. and Laennec, M. 1834. *A Treatise on the Diseases of the Chest: In Which They Are Described According to Their Anatomical Characters, and Their Diagnosis Established on a New Principle by Means of Acoustick Instruments: With Plates*. 4th edn. London: T. and G. Underwood.

Fox, D. 1830. “Stethoscope with Elastic Ends”. *Lancet*. 12: 509-510.

Granville, A.B. 1819. *A Report of the Practice of Midwifery, at the Westminster General Dispensary, During 1818.* London: Burgess and Hill.

———. 1854. *Sudden Death.* London: Churchill.

———. 1874. *Autobiography of A.B. Granville, being eighty-eight years in the life of a physician. Edited with a brief account of the last years of his life.* Ed. P. B. Granville. London: Henry S. King and Co.

Haden, C. T. 1827. *Practical Observations on the Management and Diseases of Children. With Additional Observations and a Biographical Note of the Author*. London: Burgess and Hill.

Hall, M. 1834. *The Principles of Diagnosis*. London: Sherwood, Gilbert & Piper.

Hamilton, J. 1837. *Practical Observations on Various Subjects Relating to Midwifery*. Philadelphia: A. Waldie.

Haus, C. J. 1823. *Die Auscultation in Bezug auf Schwangerschaft.* Wurzburg: S. J. Richter

Hohl, A. F. 1833. *Die geburtshülfliche Exploration*. Halle: Verlag der Buchhandlung des Waisenhauses.

Hope, A.F. 1842. *Memoir of the Late James Hope, M.D. Physician to St George's Hospital*. London: J. Mitchell and Co.

Hope, J. 1830. 'Strictures on an Essay by Dr Corrigan, on the Motions and Sounds of the Heart." *London Medical Gazette*. 6: 608-687.

———.1830. "Experimental and Clinical Researches on the Physiology of the Heart's Actions. *London Medical Gazette*. 6: 782-789.

———. 1839. *A Treatise on the Diseases of the Heart and Great Vessels, and on the Affections which May Be Mistaken for Them.* London: John Churchill.

Ingleby, J. T. 1836. *Facts and Cases in Obstetric Medicine, with Observations on Some of the Most Important Diseases Incidental to Females*. London: Longman, Reese, Orme, Brown & Co.

Johnson, J. 1820. "De l'Auscultation Mediate; ou Traité du Diagnostic des Maladies des Poumons et du Cæur, Fondé Principalement sur le Nouveau Moyen d'Exploration". *Medico-Chirurgical Review*. 3: 461-494.

———. 1822. "M. Kergaradec on the Stethoscope". *Medico-Chirurgical Review.* 3: 661-662.

———. 1829. "Mr Warburton's Bill". *Medico-Chirurgical Review.* 15: 218-221.

Jones, W.G. 1828. *A Statement Explaining the Course of Instruction Adopted at The Medical School, in Hatton Garden; and Comprising Some Cursory Hints to Medical Students on the Employment of Their Time.* London: T. & G. Underwood.

Kay, J.P. 1828. 'Stethoscope – Dr. Gregory – Clinical Wards, Edinburgh, &c.". *Lancet*. 9 (234): 754-757.

Kennedy, E. 1833. *Observations on Obstetrics Auscultation with An Analysis of the Evidences of Pregnancy, and an Inquiry into the Proofs of the Life and Death of the Foetus in Utero*. Dublin: Hodges and Smith; London: Longman, Rees and Co. & Simpkin and Marshall; Edinburgh: MacLachlan and Stewart; Glasgow: Smith and Son.

———.1831. "Obstetric Auscultation: Reply of Dr Kennedy to Dr Nagle". *Lancet.* 15: 495-497.

Kergaradec, J.A. 1822. *Memoire sur l'Auscultation Appliquée a l'etude de la Grosses*. Paris: Méquiquon-Marvis.

Kilian, H. F. 1834. *Operationslehre fur Gebürtshelfe, in zwei Theilan.* Bonn: Eduard Weber.

Laennec, R.T.H. 1819. *Traité de l'Auscultation Médiate*. Paris: J.S. Chaudé.

———. 1826. *A Treatise on the Diseases of the Chest: In Which They Are Described According to Their Anatomical Characters, and Their Diagnosis Established on a New Principle by Means of Acoustick Instruments: With Plates.* Trans. J. Forbes (1827). (2nd edn.). London: T. and G. Underwood.

Lawrence, W. 1832. *Lectures on Surgery, Medical and Operative, as delivered in the Theatre of St. Bartholomew's*. London: F.C. Westley.

Lee, E. 1835. *Observations on the Principal Medical Institutions and Practice of France, Italy, and Germany.* London: John Churchill.

Lockhart, J.G. 1830. "A Bill for Preventing the Unlawful Disinterment of Human Bodies, and for Regulating Schools of Anatomy, 1829". *The London Quarterly Review*. XLII:

Mackintosh, J. 1837. *Principles of Pathology, and Practice of Physic.* Philadelphia: Edward C. Biddle.

M'Keever, T. 1833. "On the Information Afforded by the Stethoscope in Detecting the Presence of Foetal Life". *The Lancet*. 20 (522): 715-717.

Moir, J. 1837. "Appendix". *In:* Hamilton, J. *Practical Observations on Various Subjects Relating to Midwifery*. Philadelphia: A. Waldie: 97-102.

Morgagni, G. 1769. *The Seats and Causes of Diseases Investigated by Anatomy; in Five Books, Containing a Great Variety of Dissections, with Remarks. To Which Are Added Very Accurate and Copious Indexes of the Principal Things |and Names Therein Contained. Tr. from the Latin of John Baptist Morgagni* ... Trans. B. Alexander. London: A. Millar, and T. Cadell.

Nagle, D.C.E. November 1830a. "On the Use of the Stethoscope for the Detection of Twins in Utero, the presentation of etc". *Lancet.* 15: 232-234.

———. December 1830b. “On the Use of the Stethoscope for the Detection of Twins in Utero, the presentation of etc”. *Lancet.* 15: 395-400.

———. January 1831a. “On the Use of the Stethoscope for the Detection of Twins in Utero, the presentation of etc”. *Lancet.* 15: 498-502.

———. February 1831b. “Reply of Dr. Nagle to Dr. Kennedy”. *Lancet*. 15: 622-626.

———. December 1831c. “Observations on the Use of the Stethoscope in the Practice of Midwifery”. *Lancet.* 17: 449-451.

Naegele, H. F. 1838. *A Treatise on Obstetric Auscultation*. Trans. C. West (1839). London: Henry Renshaw.

Norris, W. 1825. *The Hunterian Oration, Delivered Before the Royal College of Surgeons, February 14, 1825.* London: T. Cadell.

Piorry, P.A. 1828. De la Percussion Médiate et des Signes Obtenus à l’Aide de le Nouveau Moyen d’Exploration, dans les Maladies des Organes Thoraciques et Abdominaux. Paris: J.S. Chaude et J.-B. Bailliere.

———. 1842. Traité de Medicine Pratique et De Pathologie Latrique. Paris: Chez Pourchet.

“R”. 1818. “Notices des Séances de l’Académie Royale des Sciences de Paris, Pendant le mois de Juin.” *Bibliothèque Universelle des Sciences, Belles-lettres et Arts*. 9 (Sciences): 241-251.

Raciborski, M.A. 1835. *New and Complete Manual of Auscultation and Percussion applied to the Diagnosis of Diseases.* Trans. Fitzherbert, W. London: A. H. Baily, and Co.

Ramsbotham, F. 1841. *Practical Observations in Midwifery with Cases in Illustration*. 2nd Edition. London: John Churchill.

Riadore, E. 1830. "Account of the Medical and Surgical Schools of London, for the Session 1830-1831". *The Lancet.* 15 (369): 5-19.

Ryan, M. 1831. *A Manual of Midwifery or Compendium of Gynaecological and Paidonosology; Comparing a New Nomenclature of Obstetric Medicine, with a Concise Account of the Symptoms and Treatment of the Most Important Diseases of Women and Children, and the Management of Various Forms of Parturition Illustrated by Plates*. 3rd Edition. London: Renshaw and Rush.

Scudamore, C. 1826. *Observations on M. Laennec's Method of Forming a Diagnosis of the Diseases of the Chest by Means of the Stethoscope, and of Percussion.* London: Longman, Rees, Orme, Brown, and Green.

Semple, R.H. 1858. *On Cough: Its Causes, Varieties, and Treatment, with some Practical Remarks on the Use of the Stehtoopsce as an Aid to Diagnosis.* London: John Churchill.

Stokes, W. 1825. *An Introduction to the Use of the Stethoscope: With its Application to the Diagnosis in Diseases of the Thoracic Viscera; including the pathology of these various affections.* Edinburgh: MacLachlan and Stewart.

———. 1828. *Two Lectures on the Application of the Stethoscope to the Diagnosis and Treatment of Thoracic Disease.* Dublin: Hodges and M'Arthur.

———. 1832. "Contributions to Thoracic Pathology". *The Dublin Journal of Medical and Chemical Science.* 2 (1): 51-71.

Spittal, R. 1830. *A Treatise on Auscultation, Illustrated by Cases and Dissections.* Edinburgh: R. Grant and Sons.

Thackrah, C.T. 1832. *Effects of the Principal Arts, Trades, and Professions, and of Civic States and Habits of Living, on Health and Longevity*. 2nd Edn. London: Longman, Rees, Orme, Brown, Green, & Longman.

———. 1834. *An Inquiry into the Nature and Properties of the Blood in Health and Disease.* London: Longman, Rees, Orme, Brown, Green, & Longman.

Thomson, A.T. December 1834. Lectures on Medical Jurisprudence, Lecture XI. University of London Session, 1834-35. London Medical and Surgical Journal. 152 (VI). 673-678l

Turner, J.W. 1828. "Observations on the Causes of the Sounds Produced by the Actions of the Heart". *Transactions of the Medico-Chirurgical Society of Edinburgh.* 3: 205-229.

Turner, T. 1824. *Outlines of a System of Medico-Chirurgical Education, containing Illustrations of the Application of Anatomy, Physiology, and other Sciences, to the Principal Practical parts of Medicine and Surgery.* London: Thomas and George Underwood.

Warburton, H. 1829. *Bill for Preventing Unlawful Disinterment of Human Bodies, and for Regulating Schools of Anatomy.* Bills and Acts. Paper 200. 1-12.

Wardrop, J. 1828. *On Aneurism and its Cure by a New Operation.* London: Longman & Co.

Williams C.J.B. 1828. A Rational Exposition of the Physical Signs of the Diseases of the Lungs and Pleura. London: Churchill.

———. 1844. On the Construction and Application of Instruments Used in Auscultation. *Retrospect of Practical Medicine and Surgery.* 7: 7-9.

———. 1884. *Memoirs of Life and Work*. London: Smith, Elder, and Company.

Secondary Sources

ADAPT. n.d. “How Television Used To Be Made”. *ADAPT: Researching the History of Television Production Technology*. <https://www.adapttvhistory.org.uk/> [accessed 14 December 2020].

Ackernecht, E. H. 1967. *Medicine at the Paris Hospital, 1794-1848*. Baltimore: Johns Hopkins University Press

Agnew, R.A.L. 2002. *The Life of Sir John Forbes (1787-1861).* West Sussex: Bernard Durnford Publishing.

———. 2008. “John Forbes FRS (1787-1861).”. *JLL Bulletin: Commentaries on the History of Treatment Evaluation*. <https://www.jameslindlibrary.org/articles/john-forbes-frs-1787-1861/> [accessed 10 July 2017].

———. 2013. “A memoir of Sir John Forbes (1787–1861)”. *Journal of Medical Biography.* 22: 190-194.

Alberti, S. J. M. M. 2005. “Objects and the Museum”. *Isis*. 96 (4): 559-571.

Almond, G. 2020. “Why the Anonymous and Everyday Objects are Important: Using the Science Museum’s Collections to Re-write the History of Vision Aids”. *Science Museum Group Journal.* 13 (13). <http://journal.sciencemuseum.ac.uk/browse/issue-13/the-history-of-vision-aids/> [accessed 18 August 2020].

Bellis, R. T. 2019. “Making Anatomical Knowledge about Disease in Late Georgian Britain, from Dissection Table to the Printed Book and Beyond: Matthew Baillie’s Morbid Anatomy and Its Accompanying Engravings”. PhD thesis, Leeds: University of Leeds.

Bellot, H. H. 1929. *University College, London, 1826-1926.* London: University of London Press.

Bijker, W. E., Hughes, T. P., and Pinch, T. J. 1987. "Introduction". *In*: Bijker, W. E., Hughes, T. P, and Pinch, T. J. (Eds). *The Social Construction of Technological Systems: New Directions in the Social History of Technology*. London: MIT Press. 9-16.

Bijker, W. E. and Pinch, T. J. 1987. 'Social Construction of Facts and Artefacts: or How the Sociology of Science and the Sociology of Technology might Benefit Each Other." *In*: Bijker, W.E. Hughes, T.P and Pinch, T. J. (Eds). *The Social Construction of Technological Systems: New Directions in the Social History of Technology*. London: MIT Press.

Binnie, K. McGuire, C. and Carel, H. 2020. "Objects of Safety and Imprisonment; Breathless Patients" Use of Medical Objects in Palliative Setting". *Journal of Material Culture*. 0: 1-20.

Bishop, P.J. 1963. "Dodgson 'Notes on Consumption', 1827". *Tubercle*. 44 (1): 184-188.

———. 1980. "Evolution of the Stethoscope". *Journal of the Royal Society of Medicine*. 73: 448-456.

———. 1981. "Reception of the Stethoscope and Laennec's Book". *Thorax*. 36: 487-192.

Blaufox, M.D. 2002. *An Ear to the Chest: An Illustrated History of the Evolution of the Stethoscope*. London, New York: The Parthenon Publishing Group.

Blume, S. S. 1992. *Insight and Industry: The dynamics of technological change in Medicine*. Cambridge Mass: MIT Press.

Bonner, T. N. 1995. *Becoming a Physician: Medical Educatin in Britain, France, Germany, and the United States, 1750-1945*. Oxford: Oxford University Press.

Browne, O.T.D. 1947. *The Rotunda Hospital, 1745-1945*. Edinburgh: E. & S. Livingstone Ltd.

Chaplin, S. D. J. 2009. "John Hunter and the "museum oeconomy", 1750-1800." PhD Thesis, London: University of London.

Collins, H. 2010. *Tacit and Explicit Knowledge.* Chicago: University of Chicago Press.

Cope, Z. 1966. "Dr Charles Thomas Haden (1786-1824), a Friend of Jane Austen". *British Medical Journal.* 1: 974.

Creighton, C. 1911. "Giovanni Battista Morgagni". *Encyclopaedia Britannica.* 18: 831-833.

Davies, J.L and Murray, J.F. 2016. "History and Physical Examination" *In*: V.C. Broaddus et al. Eds. *Murray & Nadel's Textbook of Respiratory Medicine*. 6th Edn. 263-277.

Duffin, J. 1989. "Morbid Anatomy: The Anatomy of Pathology in the Early Nineteenth Century by Russell C. Maulitz". *Isis.* 80 (1): 106-107.

———. 1998. *To See with a Better Eye: A Life of R. T. Laennec.* Princeton, New Jersey: Princeton University Press.

Fleming, E. M. 1974. "Artifact Study: A Proposed Model". *Winterthur Portfolio*. 9: 153-173.

Foucault, M. 1963. *The Birth of the Clinic: An Archaeology of Medical Perception*. Trans. A. M. Sheridan. Abingdon: Routledge Classics.

Gascoigne, N. and Thornton, T. 2013. *Tacit Knowledge*. London: Routledge.

Geismar, H. 2018. *Museum Object Lessons for the Digital Age*. University College London Press: London.

Goodman, N.M. 1944. "Supply of Bodies for Dissection". *British Medical Journal*. 2 (4381): 807-811.

Hannan, L. and Longair, S. 2017. *History Through Material Culture.* Manchester: Manchester University Press.

Henk, J.H.W. Bodewitz, H. and Gerard H. de Vries. 1987. "Regulatory Science and the Social Management of Trust in Medicine." *In*: Bijker, W.E, Hughes, T.P and Pinch, T.J. (Eds). *The Social Construction of Technological Systems: New Directions in the Social History of Technology*. London: MIT Press. 243-260.

Hess, A, and Geoghegan, H. 2015. "Object-Love at the Science Museum: Cultural Geographies of the Museum Storerooms". *Cultural Geographies*. 22 (3): 445-465.

Hood, A.D. 2009. "Material Culture: the Object". In: Barber, S. and Peniston-Bird, C. M. Eds. *History Beyond the Text: A Student's Guide to Approaching Alternate Sources.* Oxford; Routledge: 176-198.

Howells, J. 1996. "Tacit Knowledge, Innovation and Technological Transfer" *Technology Analysis and Strategic Management.* 8 (2): 91-106.

Huard, P. 1973. "Les élèves étrangers de Laennec". *Revue d"histoire des sciences*. 26 (4): 315-337.

Hurren, E.T. 2016. *Dissection the Criminal Corpse: Staging Post-Execution Punishment in Early Modern England*. London: Palgrave MacMillan.

Ingold, T. 2007. "Materials Against Materiality". *Archaeological Dialogues.* 14 (1): 1-16.

Jarcho, S. 1968. "Morgagni, Vicarius, and the Difficulty of Clinical Diagnosis." *In*: Stevenson L.G. and Multhauf R.P. (Eds.) *Medicine, Science and Culture: Historical Essays in Honour of Oswei Temkin*. Baltimore: John Hopkins Press. 87–95.

———. 1964. "The Young Stethoscopist (H. I. Bowditch, 1846)." *The American Journal of Cardiology.* 13 (6): 808-819.

Jenkins, L. E. 2019. “Recovering the Clinical History of the Vectis: the Role of Standardised Medical Education and Changing Obstetric Practice.” PhD Thesis, Leeds: University of Leeds.

Jones, C. 2013. “Instruments Medical Information: The Rise of the Medical Trade Catalogues in Britain, 1730-1914”. *Technology and Culture*. 54 (3): 563-599.

———. 2013. *The Medical Trade Catalogue in Britain, 1870-1914.* London: Pickering and Chatto.

Jordanova, L. 2012. *The Look of the Past: Visual and Material Evidence in this Historical Practice*. Cambridge: Cambridge University Press.

Kilpatrick, R. 1990. “‘Living in the Light’: Dispensaries, Philanthropy and Medical Reform in Late-Eighteenth-Century London”. *In*: Cunningham, A. and French, R. (Eds). *The Medical Enlightenment of the Eighteenth Century*. (Cambridge: Cambridge University Press): 254–280.

King, L.S. 1959. “Auscultation in England, 1821-1837”. *Bulletin of the History of Medicine.* 33: 446-453.

Kline, R. and Pinch, T. 2002. “The Social Construction of Technology”. *In*: MacKenzie, D and Wajcman, J. (Eds). *The Social Shaping of Technology.* Buckingham: Open University Press. 113-114.

Kneebone, R. and Wood, A. 2014. “Recapturing the History of Surgical Practice Through Simulation-based Re-enactment”. *Medical History*. 58 (1):106-121.

Knott, J. 1985. “Popular Attitudes to Death and Dissection in Early Nineteenth Century Britain: The Anatomy Act and the Poor”. *Labour History*. 49:1-18.

Larson, F. 2009. *An Infinity of Things: How Sir Henry Wellcome Collected the World.* Oxford: Oxford University Press.

———. 2010. "The Things About Henry Wellcome". *Journal and Material Culture.* 15 (1): 83-104.

———. 2011. "The Curious and the Glorious". *Museum History Journal*. 4 (2): 181-202.

Lindsay, C. 2005. "From the Shadows: Users as Designers, Producers, Marketers, Distributers, and Technical Support." *In*: Oudshorn, N. and Pinch, T. (Eds). *How Users Matter: The Co-Construction of Users and Technology.* Cambridge: The MIT press. 29-50.

Loudon, I. 1992. "The Transformation of Maternal Mortality". *British Medical Journal*. 305: 1557-1560.

Maulitz, R.C. 1987. *Morbid Appearances: The Anatomy of Pathology in the Early Nineteenth Century.* Cambridge: Cambridge University Press.

McDonnel, G. 2012. "Famous Tandragonians: Some Notable People from Trandragee". *"Before I forget…": Journal of the Poyntzpass and District Local History Society.* 11: 35-40.

McKinlay, J.B. 1981. "From "Promising Report" to "Standard Procedure": Seven Stages in the Career of a Medical Innovation." *The Millbank Memorial Quarterly. Health and Society*. 59 (3): 374-411.

Morris, J. 2004. "Laennec's Stethoscope – the Welsh Connection". *Journal of the Royal Society of Medicine*. 97 (3):137-141.

Mosley, A. 2007. "Objects, Texts, and Images in the History of Science". *Studies in History and Philosophy of Science.* 38: 289-302.

Nicolson, M. 1993. “The Introduction of Percussion and Stethoscopy to Early Nineteenth-Century Edinburgh”. *In*: Bynum W.F. and Porter R. (Eds). *Medicine and the Five Senses*. Cambridge: Cambridge University Press: 134–153.

O’Brien, E. 1983. *Conscience and Conflict: A Biography of Sir Dominic Corrigan, 1802-1880*. Dublin: The Glendale Press.

Oxford Dictionary of National Biography.

Oxford English Dictionary.

Pearce, S. 1994. “Thinking About Things”. *In*: Pearce, S. (Ed). *Interpreting Objects and Collections.* London: Routledge. 125-132.

Peterson, M. J. 1984. “Gentlemen and ad Medical Men: The Problem of Professional Recruitment”. *Bulletin of the History of Medicine.* 58 (4): 547-473.

Pickstone, J. 1992. “Introduction.” In: Pickstone, J. (Ed). *Medical Innovations in Historical Perspectives*. Basingstoke: Palgrave MacMillan. 1-16.

Pinch, T. J. Bijker, W. E. 1984. “The Social Construction of Facts and Artefacts: or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other”. *Social Studies of Science*. 14 (3): 399-441.

———. 1984. “The Social Construction of Facts and Artefacts: or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other”. *Social Studies of Science*. 14 (3): 399-441.

Pinkerton, J. H. M. 1969. “Kergaradec, Friend of Laennec and Pioneer of Foetal Auscultation”. *Proceedings of the Royal Society of Medicine*. 62 (5): 477-483.

———. 1980. “John Creery Ferguson: Friend of William Stokes and Pioneer of Auscultation of the Foetal Heartbeat in the British Isles”. *British Journal od Obstetrics and Gynaecology*. 87 (4): 257-260.

Polanyi, M. 1958. *Personal Knowledge: Towards a Post-Critical Philosophy*. London: Routledge and Kegan Paul Ltd.

———. 1983. *The Tacit Dimension*. Massachusetts: Peter Smith.

Prown, J. D. 1994. “Mind in Matter: an Introduction to Material Culture Theory and Method. *In*: Pearce, S. Ed. *Interpreting Objects and Collections.* London: Routledge. 133-138.

Reinarz, J. 2006. “Mechanising Medicine: Medical Innovations and the Birmingham Voluntary Hospitals in the Nineteenth Century”. *In*: Timmermann, C. and Anderson, J. (Eds). *Devices and Designs: Medical Technologies in Historical Perspective*. Basingstoke: Palgrave MacMillan. 37-60.

———. 1996. “Material/Culture: Can the Farmer and Cowman Still be Friends?” *Learning from Things: Method and Theory of Material Culture Studies.* 19-27.

Reiser, J. S. 1978. *Medicine and the Reign of Technology*. Cambridge: Cambridge University Press.

———. 1979. “The Medical Influence of the Stethoscope”. *Scientific American*. 240 (2): 148-157.

———. 2009. *Technological Medicine: The Changing World of Doctors and Patients*. Cambridge: Cambridge University Press.

Rice, R. 2010. “The Hallmark of a Doctor”: The Stethoscope and the Making of Medical Identity. *Journal Material Culture*. 15 (3): 287-301.

Richardson, R. 2000. *Death, Dissection, and the Destitute.* London: University of Chicago Press.

Risse, G. B. 1971. "Pierre A. Piorry (1794-1879), the French "Master of Percussion"". *Chest.* 60 (5): 484-488.

Robb, J. 2015. What Do Things Want? Object Design as Middle Range Theory of Material Culture. *Archaeological Reports of the American Anthropological Association.* 26 (1): 166-180.

Rogers, E.M. 2003. *Diffusion of Innovations*. 5th Edn. New York: Free Press.

Sakula, A. 1979. "Pierre-Adolphe Piorry (1794-1879): Pioneer of Percussion and Pleximetry" *Thorax*. 34: 575-581.

Schaffer, S. 2000. "Object Lessons". *In*: Lindqvist, S. (Ed). *Museum of Modern Science*. United States: History of Science Publication and The Nobel Foundation. 61-76.

———. 2011. "Easily Cracked: Scientific Instruments in States of Disrepair." *Isis*. 102 (4): 706-717.

Seligman, S. A. 1980. "The Royal Maternity Charity: The First Hundred Years". *Medical History*. 24: 403-418.

Sibum, H. O. 1995. "Reworking the Mechanical Value of Heat: Instruments of Precision and Gestures of Accuracy in Early Victorian England." *Studies in the History of Philosophy of Science.* 26 (1): 73-106.

Société Médicale de Genève. 2019. "La Société Médicale de Genève vous attend!". <https://amge.ch/2012/12/06/la-societe-medicale-de-geneve-vous-attend/> [accessed 13 December 2020].

Stanton, J. 2002. “Introduction: On Theory and Practice.” *In*: Stanton, J. (Ed). *Innovations in Health and Medicine: Diffusion and Resistance in the Twentieth Century*. London: Routledge: 1-13.

Sterne, J. 2001. “Mediate Auscultation, the Stethoscope, and the “Autopsy of the Living”: Medicine’s Acoustic Culture”. *Journal of Medical Humanities.* 22 (2): 115-136.

Sturrock, J. 1958. “Early Maternity Hospital in Edinburgh (1756-1879)”. *BJOG: An International Journal of Obstetrics & Gynaecology*. 65: 122-131.

Timmermann, C. Anderson, J. 2006. “Introduction”. *In*: Timmermann, C. and Anderson, J. (Eds). *Devices and Designs: Medical Technologies in Historical Perspective.* Basingstoke: Palgrave MacMillan. 1-14.

Thompson, M. 1979. *Rubbish Theory: The Creation and Destruction of Value*. Oxford: Oxford University Press.

Trolle, D. 1975. “The Development of our Knowledge of Foetal Heart Activity: With Special Refence to Denmar”. *Clio Medica*. 10: 111-128.

Tsoukas, H. 2005. “Do We Really Understand Tacit Knowledge?” *In*: Little, S. and Ray, T. (Eds). *Managing Knowledge: An Essential Reader*. 2nd Ed. London: Sage Publications Ltd. 107-126.

Virdi, J. 2010. ““Learning from Artefacts””. *Spontaneous Generations: A Journal for the History of Science*. 5 (1): 276-279.

Weston-Davis, W. H. 1989. “The Surgical Instrument Maker: A Historical Perspective”. *Journal of the Royal Society of Medicine*. 82: 40-43.

Williams, R. Edge, D. 1996. The Social Shaping of Technology. *Research Policy.* 25: 856-899.

Wilson, A. 1995. *The Making of Man-Midwifery: Childbirth in England, 1660-1770.* London: Routledge.

———. 2007. “Porter versus Foucault on the “Birth of the Clinic.”” In: *Medicine, Madness and Social History*, edited by R. Bivins and J.V. Pickstone. London: Palgrave Macmillan.

Winter, A. 1998. *Mesmerized: Powers of Mind in Victorian Britain.* Chicago: University of Chicago Press.

Wulf, K. H. 1985. “History of Fetal Heart Rate Monitoring”. *In:* Künzel, E. Ed. *Fetal Heart Rate Monitoring: Clinical and Practical Pathophysiology.* Berlin: Springer-Verlag. 3-15.