Discourses on the Function of the Pelvis in Childbearing from Ancient Times until the Present Day

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7 Midwives' Views on the Value of Anatomical Knowledge to Midwifery Practice and Perceptions of the Problem of Contracted Pelvis (1671 -1795)

7.1 Introduction

The aim of this chapter is to explore through a limited number of surviving midwifery texts what traditional midwives knew about the process of birth, and, in particular, whether they perceived obstructed labour due to pelvic narrowness as a common problem in childbirth in the late seventeenth and eighteenth centuries.

The first part of this chapter explores the state of midwifery in the late seventeenth and eighteenth centuries, covering a period of mounting tension between various traditional midwives and men midwives. From this it emerged that midwives' knowledge of anatomy was a politically sensitive issue. In addition, the midwife-authors expressed grave concerns about the clinical competence of newly trained men midwives and also about some of their own peers. Examples in the texts suggest the competence of both types of midwife ranged from excellent to lethal. The midwife-authors envisaged men midwives as a threat; fast carving niches for themselves in midwifery practice by caring for the wealthy and influential and publishing substantive midwifery texts, thereby promoting their usefulness to society. Although the midwife-authors knew midwives sometimes made mistakes, they were painfully aware that some men midwives would try and blame them for their own errors. As the most inexperienced men midwives automatically assumed authority over traditional midwives, it was difficult for them to get their concerns about practice across and defend their reputations in public:

> ...should any misfortune happen, which perhaps is unavoidable, people are more readily reconciled to the event, because there is no appeal from what a doctor does, being granted he did all that could be done on the occasion[1]

[1] Stephen 1795, p. 73.

In this uneasy climate, some junior men midwives appeared to underestimate the expertise and knowledge of skilful midwives who acted as advisers and expert practitioners to their peers, some of whom were unafraid to challenge medical practice. Regardless, midwives attended most births in England and claimed rarely to encounter severe pelvic narrowness, even in rachitic women with skeletal deformities.

The second part of the chapter examines more specifically midwives' perceptions of the frequency of contracted pelves in traditional practice as perceived by four midwife-authors. Considering that traditional midwives attended the majority of births, their neglect of the subject of severely contracted pelves again suggests it was rarely encountered. Moreover, their texts revealed a significant preoccupation with a condition described as uterine obliquity*, which could be remedied by early intervention and correction.

The work draws principally upon the extant treatises of four English midwife-authors; Jane Sharp, Sarah Stone, Elizabeth Nihell and Margaret Stephen, who published between 1671 and 1795.[2] Traditional midwives appear to have been a disparate group: at one end of the scale were the trend-setting London midwives, who were generally well respected, while at the other end were isolated rural midwives, working in smaller communities, sometimes combining midwifery with other roles. This heterogeneous context should be acknowledged as a source of the many varied descriptions of English midwifery practice both in primary sources and in the midwifery historiography.

7.1.1 Backgrounds of the midwife-authors

Each of the four midwife-authors was an experienced midwife writing towards the end of their career. It is known that Sharp and Stone had been in practice for around thirty years and had been apprenticed to their mothers, who were also experienced midwives themselves. They also had experience of childbirth themselves, which was a general expectation of midwives. Stone and Nihell were married to an apothecary and a surgeon-apothecary respectively. Elizabeth Nihell's controversial treatise caused a stir in both

[2] The combined work of these midwives, Jane Sharp (Sharp 1671), Sarah Stone (Stone 1737): Elizabeth Nihell (Nihell 1760a, 1760b), and Margaret Stephen (Stephen 1795a), spanned a period of 154 years and was based upon their many years of personal experience. Doreen Evenden (Evenden 2000, p. 11) suggests that four midwives anonymously wrote an earlier text, TC, ID, MS, TB 1656, although Elaine Hobby (Sharp 1671, pp. xvi-xvii) is of the view that these authors were male.

London and in Paris[3], where she was fortunate enough to have previously undertaken a course in midwifery at the Hôtel-Dieu .[4]

Nihell stressed in the preface to her book that her husband's business was strictly unrelated to her own.[5] In general, however, family relationships between practitioners are likely to have enhanced the aforementioned midwife-authors' opportunities to discuss childbirth with medical men. In the cases of Stone and Nihell, their marital relationships may have given them greater access than had most midwives to medical literature,[6] and assisted them in becoming attuned to contemporary medical debates on birth, heightening their awareness of the future intentions of medical men to monopolise practice.

Writing towards the end of the eighteenth century, when medical midwifery had become more established, Margaret Stephen, appearing to seek the approval of her readership, which she assumed might include some medical men, proudly claimed to have received instruction in midwifery from a pupil of William Smellie, who had taught her anatomy and physiology and complicated midwifery. Stephen, like most midwives, also had personal experience of childbirth, having had nine children. In over thirty years of practice she claimed only to have met with 'eight labours which required the aid of an obstetric surgeon'.[7] It was with a sense of bewilderment that she pondered the increasing need for medical interventions in childbirth as:

> [she could not assign] '...a reason why women should differ so much from the rest of the female creation, and require so often what they scarcely ever require: but blessed be God, women seldom required it, until man had found out many inventions[8]

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[3]Nihell 1760a. Nihell also published a French version of her treatise (Nihell1771). It appeared not to please the well-known French midwife and midwifery teacher, Angélique-Marguerite Le Boursier du Coudray, who took pains not to use anti-male language in her own work. Du Coudray anticipated that Nihell's work might invoke a misogynistic and dismissive response from accoucheurs, in particular Alphonse Le Roy. On this controversy, see Gelbart, pp.204-5.

[4] Nihell was born in London and acquired a place at the Hotel Dieu, which normally only admitted French nationals for training. One assumes that she was fluent in French; like the Chamberlen family, she may have been of French Huguenot descent, although this is not certain. Elizabeth and her husband practised in the Haymarket area of London, in the vicinity of a number of the well-known men midwives' teaching premises.

[5] See Nihell 1756, p. iii.

[6] Percival Willughby also assisted his daughter, Eleanor, in becoming a proficient midwife; Wilson 1997,

[7] Stephen 1795, p. 18.

[8] Stephen 1795, note 4, p. 67. Thomas Denman was perhaps aware of this general argument and suggested earlier in 1787 that women were less able to give birth than other animals because of their liability to diseases, particularly rickets and mollities ossium, which even if animals were afflicted by it, would carry lesser

The title of her treatise, *Domestic Midwife; or the Best Means of Preventing 'Danger' in Child-birth,* appears to mark a change in midwives' or at least this midwife's attitude towards childbirth. The title suggests that the author was beginning to consider childbirth as a potentially dangerous event, something she may have learned from her mentor. Alternatively, the emphasis on avoiding 'danger' in the title may have been chosen to engage the attention of prospective readers. The title may also reflect the 'danger' emanating from medical misdemeanours, in which midwives were often embroiled. The text provides advice to midwives on how to avoid compromising women, and their own reputations, by trusting too much in certain types of men midwives.

7.1.2 Midwives as female writers

Women writers emerged in small numbers in the seventeenth century. Elaine Hobby reports that, by the 1650s, more than 70 English women writers had published between them around 130 texts.[9] The midwife-authors recognised that, in a male-dominated society, midwives were automatically assumed to be inferior to medical men. By publishing, they made some attempt to counter this entrenched negative perception.[10] Midwives seldom put their wisdom into print, as book authorship was a predominantly male domain. Midwives may also have considered that it was not necessary to document a role which had been learned from hands-on experience, accompanied by an experienced midwife-mentor.[11]

The medical texts tended to infer that any difficulties should be referred to them, implying that there was no need for detailed textbooks for midwives. From a midwife's

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implications for birth, because of the lesser weight-bearing capacity of animal pelves. See Denman 1787, pp. 9-17.

[9] Hobby 1992, pp. 16-17.

[10] Elizabeth Nihell was probably the most confrontational of contemporary midwife-authors, although she, too, recognised that her sex made her vulnerable and that society might regard her as inferior to the most junior of medical men; Nihell 1760, p. 58.

[11] King 1995, pp. 184-98 and Keller 1995, pp. 102-11.

perspective, they may not have wished to give away their trade secrets to unknown readers, especially men midwives and other curious males.[12]

The selected midwife-authors certainly enjoyed local recognition, acting as advisors to less experienced contemporaries. Their national reputations may be indicated by the numbers of texts printed. However, their exact readership, and the extent to which they were read by practising midwives, is difficult to establish.

It is known that Jane Sharp's treatise was edited and republished three times under the title *The Compleat Midwife's Companion; or The Art of Midwifery Improv'd* during the eighteenth century.[13] Sharp firmly believed man midwifery was an intrusion into female territory, referring readers to the scriptures, where men midwives were not referred to in relation to childbirth.[14]

Since ancient times, medical texts have implied that midwives needed to be intelligent and literate, while later portrayals, following the *Malleus Maleficarum*,[15] were negative and suggested that midwives could not read and were unskilled and bungling.[16] Whilst it is generally accepted that women's lore was spoken rather than written,[17] David Harley argues that midwives' literacy has perhaps been under-estimated in the early modern period.[18]

Regardless, Helen King argues that most seventeenth-century midwives' books were '*...a combination of antiquarianism, irrelevance, salaciousness and the blindingly obvious'*, contending that the debate over midwives' literacy was peripheral, since little could be learned from books in isolation which was useful in practice.[19] Midwives who

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[12] Midwives believed that men midwives would read their texts, if only out of curiosity, since books on generation and midwifery probably acted as early forms of sex and birth manuals; Erickson 1982.
[13] Sharp 1671, pp. xxxvii-xxxix.
[14] Sharp 1671, p. 12. This sentiment was echoed over a century later by Stephen 1795, p. 9.
[15] Lovelace and Rice 2007.
[16] Medical men appeared to measure traditional midwives by medical standards, without first ensuring that midwives were familiar with these. Many contemporary midwives based their practices upon traditional wisdom and popular midwifery texts, such as *The Byrth of Mankynd* (Raynalde 1552) and Culpeper's *Directory for Midwives,* (Culpeper 1651) while medical men adopted a modern, rationalist approach and increasingly abandoned ancient birthing theory.
[17] Cressy 1997, p. 16.
[18] Harley 1993. Andrew Wear suggests more women could read than could write; Wear 1992, p. 18. In 1861, 37.6% of women and 26.7 % of men could not sign their names in marriage registers; *Twenty-Second Annual Report of the Registrar General for Births, Deaths, and Marriages for England* 1861.
[19] King 1995, p.189.

read these books and adopted some of the harmful practices advocated therein, would simply have fuelled medical criticism.

7.1.3 Midwives and anatomy

By the late 1750s, according to Nihell, one of the strong arguments put forward by men midwives against traditional midwives was that anatomy was 'the province of a man, of a physician or surgeon, not of a woman'.[20] This issue was addressed in different ways by each of the midwife-authors, who could all see that midwives would need to improve their knowledge of anatomy to survive the male offensive and defend their practice. The prospects of bad midwifery practices marring the reputations of all midwives and weakening their hold on practice, and the equally daunting possibility of medical domination, spurred these midwives on to publish.

Sharp desired to teach anatomy to midwives, in a new and positive manner, offering inspiration to midwives as women. She addressed the pre-existing male bias in human anatomy by emphasising the natural perfection of the female form.[21] Her descriptions of women's bodies, provided analogies which were typical of the period, offering a new sense of sophistication and wonderment to female bodies previously only ever compared with the 'superior' male prototype.[22] However, she continued the tradition of describing male anatomy before female anatomy; perhaps mindful of the danger of totally alienating readers, if she did not comply with certain expected social norms. However, in describing the male parts, she was witty and turned the tables on male grandiloquence.[23] She also utilised embodied knowledge peculiar to females to demonstrate midwives' separate ways of knowing, challenging some of the literary discourses of medical men and undermining the authority of medical theorists who lacked insight into midwifery practice and personal experience of giving birth.

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[20] Nihell 1760, p. 32.
[21] Hobby 2001.
[22] In anatomical terms, the male sex was portrayed as the human prototype, the female being but an inverted male; Lacqueur 1990.
[23] Eve Keller and Elaine Hobby have both emphasised the manner in which Jane Sharp was able to challenge the ancient discourses of male anatomical supremacy present in many of the contemporary medical texts: Sharp 1671, pp.11-65; Keller 1995; Hobby 2001.

While the midwife's social role during birth was unconstrained, Sharp highlighted the disadvantaged position of most midwives being denied access to formal education. The midwife authors each considered how midwives' practical activities might be further denigrated and restricted by medical men if their knowledge of anatomy and 'touching' (vaginal examination) was shown to be seriously wanting.[24]

In order to survive and avoid harsh and degrading medical criticism, midwives would need to develop their approach to practice; adopting some medical principles, including a working knowledge of anatomy. Sharp claimed in her treatise:

> I have done with that part of anatomy, that concerns principally us midwives to know, that we may be able to help and give directions to such women as send for us in their extremities, and had we not some competent insight into the theory, we could never know how to proceed to practice, that we may be able to give a handsome account of what we come for [25]

This need was crystallised in the eighteenth century by Stone, who agreed that anatomical knowledge would enable them to more accurately conceptualise problems. Despite professing to be well-versed in anatomy and able to teach it, Elizabeth Nihell argued that in-depth anatomical knowledge was not essential for midwives, who simply needed to be able to:

> ...discern the container from the contents...what belongs to the mother and what belongs to the child and what is foreign to both.[26]

Nihell defined midwifery as essentially practical and hands-on; a role for which women were in many ways more suitably equipped as women. She claimed medicine was textually-orientated and theoretical. Stone had similarly contended that 'gentlemen pretenders' (junior men midwives) with 'only the knowledge of dissecting the dead'[27] lacked ability to deal with live women.

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[24] Although midwives often teamed up in geographical localities to support and interact with each other, there was no known national network until the end of the nineteenth century to help unite midwives and provide them with education, support and leadership.
[25] See Sharp 1671, p. 129.
[26] Nihell 1760, p. 33.
[27] Stone 1737, p. xii.

Midwives acquired expertise from attending relatively large numbers of births. Sharp suggested that men could sometimes learn from them, although men found it difficult to ask for advice from midwives and often failed to acknowledge any assistance they received, which was probably a cultural trait.

In the face of a medical offensive, use of medical terminology might have helped midwives to maintain or develop their public profile. The issue was perhaps: how much anatomical knowledge and theory did midwives need? From observations of male practice, all four midwife-authors could see that a predominantly theoretical education was not entirely helpful. Whilst appreciating the value of theoretical knowledge, Jane Sharp claimed that midwifery was predominantly a skill-based art, which could best be learned from experience, not from books:

> It is not hard words that perform the work, as if none understood the Art that cannot understand Greek[28]

Customarily, English midwives drew upon many forms of knowledge, although they lacked formal networks or guilds to provide them with educational support and guidance, or of course access to a university education. Most importantly, as women they were socially and culturally constrained by their sex, although perhaps this generalisation has not served midwives well, as some were clearly well-read, and played important and respected roles in the community. They were also acutely aware that it was women who were choosing medical care over midwifery care,[29] and of the need to accomplish the difficult task of strengthening female bonds in a paternalistic society.[30]

7.2 Midwifery: a practical job?

As with many other trades, midwifery skills were acquired by a 'one to one' apprenticeship scheme in which experienced midwives coached their juniors. As women who had usually had children themselves, they could also draw on their own embodied knowledge and intuitive ways of knowing. Such ways were of course considered inferior to

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[28] Sharp 1671, p. 12.
[29] See Nihell 1760a, p. ii.
[30] Cody 1999.

the increasingly sophisticated medical epistemology, which was beginning to embrace scientific rationality more fully. Although many medical treatises included case studies, Elizabeth Nihell noted the lack of practical information in medical treatises, which she believed was because care during labour was the realm of traditional midwives. She dedicated a subsection of her treatise to the 'art of touching', which she described as an essential part of effective practice.

Although midwives were not generally perceived as being erudite, many continued to enjoy high standing in their communities.[31] Sharp believed that most women thrived in the care of traditional midwives despite their lack of book-learning. The most important assets of a midwife, according to all four midwife authors, were practical skill, confidence, and knowing when to call in a man midwife. Like midwives today, they recognised the need for midwifery education, including applied anatomy, to enable them to deal with minor complications themselves, to better articulate practice, and to recognise the boundaries of their role.

In 1737 Stone described the increasing dependence of inexperienced midwives upon men midwives, and predicted this trend would continue or get worse if the activists amongst them did not attempt to educate their kind.[32] In the eighteenth century expert midwives were beginning to re-assess what midwifery was, pondering the value of medical science to their practice.[33] Most midwives lacked political awareness and a group identity which extended outside of their own locality.[34] The utilisation of the printed word as a medium of communication was a good partial solution.

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[31] For evidence of midwives' high standing in the community see Wilson 1995, Evenden 2000.

[32] Mary Fissell argues that Stone portrayed other midwives as unlearned and meddlesome in order to emphasise her own skills; Fissell 1991, pp. 60-61.

[33] Doreen Evenden refers to some of the testimonials from London midwives, considered to be the most advanced midwives in the country. She suggests that, in the last few years of bishops' licensing of the early eighteenth century, some of these midwives began to describe their expertise in scientific terms, using words such as *'de scientia'* or *'de scientia et experimentia,'* as opposed to *'arte and experientia';* Evenden 2000, pp. 202-203.

[34] Hugh Chamberlen the younger, John Maubray and others professed a desire to improve traditional midwifery practice. However, they also wished to restrain midwives' activities and to assert their personal authority over them. This power struggle is a distinctive tract within midwifery historiography, outside the specific scope of this study; see Donnison 1988.

7.3 The new breed of man midwife...

For centuries, society maintained a strong paternalistic notion that a woman's realm was in domesticity and childbirth was a female concern. Traditional midwives served local communities all over England and far outnumbered men midwives. Most men midwives were from a surgical background.[35] One of the principal roles of barber-surgeons had been to deal with occasional midwifery emergencies.[36] Specialist midwifery courses were available in France and Scotland,[37] whereas English universities lagged behind. Nonetheless, unlike traditional midwives, medical men had access to national and international networks and libraries through which they built up a comprehensive pool of medical knowledge on midwifery practice.

The eighteenth century was a period of rapid developments in the field of medicine, and much ancient wisdom was eclipsed by developments in modern science. The midwifery climate was altered in the 1730s by the introduction and wider use of forceps and the increase in men choosing to specialise in midwifery following apprenticeships with barber-surgeons or men midwives.[38] Elizabeth Nihell's caricatures of these men have been widely quoted in the midwifery historiography and suggest that mature entrants to the profession came from diverse backgrounds, with little previous experience in medicine; many were 'broken barbers, tailors, or even pork butchers' referring to one, whom:

> ...after passing half his life stuffing sausages, is turned an intrepid physician and man midwife[39]

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[35] Physicians were often from wealthy families and had enjoyed an expensive university education; they tended to look down on surgeons, showing even more contempt for men midwives, who they believed were doing women's work; Graham 1950, p. 311.

[36] Since the eleventh century, instruments had legally been the province of members of the Barber Surgeon Guild and later the Royal College of Surgeons. As midwives could not legally use instruments, this limited their potential to deal with complicated cases, although this law may have been flouted in rural areas. Instructions for the use of instruments were found in some midwifery texts. There are some rare cases of women being licensed as surgeons, although they often had to prove their capabilities beyond those of their male counterparts; Evenden 2000.

[37] Schnorrenberg 1981, pp. 396-402; on Scottish midwifery, Emerson and Wood 2002, pp. 96-7.

[38] The adoption of the forceps or alternatives such as the fillet, lever and vectis were influenced by political affiliations: Wilson 1995.

[39] Nihell 1760a, p. 71.

Some junior men midwives were as young as twenty-one. Midwives expressed some anxiety about their suitability for midwifery, which required intimate physical contact with women.[40] This new 'breed' of man midwife appeared to be increasingly popular with women, whilst the aforementioned midwife authors believed they lacked competence as practitioners.[41] Sarah Stone suggested midwives should study their art more, to prevent women losing their modesty to men, although families and not midwives were the ultimate decision-makers when it came to hiring expensive medical assistance.[42]

With the advent of planned 'advanced' and 'onset calls',[43] the work of men midwives in major cities began to encroach on normal midwifery. The services of London men midwives were purchased for substantial fees by the upper classes, who perceived they were buying the best care money could provide. This set a trend for emulation which spread to the middle classes, boosting the demand for medical attention which had become much more popular in general amongst the gentry.[44] Stephen suggested that these junior men midwives were a false economy, being cheaper to hire but more inept than some of the more seasoned ones. The new male enthusiasts working in the provinces soon learned that midwifery was often competitive, involved hard work and long unsociable hours, and was far more complex than it would first appear. Neither was it particularly lucrative outside the major cities.[45]

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[40] A series of pamphlets circulated towards the end of the eighteenth century which suggested women of fashion who hired a man, not only risked their lives but also their morals. In 1764, Philip Thicknesse wrote an anonymous text called *Man-Midwifery Analysed* (Thicknesse 1764), in which he suggested that men as young as twenty-one were giving their female patients lustful attention. Also Stephen 1795, pp. 9-15, 19; Donegan 1978, pp. 164-247.

[41] An anonymous treatise which may have been written by a midwife in 1773 suggested that most villages had a general doctor who could turn his hand to tooth- or child-*plucking* with equal zeal. If doctors were called to lingering labours they would be expected to do something immediately. It was suggested that the really skilful amongst them might appear to do something for the woman, whereas the ignorant might perform un-necessary interventions and in so doing, create new problems. Anonymous 1773.

[42] In 1762 an inquest reported the death of a woman who, with her husband, had ignored the midwife's advice to call in a surgeon; Fissell 1991, p. 61.

[43] Onset calls are described by Wilson 1985, pp. 350-1.

[44] The rich usually appointed a family physician. Some doctors believed luxurious lifestyles put the rich at greater risk during childbirth. The poor tended to lead more active lives, and ate more wholesome food; Guerrini 2002, p. 184-185. Of course a medical birth could have put them at greater risk of dying, and by the nineteenth century, better collection of data from the rich than from the poor (p. 383) may have accounted for the equally large numbers of maternal deaths amongst rich and poor; Razzell and Spence 2006.

[45] Loudon 1985, pp. 27-29. Although the work was demanding, it did however allow early access to new patients and provided opportunities for repeat business with the family.

From observations of medical practice, the midwife-authors all expressed serious doubts about the supremacy of medical competence.[46] Elizabeth Nihell and Margaret Stephen believed that one of the main problems stemmed from men's enthusiasm for indiscriminately trying out their new skills and instruments.[47] However, the follies of incompetent doctors were obscured by the reputations of a few eminent practitioners who had earned the respect of society for modernising midwifery with their knowledge and technical progress.[48] In the past the arrival of the barber-surgeon was associated with sadness and death, but the popular conception of forceps, as life-giving, appeared to counter this belief.

In an age when book-learning was popular and book ownership fashionable, medical texts helped men midwives to legislate for their own authority.[49] By documenting knowledge and prescribing midwifery care in a relatively sophisticated style, men midwives were able to stake a claim firmly over practice, while simultaneously encouraging women to believe that midwives were dangerous.[50]

Many of the vernacular texts were read by midwives and also by the public, who had access to a range of self-help manuals on a range of topics, for example on cooking, gardening and of course home medicine; in some cases, medical texts supplemented the hiring of a practitioner. However, Nihell believed the medical treatises contained little written on the art of midwifery which did not lead to the use of instruments, 'which cut at once the knot they cannot unty'; providing hasty, ill-conceived solutions.[51] These medical

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[46] Their training lasted just two or three months. Medical men had access to private dissections, texts, 'machines' illustrations drawn by professional artists, access to pauper patients in the London lying-in hospitals, practice with instruments and an international medical network and library. In contrast, midwives took apprenticeships of between four and seven years with experienced midwives; Manningham 1744. For details of medical midwifery courses, see Wilson 1985 and Wilson 1995, also Gray 1946 (this extensively edited text tells the story of an eighteenth-century ship's surgeon who became a man midwife).

[47] Stephen (1795, pp. 69-71) describes how midwifery instruments were used, including the forceps and the vectis, and remarks on their casual use by men to save time and curtail the process of birth.

[48] In 1749, the College of Physicians finally agreed to provide lectures on midwifery. In 1783, after much conflict, they began to grant licences to men midwives. Meanwhile, a larger number of men midwives were admitted to the less prestigious College of Surgeons, which ceased to licence men midwives in 1804; Schnorrenberg 1981, pp. 397-8.

[49] William Hunter's extravagant folio of engravings, *The Gravid Uterus*, was publicly exhibited before completion and subscriptions solicited, suggesting it was a business venture rather than simply an educational text; Herrle-Fanning 2000.

[50] Stephen 1795, p. 15

[51] Nihell 1760a.

texts may have encouraged women, families, and inexperienced midwives to seek medical assistance more readily.

In 1760, Nihell felt compelled to write to warn midwives and women of the dangers and errors being introduced into midwifery by male practitioners, and of the injuries being inflicted upon women and babies from the over-use of forceps. She suggested that the contemporary medical treatises promised remedies for difficulties, but in reality offered little practical help amongst a 'cloud' of scientific language, which 'replaced old errors with new ones'.[52] She believed medical advice led to impractical solutions which experienced midwives immediately recognised as such:

> So many [medical] authors ... have, with the utmost confidence and utmost absurdity, written upon the art of midwifery, without understanding any of it at all[53]

She protested that men midwives, often lacking clinical expertise, sometimes learned from midwives, then turned against them, and even turned women against them.[54] The midwife-authors wished to increase public awareness of the carnage which inexperienced men midwives were causing with their instruments. Nihell's text may have been perceived by some as a reaction to the accusations and denigration of midwives by men midwives, although all four midwives expressed a deep concern for what was happening to women and infants. Unfortunately, particularly where Nihell was concerned, this may have been interpreted by readers of her polemic text as an over-emotional, unlady-like and inflammatory response to medical criticism. Certainly some of the French midwives (*sages-femmes*) felt that Nihell's remarks were abrasive and threatened to disrupt their relationships with *accoucheurs*.

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[52] Nihell 1760a, p. v.
[53] Nihell 1760a, p. ii.
[54] Nihell 1760a, p. 145.

7.4 Midwife – authors condemned bad practice

Whereas the medical treatises had a noticeable tendency towards exposing the mistakes of traditional midwives,[55] Nihell recognised that it was the skill and manual dexterity of the midwife which was most important and not her sex. Despite the heavy criticism traditional midwives received in the face of a medical offensive, a number remained highly respected by all, including men midwives.[56] Likewise the midwife-authors respected the skill of more skilled and experienced men midwives, whilst showing horror and dismay at the actions of inept ones. As well as being the main providers of care, especially for the poor,[57] there is sufficient evidence to show that midwives continued to attend clients from the upper and middle classes around the wealthy districts of London.[58]

The men midwives were normally founders of or were on the staff of the newly-established charity lying-in hospitals. The hospitals were clearly a medical domain in which men midwives were allowed to develop their practice and to utilise poor patients as teaching material for their students.[59]A number of midwives also worked in subordinate roles in lying-in hospitals, as matrons, caring for women in labour or teaching medical students.[60] These midwives and monthly nurses[61] worked under medical jurisdiction and so were no threat to the medical scheme.

7.5 The quill is mightier than the midwife

Using the medium of print, midwives entered the public domain via the route medical men had so successfully utilised. The midwife-authors hoped to make midwives

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[55] Percival Willughby provides a range of examples of midwives dismembering babies or pulling on their heads or scalps in order to deliver them (something men midwives also did without this being published) in a bid to deliver the mother; Willughby 1863.
[56] Hobson 1872; Evenden 2000.
[57] In an emergency reported by Stephen, her 'preceptor' (male) was away, and she called upon two other gentlemen who, on learning that the woman was poor, flatly refused to attend; Stephen 1795, p. 51.
[58] Evenden 2000.
[59] According to Nihell, '*these ... miserable wretches, hired or under the mask of charity [were] forced to undergo, from apprentices or pupils, so many humiliations and tortures and outrages in vain;* Nihell 1760a, p. 299.
[60] At the end of the nineteenth century, over 90% of births still took place at home; Loudon (ed.) 2001, p. 212.
[61] Monthly nurses cared for women in childbirth.

and well-informed members of the public more aware of the situation as they saw it, in terms they could easily comprehend.

Perhaps out of a need to impress readers of their learnedness, the midwives claimed to have read much of the contemporary medical literature on childbirth. This added to their credibility in a way that men midwives could not argue against; fighting fire with fire.

During the fifty-eight years between the publication of Stone's treatise and that of Margaret Stephen, gruesome birth injuries caused by men midwives and their instruments continued to be reported.[62] Nihell's slightly controversial treatise, published in 1760, was noted for its overt criticism of men midwives, in particular of William Smellie. Underneath her literary attack was a sincere concern for women in childbirth. However, by page fifty-eight, she expressed a sense of futility, inferring that women's achievements were ignored because women believed they were in safer hands with men:

> ... of what importance can a woman be, who after all is but a woman?[63]

Women's contributions to knowledge were not widely recognised, even when written down.[64] They appeared only to become recognised if at some stage they were seized upon by men and documented by them. The more submissive and cautionary tone of Margaret Stephen's text, written in 1795, which more closely emulated a medical style with its greater use of medical ideology and terminology, indicates that midwives had lost more ground to medical men by the end of the eighteenth century.[65]

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[62] Sarah Stone described how infants had...*been born alive with their brains working out of their heads: occasioned, by the too common use of instruments;* Stone 1737, p. xiii. Similar gruesome examples of mortal injuries to the infant were described by Nihell and Stephen. Fewer comments were made about maternal injuries, although occasional deaths were reported from traumatic haemorrhage.

[63] Nihell 1760a, p. 58.

[64] Around this time women were becoming increasingly aware of the restrictions which society placed upon them and of the inequalities between women and men; see e.g. Wollstonecraft 1792.

[65] It was suggested by Samuel Merriman in the nineteenth century that Stephen's text was written for her by Philip Thicknesse, although Thicknesse died before Stephen's treatise was published. A debate about the sex and identity of certain eighteenth-century midwife authors is discussed by Bradbury 1988, pp. 727-33.

7.5.1 An attack on men midwives ...

Nihell's work was the most notorious publication written by a midwife in the eighteenth century, but perhaps for the wrong reasons.[66] Medical men commonly enjoyed academic debates between their equals, which sometimes involved public rebuke of named individuals[67] and which sometimes escalated into vitriolic attacks, in a manner which today would be considered libellous.[68] Nihell's treatise attracted a remarkable amount of interest for its audacious and provocative attack by a woman on men midwives.[69] Her attack was directed in particular at William Smellie. She subsequently, and perhaps not unexpectedly, received a number of public insults back in the press, although it would appear not from Smellie himself, who was also beginning to experience concerns about forceps over-use.[70]

7.6 Midwives' fingers or insensitive hands of iron?

Stone, Nihell and Stephen were particularly disturbed by the medical malpractices they had witnessed. In the preface of Stone's treatise, she proclaimed that:

> ...more women and children have died by the hands of such professors [learned persons], than by the greatest imbecility and ignorance of some women midwives, who never went thro, or so much as heard of a course of anatomy.[71]

Elizabeth Nihell referred to a live fetus having its skull pierced by forceps. [72] Margaret Stephen, writing several decades later, offered another cautionary tale of professional rivalry, defensive practice and divided loyalties. She recounted an incident in

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[66] Nihell's treatise attracted the attention of a wide readership for its acerbic attack on men midwives, especially William Smellie. This, however, detracted from its contribution to the advancement of traditional practice.
[67] See, for example, Burton 1753.
[68] See, for example, Blunt 1793.
[69] English society was of course patriarchal, and women were expected to acquiesce in male authority. Nihell's treatise was published before Mary Wollstonecraft's *The Vindication of the Rights of Woman* and may have been considered a 'good read' because it was controversial and irreverent towards men midwives.
[70] Although male authors often published personal criticisms of their peers, it was unusual for a man midwife to be criticised so boldly in public by a female midwife.
[71] Stone 1737, p. xii.
[72] Nihell 1760a, p. 92-6.

which an inexperienced man midwife was called in by a woman's family to a case which Stephen thought did not require medical intervention. She wrote:

> ... the poor woman was put in a posture to be delivered with a forceps, which when applied, soon lost their hold; the second attempt no better success; by a third effort, the head was brought forth, and the body soon followed, with a sanguinary hue all over, as if it had fallen into a butcher's tub in the slaughter house. [discovering]... no signs of life, ... he gave it to me to do what I could ... I discovered a deep wound upon the right temple ... in the direction of the temple vein.[73]

Stephen tried to stem the bleeding by holding the wound together whilst the man delivered the placenta. The female attendants were about the woman who was *'flooding'* (haemorrhaging). Meanwhile, Stephen washed and laid out the baby and the doctor whispered to her to put a bonnet on it, and handed her one. The man midwife later portrayed Stephen to the family as being responsible for the death of the baby, which he suggested had occurred earlier in labour whilst the woman was in her care. [74]

As a confident and knowledgeable midwife, Stephen disagreed with the doctor as to the cause of the infant's death, arguing that when he had given the baby to her 'to do what she could' he must have thought it to be 'revivable', and 'pulsation of the navel string' (umbilical cord) was proof of this. She suspected that the man midwife may not initially have seen the head injury, as the baby was covered in blood.[75] He responded to Stephen by conceding that the death was perhaps caused by placental separation, and not by her neglect. She retorted this could not have been the case, as there were no signs of any blood before the birth. He continued to substantiate his claim by proposing that the fetal head had 'plugged up' the discharge, but Stephen maintained the liquor was previously clear and untainted.[76]

Stephen's case sent out a message of caution to midwives not to put themselves and their reputations at the mercy of young men midwives, who might blame them for their own mistakes. Fortunately, Stephen had a thorough understanding of the situation and was able to articulate this using appropriate medical terminology, this meant that she could

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[73] Stephen 1795, pp. 58-9.
[74] Stephen 1795, pp. 60-63.
[75] Stephen 1795, p. 60.
[76] Stephen 1795, p. 62.

successfully challenged this 'perfect twig of the obstetric profession'.[77] Her example acted as a caution to other midwives, and highlighted the value to midwives of a good understanding of anatomy and the process of birth.

The medical historiography has dwelled predominantly on midwifery malpractice, although William Smellie offered some insight into the strange practices of certain men midwives when he described a case to which he was called to offer advice. In a 'private manner' he advised the man midwife not to attempt to perform an internal version on a woman whose cervix was not fully dilated. Later, after a good rest, the woman delivered spontaneously. Apart from demonstrating the deficit in this man's learning, Smellie was also struck by his extraordinary 'apparatus'; which he indulged in ridiculing:

> ...arms rolled up with napkins and a sheet pinned round his middle as high as his breast[78]

7.7 Midwives' perceptions of the prevalence of obstructed labour caused by the pelvis

Although birth statistics were not collected in the seventeenth century, Sharp's confidence in God and nature appear to be justified. Despite the wide documentation of unusual, difficult and abnormal births, there appeared to have been relatively small numbers of life-threatening complications, and relatively few women died undelivered; although some went on to die later of puerperal fever. As discussed in the previous chapter, the life of the fetus was sometimes taken in order to spare the mother's.

The expert midwife-authors appear only to have called for medical assistance on rare occasions, and although contracted pelves received an increasing press in the eighteenth-century medical literature, Nihell claimed that medical men were liable to gross exaggeration.[79] It has been argued earlier that the estimates derived from the incidence of destructive operations combined with incidences of caesarean operations have resulted in

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[77] Stephen 1795, p. 58.
[78] Smellie 1768, case 3, p. 257.
[79] In 1793, John Blunt suggested that '99 out of 100 labours' would result in natural birth, whereas one case may require the assistance of a man midwife; Blunt 1793, p. 16. Bradbury (1988) suggests that John Blunt was the pseudonym of S. W. Fores, a London bookseller.

slight over-estimations of the overall incidence of severely contracted pelves in the midwifery historiography; which were relatively minimal.[80] Such cases did not appear to concern the midwife-authors sufficiently to merit much discussion, and those that were referred were usually delivered vaginally, using forceps in mild cases, or by destructive operations.[81] Nihell, like some medical authors, found many women with classic signs of rickets had pelves of normal capacity and were often ' blessed with easier deliveries than the very best-shaped'.[82]

7.8 Midwife-authors' perceptions of prevalence of rickets and mollities ossium

Nihell argued that the medical descriptions of mollities ossium*, in which the pelvis expanded at birth, was a theoretical notion. In response to a personal challenge issued to Nihell in the *Critical Review* for March 1760, to deliver a child with a head of more than five inches diameter through a pelvis of two inches, Nihell suggested:

> I have occasionally seen skeletons, but without least reason to retract what I have said of the almost universal care of Nature in the due conformation of the pelvis. It is also true that I have cast around my eyes, and observed a number of rickety children and crooked women, both in this metropolis and elsewhere; but I never had reason either from sense, or especially from my own experience, to form the Reviewer's conclusion from such ricketiness to the distortion of the pelvis.[83]

Nihell found the pelvic diameters described by her critic hard to believe, but reasoned that in most cases the child's head bones moulded* to pass through the pelvis, resulting in conical shaped heads after birth, especially in 'first borns'. Her critic then

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[80] See chapter six, *The Blighted Pelvis*.
[81] Sharp 1671, pp. 148-9. Sharp made references to the use of *Chirurgeons* (surgeons') instruments; although midwives were forbidden to use them, they may have done so in remote areas where they had no other options. A malpositioned fetus might be successfully manipulated and delivered vaginally by the midwife if the woman had a normal or large pelvis. An abnormally large fetal head would commonly be dealt with by a man midwife using destructive instruments. See *The History of Myddle* by Richard Gough, in which the midwife instructed her husband to make some iron hooks in his smith's forge so she could pull a dead child from the womb in the hope of saving the mother: Gough 1979, p. 99.
[82] Nihell 1760b, p. 7.
[83] Nihell 1760b, p. 6.

asked her what she would do when a middle-sized child needed to pass through a pelvis where the distance between sacrum and coccyx was just an inch. Nihell rejected the notion that such small pelves existed, or conceded that these would be extremely rare monstrous types. In her usual brisk manner she retorted:

> they might as justly ask of me what would I do if I met with my grandmother's ghost as what I would do if I met with such a case.[84]

She suggested that medical men might use these examples of monstrous pelves to persuade ignorant women that medical attention was necessary in childbirth.

Nihell doubted it was possible to deliver an infant vaginally from such a freak pelvis; however, if faced with such a patient, she explained that she would do with her 'long sensitive shrewd taper fingers',[85] what medical men do with the crochet or forceps. She would use internal podalic version to remove the fetus legs first, which she believed was less ghastly than the medical approach, which involved the severing of heads and pulling-off of limbs, and also saved more lives in the process.[86]

Thirty-five years later, Margaret Stephen appeared to agree with the men midwives when she stated that, according to 'best anatomists' disproportion between the maternal pelvis and child's head was the most common difficulty,[87] sometimes caused by bony diseases such as rickets and mollities ossium* . Stephen wrote:

> When the rickets, mollities ossium, (softness of the bones) or weakness of any kind obliges the pelvis to take a distorted or confined form, or when women marry late in life, and the parts become rigid, and the articulation with the coccyx with the sacrum becomes anchilosed, so that near three quarters of an inch are lost in the long diameter of the

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[84] Nihell 1760b, p. 9.

[85] In a bid to ridicule Nihell, her critic suggested midwives might use their fingers to *titillate* women during touching. Nihell managed to deflect this accusation by challenging the critic's own dishonourable ambitions. Nihell 1760b, pp. 2-3.

[86] In view of the size of the aperture of some of the preserved dried pelves at Manchester (also seen in the Virtual Pelvis Museum), this would appear very difficult if not impossible to have done. Nihell practised in the south of England, where it would appear severely contracted pelves were less common. She may well have been able to perform these procedures on women with moderately contracted pelves or mild mollities ossium. Nihell claimed to have encountered women with skeletal deformities in her practice, while claiming not to have met with such severe cases in Paris or London, reinforcing her perception of the extreme rarity of severely contracted pelves. .

[87] Stephen 1790, p. 64.

> lower aperture of the pelvis, it must occasion difficult labours; and as the chief difficulty arises from the narrowness of the pelvis, midwives when first employed by a patient, ought to examine the capacity of the pelvis [88]

She agreed with medical authorities who had taught her that a vaginal assessment of the size of the pelvis should be made by placing four fingers in the vagina. If the four fingers could be admitted in a direct line from the symphysis pubis to the nearest vertebra, the pelvis was considered adequate (providing the midwife's four-finger breadth was the equivalent of three inches or more).[89]

Nihell also subscribed to the notion of performing an initial pelvic assessment in order to establish the distance from the pubes to the sacrum,[90] first described by William Smellie.[91] Stephen did not acknowledge any of the previous midwife–authorities in her treatise, and quoted from medical texts. This might suggest she held little regard for Stone's or Nihell's work, alternatively she may have felt that references to medical works carried more authority. Most midwives appeared to conform to the social values of their time, acting in a subservient manner towards medical men. Some were of course married to medical men; these women appear to have been the most outspoken and confident at challenging medical authority.

7.9 Delay in labour – obstruction or obliquity?

Nihell commented that most women would labour for two to three days before the midwife would consider the need to call in a local surgeon or man midwife. During this period the majority of women gave birth, although some infants may not have survived, or survived for only a short time afterwards. Margaret Stephen suggested 'one woman in some hundreds' may require the aid of an 'obstetric surgeon' because of 'disease',

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[88] Stephen 1790, p. 65.

[89]Some medical lecturers charged midwives twice as much as medical men and would leave important pieces of instruction in Latin. As Nihell suggested, they would intentionally mislead them, putting lives at risk. Stephen 1795, p. 20; Nihell 1760a.

[90]Nihell believed that midwives needed only a superficial knowledge of anatomy in order to *touch* (perform a vaginal examination). She defined the basic anatomical landmarks of the female pelvis and described how the *predisposition of the passage* and the position of the fetus could be ascertained along with the situation of the uterus.

[91] This is discussed in chapter nine.

'malconformation of the pelvis' or fetal complications.[92] A significant number of maternal mortalities would have occurred in the early postnatal period, as a result of secondary infection (childbed fever) or haemorrhage. Nihell believed that doctors over-diagnosed narrow pelves and obstructed labour, leading to inappropriate and too frequent intervention.[93]

> [many male authors write about] ... heads too large and a passage too narrow in which they state them as difficulties that are invincible, when the case is far from being so[94]

Nihell believed obstructed labour might be diagnosed before the fetal head had been allowed sufficient time to mould. She also suspected that some cases of delay in labour may have been caused by undiagnosed uterine obliquity*; a condition neglected by medical men,[95] eager to get busy with their instruments. Uterine obliquity was something skilled midwives could resolve without need of men midwives; this may have been the reason why men midwives chose to overlook this problem.

Apart from the need to diagnose uterine obliquity early, intimate contact and considerable manual dexterity was involved in its rectification. In the light of reports about the dishonourable, lecherous intentions of some men midwives, correction of uterine obliquity may not have appealed to men midwives concerned about their reputations.[96]

Stephen acknowledged that forceps saved some lives but sometimes caused more harm than good. She described a climate of consumerism and ignorance in which 'those unacquainted with the nature of labours', with good intentions,[97] may call in medical assistance after forty-eight hours had passed; unwittingly putting the mother into 'danger' from medical harm,[98] whereas Stephen believed that if a woman were given more time, she might safely labour for three days and give birth with minimal assistance.

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[92] Stephen 1795, p. 10.
[93] Although men may have been hired by women, a number of Nihell's counterparts may have been responsible for calling in medical aid and attracting cases to their attention in the first place.
[94] Nihell 1760a, p. 275.
[95] Whilst uterine obliquity was not discussed by Smellie in the first volume of his treatise, it is mentioned in his second volume (1768), which was published after Nihell's treatise.
[96] Nihell also suggested that midwives, as women, may have been able to carry out these procedures more delicately, although men midwives argued some solutions required brute force.
[97] Stephen 1795, p. 68.
[98] *ibid.*

7.10 Traditional midwives who lacked midwifery skills

Stone believed some midwives, through ignorance and inexperience, did not know when to intervene or refrain.[99] She sensed that a form of dependence of junior midwives upon men midwives was developing and that, unless all midwives could be rapidly educated, this was going to happen before the activists amongst them could do anything about it.. Stone suggested that midwives in country areas dealt mainly with robust working-class clientele who tended to experience relatively few complications. Because of this, the least complication, such as 'a common case, as a child's pitching wrong',[100] tended to baffle them. Stone suggested that not all midwives knew how to deal with uterine obliquity, leading them to call for midwifery assistance or to the family calling for a man.[101]

7.10.1 Need for medical assistance

The traditional midwifery treatises focussed on the normality of birth and the simple logic and dexterous skills required for correcting most problems. In contrast, medical treatises taught of the dangers of childbirth and focussed upon resolving them using a technical approach. While a revolution seemed to be occurring in medical practice, traditional midwives continued to work with very little medical assistance. Sarah Stone coped with most complications herself, calling in a man midwife on only a very few occasions, and suggested that '...where twenty women are deliver'd with instruments nineteen [if not twenty] may be delivered without'.[102] Working in a rural area, Sarah believed that the vast majority of complications could be remedied without the need to call in a man midwife. Throughout her 35 years of overall experience, she claimed only to have seen four cases which called for the use of instruments.[103] Of course her treatise was published only several years after the introduction of forceps, whilst rates may have still been on the increase. However, her observations suggested that midwives in the south of

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[99] See, for example, Stone 1737, pp. 23-5.
[100] Stone 1737, pp. vi-vii.
[101] *ibid.*
[102] Stone suggests that there were few men midwives covering the area around Taunton, which may be one reason why she had to be self-reliant; Stone 1737, p. xiv. Some fifty years later, Margaret Stephen suggested that only *one woman in some hundreds* required medical assistance; Stephen 1795, p. 10.
[103] This includes well over 5,000 births during Stone's seventeen years working in Somerset.

England who worked amongst the working classes and the poor met with relatively low levels of complicated cases, which would have included severely contracted pelves.

Stone documented a range of problems she dealt with, many of which would now be regarded as obstetric cases (see Table 7.1, p.172). These cases required midwives to have a lot of skill and manual dexterity which the midwifery authors acknowledged not all midwives had; mainly because of lack of exposure to sufficient numbers of abnormal cases and lack of a broad midwifery education.[104]

7.11 The growing medical authority over birthing theory

Medical men perceived their own standards as normative and wished midwives to work according to their authority, as prescribed in their literary discourses and conveyed to the public.[105] Midwives who did not acknowledge the medical model of working, or who failed to articulate their practice in medical terms, were considered bad practitioners, regardless of the outcomes they achieved. No allowances were made for the fact that the average midwife, as a woman, would not have had the benefit of a good general education and could ill afford expensive courses of lectures in midwifery, anatomy and dissection to help realise these high medical principles.[106] (This may, of course, have been their expectation and part of the plan to take control).

By setting down such medical 'rules of engagement' in their treatises, men midwives boosted their own status as modern and learned leaders of a new field of medical practice, simultaneously lowering public expectations of midwives in the higher echelons of society.

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[104] Elaine Hobby suggests that the survival rate of infants at birth was around 80-85%; Sharp 1671, p. xv. See also chapter six on maternal mortality.

[105] One of the solutions to counteract female 'ignorance' put forward by the Chamberlen family who introduced the midwifery forceps was the formation of a college of midwifery from which they would offer midwives courses of instruction. The midwife Elizabeth Cellier sensed that their intentions were not altogether altruistic, and the midwives abandoned the scheme. Cellier 1687a (2006) and Cellier 1687b (2006). Cellier 2006, pp. xi-xiii

[106] The public obtained information about birth from self-help books - such as the widely-disseminated and much-reprinted *Aristotle's Master-piece* (Aristotle [pseudonym] 1749), a book almost certainly written by an anonymous medical copyist -- much to the dismay of medical men. These self-help books were amalgamated versions of ancient and traditional texts, with limited reference to anatomy and few clear anatomical illustrations, in stark contrast to the lavish works of William Smellie or William Hunter. There was also a fascination amongst the public with reports of monstrous births, which were reported in the popular press.

Table 7.1.

Profile of Sarah Stone's Intrapartum Cases Studies.

Compiled from: Stone 1737,. *Complete Practice of Midwifery*

Type of Case Discussed	Number of examples
Head of infant lodged on the share bone	5
Macerated child / stillbirth	3
Midwifery mismanagement	1
After burden (placenta) left behind for eight days	1
Child with dropsy of the head (Hydrocephalus)	2
Arm presentation	6
Shoulder presentation	1
Twins	2
Face	1
Short navel string (cord)	1
Congenital abnormality (tumour on back/tumors on head)	2
Mis-diagnosis of labour 6 weeks too early	1
Severe constipation	1
Skins (membranes) too thick, need to artificially break them	1
Too strait lacing (corsets)	1
Small pox & pre-term labour	1
Breech	1
Delivery of woman with a *multitude of bladders of water*	1
Knee presentation	1
False labour	1
Delivery of baby with arm torn off by the midwife – who should have performed IPV	1
Woman with spontaneous rupture of membranes for six weeks	1
Spurious labour	1
Woman unable to make water, treated by catheterisation	1
Antepartum flooding (haemorrhage)	3
Face to belly (occipito-posterior position)	1
Delivery of woman with prolapsed uterus (? before or after delivery)	1
	Total = 43 cases

Junior traditional midwives and those that had undertaken medical lectures appeared to be more easily attuned to medical edicts than the highly experienced midwife-authors such as Stone and Nihell, who were more critical and questioning. Writing in 1744,

Sir Richard Manningham, of the College of Physicians, published *An Abstract of Midwifery for the use of Lying-in Infirmary.*[107] He set out guidance for male students of midwifery at the infirmary, in which he acknowledged that women 'suffered greatly, by the use of instruments', hoping to convince students that:

> By our method...there is so little occasion for the present frequent use of instruments, that, excepting in a case or two, which but rarely happen, they ought entirely to be laid aside[108]

Manningham made a point of warning readers that forceps were especially harmful if used in a distorted or narrow pelvis.[109] Whilst some men persevered with the forceps, others abandoned them following grisly failures. Even Hugh Chamberlen the younger (1664-1728) had to admit to forceps failure when challenged by Mauriceau (1637-1709) to deliver a rachitic dwarf.

Following initial dissatisfaction with the forceps, Smellie went on to become one of the most prolific instructors in their use. Later, he found himself returning to his initial negative stance, holding reservations about their use. Others, such as Maubray, Manningham, Douglas and Hunter adopted conservative approaches to the management of difficult births by the head, publicly opposing the use of forceps.[110] Richard Manningham, William Hunter, William Smellie and John Maubray were amongst those who implored others to heed their advice about conservatism in the use of forceps.[111] These men recognised the considerably difficulty of using them effectively, and the terror and damage they struck into women, even though they may have requested their use.[112] Midwives were probably more able to busy themselves and to distract women from the pain whilst waiting for nature to take its course than men midwives. Regardless, it would seem that

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[107]The author, Sir Richard Manningham, was perhaps unusual, being a physician and not a surgeon; Manningham 1744.

[108] Manningham, 1744, p. viii.

[109] They were also harmful when the soft tissues were swollen by the head being *long in the passage* or if the child was dead and the head had not *descended low in the passage*; Manningham 1744, pp. vii-viii.

[110] Wilson 1985; Wilson 1995.

[111] John Maubray wrote: ' ... *I am positive that let who will use instruments, they kill many more infants than they ever save and ruin many more women than they deliver fairly; ... it is also sufficiently evident even to those who have no judgement that way, by the notorious fatalities and tragical events they daily hear of ...*' Maubray 1724, pp. 181-2.

[112] Nihell 1760b, pp. 16, 28.

inexperienced men midwives continued to use them, no doubt contributing to the increasing maternal and infant death rates over this period. The ability to 'sit back and do nothing' may not have met the expectations of fee-paying families, who desired that something be done to deliver the mother. It would appear to have taken great wisdom and confidence for men midwives to do nothing in some cases.

7.12 Sarah Stone's advice for midwives dealing with particular problems

Sarah Stone's treatise, *A Complete Practice of Midwifery* was published in 1737 and consisted of a vade mecum (hand book) of forty-three observations (cases). These were selected from approximately 5,100 births which she attended during the seventeen years she practised around Bridgewater and Taunton in Somerset. Stone's work appears to offer practical advice in a manner that midwives might understand, encouraging them to develop skills of observation, reflection and better manual dexterity.

It is possible that these observations were the sum total of complicated cases she encountered during this time, as some cases seem to be quite repetitious. There were a number of cases in which the head of the infant seemed to be lodged on the share bone or os pubis, and of arm presentations (see Table 7.1 for a summary of Stone's cases).

7.12.1 The 'child being lodged on the share bone'

In the past women tended to have larger families, leading to abdominal and uterine muscle laxity. This allowed the fetus too much freedom to move around, causing a range of fetal malpositions in labour.[113] Stone recorded a total of five cases in which women suffered delay caused by the child being 'lodged on the share bone (pubic bones)'. Whilst this condition may have occurred because of a narrow pelvis, it would appear that Stone was able to deliver women after a certain amount of manual re-alignment of the fetus in the uterus. The explanation by Stone suggests a problem nowadays described as a pendulous abdomen, which can cause fetal malpresentation, including an oblique lie. This

[113] Perhaps surprisingly, Stone does not appear to mention the possibility of cord prolapse, described by Smellie (Smellie 1768) and now commonly associated with an abnormal lie of the fetus.

may lead to the fetus being lodged on the 'share bone' in an adequate pelvis; accounting for an ensuing vaginal birth, once the position of the fetus has been altered to a more favourable one.

In observation one,[114] Stone attended a woman who was experiencing a prolonged labour of three days' duration. She was getting weaker and her contractions were decreasing. On vaginal examination, Stone found 'the child lay on the share bone (pubic bones)' and her membranes had ruptured. Stone's task was to 'relieve her child from the os pubis,' and 'strengthen her pains'. The result was a live daughter 'in the space of three hours'.[115]

In observation four,[116] the woman had been in slow labour for forty-eight hours and her labours had all been similar in nature. Her pains (contractions) were short and sharp, and forced the child's head on to the os pubis. Stone condemned the common midwifery practice of 'press[ing] hard on the back of the body', (probably pushing back the mother's sacrum or coccyx). She advised midwives to ascertain the position of the mouth of the womb and to dilate the *matrix* (cervix) to speed up the labour if the pains were infrequent[117] while attempting to correct any fetal malposition. In this condition the matrix was often located very anteriorly or posteriorly (it is normally found in a central position, which is easier to locate). Stone described a dual manipulation of cervix and child:

> [she] gently drew the matrix towards the os pubis and dilated it with two fingers at the same time relieved and kept back the child's head from the os pubis[118]

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[114] Stone 1737, pp. 1-2. Whilst a pendulous abdomen might be associated with a contracted pelvis, it was also common in women of high parity whose abdominal muscles were weakened by a large number of pregnancies, allowing the fetus great freedom.

[115] Isobel Grundy noted how Stone presented herself as the hero in all her stories. It may be possible that Stone selected her most successful cases as examples for others to learn from; although this is doubtful, since she mentioned several separate cases of the same condition. In the contemporary climate it would perhaps have been literary suicide to describe any unsuccessful cases, even though lessons could be learned from them; Grundy 1995.

[116] Stone 1737, p. 8.

[117] This practice of stimulating labour is criticised by some men midwives as, 'ancient' and 'meddlesome', although Smellie discusses this technique. Stone claimed she could stimulate contractions by :

> '... [putting] my two fingers just within the entrance of the uterus, strengthening her pains' [and bringing forward the matrix to the os pubis] ... I am always capable of strengthening and lengthening a woman's pains if in true labour' (Stone 1737, p. 130).

[118] Stone 1737, pp. 9-10.

Stone appears to have moved the child's head with her external hand by applying pressure. In case number five, the woman was sitting in a chair with 'symptoms of death in her face'.[119] Stone managed the case as before, and criticised the midwife for 'working on the back' which she suggested was 'much approved of by other authors'.[120] Stone maintained that once the fetus was re-aligned and moved off the pubic bones, the back would 'soon yield'.[121]

7.12.2 Limb presentations associated with a small pelvis or uterine obliquity

In Table 7.1 of Stone's cases, there were a remarkably high number of limb presentations documented. At the beginning of the eighteenth century van Deventer suggested that uterine obliquity might occur when the pelvis was small and the uterus was full, causing the uterus to incline in a certain direction, extending the uterine ligaments in the process. He described how this sometimes caused the fetal head to become wedged against the ossa pubis, leading to a hand or arm presentation if the fetus was lying on one side with its head wedged against the pubic bone.[122] Sarah Stone criticised midwives that intervened to press back the os sacrum (Deventerian method), and contended that it was more important for the fetus to 'clear' the os pubis.

Manningham described a number of different types of obliquities of the womb. The first was 'when the womb was hanging too much forwards' which he suggested was fatal if not recognised. Another type was when the womb was 'being pressed too much against the backbone' and two other types when it was 'lying too much oblique on either side'.[123] Smellie suggested that uterine obliquity might be caused by a large fetus, and described artificial rupture of the membranes as a solution.

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[119] Stone 1737, p. 11.
[120] Stone 1737, p. 12.
[121] Stone 1737, pp. 12-13.
[122] Cord prolapse may also have been a risk.
[123] Manningham 1744, p. 15.

7.12.3 Hand / arm prolapse

The English man midwife Percival Willughby had earlier referred to relatively frequent occurrences of arm presentations in the seventeenth century, though they are now quite uncommon. Willughby described women being left for days with limbs presenting in their vaginas, especially if their contractions faded away and midwives did not know how to initiate the 'handy operation' (internal podalic version) to deliver them. He described midwives pulling on prolapsed arms in a bid to extract the fetus whilst the mothers took 'midwives' powders' to augment labour. This inevitably caused further swelling, congestion and greater impaction of the presenting part.[124] Sarah Stone documented at least six separate instances of mismanagement of arm prolapse, where midwives delayed calling for assistance for too long.[125]

Another complication reported by van Deventer was when the head of the infant was locked in the cavity or crookedness of the os coccyges, lying with its face towards the mother's front (occipito-posterior position).[126] In this scenario the fetal head engaged but the fetus was propelled into the posterior region of the pelvis by the angle of inclination of the uterus in relation to the pelvis. The pushing back of the sacrum and coccyx was advised to make space for the infant to exit the pelvis and uterus. Other authors focussed upon altering the position of the mother or binding the abdomen. Van Deventer described an ill position of the womb, sometimes caused by an infant at the 'bottom of the womb':

> [the fetus] '... seated on the left side a little elevated or depressed, the orifice being turned towards the spine of the right os illium or os pubis against which the infants are wont to thrust their heads and often stick there too long ... the brain being broken; or leaping past the said spine to the right they lie athwart the pelvis [transversely] ... [and] ... cannot be moved without the skilful assistance of a man or woman' [127]

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[124] Percival Willughby refers to one such case in which a midwife tugged on a tumour, thinking the woman was pregnant and in obstructed labour. Willughby 1863, p. 9.
[125] Stone 1737, pp. 26-7.
[126] Stone 1737, p. 56.
[127] van Deventer 1716, p. 57. This description may be due to the fetal head being deflexed in an occipito-posterior position, which may occasionally rotate, only then to become lodged with the occipito-frontal diameter in the transverse diameter of the pelvis, now known as a 'deep transverse arrest'*.

Incidentally, it is of note that van Deventer acknowledged the capabilities of midwives in this quotation.

7.13 Margaret Stephen's treatise (1795)

Unless the fetus was completely wedged in the uterus or pelvis, it would appear that Stone, Nihell and Stephen dealt with complicated cases without calling in doctors. Margaret Stephen was an experienced midwife and teacher of other midwives, who claimed she only required the assistance of an 'obstetric surgeon' eight times in her career.[128] However, the influences of medical practice upon Margaret Stephen's practice were visible. The title of her treatise, *Domestic midwife: or the best means of preventing danger in child-birth* reflected the general tone in the medical literature in which childbirth was portrayed as a risky business. Stephen advised midwives to err on the side of caution in their practice, ensuring women were referred to men midwives at the first sign of trouble. She also suggested that she was willing to relinquish her role as midwife teacher to men, if they were to offer female pupils the same 'extensive instructions' they gave to males.[129]

While Stephen insisted that her book was based upon her own practice, she conceded that ideas from the medical literature had been included. She acknowledged that the format of her pocket-sized manual was inspired by Thomas Denman. She felt the need to defend its brevity, suggesting it was written with midwives and mothers in mind.[130] She claimed to have read widely, and undertaken a course of instruction from a man midwife. Like men midwives, she described women as 'patients' and her own teaching methods employed medical techniques such as the use of 'machines' (practice models) and clinical demonstrations. She informed her pupils of the anatomy of the pelvis and fetal skull and the various diameters and measurements described in the medical texts.[131] Samuel Merriman went so far as to suggest that Stephen's text was actually written by a man;

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[128] Stephen 1795, p. 18.
[129] Stephen suggested that midwives had access to medical books, which was fortunate, as some men midwives appeared to wish to withhold information from them: Stephen 1795, p. 6.
[130] Stephen 1795, p. i.
[131] Martha Mears also wrote a general treatise, *The Pupil of Nature*, at around the same time, which exuded a sense of subordination to male professionals; Mears 1797. Herrle-Fanning suggests that Mears' treatise was a failed opportunity to carve out a professional identity for midwives, to counter the predominant male model of midwifery practice; Herrle-Fanning 2000.

Philip Thicknesse. In fact, although he may have assisted Stephen with preparation of the manuscript, Thicknesse died before the text was published.

Clinical decision-making is part of the intrinsic nature of midwifery. Stephen was against early intervention and believed women could labour for up to 'three days and nights'[132] with her first child, whereas most men midwives began to stipulate a maximum of twenty-four hours [133]

As with the other midwife-authors there is an underlying sense of loathing as Stephen describes the use of destructive operations, having seen two cases in which women died; one after the over-large fetal head was decapitated and the other, an hour after delivery.[134] She included details of operative procedures but cautioned midwives not to attempt these operations themselves.[135]

7.14 Conclusion

During the 154 years from when Sharp first wrote *The Midwives Book* to when Stephen published her treatise, men midwives gained increasing authority in the field of midwifery practice. Regardless, traditional midwives carried most of the workload, and as far as the midwife-authors were concerned, contracted pelves were not a particularly common problem in childbirth. Moreover, they claimed that forceps were being used indiscriminately by men midwives, who generally overstated the need for medical intervention.

As experts in the art of traditional practice, the midwives were able to distinguish realistic and practical male knowledge from that which they felt was merely academic and theoretical. They were however concerned that less experienced colleagues were inclined to call in medical aid too soon, fuelling medicalisation, when this could have been avoided

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[132] Stephen 1795, p. 66
[133] Denman 1786, p. 2.
[134] Stephen 1795, p. 73.
[135]Dutch and Scandinavian midwives used instruments in the nineteenth century, and no doubt midwives in rural areas of England would have tried to assist women in life or death situations by whatever means they could, as described by Gough in 1700 (Gough 1836). The Irish midwife Mary Donelly was renowned for successfully performing a caesarean operation. Any such accomplishments in England would also have been difficult to reconcile with the cultural circumscription of male and female roles in midwifery practice. For further examples of how midwives and medical men found it difficult to learn from one another, see Tatlock 1992.

if they had had a better insight into the causes of difficulties and a wider repertoire of the respective appropriate management strategies.

7.14.1 The nature of midwifery knowledge

Operating within a male-dominated society, midwives faced insurmountable handicaps in communicating their own worth to a relatively intolerant male-dominated society. The nature of traditional practice militated against its successful translation into a medico-technical format. Midwives concerned themselves less with theoretical knowledge, although they began to realise its power and the value of using anatomical theory. They were also aware that some medical men preferred to keep midwives in the dark so that they could malign them to their own advantage.

The difficulty in fully articulating normal midwifery practice in print was partly due to the nature of midwifery, which was grounded in embodied knowledge. Midwives were less educated and articulate, and learned from apprenticeships. Their discipline was not centred on discursive phenomena.[136] In contrast, medical men relied heavily on book-learning.

The personal accounts or stories the midwife authors used were based upon their own observations and actions. While men used some case studies, they more frequently converted this into conceptual knowledge, which was less personalised and more generalisable. Unfortunately, 'male, visual, discursive knowledge was [and continues to be] given higher status than female, felt, and embodied knowledge',[137] devaluing applied traditional midwifery practice.

7.14.2 Gender issues

When traditional midwives began to use medical terminology they ran the risk of loosing their distinctive traditional identity; nevertheless, a compromise was necessary. The midwife authors all read medical treatises and displayed a level of connected knowing.

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[136] This suggestion has emerged from the work of Susan Pitt; Pitt 1997.
[137] Pitt 1997, p. 227.

They tried to understand the medical discourses, whilst expressing certain ideas of their own.[138] Writing towards the end of the eighteenth century, Margaret Stephen adopted a medical approach, including chapters on the maternal pelvis and the diameters of the fetal skull, and described the use of instruments used by men midwives.[139]

Despite their efforts, midwives lacked the sort of strong professional network and educational support experienced by men midwives and remained a much more disparate group. They lost a degree of influence over practice as the discerning public began to consider medical knowledge more powerful and doctors as able to offer women a type of care that midwives could not, and were forbidden to give.

7.14.3 Authoritative knowledge

The reasons why some practices became authoritative and others faded into obscurity remains complex and is a multifaceted conundrum. On the whole, medical knowledge was perceived as knowledge that counted and became embodied in a medical epistemology which was presented as being totally objective.

Some comparisons can be made between the situation in the eighteenth century, when midwives began to be concerned about the rate at which forceps operations began to increase and the harm it was causing to women, and the present situation of escalating caesarean section rates. While the influences upon such trends is complex, common cultural factors can be identified: disempowered women alienated from their bodies, less confident midwives perceiving the medical profession as the mediators of the birthing experience, and growing economic prosperity, all played and continue to play a part in them.

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[138] This gives the impression to readers that contemporary medical authorities provided more powerful ways of knowing, although medical knowledge was not unquestioningly accepted, and in many ways conveyed the same views as traditional midwives, configured in a *scientific* format.

[139] As midwives learned practical midwifery during apprenticeships, the authors probably considered that documenting everyday practice was un-necessary and might provide readers with too much insight into their *modus operandi*.

8 Widening of the Pelvis by Surgical Division of the Pubic Bones to Assist With Delivery of the Fetus

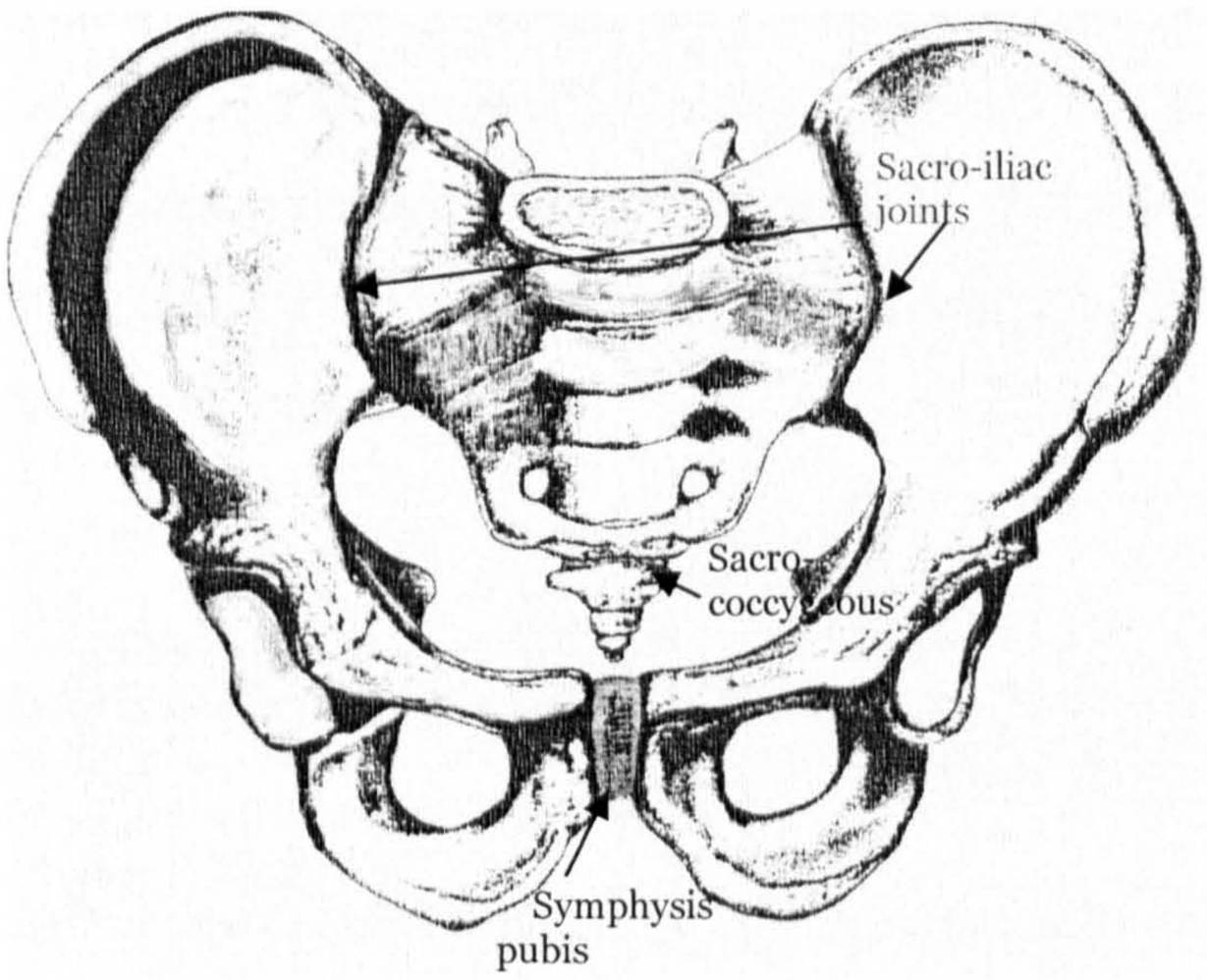
8.1 Introduction

The management of fatally obstructed labour became a central feature of the eighteenth-century medical literature. Men midwives (often with a background in surgery) cornered this end of the midwifery market and created a niche for themselves, devising operative techniques and instruments for the management of difficult birth. Use of these required technical and anatomical knowledge, skilled manual dexterity, practical experience and a good sense of timing to obtain optimal effect. Whether their use was always necessary is questionable, and in the hands of the inexperienced, these inventions were potentially lethal.

The symphysiotomy operation was devised in France where it was introduced by Jean Louis Sigault accompanied by Alphonse Le Roy in 1777. Although a range of approaches to obstructed labour were developed, symphysiotomy is singled out for discussion in this chapter because of its particular relevance to this thesis, as the operation involves the surgical division of the pubic bones of the pelvis in the region of the symphysis pubis (see Figure 8.1).

Figure 8.1 Female Pelvis – Demonstrating Pelvic Joints

Adapted by the author.



Despite a vast literature on symphysiotomy and its derivative operations[1] extending from the 1760s up until the present time, it seems to have been given relatively little recent attention by medical historians.

As previously discussed, in severe cases of obstructed labour caused by pelvic deformity and contraction the fetus would be unable to enter the pelvic cavity from above. Consequently, it was impossible for an operator to access the fetus internally, and so manual attempts at removal or to apply forceps were out of the question.

In France in the 1790s, apart from performing a caesarean operation, which caused the loss of two out of three mothers, there were very limited ways of dealing with severe contraction.[2] In England, methods such as early induction of labour and craniotomy aimed to preserve the mother's life. These options were not acceptable in Roman Catholic France because of the possibility of actually killing a living fetus. There was also a concern about the future integrity of the mother's reproductive system.[3]

Symphysiotomy held promise as a less invasive alternative to the caesarean in cases of contracted pelvis or cephalo-pelvic disproportion (CPD). This involved the division of the pubic bones in the centrally-situated region of the symphysis pubis in an attempt to widen the pelvis and allow vaginal birth to take place. Sigault first proposed the operation in 1768, when it was rejected by the French Royal Academy of Surgery. The first operation was performed in France in 1777 where it initially received a rapturous reception from the Faculty of Medicine.

Its pioneers, the surgeons and accoucheurs Jean Rene Sigault (b.1749) and Alphonse Le Roy (1742-1816) were awarded medals for their work, although shortly afterwards, the operation became the subject of much debate and controversy. Once the initial curiosity of the English men midwives had been satisfied, many concluded that it was a barbarous operation of limited use. Regardless, symphysiotomy remained on the margins of mainstream obstetrics, undergoing limited revival towards the end of the nineteenth century, when a similar operation, pubiotomy,[5] was further explored.

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[1] Symphysiotomy was given several different names in the English medical literature, and similar operations were also devised which also involved division of the pubic bones; see Aitken 1785, 1786, Section 8.7, 'Pelvitomy Nova'.
[2] Brockliss and Jones 1997, pp. 560-2.
[3] Loudon 1992, p. 133.
[5] See Kerr and Chassar Moir 1949, pp.583-7 for details of the pubiotomy operation.

Although a wide range of papers were published on these operations, from various parts of the globe, either advocating or denigrating their use, symphysiotomy and pubiotomy were eventually relegated to the history books in the west. However a niche was found for symphysiotomy in the twentieth century in developing countries, where caesarean operations were not always an option.

8.1.1 Literature review

The British men midwives followed reports of this operation in France with interest. Opinions of eighteenth-century English men midwives on this operation were documented in contemporary English midwifery treatises. During the nineteenth and twentieth centuries, sources available on symphysiotomy and similar operations became extensive, necessitating a selective review of the literature.[6] The operation was reported both by Sigault and by Alphonse Le Roy; the latter version was translated into English in 1778. This chapter relies upon the English translation of the treatise of Le Roy, who witnessed the operation and provided follow-up care of the patient.[7]

8.2 Development of surgical symphysiotomy

From antiquity, it was commonly assumed that separation of the pubic bones was a natural phenomenon which occurred at birth to allow fetal egress.

As previously discussed, since the mid-sixteenth century, when the Italian anatomists challenged the theory of separation of the pubic bones, this phenomenon became more widely accepted as a rare event, occurring occasionally during pregnancy, labour or the immediate post natal period. It was not part of the normal process of birth.[8] However, the concept of separation to allow fetal egress may have inspired the development of surgical symphysiotomy.

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[6] A brief examination of the Index Catalogue of the Library of the Surgeon General's Office (1879 onwards) and *Index Medicus* illustrate the vast literature on symphysiotomy and related operations.

[7] Le Roy 1778.

[8] The possibility of spontaneous pelvic joint separation during normal labour was refuted by Jean Louis Baudelocque (1746-1810) who suggested the phenomenon was pathological in nature. In 1781 he concluded that separation of the pelvic bones was rarely seen at dissection and not associated with laborious labour or a distorted pelvis any more than with a normal-shaped pelvis and normal-sized fetus, although it sometimes occurred after instrumental delivery or a fall. He also noted that the composition of the ligamentous tissue of the symphysis predisposed to pubic bone separation. Baudelocque 1790

A number of men midwives described ways of widening the pelvis. The traditional (ancient) remedies included baths, lotions, and the application of fat or oils to the pelvic bones, to relax them. Ideas about symphysiotomy were mooted in France as early as 1319, when Jacques D'Ambroise attempted the first symphysiotomy on the body of a woman executed for stifling her child,[9] and later submitted again by another Frenchman, Severin Pineau.[10]

The English man midwife, Thomas Denman reported the use of distending instruments to widen the pelvis by achieving or increasing pubic bone separation.[11] These consisted of bags of air or water used to apply internal pressure to the pelvic bones. Thomas Radford suggested their use was feasible in women suffering from mollities ossium who had soft pelvic bones, susceptible to movement by pressure.[12] In the late eighteenth century, pelvic bone separation continued to be explored in a number of experimental studies.

8.2.1 Animal and human experimentation

Jean Rene Sigault (b.1740) had been interested in the possibility of symphysiotomy as a student. In 1768, he attempted to convince the Paris Academy of Surgery of the benefits of surgical separation of the pubic bones in cases of obstructed labour.[13] His work was rejected by the Academy, leading him to approach the Paris Faculty of Medicine. In the interim period, others were also carrying out experimental work in this area. Between 1769 -1770 Peter Camper (1722-1789) Professor of Anatomy, Medicine, and Surgery at Amsterdam and Groningen, having been denied criminal corpses on which to experiment, successfully carried out the operation on a pig.[14]

The Paris surgeon, Alphonse Le Roy experimented on corpses and claimed to have achieved a greater degree of pubic bone separation than Sigault. He noted that pelvic separation on male corpses was limited when compared to females, and the greatest amounts of separation were gained in women who had died in or around the time of childbirth. He noted that the operation was easier on pregnant corpses, probably because the cellular membranes, muscles,

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[9] Le Roy 1778, p. 11.
[10] Le Roy 1778, p. 15.
[11] Denman 1788, p. 14.
[12] Radford 1880, p. 61.
[13] Gelfand 1980, p. 153. For a secondary account of Sigault's work on Symphysiotomy, see Churchill 1872, pp. 416-417. For brief profiles of Sigault and his rival Baudelocque, see Baskett 1996, pp. 17, 213.
[14] Le Roy 1778, pp. 16-17.

bones and joints were more relaxed in pregnancy.[15] Also, at this time, the pubic region was tender and the joints of the pubes softened and swelled, distending and separating the periosteum of the bones. He suggested that this softening effect that pregnancy had on the body tissues also underpinned the country practice of impregnating mature cows to make their meat tender.[16]

Inspired by Severin Pineau and Jacques D'Ambroise, Le Roy suspected that lifting the thighs of women at symphysiotomy might increase pubic bone separation.[17] However, the articulations on cadavers were more rigid than normal. Le Roy concluded that the experiment might best be carried out on a warm dead body.

8.2.2 In the interests of mankind ...

Le Roy took advantage of a rare opportunity when a midwife called him to a case in which a mother had just died. He gained permission from the relatives to perform an 'operation ... which was of interest to mankind'.[18] When the family left the room, Le Roy proceeded to perform the separation and moved the legs to obtain a pubic space, the breadth of 4 knuckles (two inches and a half) and then reduced the space again, resulting in some ligament damage and minimal bladder injury. Sigault and Le Roy arranged to carry out the next experiment together on a living woman.

8.2.3 The first successful symphysiotomy

The first operation was performed on a Madame Suchot; according to Le Roy, Madame Suchot was 38 years old and 3' 8" tall around the time of the operation.[19] She had a history of four previous stillbirths from CPD. Her first infant was delivered vaginally by Sigault and an assistant, with much 'moulding' to its head (over-riding of the skull bones). The next three of Madame

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[15] Le Roy 1778, pp. 18-24.
[16] Le Roy 1778, p. 20.
[17] Le Roy 1778, pp. 11-15, 24.
[18] Le Roy 1778, p. 25.
[19] Madame Suchot appeared to have suffered from childhood rickets, leading to rachitic dwarfism and a contracted pelvis.

Suchot's issue were delivered by Sigault using the crochet. It was agreed that she was an ideal candidate for the new operation.[20]

8.2.4 Postnatal complications

Madame Suchot's recovery was monitored daily by M. Le Roy, who invited other surgeons and physicians to her bedside to examine her. He reported that she was initially in great pain, especially in the region of her left hip. She developed several fevers, had a heavy lochia (vaginal discharge after birth), and a discharge from her symphysiotomy wound. She intermittently passed little urine, followed by periods of incontinence.

During her recovery, Madame Suchot had been put on a strict diet by Le Roy, but, feeling wretched and starved, she had deviated from it. Le Roy claimed this was the cause of her post-natal complications. Jean Louis Baudelocque was amongst the medical men invited to see Madame Suchot at her bedside. He saw her on her thirteenth post-operative day and noted that the infant seemed small and immature; Le Roy attributed its size to feeding problems.

On the forty-sixth post-operative day, wearing a binder around her hips, Madame Suchot managed to stand and weight-bear. Later, she went to the College of Physicians to be examined and questioned about her recovery. She is reported to have told them she could retain her urine unless there was a great quantity to come away, and it never came from her involuntarily, unless she walked or stood, suggesting her incontinence occurred frequently. Le Roy argued that she was prone to occasional urinary incontinence before the operation, while acknowledging that her

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[20] Le Roy described the procedure carried out on Madame Suchot in precise detail. She was positioned in a dorsal position (on her back) with her thighs slightly opened. After shaving the pubic area, a catheter (urinary drainage tube) was introduced into the bladder. The inferior part of the integument (tissue surrounding pubic bones) was drawn down and the first incision begun 2-3 lines above the pubic bones and ending in the middle of the symphyses. The cartilage was then exposed with only a small amount of bleeding. He advised this was cut to one side of the mid-line in order to preserve the suspensory ligament of the bladder, recommending separation was made on the left side, as the neck of the bladder was more inclined to the right. Inadvertent division of the suspensory ligament of the bladder would have risked postnatal urinary incontinence. The cartilage was to be cut whilst directing the catheter out of the way. Afterwards, the catheter was left in and a container attached to collect the urine. The wound was dressed with dry lint 'moistened with brandy' and egg white.
Postnatal healing was explored on animals by Parisian surgeons. They suspected callus formation (bone healing) helped to widen the pelvis by producing new bone growth, useful in future pregnancies. Sigault and Le Roy realised that their patient would need to be immobilised in bed afterwards, with the pubes supported and given sufficient time for the bones to knit together before weight bearing again.

urinary sphincter had been injured in the operation. A fistula[21] may of course have developed following a previous traumatic birth. Overall the panel judged the operation a success, and Sigault and Le Roy were both awarded medals.

The procedure was subsequently practised by others in Italy and other parts of Europe with varying success; some proposed modified techniques, and several fine saws or cutting wires were invented for the division of the pubic bones.[22]

8.3 Baudelocque's concerns about the benefits of the operation

Jean Louis Baudelocque and others seemed to view the achievements of Sigault and Le Roy with suspicion. Baudelocque had written a thesis on the drawbacks of symphysiotomy eleven months prior to Madame Suchot's operation. He appeared to doubt Sigault and Le Roy's success, and described his own parallel experiments to assess the achievable limits of pelvic widening and possible damage to neighbouring physical structures.

Sigault and Le Roy were acquainted with Baudelocque, and there was clearly tension between them and others concerning the development and utility of this operation. Le Roy began his account of the first operation with a protest at the negative reactions of peers to their accomplishment. Le Roy, an established surgeon, believed that these negative criticisms were based upon professional, envy and desire for revenge.[23]

Baudelocque's three-volume treatise *A System of Midwifery,* written in 1781,[24] discussed spontaneous symphysiotomy in volumes one and three. Volume three contained a 116-page section entitled 'Of the section of the pubes'. He reported an initial surge of interest in the potential of the new operation, claiming that it was performed '...more times in the space of 4-5 years than the caesarean ... in the course of twenty or thirty or longer'.[25] However, Baudelocque chose to reserve judgement on its success, inferring that the Faculty of Medicine was hasty in promoting the new procedure after only one operation had been performed. In the period prior to

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[21] In prolonged labour, the fetal head may cause compression of the soft tissues against the bones of the pelvis, leading to a lack of blood flow in this area and necrosis (tissue death). A hole then forms between the maternal vagina and bladder and/or vagina and rectum, depending on the region being compressed, to cause urinary incontinence, faecal incontinence or both.

[22] See Speert 1973, p. 285, for illustrations of pubiotomy instruments.

[23] Le Roy 1778, p. xi-xvi. Le Roy also harboured a deep distrust of women and midwives; Gelbart 1998, p. 205.

[24] Baudelocque 1790.

[25] Baudelocque 1790 volume.3, p. 241.

the unification of the schools of surgery and medicine, Toby Gelfand suggests that the Academy of Surgery and Paris Faculty of Medicine were rivals and that the Faculty may have had its own motives for celebrating this success so early and so widely.[26] Meanwhile, Baudelocque protested that the operation was:

> ... the fruit of an opinion too hastily embraced by persons of science, but too credulous concerning the pretended advantages of spontaneous separation of the ossa pubis. [27]

8.3.1 The amount of space achieved was limited and unpredictable ...

As a result of his morbid experiments, Baudelocque calculated that to produce any significant increase in the anterior-posterior (A-P) diameter of the pelvis, a proportionately much larger separation of the symphyses pubis was required?[28] Consequently a separation of 2.5 inches would only increase the A-P diameter of the superior straight (inlet) of the pelvis by 4-6 lines[29] to allow fetal egress. The amount of separation obtainable varied between cases, but in general pelvic expansion would be insufficient to enable a vaginal delivery in severe cases of CPD. Baudelocque argued that the procedure could not replace the caesarean or destructive procedures as previously anticipated.

Baudelocque appeared to question Le Roy's reported measurements of Madame Suchot's pelvis, which may have exaggerated its smallness. He inferred that Madame Suchot's fifth baby delivered by symphysiotomy was slightly premature and quite possibly smaller than her other four children.[30] Baudelocque had examined Madame Suchot's pelvis internally and externally many times over with his students, and claimed that it was not uniformly contracted:[31] towards the left side there was adequate room for her child to be born without a symphysiotomy.[32]

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[26] Gelfand 1980, 153.
[27] Baudelocque 1790, volume 1, p. 43.
[28] The ratio was 2 lines of anterior-posterior (front to back) expansion for every 6 lines of separation in the transverse diameter (width).
[29] According to Le Roy (p. 12), twelve lines equalled one English inch and twelve inches a foot, although a French foot equated with 13 English inches.
[30] Baudelocque (1790, volume 3) inferred that on some occasions the operation may not have been necessary in the first place.
[31] This suggests that Madame Suchot was a rare and interesting case, and that accoucheurs and students regularly examined her, perhaps for a fee.
[32] Baudelocque 1790 volume 3, pp. 276-8.

Baudelocque was later concerned about the inappropriate use of the procedure by impulsive surgeons. He described one of Sigault's patients,who refused to have a symphysiotomy and went on to manage a normal delivery. A local midwife, Madame Bellami, believed the mother's pelvis was not particularly small and the baby was relatively large, which seems to raise questions about the extent of Sigault's achievements.

Other major misgivings were associated with the potential morbidity and mortality of the procedure. Although maternal mortality was generally high from operative procedures and secondary infection, Baudelocque reveals that out of a total of five of Sigault's cases, one mother and four infants died and of Le Roy's five cases, one mother and no infants died.

8.3.2 Baudelocque's experiments

Baudelocque had access to pauper patients at the lying-in hospital where his experimental studies were carried out. He performed a symphysiotomy experiment on a mother who died following a caesarean operation. He then tried to force the dead baby through the pelvis, resulting in much maternal injury. He found that the sacro-iliac symphyses (see Figure 8.1) could separate and tear to different degrees and not always equally so. When the separation was sudden or too excessive it resulted in '... severe pains, ... impossibility of walking, ... inflammation, fever, abscesses, caries, and lastly death itself'.[33] Others suffered with chronic pain for years afterwards.

8.3.3 Better not to get pregnant?

Baudelocque reflected on the limited amount of help available to women with severely deformed pelves, whom he described as victims of the 'sad resources of our art'.[34] He proposed that pre-marital pelvic assessment might help avoid life-threatening pregnancies:

> What woman would have purchased the title of mother so dear, if she had been assured that in becoming pregnant she could have no resource but the caesarean operation, or in the section of the pubes? What woman would have consented to the

[33] Baudelocque 1790 volume 1, p. 44.
[34] Baudelocque 1790 volume 1, p. 86.

> sacrifice of her child, to save her from these operations? And who would have wished to taste the sweets of the hymen at that price? [35]

8.4 The British Response to Symphysiotomy

Paris was considered a European centre of medical excellence, assisted by its relatively liberal rules on human dissection.[36] It was also considered to have the best surgeons, and offered courses in surgery and midwifery. Many English men midwives travelled to Paris to undertake such courses, despite political and language differences (though these may have been alleviated by the use of Latin). English men midwives developed close links with their peers in France, and when the first symphysiotomy operation was celebrated in 1777, Dr John Leake,member of the Royal College of Physicians, London and man midwife to the Westminster New Lying-in Hospital contacted Le Roy, who had assisted at the operation, to obtain a personal copy of his report. Leake then promptly arranged for its translation into English and its publication in 1778.

Symphysiotomy was discussed amongst the English men midwives, and received a mixed reception. The curious included John and William Hunter, Thomas Denman and William Osborn, who attempted to find out more about the operation. William Hunter performed his own dissections of the symphysis pubis[37] and considered the use of the operation very carefully, concluding that Le Roy's report was based upon limited evidence. His views on the division of the ossa pubis were stated in his 1778 correspondence with an acquaintance, James Vaughan. (Vaughan had previously had sent him a dried pelvis severely affected by mollities ossium for his collection, and subsequently invited him to include some of his comments on the pelvis in his forthcoming publication.)[38]

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[35] Baudelocque 1790 volume 1, p. 86-7. Baudelocque was also more conservative about the use of the caesarean operation. He tended to agree with the English men midwives who were not prepared to sacrifice the mother's life for the child's. For further reading on the moral dilemmas and religious influences upon medical practice, see Loudon 1992, pp. 133-135.

[36] By the mid-eighteenth century in England, the by-laws of the Barber Surgeons Company had lapsed, and dissections were allowed to take place, although obtaining corpses remained a problem; Richardson 1988, Gelfand 1972.

[37] Hunter 1764.

[38] Hunter 1778.

8.4.1 Limitations of the operation

Le Roy acknowledged that the operation was not effective in cases of severe pelvic contraction, although he did not believe that such pelves (i.e. with apertures of less than two inches) existed. This intrigued Hunter, who had four such specimens in his collection. Hunter concluded on balance that to perform a symphysiotomy on a healthy woman simply to save the child was not justified. Furthermore, the standard English practice of lessening the head or craniotomy, if practised with due care, was safer. Hunter believed that symphysiotomy was far too drastic a procedure to which to subject a woman:

> [having] ... the strongest joints of their body cut and torn asunder, to secure a chance only, of a living child.[39]

To the dismay of William Osborn, Hunter conceded that when the pelvis was too narrow to admit access to the child by the crochet (metal hook for destructive operations), symphysiotomy, in combination with craniotomy could be better than the caesarean operation and might save the mother.[40] He feared, however, that this combined operation was of limited utility, and in the hands of junior or over zealous practitioners might become abused, to the great terror of mankind.[41]

8.4.2 The procedure of 'lessening the head'

William Osborn was a firm advocate of the procedure of lessening the head (craniotomy). In 1783, Osborn wrote *An Essay on Laborious Parturition in which the Division of the Symphysis Pubis is Particularly Considered.*[42] In this 271- page essay, he reviewed 25 symphysiotomy cases from France and other nations, concluding that the operation was in no circumstances 'warrantable'.[43] He also suggested that Dr Leake, while claiming to investigate the use of this operation with a spirit of scientific enquiry, appeared to be defending its utility against a significant number of general criticisms.

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[39]Hunter 1778, p. 95.
[40]Hunter 1778, p. 96.
[41]Hunter 1778, pp. 97-8.
[42] Osborn 1783.
[43] Osborn 1783, p. 142.

Osborn believed that the space gained by division of the pubes was invariably insufficient to allow the child to pass through the pelvis alive, and that in these cases a caesarean was be the only realistic option. Based upon case reports and experimental investigations, he believed that the trauma to the surrounding tissues and joints, even when a small expansion was obtained, would be considerable. He also argued that symphysiotomy would not provide sufficient space for the use of the crochet in severely contracted pelves, objecting strongly to William Hunter's proposal to use the combined operation of symphysiotomy and craniotomy.[44]

8.5 The first symphysiotomy in England

Symphysiotomy was first successfully carried out in England in 1782, by John Welchman, a surgeon from Kington, Warwickshire, who was assisted by his son. The patient was called Mary Ordway, and he had attended her six years previously when she had given birth normally. At the age of 39, she called for Welchman's assistance again. When he arrived he was stunned by her appearance; she had previously been around 5 feet 6 inches tall, but was now less than 4 feet in height, 'with her knees and chin almost meeting'.[45] She had walked on two sticks for several years, but was now mostly confined to bed or to her elbow chair.[46] He was summoned on Monday 2nd September, and on examination he could only just get his forefinger between the ischial tuberosities and reach round 'the jetting in of the os sacrum'.[47] The fetus was in a breech position high above the pelvis.

The mother had displayed the classical signs of maternal distress in labour for several days, including a racing pulse, vomiting, lack of sleep, pain and fever. On Tuesday 3rd September she had some 'flooding' (vaginal haemorrhaging) followed by strong contractions, but there was no further progress in labour, and Welchman and his son were concerned that Mary Ordway would not live without an operation. They tried without successl to obtain a second opinion before carrying out the operation, which had not been performed before in England on a live subject. As the flooding continued, with her consent, the operation went ahead. Welchman followed Le Roy's

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[44] Osborn 1783, pp. 135-43.
[45] Welchman 1790, p. 47.
[46] Mary Ordway appeared to have suffered from mollities ossium.
[47] Welchman 1790, p .47.

procedure and delivered a macerated stillborn infant. Although Welchman believed the operation had been a technical success, Mary Ordway died afterwards of sepsis.

Welchman's son obtained her pelvis for measuring and drying, and was able to confirm that it was contracted. As his son prepared the pelvis, Welchman noted how very soft and pliable it was. [48] He concluded that the pelvis might not have expanded quite so much if the bones had not been so soft, suggesting that this feature contributed to the success of the symphysiotomy. Finally he urged novice practitioners not to be too hasty in using it, advocating patience and caution.

8.6 Was symphysiotomy as effective as initially hoped?

Le Roy (1778) was aware of the reservations expressed by others about the procedure. He chose to believe that this was as a result of him exposing the 'false practices' of others, who subsequently retaliated by criticising his work.[49] However, some concerns were from commentators who were not acquainted with him.

In 1799, John Hull of Manchester collected details of 44 cases of section of the symphysis pubis from France, Britain and Europe, carried out between 1777 and 1793.[50] Much of the data were obtained by Baudelocque, which reinforces Anglo-French midwifery connections. In the case collection, thirty women survived and fourteen died. In Hull's tables, fifteen babies were born live, twenty-two died around the time of birth and seven were unaccounted for. Hull noted discrepancies in the data, arising from differences between pelvic measurements recorded around the time of the operation by the operators and those carried out later by others, namely Baudelocque. In several cases, the A-P diameters of the inlet of the pelvis appeared to be under-measured, appearing to be smaller than they actually were. Hull conceded that measurements could not easily be obtained on live subjects, and made allowances for some differences. However, in case 12, the A-P dimensions of the pelvis were reported as being one and a half inches or one and two thirds of an inch from the sacrum to the symphysis pubis, and yet the patient was reported to have laboured 'naturally' on two subsequent occasions. Hull concluded

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[48] Welchman 1790, p. 4.
[49] Le Roy 1778, p. xiv.
[50] Hull 1799.

that the reporter was either 'egregiously mistaken or guilty of a wilful misrepresentation'.[51] From the list of 14 mothers that did not survive the operation, Hull doubted whether the operation was successful in mothers whose pelves measured less than two and a half inches from pubis to sacrum.

In the early days after a small number of operations had been performed, there was significant maternal and infant mortality and morbidity. Le Roy argued in 1778 that symphysiotomy was less likely to result in loss of the mother than caesarean. However, Baudelocque and others questioned the efficacy of the procedure, as the degree of expansion in the width of the pelvis to obtain sufficient increase in the anterior-posterior (A-P) diameter of the pelvis was not always obtainable. Its utility in cases of severe cephalo-pelvic disproportion (CPD), when large degrees of separation were necessary, was limited, and so caesarean or destructive operations could not be entirely replaced by symphysiotomy as originally hoped. Le Roy acknowledged that maternal injury was also a possibility, especially ligament tearing when separation of the thighs occurred too rapidly. As for injury to the bladder and urethra, he believed this was surmountable by careful operative technique.

Nevertheless, the authenticity of Madame Suchot's case was questioned by Baudelocque who queried whether a normal birth might have been possible, as the baby appeared to be relatively small. The procedure was subsequently experimented with in other parts of Europe, particularly Italy and Spain, where it met with varied degrees of success and criticism.

Notwithstanding its acceptance in some parts of Europe, English men midwives tended to believe that the procedure was 'over-applauded' in France and that the achievements of Sigault and Le Roy had been overstated. Thomas Denman wrote:

> ...there could scarcely have been greater exultation had he [Sigault] invented a method by which the whole human race should in future have been freed from the pains and dangers of parturition.[52]

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[51] Hull 1799, table II attached at back of treatise (no page number).
[52] Denman 1788, volume 2, p. 222.

8.7 Symphysiotomy in Ireland and Scotland

In Ireland, William Dease[53] advised against the procedure on similar grounds to Baudelocque. Similarly, in 1785, the Scottish man midwife, surgeon and anatomist, John Aitken, listed ten common objections to the operation.[54] Aitken has been associated by historiographers with the invention of the pubiotomy and pelviotomy operations.[55] After close examination of the primary sources this author argues that this link has been inaccurately interpreted and replicated in the midwifery historiography.

In the three editions of Aitken's treatise *Principles of Midwifery or Puerperal Medicine* (published in 1784, 1785, and 1786), the words 'pubiotomy'* and 'pelviotomy' are notably absent.[56] Instead, Aitken used the term 'pelvitomy' which he annotated in the 1785 edition as being synonymous with 'symphysiotomy', 'synchondrotomia', 'section of the symphysis pubis' and 'the Sigaultian operation'.[57] He outlined the procedure for pelvitomy or symphysiotomy in all three editions. In the 1784 edition he added a footnote in which he described a knife he had invented which could be used to divide ossified cartilage safely.[58] In the 1785 edition, he appended a ten-point list of objections to pelvitomy or symphysiotomy. After objection two, which was related to the potential for injury to the neck of the bladder, he added a footnote in which he suggested that this objection could be removed by the use of his flexible knife, which '*cuts from within outwards*'.[59] Aitken was a surgeon and anatomist, who had devised a saw to divide bones in anatomical demonstrations.[60] It seems possible that Aitken took the opportunity to advertise his cutting invention, while remaining generally unenthusiastic about symphysiotomy. Other historiographers may have assumed from his mentioning of his invention in this context that he was in favour of the procedure.

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[53] Dease 1783, pp. 67-70.
[54] Aitken 1785, pp. 78-9.
[55] See, for example, Graham 1950, pp. 365-6.
[56] Aitken 1784, 1785, 1786.
[57] Aitken 1784, p. 41. p. 75.
[58]Aitken J. (1784), p.42.
[59]Aitken J (1785), pp.78-79.
[60] Skippen et al. 2004, p. 74.

8.8 'Pelvitomy nova'

Aitken proposed another operation which he called 'pelvitomy nova' as an alternative to embryotomy or hysterotomy (incision in the uterus like caesarean but performed before the fetus has fully matured). This involved cutting the pubic bones on each side of the ossa pubis, to create a moveable window of bone which would allow the fetus to pass through the pelvis and deliver vaginally[61]. He added that he was, 'employed in trying the effect of this operation on brutes' which suggested it was in its experimental stages.[62] Aitken also described the use of pelvitomy nova at post mortem to remove a fetus from the uterus. It has been suggested that Aitken's operation was attempted with fatal results by Galbaiti in 1832.[63]

Descriptions of pubiotomy which subsequently emerged in the nineteenth-century literature involved one cut through the pubic bone to one side of the symphysis pubis. It therefore appears that Aitken did not actually invent and name the pubiotomy operation, although he did propose pelvitomy nova.[64]

8.9 The revival of symphysiotomy in the late nineteenth century

The problem of narrow pelves caused by rickets and mollities ossium remained a feature of the obstetric literature until the 1950s. Most mainstream English obstetric textbooks from the mid-eighteenth century up until the mid-twentieth century provided chapters on deformed pelves and the use of forceps, and increasing space was taken up with discussion of the caesarean operation. Most gave only a passing mention to symphysiotomy.

During the late nineteenth and early twentieth centuries a steady stream of case reports on the use of symphysiotomy and pubiotomy were published in the medical press. These originated from a variety of countries in Europe, North and South America, Canada, Australia, South Africa,

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[61] Aitken J. (1785)p. 84.
[62] Ibid.,p. 84.
[63] Graham 1950, p. 366.
[64] Reports about the development of pubiotomy have long been contradictory; according to Munro Kerr, division of the pubis and ischium was called 'pelviotomy' and was associated with Aitken. Division of the pubis, 'pubiotomy', was developed by Champion and Stolz. However in the original work of Aitken, 'pelvitomy' was considered to be the same as symphysiotomy. Aitken proposed pelvitomy nova, which involved the cutting of the pubic bones twice to create a movable flap, which is why it is actually different to pubiotomy.
See Kerr and Chassar Moir 1949, pp. 583-5.

Russia, and India.[65] In America in 1819, Samuel Bard described symphysiotomy as 'cruel and of little benefit'. [66]

In England, the north west was one of the regions most affected by rickets and mollities ossium. Many of the early caesarean operations were carried out in the Manchester area, where Thomas Radford (1793-1881) practised. In the second edition of his work *Observations on the Caesarean Section, Craniotomy and on other Operations*, Thomas Radford gave the impression that symphysiotomy had generally been 'discountenanced'.[67] He advised that in severe cases of contracted pelvis, where the cavity of the pelvis was completely obliterated, a caesarean was the only realistic option to ensure the mother did not die undelivered. He referred to a *'rancorous controversy'* blazing in the north around the year 1798 between Dr John Hull (1761-1843), who was in favour of it, and a Mr Simmons, who was not.[68] Radford recounts how Mr Simmons (1762-1830) boldly proposed a combined operation of symphysiotomy and craniotomy in preference to caesarean, on grounds of safety. However, when Mr Simmons was asked to attend Elizabeth Thompson, who had a severely contracted pelvis, he turned down the opportunity to do a combined operation, and the woman was eventually transported on a cart to the Manchester Lying-in Hospital for a caesarean,[69] by which time she was in a very poor state.

In 1854, James Mathews Duncan of Edinburgh suggested that the operation had some merit, despite its bad press:

> British obstetric authors have loaded the operation itself [symphysiotomy] with calumnies which are quite unfounded and raised difficulties about it which are sufficient to deter a superficial inquirer from its consideration.[70]

He believed that, in comparison with other types of instrumental delivery, the operation was one of only 'slight danger'.[71] Regardless, Fleetwood Churchill, Fellow and ex-President of the King and Queen's College of Physicians in Ireland, advised strongly against symphysiotomy in his popular textbook of 1872, *On the Theory and Practice of Midwifery*.[72] He suggested the only

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[65] See for example *Index Medicus*: 1-21, 1879-1898; series 2, 1-18, 1903-1920; series 3, 1-6, 1921-1927.
[66] Bard 1819, p. 20.
[67]Radford 1865, p. 6.
[68] Radford 1865, p. 3.
[69] Radford 1865, p. 6.
[70] Duncan 1854, p. 67.
[71] Duncan 1854, pp. 60-9.
[72] Churchill 1872, pp. 416-24.

reason for discussing the procedure was out of 'duty to point out its inapplicability'.[73] He also referred to the predominantly negative comments of eighteenth-century English men midwives, the high mortality and morbidity associated with the procedure and its limitations as a substitute for the caesarean operation. Drawing on the advice of past authorities, he noted the serious harm caused to the mother when symphysiotomy was used in conjunction with craniotomy or the forceps. Many other texts emphasised the risks and limitations of symphysiotomy, echoing some of the negative beliefs of previous authors.[74]

In London in 1893, a Dr Arthur Lewers presented a 'living specimen' to a meeting of the Obstetrical Society of London on whom he had performed a symphysiotomy;[75] this suggests symphysiotomy, continued to be rare in England.

8.10 Symphysiotomy in nineteenth-century France

As the nineteenth century came to a close, there was a revival of symphysiotomy in France. Adolphe Pinard, professor at the Faculty of Medicine in Paris, performed sixty-nine symphysiotomies, resulting in seven maternal deaths and the loss of eight infants. He expressed his objection to comparisons being made between symphysiotomy and other ways of managing obstructed labour, such as early induction of labour, combined craniotomy and embryotomy operations and caesarean operations, on the grounds that they were often carried out in quite different circumstances and were therefore not comparable. He argued that symphysiotomy was better than induced labour because it gave women more opportunity to deliver normally, and could be held in reserve.[76]

In 1895, Pinard reported on the outcomes of 107 cases of contracted pelvis. Whilst 77 women delivered spontaneously, suggesting pelvic contraction was mild, 20 of the remaining 30 were delivered by symphysiotomy. There were three maternal and four perinatal deaths, apparently from causes unrelated to the operations. In August 1893, Professor Pinard, in consultation with the anatomist Louis Farabeuf, decided to carry out an ischio-pubiotomy on a woman with a very bad history of previous stillbirths. News of this was published in England in

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[73] Churchill 1872, p. 416.
[74] Playfair 1886, volume 2, pp. 242-3.
[75] Lewers 1893, p. 300-1.
[76] Anonymous 1896.

The Lancet. This was followed by a letter signed 'M.R.C.P', in which it was suggested that the pelves in Pinard's cases were only moderately contracted, undermining his claims.[77] By 1910 it was reported that Pinard had abandoned symphysiotomy in favour of the caesarean operation.[78]

8.11 Success in America and Canada

Another letter by Robert Harris of Philadelphia was forwarded to *The Lancet* in 1893, originally sent to an English acquaintance. This letter included references to ten clinical case studies and offered a positive evaluation of symphysiotomy in America and Canada.[79] It would appear that symphysiotomy continued to receive a mixed reception, and various versions of the operations and individual circumstances may have contributed to its variable success or failure.

Edward Ayers, an American professor of obstetrics, viewed symphysiotomy as a legitimate, albeit limited option when confronted with bony dystocia (obstructed labour) if faced with the alternative to caesarean of craniotomy on a live fetus or IPV.[80] His report in the *American Journal of Obstetrics* in 1897 described a previously reported series of five personal cases of symphysiotomy;[81] four had been successful and in the fifth case, the mother lost her life. The death occurred after she developed a fistula which led to sepsis and fatal pneumonia on the 33rd post natal day.

Ayers reported another three cases of failed forceps in which he managed to complete the deliveries by performing a symphysiotomy and re-applying the forceps. He also devised a symphysiotomy 'hammock bed', to encourage 'firm union' of the pelvic bones, which he sometimes used in conjunction with silver sutures to reduce the chances of bone disunion.[82]

His paper considered the appropriate use and timing of symphysiotomy and addressed the difficulty of timely intervention:

> Stepping out of our libraries, where we are prone to draw fine-lined distinctions based on pelvic mensuration and mortality statistics, and standing in the shoes of the practitioner we must affirm that the greatest number of cases of symphysiotomy

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[77] M.R.C.P. 1893.
[78] Blacker 1910, p. 454.
[79] Harris 1893.
[80] Ayers 1897, p. 5.
[81] Ayers 1897, p. 5.
[82] Ayers 1897, p. 7-9.

> or of those deserving it are such as are first seen when in labor. And to my mind the most difficult errors to avoid are; failure to operate when it should be done [and] performing the operation when the forceps might have delivered the child
>
> ... Where we have one case of sharply contracted pelvis that even a novice will recognize, we have twenty that are in the border-land between forceps and symphysiotomy, and I am afraid we can never lay down rules that will not leave the greater part of the equation to expert judgment in the given case [83]

By highlighting the subjectivity of clinical judgement, his comments reaffirmed that obstetrics, despite its scientific basis, was still to some extent an imprecise art. He maintained that symphysiotomy had a limited scope of use within the obstetrician's armamentarium and that the ultimate decision about choice of treatment should rest with parents, which was quite an enlightened opinion for its time when attitudes tended to be more authoritarian..

8.12 British opinions in the early twentieth century

In 1910, G F Blacker[84] presented a paper to the Harveian Society of London on 'The treatment of labour in contracted pelvis, with special reference to the justifiability of pubiotomy'. He presented an algorithm in which various degrees of pelvic contraction defined by the width of the A-P diameter of the pelvis were linked with appropriate treatments.

A. J. Wallace of Liverpool[85] considered the use of forceps and symphysiotomy or symphysiotomy and forceps. Apart from the mechanical difficulty of delivery, he drew attention to the fetus, at significant risk of severe head compression, either from the contracted pelvic bones, or the use of forceps in combination with symphysiotomy. He suggested that in some cases a delivery might be so difficult to achieve that the fetus would be left badly injured or dead.

In the Irish midwifery textbook *Rotunda Practical Midwifery,* published in 1908, Ernest Hastings Tweedy and G. T. Wrench compared symphysiotomy with pubiotomy.[86] They also

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[83] Ayers 1897, p. 2.
[84] Blacker 1910.
[85] A. J. Wallace, surgeon to the Hospital for Women and the Maternity Hospital Liverpool reported a significant number of deaths in Germany where hebosteotomy (an American term for pubiotomy) was designated unsuitable for use in private houses. He referred to 1,000 further cases, although the figures do not seem to add up; there were 33 maternal deaths in 510 cases up to 1909; Wallace 1913.
[86] Hastings Tweedy and Wrench 1908, pp. 319-26.

referred to the work of Gigli in Italy, who had performed over 300 pubiotomy operations; they believed that this procedure might be more effective than symphysiotomy.

In a report to the Edinburgh Obstetrical Society, John Halliday Croom believed operations for the enlargement of the pelvis were 'not uniformly safe for the children and were not unassociated with considerable risk to the mother'.[87] In a 1914 edition of the *British Journal of Nursing's* supplement, *The Midwife*, a report was published of a British Medical Association meeting in Aberdeen at which Professor Frank of Cologne spoke on symphysiotomy. He apparently opened his speech by stating that:

> ... 100 years ago people tried to pass a law to prohibit the operation of symphysiotomy as if it were an attempt to murder [88]

Frank had performed symphysiotomy 155 times, losing two women from medical conditions unrelated to the operation. He proposed that the older techniques had been more dangerous, justifying why even the best surgeons of the day sometimes lost women. He focused on modern refinements of the operation which had reduced the risk of complications. However, in 1917 the English textbook *Midwifery by Ten Teachers* still cautioned readers on the dangers of symphysiotomy and suggested that, according to published results, the maternal and fetal mortality for pubiotomy were 'considerably higher' than for caesarean.[89]

8.13 Declining interest in symphysiotomy and pubiotomy

As the twentieth century advanced, symphysiotomy and pubiotomy merited limited discussion in most English obstetric textbooks. Discussions appeared to continue to contradict one another, with a general tendency to disregard the use of these operations. Chassar Moir and Kerr were probably the staunchest advocates of symphysiotomy in England. Kerr had performed the procedure on nineteen occasions. However, in their obstetric text, *Operative Obstetrics,* they stated: 'We cannot stress too strongly the importance of recognizing the limitations of symphysiotomy,' suggesting that they thought inappropriate use could incur grave dangers.[90]

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[87] Anonymous 1911, p. 39.
[88] Anonymous 1914.
[89] Berkeley, Andrews and Fairburn (eds), p. 685.
[90] Kerr and Chassar Moir 1949, p. 587.

They also referred to an Irish report of 12 successful cases of symphysiotomy and pubiotomy.[91] One of the advantages of the operations proposed by the Irish authors was a lack of anxiety in future labours about rupture of a uterine scar as is the case following caesarean. By 1947, the American obstetricians Joseph De Lee and J. P. Greenhill,were claiming that symphysiotomy and hebosteotomy had been abandoned in their country, although they described the operations in some detail.[92]

Descriptions of the procedures for symphysiotomy and pubiotomy were still discussed in texts, although authors suggested these operations were mentioned out of 'historical interest'.[93]

8.13.1 The practice of symphysiotomy in Ireland 1950s-1980s

In 1954 D. T. O'Driscoll wrote a letter of complaint to *The Lancet* in which he argued that symphysiotomy had fallen into 'disrepute' as the caesarean became easier and safer, although it still had a place in obstetrics. He referred to its revival in Eire by Spain and Barry at the National Maternity Hospital, Dublin in the early 1950s, and wrote to complain about the way the operation had been disparaged in obstetric textbooks.[94]

Fifty years on, Irish women who underwent symphysiotomies between the 1950s and 1980s are now demanding a public enquiry into the practice, which left some of them with severe side-effects. The 'SOS' (Survivors Of Symphysiotomy) group wished to know why the procedure was carried out so often in Ireland compared to other European countries, and alleged that obstetricians performed the operation in preference to a caesarean in the belief that 'women subjected to repeated caesareans might be tempted to use contraception'. The survivors' group argued that the operation was sometimes done without consent and with no explanation. They reported that the operation left a *'lot of women in wheelchairs and housebound'*, with a range of debilitating physical and psychological problems.[95] Early in 2005 the Irish Health Service Executive acknowledged on their web site the needs of sufferers, and has appointed liaison

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[91] Kerr and Chassar Moir 1949, p. 588. They also referred to osteoplastic experiments to enlarge the pelvis, pp. 587-588.
[92] De Lee and Greenhill 1947, pp. 842-8.
[93] Strachan 1947, pp. 678.
[94] O' Driscoll 1954.
[95] Condon 2003

personnel to each Health Board and to the Voluntary Hospitals to deal with support and compensation.[96]

8.14 Symphysiotomy and pubiotomy, outmoded by the caesarean operation in the west

As caesarean rates increased in the late twentieth century in the modern industrial west, symphysiotomy and pubiotomy faded into obscurity. Advances in medicine and public health in general, along with developments in obstetric techniques, contributed to reductions in maternal mortality in the west. Meanwhile in the developing world, where recourse to caesarean was more restricted, the symphysiotomy operation became popular.

8.15 A legacy from the past for the developing world?

In 2002, Björklund published an evaluative study of symphysiotomy which reviewed 5000 cases.[97] These were published from 1900 to 1999, from 28 countries and four continents.[98] The majority of twentieth-century studies were completed in Africa.[99] The analysis was divided into two sections, covering the first and second halves of the twentieth century. The figures suggested downward trends in mortality and morbidity as the century drew to a close, although there may have been confounding factors related to this, such as more careful selection of candidates for surgery and improved techniques.

In the first half of the century there were 40 maternal deaths in a combined analysis of 2057 operations. Twenty died from sepsis, and it is claimed that only two deaths were directly attributable to symphysiotomy. The acceptability of the procedure and its relative ease of use and low cost enhanced its attractiveness in developing countries.

In some Roman Catholic countries, caesarean was believed to limit fecundity, which increased the acceptability of symphysiotomy.[100] In Africa, it also appears a vaginal birth was

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[96] Condon 2003

[97] The threshold for inclusion in the review was 25 cases as a minimum.

[98] Björklund 2002.

[99] For example Seedat and Crichton 1962; van Roosmalen 1991; Maharaj and Moodley 2002.

[100] Caesarean rates in certain parts of South America are now amongst the highest in the world: Flamm 2000, p. 139. Groom suggests that international variations need more careful analysis; Groom 2000. High caesarean rates in Brazil

more culturally acceptable than a caesarean. In addition, it was feared women in rural areas having had a caesarean may not avail themselves to medical/midwifery assistance in subsequent pregnancies. In parts of rural Africa, symphysiotomy was taught to midwives to use in cases of mild CPD. Recourse to symphysiotomy in borderline cases of CP were also thought to have reduced the incidence of vesico-vaginal fistula (a connection between the bladder and vagina, caused by tissue contusion and eventual tissue breakdown so that an artificial channel is formed and urine is secreted from the vagina), a common problem in survivors of severe protracted labour. Careful selection criteria for symphysiotomy included relative rather than absolute pelvic contraction and a live fetus as the most important pre-conditions. Symphysiotomy was also used in cases of shoulder dystocia (difficulty with delivering the shoulders) to increase the space available through which to deliver the shoulders.[101]

In the second part of the twentieth century, Björkland reported three maternal deaths in 1,954 cases (two from eclampsia and one from pulmonary embolism). Earlier intervention in labour also meant that women were in a better condition to tolerate the procedure. Trends in perinatal mortality have not improved as much as maternal mortality, and this was believed to be associated with selection and timing of the intervention.[102]

Both Björkland[103] and van Roosmalen[104] report that much maternal morbidity was related to trauma at delivery, although many of these problems had resolved one month after birth. Some of the serious problems included vesico-vaginal fistulae, with 50% being caused by trauma at birth (sometimes by forceps or rough handling, or by not using a catheter during the procedure) and the other half resulting from the effects of prolonged labour and pressure on the bladder neck. Most retropubic haematomata (bruises behind the pubic bone) were self-limiting, and pubic bone infections or retro-pubic abscesses appeared to resolve themselves. Other long-term complications reported were stress incontinence and difficulties in walking. Although, follow-up of long-term complications was sometimes difficult in the developing world, the authors believed that in the long term women were able to continue their daily lives.

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appear to be associated with demand by rich private patients, encouraged by private health care, reminiscent of the forceps 'epidemic' of the mid-eighteenth century; Quadros 2000. It has also been suggested that choice is now a maternal factor in the UK; Efekhar and Steer 2000.

[101] Wykes *et al.* 2003, p. 219.

[102] Seedat and Crichton 1962, pp. 554-8.

[103] Björkland 2002.

[104] van Roosmalen 1991.

Techniques for the management of obstructed labour evolved in divergent directions in the second half of the twentieth century. While in Britain today symphysiotomy has been eradicated by the escalating use of the caesarean, in developing countries it has found a niche as a potential life-saver,[105] fully endorsed by the World Health Organization.[106]

8.16 Conclusion

To conclude, the operation of symphysiotomy was greeted with a high degree of suspicion in England from its inception. The artificial widening of the pelvis promised a simpler solution in obstructed labour to the more hazardous caesarean.

While it had some advocates, and attracted the attention of many eminent writers on midwifery, who were interested in its potential, it never really became established into mainstream obstetrics in the West. This was on account of its surprisingly limited scope, which meant it was suitable only for cases of borderline pelvic contraction.

During the nineteenth and twentieth centuries operations to widen the pelvis evolved and became less invasive. Examples of small case study series were published from time to time, although the operations were generally regarded as obsolete.

Symphysiotomy made a comeback during the twentieth century, particularly in Eire and parts of the developing world. The long-term adverse effects of the operation which emerged in Eire have yet to become apparent in the developing world, where mortality rates are still a preoccupation and health care provision is limited. In these countries symphysiotomy continues to be endorsed by the World Health Organization.

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[105] Wykes *et al.* 2003
[106] World Heath Organization 2003, also Liljestrand 2002.

9 Mapping the Pelvis: Charting and Plotting Pelvic Terrain

Obstetrics is largely a mechanical art. Every case is an engineering problem. The obstetrician like the engineer must guide himself wholly in accordance with the principles which make a given mechanical problem safe or unsafe, possible or impossible (Rongy, 1930)[1]

9.1 Introduction

The first part of this chapter focuses on early medical attempts to describe the specifications of a normal female pelvis. The second part discusses the new enthusiasm for pelvic mensuration (measurement) created by the discovery of X-rays at the end of the nineteenth century. This chapter should be read in conjunction with chapter ten, which explores efforts in the twentieth century to develop more sophisticated forms of pelvic classification.

Although traces of early twentieth-century pelvic theory remain in modern-day texts, it needs to be acknowledged that the huge amount of human endeavour which went into pelvic mensuration has been lost, disregarded, or extricated from its original context and used differently. The last vestiges of pelvic theory are to be found in many of the texts currently in use in midwifery and obstetric texts. With the benefit of hindsight it is possible to identify the component elements of this influence on present-day practice.

As previously discussed, the forceps had been used in England since the 1730s, and the caesarean operation on live women was more earnestly pioneered from the late eighteenth century onwards.[2] By the latter half of the eighteenth century, English men midwives understood the dynamic nature of birth, in which the strength of contractions, the position of the fetus in relation to the pelvis and the dimensions of the fetus, particularly fetal skull size, could all affect progress. With further refinements in anatomical knowledge, assisted by advances in technology, the eighteenth and nineteenth centuries saw a further exegesis of the physiology of labour. Predicting whether a fetus would pass through the pelvis was classed as a mechanical challenge. Such activities contributed to legitimating the role of doctors in childbirth.

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[1] Rongy 1930, p. 420.
[2] Young 1994; Francome *et al.* 2006, pp. 11- 44.

The focus of this chapter is on the development of pelvic assessment in England and on the use of instrumental pelvimetry for assessing pelvic size, which was more enthusiastically pioneered in France and Europe.

As time passed, the apparent scientific objectivity of numbers lauded by leading medical scientists in the nineteenth and twentieth centuries[3] was frustrated by the quirkiness of nature which created the need for revision of systems of pelvic classification. Minor inconsistencies were overlooked by influential obstetricians, who, perhaps out of professional pride, desired to suppress or temper irregular findings. In this way scientists occasionally broke their own strict rules, reverting to subjective forms of practice, vanquishing their professed trust in numbers.

9.1.1 The female pelvis: fit for purpose?

Eighteenth- and nineteenth-century anatomists tended to emphasise the sexual dimorphism of the human skeleton, focusing in particular on the differences between skull size and pelvic shape.[4] The more spacious female pelvis was cited as evidence that women were naturally suited to childbearing, serving a contemporary paternalistic socio-political purpose.[5]

Differences between male and female as described by physical anthropologists focussed on the larger skull of the male, which they linked to greater intellect, and a sturdy and compact pelvis, which signified greater physical strength. The female, by contrast, had a smaller cranium and a wider pelvis fit for childbearing. These differences were construed teleologically as reasons why men should engage in public life and women should be confined to the home. However, obstetricians desired to construct a notion of female defectiveness when it came to childbirth. They emphasised conditions such as pelvic inadequacy which served to undermine public confidence in the natural process, thereby creating a greater need for medical assistance.

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[3] The term *scientist* was first coined in England by William Whewell in 1833; Bynum 1994, p. 94.
[4] Schiebinger 1987.
[5] *ibid.*

9.2 The importance of a good working knowledge of the pelvis

From the eighteenth century onwards, a good knowledge of pelvic anatomy was considered essential for all midwives. The texts proclaimed that 'good' practitioners performed vaginal assessments of pelvic space early on in labour or before it began in order to detect a narrow pelvis. If midwives were persuaded to do this to medical specifications, they would also be in a position to refer more women to doctors, and to do so earlier. The man midwife would also have more time to obtain a second opinion on the management of the case if necessary; assuming of course that someone could afford to pay for a doctor.[6]

The midwifery texts of the nineteenth and twentieth centuries tended to describe reproductive anatomy and physiology first. This normally included a description of the normal pelvis and its landmarks with explanatory diagrams of the pelvis, often followed by images of severely deformed pelves (see Figure 9.1p.210.).

Whilst deformed pelves were often found in association with other skeletal deformities, men midwives continued to believe that significant degrees of pelvic contraction might be concealed within women of normal outward appearance.[7] This concern, along with the descriptions and examples of distorted pelves, amplified the problem and the need for medical supervision of childbirth.

Medical men recognised that just a few fractions of an inch in pelvic space could make the difference between a successful vaginal birth and life-threatening pelvic obstruction. As the French accoucheur, Guillaume Mauquest De La Motte (1655-1737) had remarked:

> ...women tho' alike externally are very different internally. It is this space as it is larger or smaller which makes the birth of the child more or less easy: and when the first deliveries have gone on well, the succeeding ones proving otherwise, tho' the children appear of a like bigness; it must be that the heads of the former were either smaller or more tender, so as to be able to conform themselves to the passage: and indeed a very trifling difference here alters the case very much[8]

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[7] See chapter six.
[8] La Motte 1746, pp. 156-7.

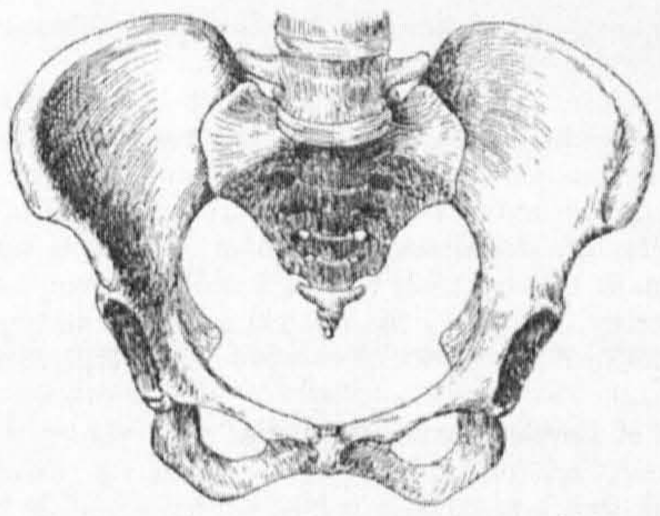

FIG. 163.—The generally contracted non-rachitic pelvis.

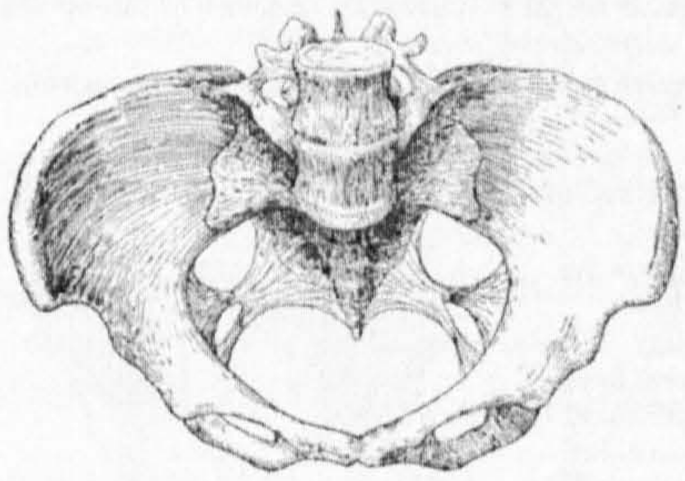

FIG. 164.—The simple flattened pelvis.

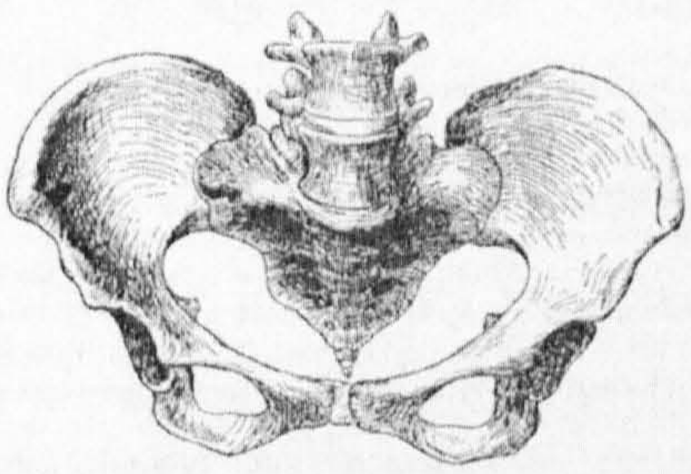

FIG. 165.—The rachitic flat pelvis.

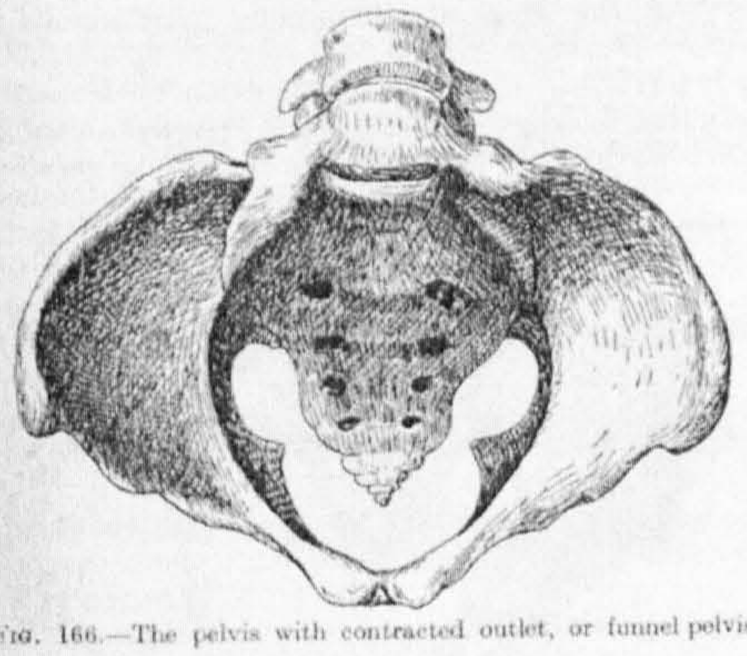

FIG. 166.—The pelvis with contracted outlet, or funnel pelvis.

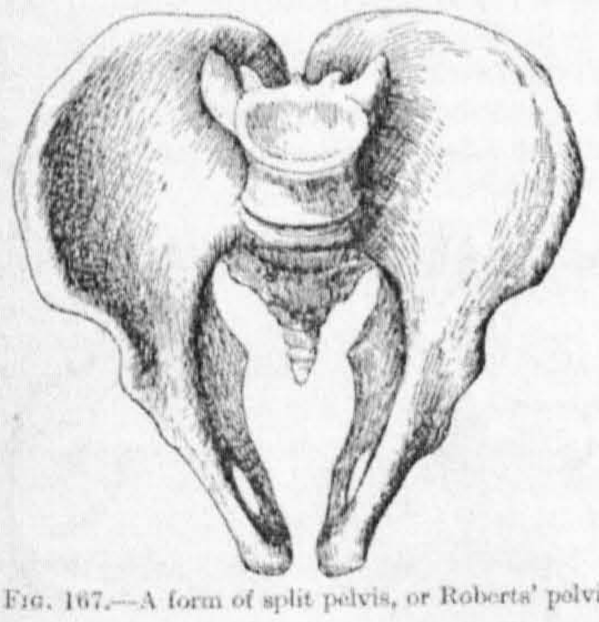

FIG. 167.—A form of split pelvis, or Roberts' pelvis.

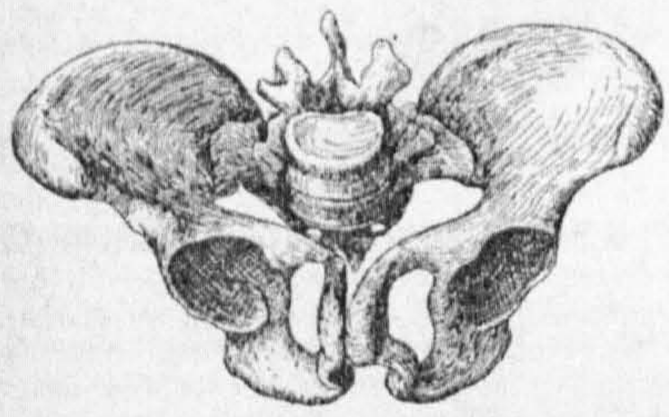

FIG. 168.—The osteomalacic pelvis.

Figure 9.1
Title: Types of Contracted Pelvis
Note: From: Davies T B, *et al.* (1936) *The Queen Charlotte's Textbook of Obstetrics*, p. 324-5 Queen Charlotte's had specialised in cases of contracted pelvis in earlier years.

9.3 Knowledge of the internal contours of the pelvis

Much research was carried out on dried pelves and corpses, complemented by work on live women. Eighteenth-century men midwives, including Hendrik van Deventer (1701), Sir Richard Manningham (1744), and William Smellie (1752) resolutely stated that all

midwives, including traditional midwives, should know how to detect narrow pelves and should carry out vaginal examinations as part of their routine care early on in labour.[9]

If these instructions were to be followed to the letter, a lot more vaginal examinations would be carried out possibly increasing the transmission of puerperal fever. As far as males were concerned, the issue of intimacy and impropriety with female patients was a cause of public concern.[10] However, the clinical importance attached to these procedures enabled medical men to justify their actions and to distance themselves from these debates, whilst satisfying the public of their necessity.

Various means of assessing the size of the internal aperture of the pelvis were described.[11] The most common practice was to assess the internal breadth and width of the pelvis using specific bony landmarks at the level of the pelvic inlet and the outlet in order to assess quantitatively the useful space available to the fetus (the mid-pelvis or cavity was described later). Many other factors came into play, such as the strength of contractions and the size of the fetal head, which was normally the biggest and hardest part of the fetus.

By the nineteenth century, the pelvis was considered as the part of the equation with fixed dimensions. Strength of contractions, fetal position and size, capabilities of the fetal skull to mould in labour, and various other considerations such as the position of the mother were more difficult to include in any type of prognostic formula because of their dynamic nature. So, despite a scientific approach, these factors meant that a totally reliable prediction of the outcome of labour based upon pelvimetry eluded medical men. Nevertheless, advanced pelvic theory added sophistication to the art of midwifery, latterly called obstetrics.

This had a major effect on the relationship between women and their doctors, as mothers in labour knew less about what was happening to their bodies than their attendants, requiring them to ask the 'experts' what was happening. This excluded women and families from participating as they had done previously, when they played a larger part in telling the doctor what they thought was wrong with them. These advances in obstetrics also

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[9] Abdominal examination to define fetal position became a standard practice in the late nineteenth century. Additional refinements permitted the description of the relationship between the presenting part and the pelvic brim, and the technique of 'head fitting' enabled obstetricians to gauge roughly whether it was possible for the fetal head to engage in the pelvis. Head fitting is described in Towler and Butler-Manuel 1973, 64-5.

[10] Discussed in chapter seven.

[11] Abdominal assessment of engagement of the fetus in the pelvis was introduced in the nineteenth century.

increased the division of labour between doctors and traditional midwives and reinforced the authority of the doctor, making medical care more attractive to consumers, whether they were fee-paying or not.

9.4 The beginnings of pelvimetry

William Smellie (1697-1763) described in detail the internal contours of the typical female pelvis and defined certain landmarks which are still used in midwifery today.[12] He noted specific landmarks on the pelvis and measured the dimensions of the pelvic aperture at particular sites. He also measured the depth of the anterior and posterior (front and back) pelvic walls. He described how he obtained 'typical' pelvic measurements in inches for each of these diameters.[13] It is uncertain whether these measurements were based upon the measurements of one pelvis or a number of pelves, to reflect the ideal, the average or a particular example.[14]

Smellie previously noted:

> [The] junctures of the sacrum with the Ilia, as well as that of the ossa pubis, seem to yield a very little alternately [15]

However, when it came to pelvic mensuration, he considered that this made no significant contribution to the available space and made no allowance for this effect. By presenting the pelvic diameters as exact measurements, he implied that the bony pelvis was a rigid

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[12] Smellie 1752, pp. 78-86.

[13] The length of the pelvic brim from *back to forepart* was designated as being four and a quarter inches and the width, five and a quarter inches. Smellie noted that the width at the pelvic outlet was in reverse order to the brim, with the width being *no more than four inches and a quarter* and the *distance from the os coccyges and the lower part of the os pubis* (which moves back at birth) *being almost five inches*. He also related these dimensions to those of the fetal skull and described how the fetal head normally engaged and descended through the pelvis, making best use of the available space; Smellie 1752.

[14] One of William Smellie's critics, John Burton, took a more casual approach to 'standard' pelvic measurements:

> 'I have been at paines to measure the bones of the pelvis of several female skeletons, and having found one of a good sizeable and well proportioned old woman (whom I knew when alive) I took the just dimensions, and wrote them down as standard'.

See Burton 1751, p. 2. Many early modern illustrations of pelves reflected an ideal pelvic form; see Stromberg and Williams 1993.

[15] Smellie 1752.

structure of fixed proportions. This view was later reflected in France, where Jean Louis Baudelocque claimed that the pelvis was 'incapable of any kind of dilation'.[16]

By the 1750s, Smellie was known in medical circles as an expert in midwifery and an accomplished author and teacher. He communicated widely with other men midwives at home and abroad, especially with the accoucheurs who had been at the vanguard of developments in French midwifery. In London, Smellie had been responsible for the training of around a thousand men midwives, including Thomas Denman.[17] Smellie observed the process of birth free of its 'natural complications', which John Pickstone suggests was a popular technique of early modern sciences.[18] He focussed on birthing mechanisms and on how the course of labour might be altered by different pelvic contours and sizes.[19] His birth machines helped him and later, his students, to think through possible mechanisms of birth.

Smellie believed narrowness of the anterior-posterior (A-P) diameter of the pelvic inlet (front to back) was the most frequent cause of bony obstruction in labour and he devised a procedure to assess the 'diagonal conjugate'* of the pelvis. This diameter was reported as being accessible on vaginal examination and the next best measurement to the true conjugate*, being used to estimate the distance between the inner aspect of the symphysis pubis and the inner aspect of the sacral promontory.

Smellie's method of assessing the diagonal conjugate using one finger (which ideally required long fingers) appeared to be the most conservative technique, which may have accounted for its popularity:[20] It compared favourably with other methods such as putting the whole hand into the vagina or using instruments for internal pelvimetry. This

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[16]Baudelocque 1790, volume 1, p. iii.

[17] Smellie taught his students the mechanism of birth using his teaching *machines*. These machines were introduced from Europe. Some lecturers devised their own versions made from materials such as leather, glass and dried bones. According to Elizabeth Nihell, Smellie's teaching machine was:

> ... a wooden statue, representing a woman with child, whose belly was of leather, in which a bladder full, perhaps of small beer, represented the uterus. The bladder was stopped with a cork, to which was fastened with a string of packthread to tap it, occasionally, and demonstrate in a palpable manner the flowing of the red coloured waters. In short, in the middle of the bladder was a wax-doll to which were given various positions. (Nihell 1760, p. 50)

[18] Pickstone 2000, p. 137.

[19] Experiments in morbid anatomy were carried out on the corpses of deceased women and their unborn fetuses.

[20] Initially the examination was performed using the index finger; by the nineteenth century; the middle finger was used as well. See Herman 1901, p. 174-9 for an explanation of the procedure.

procedure remained part of clinical practice until the end of the twentieth century, despite challenges to its feasibility and reliability.

Figure 9.2

Measuring the diagonal conjugate in the upright position (9.2)
Source: Galabin 1897 [21]

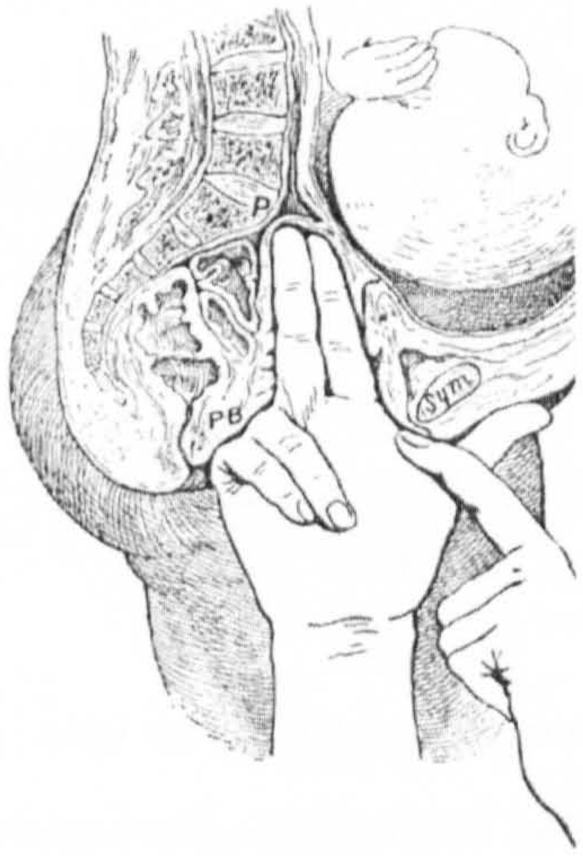

Fig. 176.—Measurement of diagonal conjug

(Early methods of vaginal examination involved the use of one digit).

Numerical representations began to replace the subjectivity of traditional practice and reflected trends in the wider field of medical practice.[22] The 'scientific' approach to understanding childbirth involved reducing the natural process to mechanical and mathematical principles. Mathematics was the basis of scientific thinking and provided doctors with criteria for judging the 'truth'. Once normality was defined, pelvic mensuration could be used to identify abnormally-shaped or unduly small pelves in a demonstrative fashion. Another crucial factor was the size of the fetus, which was much more difficult to assess. Smellie's ex-student Thomas Denman later reflected:

> … on the whole a fondness for an imperfect knowledge, and some affectation of mechanical principles seem to have been very detrimental: as to them the frequent and unnecessary use of instruments in the practice of midwifery may have in great measure be attributed[23]

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[21] Galabin 1897, p. 514.
[22] Technological inventions which enhanced medical practice were gradually introduced into midwifery to measure, for example, body temperature, blood pressure and fetal heart rate.
[23] Denman 1788, p. 47.

Denman seemed to suggest, like his contemporary traditional midwife-authors, that an over-reliance upon objective measures led to a neglect of attention to the whole picture and to unnecessary interventions.

9.5 The dimensions of the fetus

Smellie wrote about the importance of the size of the fetal head in relation to the size of the pelvis:

> In order to demonstrate the advantage of knowing the wideness, depth and figure of the inside of a well formed pelvis, it will be necessary to ascertain the dimensions of the head of the child, and the manner of its passage in a natural birth [24]

He also examined the relationship between pelvic dimensions and those of the fetal skull during birth, and noted how the fetal head would normally engage with its widest diameter in the widest diameter of the pelvic brim.

Very early on, Jean Astruc (1684-1766) had had reservations about reducing birth to numbers.[25] While recognising the advances in practice, he acknowledged the difficulty of applying rational principles to such an enigmatic process. In 1767, he reflected on the achievements of the past sixty years in the field of midwifery, stating:

> ... there is little wanting to render the art of midwifery perfect; and to bring the operations, necessary in the practice of it, to a geometrical certainty. Nor is there any reason for wonder at it: for, after all, this art may be reduced to the following mechanical problem. A distensible cavity of certain capacity, being given to draw a flexible body of a given length and thickness, through an opening dilatable to a certain degree; which might be resolved geometrically, if the different degrees of the vis invertia or clastuity in the uterus, and of the force and weakness in the child; the greater or less inflammatory quality of the blood; the more or less irritable disposition of the

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[24] Smellie 1752 volume 1, p. 84.

[25] Jean Astruc was a theorist and a Royal Professor of Physick to the French King. He suggested that pelvic expansion might occur if there were a degree of cephalo-pelvic disproportion (CPD). In such circumstances the tight fit of the fetus would put pressure on the symphysis pubis, acting as a lever and triggering a cartilage softening process, sometimes referred to as mollification. See Astruc 1767, pp. 8-9.

> nerves of the uteruses, etc. did not superinduce that uncertainty in the matter which physiological facts ever give to all physico-mathematical questions. [26]

Astruc acknowledged that the dynamic and sometimes unfathomable nature of birth did not lend itself to mathematical precision.

9.6 The nature of numbers

Mathematics was a widely-recognised science, excellent for conveying an objective message in an impartial and seemingly objective manner.[27] As Theodore Porter suggests:

> A highly disciplined discourse helps to produce knowledge independent of the particular people who make it.[28]

In 1872, Churchill (1808-1878)[29] provided an overview of sets of pelvic measurements by seven different English and French authors[30] in his textbook, *On the Theory and Practice of Midwifery* (see Table 9.1 overleaf).

> Men midwives claimed that pelvic mensuration was important because a fraction of an inch could make the difference between a normal birth and one which required assistance. In reality the vagaries of nature meant that the indices were liable to imprecision.[31] Churchill addressed this in a rather cavalier manner, advising that, while pelvic brim measurements varied between women, if the smallest estimates were taken 'half an inch could be allowed for variations' and the measurements would give 'an idea' of the diameters of the brim,[32] thereby compromising the ideal of precision.

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[26] Astruc 1767, p. 36.
[27] Porter 1995.
[28] Porter 1995, p. ix.
[29] Churchill 1872, pp. 15-16.
[30] Measurements on dried pelves would differ from those carried out on cadavers; in the latter, the bones were covered in soft tissue. The consistency would vary again from examination of a live woman and of course, pelves, like people in general, came in a range of different shapes and sizes.
[31] Further slight discrepancies within these figures can be found in other texts, for example see Galabin and Blacker 1910, p. 17.
[32] Churchill 1872, pp. 15-16.

Table 9.1

A series of pelvic brim measurements by various English and French authors (top legend) Source: From Churchill (1872) [33]

	Den-man.	Burns.	Rams-botham.	Rigby.	Baude-locque.	Vel-peau.	Mo-reau.
Antero-post. diameter	4 in. & a frac-tion.	4 in.	4 in.	4·3 in.	4 in.	4 in.	4 in.
Transverse .	5	5	5¼	5·4	5	5	5
Oblique . .		5⅛	5	4·8	4½	4¼	4½

The textual discourses seemed to have a life of their own. Most British medical men based their clinical judgements upon clinical assessments, backed up by their own clinical experience; few relied simply on pelvimetry results. In a letter to William Osborn, Alexander Hamilton (1739-1802), the Scottish professor of midwifery, pointed out the 'impossibility of measuring the pelvis in a living person with geometric accuracy'.[34]

On a superficial level, numerical data communicated impartiality and objective truth, and although highly subjective by scientific standards, personal intuition continued to underpin clinical decisions. Such subjective judgements may well have been publicly discussed or documented in a more objective format.[35] Pelvimetry had an essentially cosmetic function; it added to the appearance of scientific objectivity and thereby served to legitimate clinical decision-making, but, owing to its in-exactitude in practice, could not really inform a process that was essentially subjective and intuitive

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[33] Churchill 1872, p. 15.
[34] Hamilton 1792, pp. 4-5.
[35] Mindful that his claim might be controversial, Chassar Moir described how experienced obstetricians might *sense danger ahead* and *when continuance of trial labour is* [was] *dangerous and caesarean* required. Chassar Moir suggested that as the obstetrician gained experience, he learned to sense danger ahead - *to feel it in his bones.* See Chassar Moir 1956, p. 357-8.

9.7 Pelvic geometry

The new era of modern science and classification was a science of order in which the visible was described and classified using specific criteria to identify commonalities and differences, separating normal from abnormal. Whereas geometrical formulae and Fibonacci numbers[36] appeared to reflect patterns seen in nature in a consistent manner, the application of mathematical formulae and classifications to birthing theory offered a lesser degree of certainty, while offering a superficial air of scientific legitamacy.

In *The Order of Things,* Michel Foucault referred to the use of geometry in botanical classifications and described how:

> Forms and arrangements ... must be described by other methods: either by identification with geometrical figures, or by analogies that must all be 'of the utmost clarity'... [to act]... as a spontaneous link between what one can see and what one can say [37]

Geometry in obstetrics may have been inspired by its applications in the natural sciences. It was employed in the eighteenth century by the Swedish botanist, Carolus Linnaeus (1707-1778) to classify flora and fauna. Linnaeus became known as the inventor of modern scientific classification.[38]

9.8 Reality constructed from artifice: Geometry and eighteenth-century pelvic theory

André Levret (1703-1780), a well-regarded Parisian accoucheur, used a geometrical approach to pelvic theory, plotting the journey of the fetus through the pelvis. The title of his treatise, '*L'art des accouchemens, démontré par les principes de physique et de méchanique'* (1753), conveyed to readers his objective, mechanical approach and his desire to order nature. The following illustration of the gravid uterus at various stages of growth exemplifies this (see Figure 9.3).

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[36] Fibonacci numbers, first identified in the twelfth century, reflect patterns seen in nature: Knott 1996-2007.
[37] Foucault 1970, p. 147.
[38] Linnaeus' work is also referred to in the following chapter.

Figure 9.3

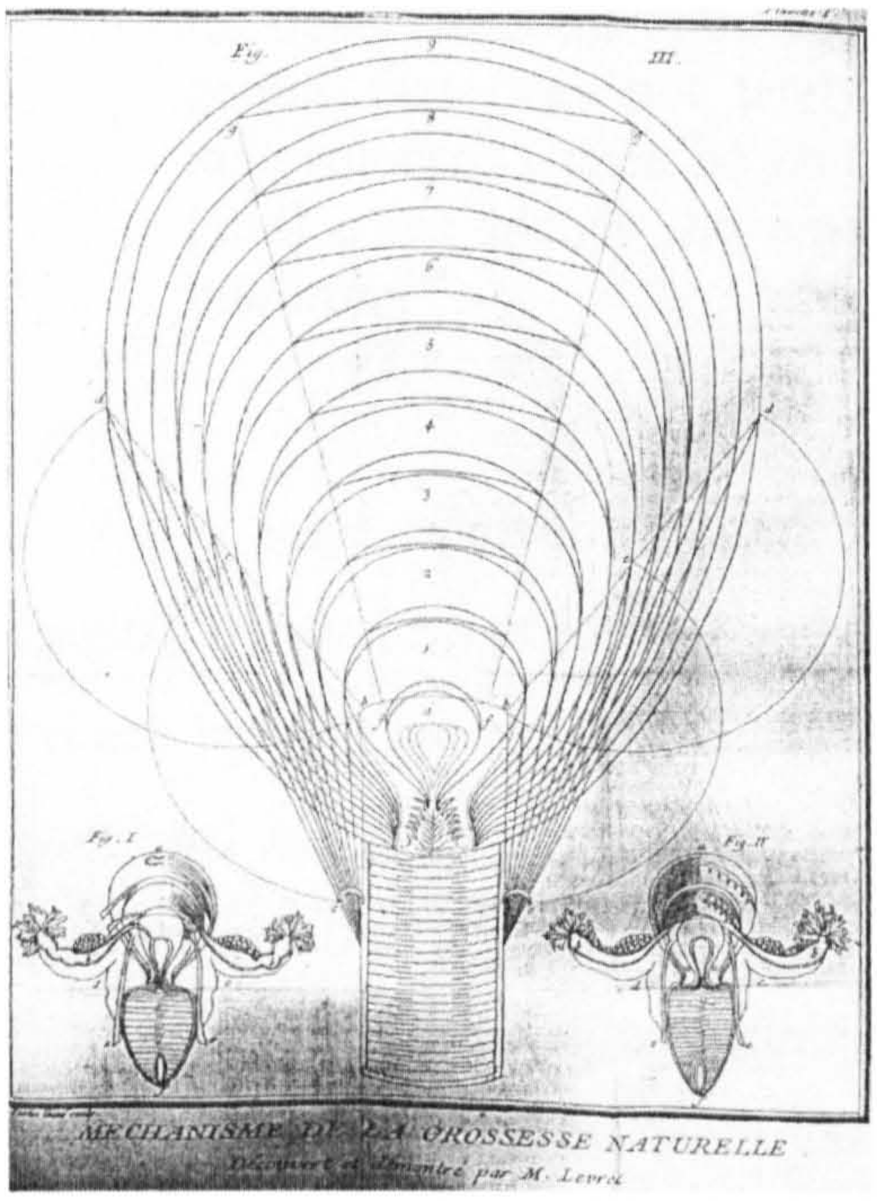

Figure 9.4

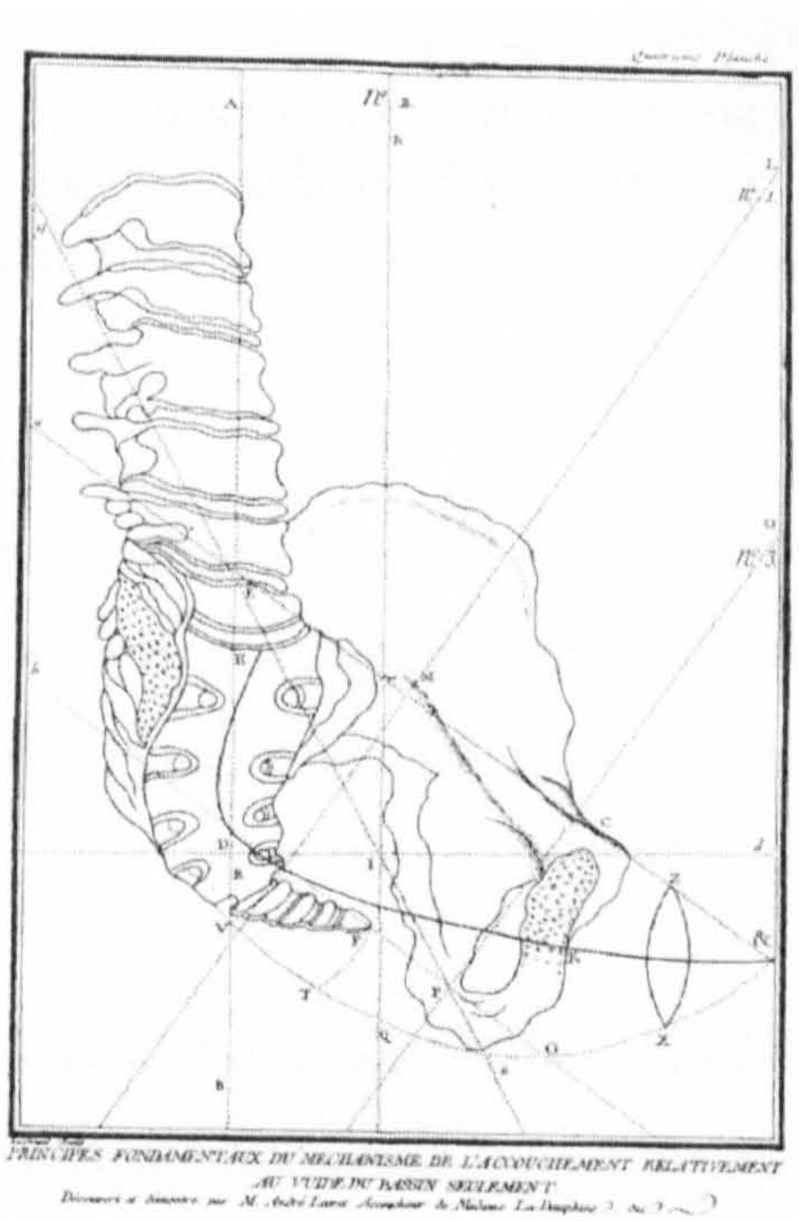

Figure 9.3 : *Méchanisme de la grossesse naturelle*
Figure 9.4 *Principes fundamentaux du méchanisme de l'accouchement relativement au vuide du raisin reulement*
Sources : Levret 1753.
Reproduced with permission. John Rylands University Library, University of Manchester.

Levret's illustration of the pelvis in cross-section (see Figure 9.4) emphasised the curve of the birth canal and the changing axis of the pelvis from brim to outlet.[39] It was shown in cross-section and over-scored by a series of lines and a parabola, mapping the angles, planes and centre of gravity of the birth passage at various points. Levret defined the angle of inclination of the pelvis to the ground and divided the pelvis into three levels or plains: the inlet, mid-pelvis and outlet. This work appeared to lead to refinements being made to forceps which reflected the curve of the birth canal.

Peers accused him of theorising too much and over-complicating matters, compartmentalising his theoretical knowledge of the pelvis and neglecting practice. In a discussion on the state of midwifery in France, the English man midwife, A Tolver, suggested that Levret:

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[39] The information conveyed in this illustration earned Levret the most recognition. He suggested the pelvic inlet in a standing position was 35 degrees to the ground (later found to be 55 degrees). A series of accoucheurs made subsequent amendments to Levret's concepts and simplified them.

> ... treats different opinions with too little respect, and sees every effort of genius that does not tend to elucidate his own theory, with the eye of malevolence; Hence he hath fettered the free expansion of his capacity ... [and] often blends the errors of prejudice and fancy with the most solid reasoning[40]

A large number of French treatises were translated into English, although no English translations of Levret's work have been found by this author. Copies of the original French treatise are available in UK libraries, which suggest his work was not as widely embraced in England as it was in France, where his status was paralleled with that of William Smellie.[41]

Levret's composite illustration, *Méchanisme De Differentes Grossesses* (Figure 9.5 p.221), conveyed several messages in a single image. The small illustrations of pelves along the bottom of the picture show a normal pelvis (left) next to a contracted (rachitic) type of pelvis (right). Between the legs of the skeleton is a diagram of the respective pelvic brim types.

Medical historians have argued that it was Levret who first offered insight into the appropriate angles of traction to be used during a forceps delivery. However, this thesis argues that, practitioners were likely to have acquired more useful information about the individual orientation and capacity within a particular pelvic cavity after performing vaginal examinations. Nevertheless, by slavishly applying mathematics to human anatomy and by documenting their art, men midwives and accoucheurs were able to stake claims over midwifery theory. The work was in keeping with modern aspirations, and was often embellished by impressive visual material and relatively detailed explanations. Traditional midwives could not compete with men on these terms.

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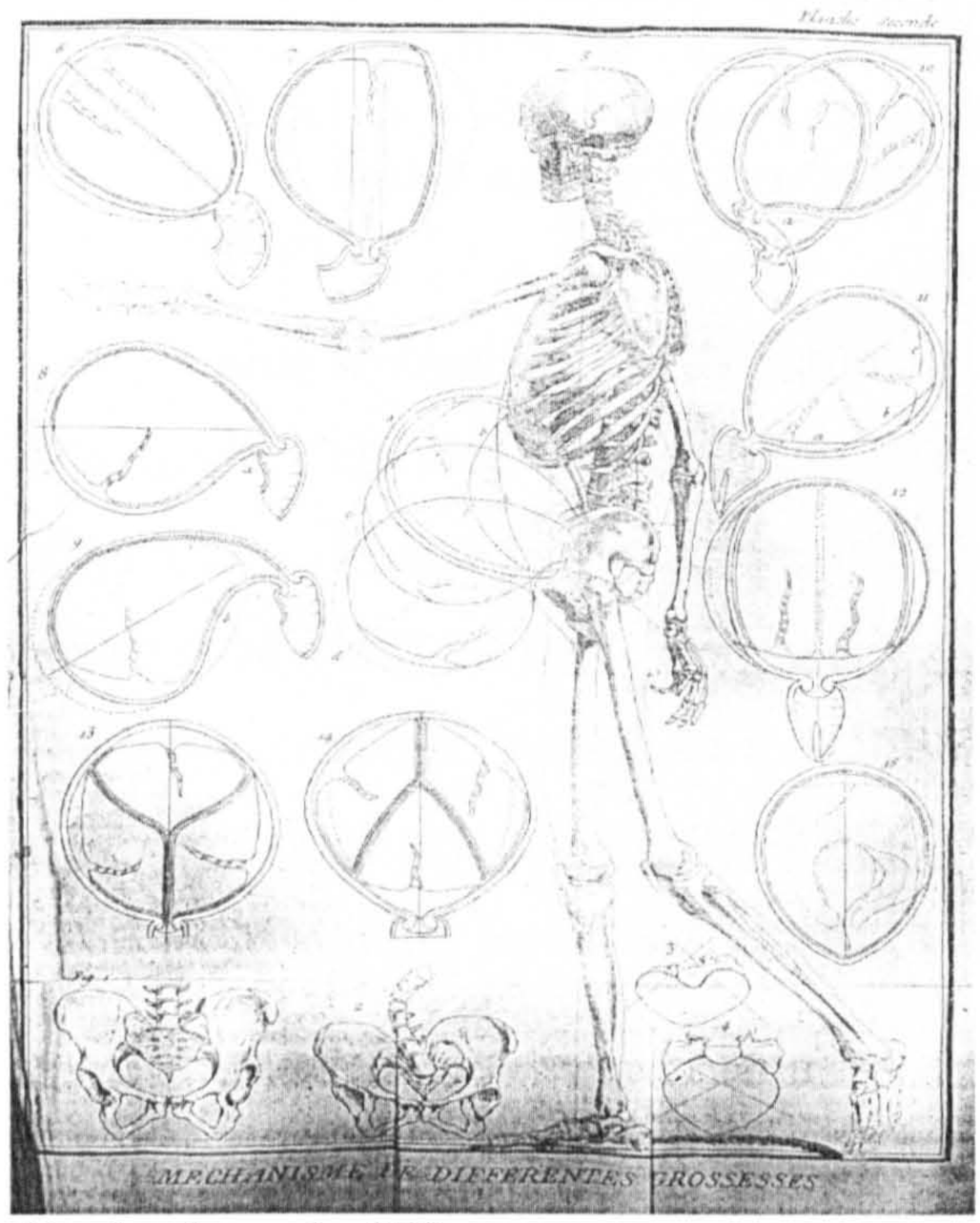
[40] Tolver 1770, p. 3.
[41] William Smellie is reputed to have owned an original French copy of Levret's work.

Figure 9.5



_Mechanisme de differentes grossesses
Source : Levret A (1753)
On the skeleton the lowermost position of the uterus shows a pendulous abdomen which was associated with grand multiparity (4 or more pregnancies) and sometimes pelvic contraction and cephalo-pelvic disproportion. The altered shape of the contracted pelvis (bottom, middle) is compared with the normal pelvic brim (as seen between the legs of the skeleton).

9.9 Making the pelvis fit: Man-made rules and standards

The German polymath,[42] Carl G Carus (1789-1869) simplified Levret's diagram of the pelvic axis, henceforth known as the curve of Carus. He superimposed a complete circle onto a cross-sectional image of a pelvis to demonstrate a perfectly-curved birth canal axis; calculating the geometrical relationships between the symphysis pubis and the posterior wall of the pelvis at the level of the sacral promontory, mid-pelvis and coccyx.[43] However, Carus was aware of the limited clinical application of his theory commenting:

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[42] See Stair Sainty Matthiesen Inc.: the Matthiesen Gallery (n.d) for a brief biography of Carus.
[43] Carus' diagram is cited by Speert 1973, p. 218

> The female pelvis shows itself as normal in all respects much less often than seems to be generally believed; and I have found this to be the case particularly with the curvature of the pelvic cavity, in which respect scarcely one pelvis whose curvature measures up completely to the true norm is likely to be found among a considerable series of otherwise rather well-formed pelves [44]

Carus recognised the difficulties of trying to fit nature into a geometric scheme, although he claimed the curve of the path of the fetus through the pelvis followed the path of a curve from a perfect circle, this was allotted the title of the 'true norm'.[45] Carus further subdivided the curve into three regions by applying the three pelvic plains of Levret. The curve and plains were later found to be affected by the position and depth of the pubis in relation to the position and depth of the sacral promontory and sacrum, which could vary in length. The birth canal was more accurately described later as a straight cylinder at its upper end and curved at its lower end[46]

It was widely recognised at the time that the coccyx could interfere with the process of birth depending on its length and curvature. The American obstetrician Charles Meigs (1792-1869) claimed in triumphant tone that knowledge of the curve of Carus was so important to midwifery that without it, a practitioner would be:

> ...incompetent scientifically to deliver a placenta and far less to extract a child by turning, or to apply and deliver with the forceps or the crochet [47]

In his enthusiasm for his art, he appeared to over-state the value of knowledge of the curve of Carus; after all most babies were born regardless. During the late eighteenth and nineteenth centuries, quantification became highly acceptable within society as an objective means of resolving many issues. By the mid-nineteenth century it had attracted the attention of governments who recognised the value of using ostensibly objective numbers and statistics to support socio-economic decisions.[48] As Theodore Porter contends, the objective

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[44] Carus, cited by Speert 1958, p. 165.
[45] This finding was to re-emerge in Caldwell and Moloy's attempts to classify pelves by shape in the early twentieth century (also discussed in the following chapter).
[46] See Galabin 1897, pp. 17-18.
[47] Meigs, cited by Speert 1958, p. 165.
[48] See Barnes on science and ideology in Barnes 1974, pp. 125-51.

method may be an esteemed rather than a profound one. From a professional standpoint, the 'scientific' approach was enthusiastically embraced by obstetricians, reflected in the titles of some contemporary obstetric textbooks, where the word 'science' or 'scientific' formed part of the title.[49]

9.10 The Proliferation Of Special Pelvic Measuring Devices

In Europe, many internal and external pelvimeters were devised and used up until the first half of the twentieth century.[50] Internal pelvimeters were particularly complicated to use, requiring great manual dexterity (see Figure 9.6). The devices for internal assessment invaded women's privacy, and their use was no doubt painful for women to endure. The practicalities of use, the thorny question of accuracy and the after-effects of their use on clients were not addressed in the literature. No doubt it came as a relief to everyone concerned when non-invasive external pelvimeters were invented in the late eighteenth century, although some men advised the use of both types of instruments.

Figure 9.6

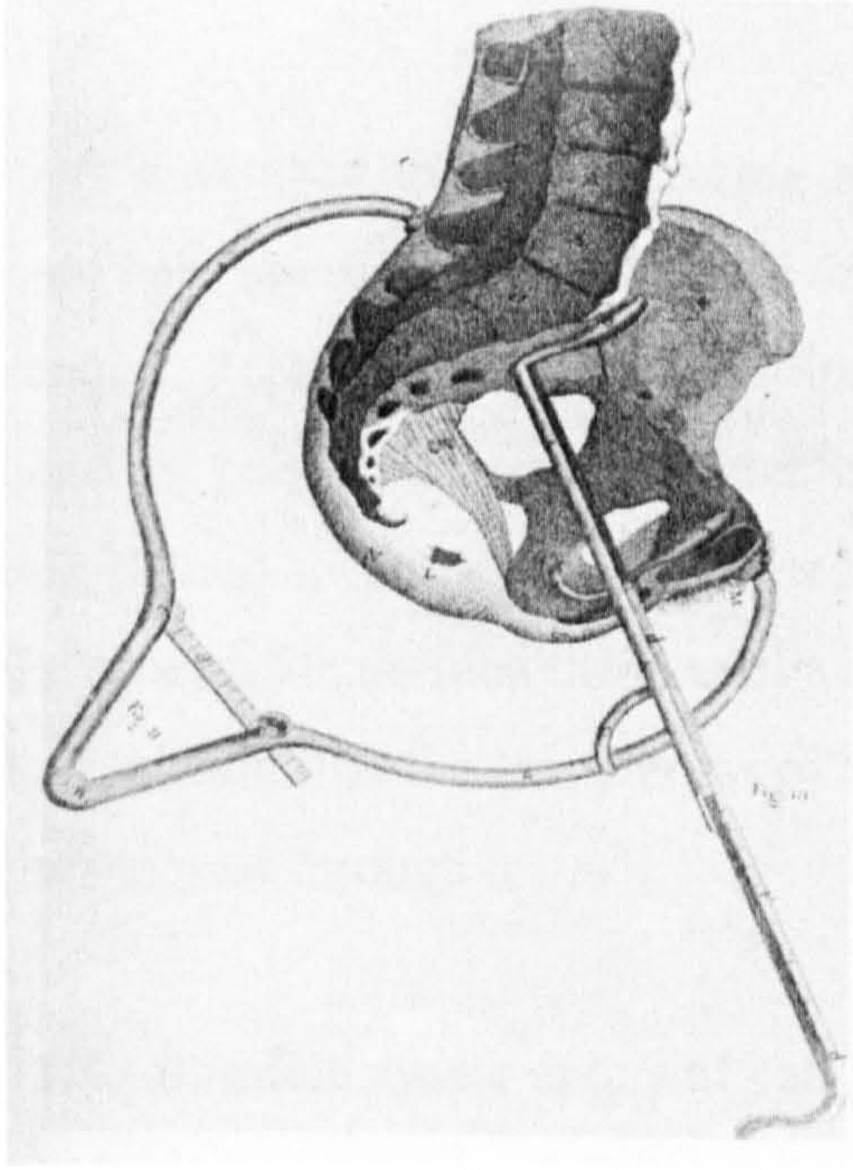

Figure 9.6 Coutouly's internal pelvimeter[51] alongside Baudelocque's external pelvimeter.
Source: Baudelocque 1790, volume 1.
Reproduced with permission. John Rylands University Library, University of Manchester.

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[49] By the nineteenth century the obstetric texts began to emphasise the scientific nature of childbirth, with titles such as *The Science and Practice of Midwifery*, by W. S. Playfair or *The Science and Art of Obstetrics* by Theophilus Parvin.
[50] Felix Skutsch demonstrated a range of pelvimeters in Skutsch F. 1887, Die *Beckenmessung an der lebenden Frau*, Jena, illustrated in Eastman 1948, pp. 317-24. See also Jarcho 1933.
[51] Internal pelvimeters were not particularly popular in England.

9.11 Baudelocque's contributions to pelvimetry

In keeping with contemporary medical thought, the Parisian professor of midwifery, Jean Louis Baudelocque (1746-1810), described birth as a mechanical process subject to the laws of motion. He acknowledged it was most often accomplished by 'natural forces' and so the large amount of work on the management of difficult labour was focussed upon the small proportion of women who required medical assistance. However, he suggested it was dangerous for women to be 'left to nature' for too long, as excessive compression of the maternal soft parts of the pelvis could cause contusion, tissue death, suppuration and gangrene and severe fetal head compression and brain injury.

As previously stated, contracted pelves were not consistently identifiable from external physique. This problem was alluded to earlier in France by La Motte (1665-1737):

> ...many crooked women may be delivered naturally; while others, who enjoy the finest external proportions, cannot have the same good fortune, the narrowness of the pelvis producing obstacles insurmountable by the common agents of delivery [52]

It was envisaged that by assessing as many women as possible antenatally, pelvimetry would help identify potentially difficult cases so that the appropriate management could be arranged. Possibly influenced by Smellie, Baudelocque concentrated on the difficulties caused by pelvic narrowness, which he divided into absolute and relative causes, absolute being related to a severely-contracted pelvis, and relative being related to the size of the child's head. He defined the size of a newborn's head as being no more than ten inches and a half, stating that the 'suppleness of the cranium' might allow a head the same size as the pelvis to pass through it.

9.11.1 Baudelocque's external pelvimeters

Callipers were non-invasive tools used for such varied things as carpentry and cartography in the eighteenth century. These were adapted for medical use, such as

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[52] Baudelocque 1790, volume 1, p. 88.

pelvimetry, and in the nineteenth century they were used by phrenologists and physical anthropologists.

External callipers were used in midwifery from the eighteenth to twentieth centuries to measure the external conjugate of the pelvis.[53] Deductions of 3" or 7.5cm were made to allow for the thickness of skin, subcutaneous tissues and bones. The appeal of this technical procedure was that it was relatively painless and slightly more dignified than internal pelvimetry and could be used during pregnancy as well as in labour, regardless of a woman's age or parity (number of pregnancies).

Baudelocque tested the accuracy of the callipers on cadavers by comparing external and internal measurements. Medical historians have suggested that the availability of corpses were at a premium in Paris around this time, as large numbers of students flocked there for anatomy courses. Regardless, Baudelocque appeared to have little difficulty obtaining bodies for his experiments in pelvic assessment, although they were not exclusively conducted on female corpses.

Various types of external pelvimeters were subsequently devised and 'Baudelocque's diameter' became recognized internationally.

9.11.2 Baudelocque's thoughts on the state of contemporary midwifery practice in France

Baudelocque was not afraid publicly to accuse fellow accoucheurs of incompetence at 'touching'. Writing at a time when operative techniques carried high rates of maternal mortality; Baudelocque emphasized the need for accuracy and for clinically competent accoucheurs to ensure correct diagnoses and appropriate management of cases. The consequences of inaccurate clinical assessments were inappropriate clinical decisions, which could cost lives.[54] Baudelocque advocated frequent practice of vaginal examinations on corpses to improve clinical expertise.

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[53]A range of external callipers were invented for measuring various diameters of the pelvis, see Jarcho 1935, pp. 147-87.

[54]He was of the view that some of his colleagues were incompetent at vaginal examination, leading to serious errors of judgement. He also suggested the caesarean section rate in France could have been elevated by over-detection of contracted pelves by errors in clinical judgement.

In view of the limited success in relieving severely obstructed labour, he advised that certain women would be unwise to 'risk' childbirth. and accoucheurs should offer pre-marital or pre-conceptual pelvic assessments to 'deformed women' and counselling about pregnancy. [55]

Whilst promoting external pelvimetry, Baudelocque added a rider to his text in which he seemed to recognize the limitations of this procedure. He advised that internal pelvic assessment, such as the insertion of a fist into the vagina[56] might be reverted to in labour.[57] Interestingly, he displayed external callipers alongside Cantouly's internal pelvimeters in his text.

9.12 The value of external pelvimetry was first challenged by Michaelis

Gustav A. Michaelis (1798-1848) completed a relatively large study of a series of pelvic measurements (1000 pelves) published posthumously in 1851. He put forward the view that Baudelocque's diameter did not provide a reliable estimate of the size of the true conjugate of the pelvis, and that a true conjugate of 8.75 cm. or less was contracted.

Michaelis made it clear that the potential for pelvic diameters to interfere with the process of birth was at the crux of the matter. However, this was only one factor in a complex clinical picture, and average measurements were not reliable when it came to clinical decision making. For example, a small pelvis might be of no importance if the fetus were also small. English discussions of Michaelis' work do not appear to explore these issues, and external pelvimetry continued to be a feature in English midwifery textbooks for another century.

9.13 Early forms of pelvimetry in Britain

In England, whilst keeping up with technological developments, obstetricians seemed cautious about the use of instrumental pelvimetry, preferring to rely on digital

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[55]Baudelocque 1790, volume 1, pp. 86-7. See also chapter eight 8.3.3

[56] The technique of inserting a fist into the vagina to assess pelvic size had been recommended by various authors since 1769; Herman 1901, pp. 175-9.

[57] Galabin (1897) claimed internal digital assessment was commonly carried out in England; being less painful to the patient and less likely to produce such gross errors as internal callipers.

examination and the overall clinical picture.[58], Churchill claimed in 1872 that pelvimeters were 'seldom used' in Britain. Moreover, he put forward the view that information about the 'magnitude of the pelvis' was reasonably afforded by a vaginal examination, which provided an estimate of the size of the pelvis and its relationship to fetal head size during labour as described by Smellie. Responding to a paper on the treatment of labour in contracted pelvis and the use of pubiotomy, presented at the Harveian Society of London in 1910, Dr Griffith claimed estimates of degrees of contraction needed *a practiced hand to be reliable:*

> ...relying on the supposed accuracy of pelvic measurements was too artificial to guide the practitioner in his management of these cases...[59]

In 1913 Daniel Dougal, resident obstetric officer at St Mary's Hospital, Manchester, reinforced previous concerns that external callipers were unreliable.[60] He went so far as to suggest their margin of error meant they were not only 'useless' but 'dangerous'.[61]

Dougal investigated the reliability of estimates of the true conjugate* by digital assessment of the length of the diagonal conjugate*.A series of measurements yielded only an approximate correlation between the true conjugate and the diagonal conjugate, which was *open to grave errors*.[62] He concluded his paper by advising that:

> ... it must be remembered that the indirect method is the only one capable of general application, and when used with a full knowledge of its limitations gives sufficiently accurate results in the great majority of cases.[63]

Research continued to undermine the efficacy of external pelvimetry, although it remained in the texts for another thirty years or so. One reason may have been the continued support

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[58] Galabin and Blacker 1910.
[59] Griffith 1910, p. 453.
[60] Tissue thickness varied, so the deduction of a set amount from the external diameter to estimate the internal diameter was liable to error; Dougal 1913, pp. 263-270; Galabin 1904, In France, Mesdames Boivin and La Chapelle also expressed doubts about the reliability of these measurements; Churchill 1872, pp. 20-21. Madame La Chapelle suggested that the best proof of a well formed pelvis *was the impossibility of reaching the sacro-vertebral angle with the finger*; cited by Dougal 1913, p. 267.
[61] Dougal 1913, p. 266.
[62] van der Hoeven, cited by Dougal 1913, p. 270.
[63] Dougal 1913, p. 270.

for its use by certain eminent obstetricians and authors, such as the American obstetrician, Joseph Bolivar De Lee (1869-1942).

9.14 The role of the medical press in the dissemination of practice

The sharing of obstetric knowledge across the Anglophone world was strengthened by the increasing number of journals dedicated to obstetrics that were launched in the early twentieth century, such as the *Journal of Obstetrics and Gynaecology of the British Empire,* which was established in 1902. Obstetricians of the early twentieth century tended to publish in mainstream international medical journals such as the *British Medical Journal* (*BMJ*), which had considerable impact in the USA.[64] The *Journal of the American Medical Association* (*JAMA*), established in 1883 on the model of the *BMJ,* [65] published in the early twentieth century a comparatively extensive series of papers on the work of Thoms and of Caldwell and Moloy on X-ray pelvimetry and other aspects of pelvic theory. In America, Professor Joseph De Lee[66] had established himself as co-author of a successful obstetrics/gynaecology textbook, a text for obstetric nurses and also as editor of the obstetric section of the *Year Book of Obstetrics and Gynecology*.[67] He was also on the editorial board of the *American Journal of Obstetrics and Gynecology (AJOG).*

9.15 Dualism between theory and practice

Joseph De Lee was a powerful, internationally recognised American author and, like many of his colleagues and in keeping with the wider aims of the American Medical Association, he desired obstetrics to be seen as a scientific and objective discipline.[68] In the

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[64] Burnham 1992.
[65] Knoll 1992, p. 147.
[66] De Lee was Professor at the University of Chicago Medical School and Chief of Obstetrics at the Chicago Lying–in Hospital and Dispensary.
[67] The *Year Book* contained annual reviews of published papers in obstetrics, mainly from American and English medical journals.
[68] The objectives of the American Medical Association glorified medical practice and aimed to improve medical education; Knoll 1992, p. 146. American obstetricians envisaged themselves as the sole practitioners in midwifery, and aimed to oust midwives. In 1910, one maternal death was reported for every 154 births in United States of America, compared with the Swedish rate of one in 430. In the 1930s, notwithstanding the

preface of the sixth edition of his textbook, published in 1933, De Lee suggested not using pelvimetry was not only neglectful but shameful:

> most men do not trouble themselves with pelvic measurements and prepartal study of the probable mechanism of labour ... they let the patient have a longer or shorter test and perform caesarean section if difficulties arise. Such a course is degrading to our art, and results in a high maternal and fetal mortality ...[69]

The *1934 Year Book*[70] carried a report on Thom's work which suggested that external pelvimetry was no longer credible, and internal assessment using x-ray pelvimetry was the only sure method.

In his editorial comments, which usually followed each review, De Lee confided to the readership that he had been pointing out the unreliability of external pelvimetry for the past twenty years, and, while he desired to omit it from the next edition of his textbook, he felt this would be:

> ... too unorthodox. As they do help a little, if only to keep the accoucheur's mind on the subject of pelvic mensuration[71]

Oakley suggests that paradigms are normative and guide practitioners:

> Paradigms are deeply embedded in the socialization of adherents and practitioners; paradigms tell them what is important, legitimate and reasonable[72]

De Lee was in a position to influence obstetric thinking through his texts. He considered himself to be an 'orthodox' obstetrician, dedicated to scientific rules and principles. This may have led to his reluctance to dismantle established obstetric theory, which he had no doubt endorsed for much of his career. He argued that such measurements

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implementation of the Flexner report's recommendations (1910) to improve medical education, maternal death rates in the USA had only marginally improved.

[69]De Lee 1933, p. iii.

[70] De Lee and Greenhill (eds) 1934.

[71] De Lee and Greenhill (eds) 1934 p. 41.

[72] Oakley 2000, p. 27.

still provided an indication of severe pelvic contraction.[73] He appeared to fear that readers might consider him too radical if he omitted the section on pelvic mensuration. However, De Lee's literary opinions and reported behaviour could be quite extreme,[74] so his alleged fear of being perceived as 'unorthodox' in the *Year Book* was a weak excuse to ignore consistent evidence that external pelvimetry was outmoded. De Lee was a bold man driven by his belief that he was making a positive contribution to society by introducing aggressive methods of managing childbirth.[75] Judging by the tone of many of De Lee's editorials in the Year Book, he was not normally afraid of being outspoken, although he appeared hesitant about this particular change.

As an editor, De Lee was in a powerful position which he exploited to regulate the type of information entering the obstetric press. He believed external pelvimetry was one of those elements which had elevated the scientific status of obstetrics. He no doubt helped to extend the period during which external pelvimetry remained enshrined and untarnished within obstetric theory. However, the influence of texts over practice is difficult to ascertain, particularly during a period when senior obstetricians commanded personal authority over local practice.[76]

Going back to the eighteenth century, England and America shared similar ideals and exchanged them freely across the Atlantic. British obstetric textbooks continued to describe methods of external pelvimetry until the 1950s. In the 1956 edition of *Operative Obstetrics,* Kerr suggested the Baudelocque diameter and various other external pelvic diameters measured with callipers were not 'now invested with the importance that was once accorded to them', he then went on to describe them.[77] Abandoning external pelvimetry went against the grain for certain obstetricians, who were attached to the

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[73] Severely contracted pelves would normally have been evident on a general clinical examination, in late pregnancy or in labour, when the fetal head failed to engage in the pelvis.

[74] Joseph De Lee appeared to exhibit misogynistic and sociopathic tendencies and was 'obsessional, arrogant and autocratic'; Baskett 1996, p. 58.

[75] De Lee believed that childbirth was a pathological state which routinely required medical expedients. He implied that scientific advancement might entail the sacrifice of women's lives (of the poorer classes) for the greater good; see Gibson (1996), who provides an edited summary of his 1915 paper, *Progress Towards Ideal Obstetrics of* 1915.

[76] Until the 1990s, consultant obstetricians created their own individualised routine care policies and standing orders for medicines, to be followed by hospital midwives. This meant that before the relatively recent introduction of evidence-based practice, women in the same hospital with the same condition might be treated differently depending on who their consultant was.

[77] Chassar Moir 1956, p. 310.

practice. The wielding of the external callipers had become a symbolic procedure and something most patients were likely to have happily tolerated. They would need to be replaced by something impressive.

Simultaneous developments in the field of Roentgenology* perhaps held out more promise. There was the expectation that XRP could help advance the field of obstetrics and increase its status as a medical speciality in the American post-Flexner period.

At the same time, a campaign for routine X-ray pelvimetry (XRP) and X-ray rooms next to birth rooms was launched, in the hope that:

> ...each labour [could] be studied with that scientific carefulness which is given to the study of medical and surgical cases[78]

9.16 The impact of a new technology on developments in pelvimetry

Whilst the most popular forms of pelvimetry entailed a vaginal assessment and / or external pelvimetry, which were relatively cheap and easy to master, work had commenced on X-ray pelvimetry at the turn of the twentieth century. X-rays were discovered by Wilhelm Conrad Röntgen in 1895.[79] The discovery was widely publicised, and the medium put to a range of medical and non-medical uses. X-rays may have been perceived by the public as being similar to the very popular innovation of photography,[80] albeit with a different range of commercial and clinical applications.

Roentgenology was first exploited as an obstetric tool in France and Germany in 1898, where it was used to visualise and measure certain diameters of the maternal pelvis in living women.[81] It also offered obstetricians a first glimpse of their unborn patient, the fetus.[82]

It was envisaged that X-ray pelvimetry [XRP] offered more accurate measurements of pelvic diameters, while its potential side effects were under-estimated. From a

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[78]De Lee 1934, p. 43
[79]Kevles 1997.
[80]McGrath 2002.
[81]See Hiddinga 1995, pp. 128-38 and Oakley 1984, pp. 98-105.
[82] Apart from pelvimetry and attempts at fetal cephalometry, X-rays were used in obstetrics to confirm pregnancy, assess gestational age or confirm fetal death. They were also used to confirm multiple pregnancies or the presence of severe fetal malformations, and to locate low-lying placentae or retained products of conception. For an explanation of the early uses of X-rays in pregnancy, see Moore 1933; Reinberger and Russel 1935; also Oakley 1984, pp. 98-105.

sociological perspective, X-rays enabled doctors to obtain knowledge about women's bodies of which women themselves were unaware and could not obtain or interpret for themselves. This gave them greater leverage in the mother–doctor relationship, and created a dependent relationship between women and obstetricians. The wider use of X-ray technology in Britain in the 1940s to 1960s further elevated the importance of medical supervision of childbirth and undermined the ability of midwives, with limited knowledge or access to technical sources, to care for women autonomously. It also served to impose the need for midwives to refer women for initial consultation with a doctor. This was further endorsed by the National Health Service provisions for free maternity care and wider eligibility to maternity benefits. [83]

9.16.1 Harnessing the power of X-Ray vision

America emerged as a leader in the field of obstetric Roentgenology in particular, X-Ray Pelvimetry (XRP). The accuracy of XRP improved over time and created a niche for Roentgenologists (now radiologists)[84] in obstetrics to obtain and read the x-rays. Despite the serious effects of exposure to radiation on early X-ray workers, the safety of mothers and fetuses was given relatively little consideration throughout the first half of the twentieth century in America, where X-rays were liberally used.[85] Not only did enthusiasts highlight the clinical value of XRP; they also linked it with the term 'scientific' in the obstetric literature.[86]

There appeared to be clear differences of opinion concerning the value of XRP both in Britain and America, with some obstetricians believing it should be used routinely on 'primigravid' patients (first pregnancy), whilst others believed it was an expensive resource of limited value.

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[83] In England in the 1940s hospital beds were booked in advance and maternity services were paid for according to patients' means; Cumberlage 1948.

[84] The Röntgen Society was formed in 1897 in London, and The Society of Radiographers was formed in 1920 to regulate the practice of radiography in Britain. The Röntgen Society amalgamated with the British Institute of Radiology in 1927. See http://www.bir.org.uk/history.html. The Society of Radiographers is an entirely separate entity: http://www.sor.org

[85] These early experiments could never be repeated on safety grounds, although some of the X-ray films were re-used in later studies.

[86] On modernity, see Lawrence 1994, pp.55-83,

9.16.2 Pioneering X-Ray pelvimetry in the USA

Preliminary work was carried out on dried pelves rather than women, which was fortunate as X-ray exposure times could range from 45 minutes to several hours. Early work focused on refining X-ray techniques, optimal positioning of patients and refining methods of mensuration and interpretation, which involved complex mathematical calculations, crucial to its accuracy.

The American obstetrician Herbert Thoms of Yale University led much of the early work aimed at improving techniques and accuracy.[87] William Caldwell and Howard Moloy (C&M), research colleagues from Columbia University, emerged in the 1930s as the other two major American researchers in this field.[88]

In the early 1990s Anja Hiddinga carried out a project on the production of medical science and technology in the field of obstetrics which focussed in part upon the aforementioned American pioneers of XRP. She concluded that the project was greatly supported in its development by a combination of the institutionalisation of medical authority and the prevailing socio-economic climate.[89] Hiddinga's research illuminated the way in which the 'cultural authority' of science and technology became of greater importance than its 'technical fruits'.[90] Whilst most new knowledge was constructed alongside evolving social conditions, some ideas, such as radiographic Pelvimetry, were 'decontextualised' to transcend historical periods and geographic locations, acquiring an elevated scientific status which lingered on, sometimes long after their utility was challenged.[91]

As previously demonstrated, there are numerous instances of this happening in the past, as with, for example, the Galenic dogma which lingered on into the sixteenth century and prevented anatomists from seeing Galen's errors for considerable time.

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[87]X-ray exposure times were reduced by improved equipment and materials, and the optimal positions for pelvimetry were established by the 1920s - 1930s.
[88] Hiddinga 1992, 1995.
[89] Hiddinga 1995, p. 4.
[90] Hiddinga 1995 examines the development of radiology as an independent specialty between 1920 and 1945 and analysed the relationship between physicists and obstetricians, focussing on the work of Thoms and Caldwell and Moloy in America.
[91] Hiddinga 1995.

9.16.3 Twentieth-century pelvic radiography

In the late nineteenth and twentieth centuries obstetric literature became increasingly sophisticated in terms of its organisation, detail and coherence. The books and journal papers were written almost entirely by experienced obstetricians, who still provided personal opinions; albeit with far fewer case study reports and pieces of anecdotal evidence from personal practice. They retained authorial authority but couched this in more impersonal and objective terms. Some existing theory was revised and systems and nomenclatures re-formulated or expanded.

XRP was promoted as providing more precise measurements of pelvic diameters[92] but failed to become widely integrated into obstetric practice because of the expense of providing the necessary infrastructure of support facilities.[93] While it was described by its advocates as a progressive innovation which made a significant contribution to the advancement of modern obstetrics, digital assessment of pelvic capacity and the use of external and internal pelvic callipers continued to be the mainstay of most practitioners.

9.16.4 Thoms' campaign for mass screening of primigravidae

Thoms appears to have had a lifelong interest in pelvimetry and a very successful record of achieving medical funding for his projects. The very early work he carried out on dried pelves from museums; other data were collected from living women's pelves. Thoms hoped to be able to combine sets of data from various sources in his research, but found this impractical because of the slightly incompatible methods used to take and interpret X-ray films. By the 1920-30s, contracted pelves and rickets were on the decline, and his work met with a mixed reception from obstetric colleagues, who thought its clinical application was limited.[94] Thoms then looked at screening for borderline contracted pelves, which required

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[92] Although much was written about pelvic brim diameters in the twentieth century, papers were also written about mid-pelvic and outlet contraction, although this work was generally less high-profile.
[93] In the early years the costs of XRP were passed on to patients. The cost of the equipment was initially a constraint upon uptake, but gradually X-ray departments were incorporated into large hospitals in Britain and USA and used for a variety of medical indications. By the mid- to late 1940s in Britain, the large maternity units had access to X-ray facilities.
[94] Hiddinga 1995.

the systematic screening of all primigravid pelves (women expecting their first baby). His study group comprised the women attending for antenatal care at the local clinic.

Hiddinga[95] suggests that Thoms' proposal for extensive screening also fed another of his research aspirations, the desire to define further the measurements of the standard female pelvis.[96]

Thoms utilized X-ray data and a formula for establishing a pelvic brim index, based upon earlier work of a professor of anatomy from Edinburgh, Professor William Turner.[97] A major difficulty in getting this research into practice was the general lack of equipment and expertise outside of Thoms' locality. Regardless, Thoms argued repeatedly in his publications that all primigravidae should be X-rayed, and whilst he acknowledged XRP should not be used in isolation to clinical assessment, he stated:

> To those who think that pelvic measurements have but academic interest I would point out the truth of Lord Kelvin's dictum that : "When you can measure what you are speaking about and express it in numbers you know something about it, but when you cannot measure it, when you cannot express it in numbers your knowledge is of meagre and unsatisfactory kind" [98]

Thoms was a scientist and a staunch believer in quantitative analysis. Numbers were widely understood to convey objective meaning to others, and could also be used to challenge and undermine existing beliefs in an incontrovertible manner. Thoms began an aggressive campaign in the medical press to win over the minds of obstetricians. His arguments proposed that not offering primigravid women XRP was tantamount to negligence and also meant that obstetricians were not practising 'modern scientific obstetrics'.[99]

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[95] *ibid.*

[96] In addition to data from patients at the New Haven Hospital Clinic, he collected data from orphaned children and adolescents (age 5-15 years), female student nurses, and male medical students.

[97] Measuring callipers were conventional instruments used by joiners, cartographers and map readers. They were also used by phrenologists and physical anthropologists in the early nineteenth century to compare human skulls and, to a lesser extent, pelvic variations. Realizing that both numerical and descriptive classifications of pelves would be useful, Turner devised a system of pelvic brim classification: Turner 1886. See also Thoms 1956, pp. 13-19.

[98] Thoms 1941, p. 965.

[99] See for example, Thoms 1933, p. 100 (point 3).

9.17 Early responses to the work on x-ray pelvimetry by the obstetric community

Despite an aggressive campaign in the obstetric literature, the uptake of XRP was unhurried, with resistance to it coming from obstetricians on both sides of the Atlantic. Thoms believed it was because most women gave birth spontaneously and most obstetricians considered clinical assessment to be adequate. If a contracted pelvis was suspected a 'trial labour' or a caesarean section was planned electively, or if the problem was detected in labour, an emergency caesarean was performed.[100]

The high cost implications of setting up an obstetric X-ray service was perhaps an obstacle to its rapid integration into mainstream obstetrics, which was gradually overcome to some extent. The procedure required specialist equipment, appropriate housing in a hospital department, specialist personnel to take the X-rays and assistance from radiologists with interpretation of films.[101] Although Thoms recognised that obstetricians were reluctant to accept changes to established practice,[102] he relentlessly tried to convince them of the essential need for XRP:

> If knowledge of the shape and size of the bony pelvis is indispensable to the practice of scientific obstetrics, roentgen pelvimetry is a sound procedure and its routine use, particularly in primiparous patients, is also indispensable.[103]

In New York in 1943, Javert and colleagues argued that XRP was more sensitive than extensive physical pelvimetry in identifying cases of contracted pelvis (CP). [104] They claimed the local incidence of morbidity from CP was around 15-30% which was more frequent than the incidence of syphilis, a serious sexually transmitted disease with an incidence of only 1%. Despite the benefits of routine pelvimetry being uncertain, they

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[100] Thoms 1934a, p. 602.
[101] Anja Hiddinga proposed that new technologies were dependent upon the organisational goals of a specialism, such as the organisation of medical care and hospitals and the relationship between medicine and commercial manufacturers of equipment; Hiddinga 1992.
[102] Thoms 1934a, p. 602.
[103] *ibid.*
[104] Javert *et al.* 1943. They claimed that clinical assessment picked up only 75% of the contracted pelves identified by XRP.

proposed that the public health authorities should recognise the value of X-ray pelvimetry and insist on every childbearing woman having at least one radiographic examination in their lifetime.[105]

The era of radiography promised to take obstetrics further into the realms of antenatal fetal surveillance and prenatal diagnosis, influencing medical decisions about the timing and mode of interventions. Although decisions could not be based upon certainties, scientific evidence could furnish clinicians with guidelines for decision-making. Pelvimetry was seen by some as a useful and impressive tool in their armoury.

Against the backdrop of high American maternal mortality rates,[106] the American obstetrician, Joseph De Lee believed that XRP was a means of raising the standard of obstetrics. He believed that such a scientific and technical medium also helped obstetricians further to delineate their role from that of midwives, which was a greater imperative in the USA than in Britain.[107]

The word 'scientific' begins to appear as a selling point for pelvimetry in the obstetric literature. In 1934, Thoms continued to emphasize the value of knowing the true measurements of the pelvis, promised by XRP:

> ...it should be realised that the greater the exact knowledge of all the factors concerned in the problem of disproportion, the less reliance will be placed on the rule of thumb methods now used.[108]

He frequently pleaded for X-ray pelvimetry to become a routine procedure during the antenatal period, suggesting it was irresponsible not to offer it to all women. The American obstetrician, Julius Jarcho, who wrote *The Pelvis in Obstetrics,*[109] acknowledged the limitations of pelvimetry and the danger of not taking into consideration other influences in labour, but he believed X-rays were harmless, and advised:

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[105] *ibid.*
[106] Maternal mortality was linked in USA with the increased rates of medical intervention and obstetricians were charged with finding ways to reduce this. Anspach argued that obstetricians appeared to be more of a *menace* than midwives; Anspach 1923, also Hiddinga 1992, p. 131.
[107] Emmons and Huntington 1912.
[108]Thoms 1934 a, p. 603.
[109] Jarcho 1933,

> To the general practitioner or physician who does an occasional delivery, a roentgenographical examination in the later months of pregnancy would very often furnish an excellent guide as to the right course. It would inform him as to whether it should be a home delivery or whether it is to be a hospital case.[110]

Following a review of a paper on the value of Roentgen rays in obstetrics,[111] *The 1935 Year Book of Obstetrics and Gynecology* carried an editorial comment which commended the achievements of Caldwell and Moloy[112] asserting that their biggest accomplishment was that of 'raising the standard of the practice of obstetrics'...

> ... By putting the conduct of labour on a high plane they [Caldwell and Moloy] have rendered preposterous the idea of a midwife being allowed in the birth room and have shown our schools what they must teach in their obstetric curricula[113]

In 1940, towards the end of his career, Thoms argued that limiting the use of Roentgen ray pelvimetry to cases when disproportion or arrest of labour was suspected was not only unsound, but 'thoroughly unscientific'.[114]

The American obstetrician and medical historian Harold Speert claimed that although only one variable was being measured (pelvic size), XRP was a 'boon'[115] for obstetricians, and;

> an objective method for predicting and observing the course of labour and for guiding him [the obstetrician] in his management of feto-pelvic disproportion[116]

Nicholson Eastman, another American professor of obstetrics, held an opposing view;

> ... there is no phase of obstetrics which has been so fraught with blunder, oversight and floundering as has pelvic mensuration ...

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[110] Jarcho 1933, p. 240.
[111] Reinberger and Russel 1935, p. 235.
[112] Discussed also in chapter ten.
[113] De Lee 1935, pp. 37-8.
[114] Thoms 1940, p. 9.
[115] Speert 1973, p. 219.
[116] *ibid.*

> [With currently] ... diverse notions as to what constitutes disproportion, conflicting opinions about the values of X-ray mensuration, and so forth - it would appear this old legacy of error is still with us. [117]

Writing in the late 1940s, he argued that obstetricians sometimes allowed pelvimetry measurements to over-influence clinical decisions and claimed that errors were sometimes made in the reading of X-ray films by inexperienced obstetricians. Hiddinga[118] found that, despite the vast American literature on the topic of XRP, an American South Atlantic Regional study carried out in 1947 estimated that only 4% of cases in that region received XRP, which is fewer women than in the UK at this time. In view of this and the great amount of attention the subject received in the medical press, it appears to have achieved limited success in American obstetric practice, despite the vast amount of literature produced in the 1930s-40s.

9.18 'X-ray pelvic dystocia'

For some obstetricians, an enthusiasm for XRP was turning to distrust of it by the late 1930s.. Two significant authorities from the USA and Britain respectively, De Lee and Chassar Moir, suspected that XRP was over-diagnosing CPD and cautioned obstetricians about performing a caesarean on the basis of pelvimetry alone. In a commentary in the 1939 *Year Book*, De Lee wrote of a change of heart concerning the benefits of Roentgenology to obstetrics, stating that even the best X-rays could be misleading. He proposed that many judgements about performing caesarean section were being made on an erroneous basis. He referred to an obstetrician in America who had delivered 50 babies vaginally after the mothers had had previous caesareans for pelvic dystocia attributed to CPD. This condition was labelled 'X-ray pelvic dystocia'.[119]

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[117] Eastman 1948, p. 301.
[118] Hiddinga 1992.
[119] De Lee 1939, p. 26.

9.19 British developments in X-ray pelvimetry

At the Nuffield Unit in Oxford in 1937, Kerr continued to pursue the use of XRP in obstetrics and gained support for investigating the value of radiology in forecasting the course of labour. An X-ray unit was installed for this purpose near the labour ward in his workplace. In 1939 he stated:

> I do not think that ... we who advocate routine pelvic radiography for all primigravidae have lost our sense of proportion on this matter as many suggest today. On the contrary I make bold to predict that before many years pass it will be accepted as an essential detail of the antenatal examination [120]

Research seemed to simply reinforce the observations of the eighteenth century male and traditional midwives who suggested that in cases of suspected contracted pelvis, women often delivered normally. In 1940, Hastings-Ince and Young found that in a sample of 509 women, six were diagnosed as having a contracted pelvis. Five of these had spontaneous vaginal births of infants weighing six to seven pounds and one fetus died *in utero*. The only baby delivered by caesarean was born after 68 hours of labour and weighed only 5¾ lbs. This report cast doubt upon the reliability of the diagnosis of pelvic contraction by XRP and the usefulness of this technology.

Between 1938 and 1944, Maeve Kenny, an obstetrician at the British Postgraduate Medical School, claimed that just over 10,000 women were delivered in her unit and that 94.8 per cent were delivered vaginally without difficulty. During this time a series of a 1,000 radiographs had been performed on 'suspect cases' and 520 operative deliveries performed, highlighting what was described as 'an overlap between anxiety and acumen'.[121] Kenny allocated the suspect pelves to Caldwell and Moloy's four pelvic classifications, on the basis of which she argued that, in general, pelvic shape was more important than size in giving an indication of the likely birth outcome. She claimed that knowledge of pelvic shape helped inform decisions in labour; although predictions were not always accurate. She did, however, acknowledge that the:

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[120] Kerr 1939, p. 860.
[121] Kenny 1944, p. 277.

> ... maternal physical and mental powers of endurance were so important as to make even the most careful radiographic forecast haphazard or approximate only[122]

Regardless, Kenny proposed, while, accepting the high sensitivity and lack of specifity of pelvimetry, that a survey of pelvis and fetus measured with scientific accuracy 'should form at least the basis on which suspect cases may be safely treated'.[123]

After World War Two a turning point had been reached in obstetrics. Reduced risks of maternal mortality led to a refocusing of priorities and the dawn of fetal medicine. With the wellbeing of the fetus in mind, Chassar Moir cautioned that spontaneous labour was sometimes safer for the woman but not safe for the baby.[124]

The obstetrician and textbook author Ian Donald was resigned to the fact that routine pelvimetry for primigravidae might one day become as routine as chest X-rays.[125] Whilst he personally believed that routine XRP was unnecessary and that the subject remained controversial amongst obstetricians, he was prepared to submit to science:

> feelings run high at meetings where it is discussed, but these pioneers are not likely to be discouraged. In the end the science as distinct from the empirical approach must prevail.[126]

As previously suggested, some obstetricians swore their allegiance to obstetrics as a scientific profession whilst in reality placing greater importance on clinical experience. Obstetrics appeared to function on two levels; a theoretical (literary) level and a practical level which sometimes defied the theoretical discourse in favour of a more intuitive approach.

The uncertainty about the use of XRP was reinforced by Ian Donald in his book *Practical Obstetric Problems*:

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[122] Kenny 1944, p. 278.
[123] Kenny 1944, p. 278. The arguments suggest that 'more information is better' and are reminiscent of those used to rationalise the widespread use of electronic fetal monitoring implemented in the 1970s and 1980s, initially used on suspect cases, later becoming part of routine practice.
[124] As maternal mortality and morbidity declined, fetal wellbeing began to emerge as an obstetric focus. By the late twentieth century, caesareans began to be performed for fetal indications, such as fetal distress, breech presentation or multiple pregnancies.
[125] At this time all women had a routine chest X-ray at their booking (first) visit.
[126] Donald 1955, p. 268.

> The art of obstetrics is more often travestied in the name of disproportion than in any other instance.
> ...[the problems] are more than matters of mathematical measurement and demand a skill and expertise which no textbook can provide ... it is possible nowadays to measure up the pelvis in all sorts of planes, and yet the fact that trial of labour is so frequently instituted is acknowledgement enough of the inadequacy of these scientific methods.[127]

Regardless, Donald believed it was:

> better to make a scientific study of difficult labour than to fall back on routine use of a trial of labour [which was] a confession of present-day ignorance [128]

The irony was that science could not provide totally reliable solutions, and basic clinical skills and a measure of personal intuition were, and still are, reverted to in a crisis of scientific faith.

Chassar Moir accepted such uncertainties and offered a brief insight into something which may be described as obstetric artistry in the clinical decision-making process; a trait obstetricians frowned upon in midwives. He mused that personal feelings should be allowed to affect decisions, such as when to stop a trial of labour and opt for surgery or when to induce labour. He suggested that, rather than applying rigid criteria and standard solutions, one should look at each case upon its own merits and fine-tune the decision making process to optimise the time and type of interventions.[129] In this way obstetricians have subsequently become victims of their own success, facing lawsuits when things go wrong and standard policies have not been followed, regardless of the limitations of scientific obstetrics in accurately predicting outcomes.

For centuries medical men have acknowledged that the woman's disposition might affect progress in labour, and while the feelings of obstetricians were occasionally alluded to, consideration of the mothers' feelings about trial labours and so forth were rarely given any consideration in the literature. This was perhaps part of the ethos of modern medicine, which encouraged doctors to distance themselves from their patients, with a view to facilitating objectivity.

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[127] Donald 1955, p. 254.
[128] Donald 1955, p. 268.
[129] See Chassar Moir 1956, p.357.

In the *Historical Review of British Obstetrics* written by Kerr *et al.* in 1954, the use of X-ray pelvimetry was described as being 'still *sub judice*'.[130] For most British obstetricians, callipers and vaginal assessment of the diagonal conjugate were sufficient.

After considerable experience with XRP, Chassar Moir conceded in 1956 that XRP could not replace good obstetrics but, along with clinical vigilance, helped to avoid 'the occasional obstetrical blunder,'[131] concluding:

> Like all tools, it is clumsy or precise, dangerous or beneficial, according to the knowledge, skill and experience of the user.[132]

More of the large maternity units in the UK had their own X-ray departments by the late 1940s, and it was becoming routine in many of these clinics to X-ray all primigravidae.[133] In 1946, the annual number of antenatal patients in the UK receiving X-ray pelvimetry tests was 28.5 %.[134]

In 1947, Queen Charlotte's Hospital performed 410 pelvimetries, although this hospital tended to specialize in abnormal cases.[135] Despite their widely-reported limitations, external pelvimetry and internal pelvic assessment continued to be widely used and described in the textbooks.[136] By 1954, the rate of pelvimetries at Queen Charlotte's Hospital, London, was as high as 66.7 % of cases and coincided with the introduction of new X-ray equipment.[137]

In Scotland, McLennan acknowledged in 1944 that if the incidence of CPD in the population was around 3%, X-rays were not merited for everyone. Nevertheless, he argued that in certain cities of urban Scotland, the incidence of contracted pelves remained higher than average and so he was reluctant to limit the local use of antenatal pelvimetry everywhere. McLennan pointed out the need to take into account other outward signs of CPD such as the patient's height and stature, discussed in chapter ten, alongside findings

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[130] Kerr, Johnstone and Phillips 1954, p. 120.
[131] Chassar Moir 1956, p. 346.
[132] *ibid.*
[133] Oakley 1984.
[134] *ibid.*
[135] Personal communication from Professor Geoffrey Chamberlain, past president of the RCOG (2004).
[136] Chassar Moir 1956, p. 19.
[137] Oakley 1984. p.105. These figures were for the period immediately before A. Stewart's report on the dangers of X-rays to fetuses, also discussed by Oakley.

from external pelvimetry and internal (digital) pelvic assessments. He advised that with multiparous women (more than one pregnancy), difficulties with past deliveries should be treated 'suspiciously'. Primigravidae were unknown quantities, also to be treated with suspicion. The now familiar notion that doctors saw pregnancy as normal only in retrospect was beginning to emerge in the medical literature.[138]

By the early fifties, as documented by De Lee in America, relationships between obstetricians and radiologists had deteriorated. Chassar Moir of the University of Oxford described a 'lack of collaboration between radiologist and obstetrician',[139] which he believed had contributed to the slow assimilation of XRP into mainstream obstetrics. He also believed some obstetricians had taken a flippant approach to the interpretation of X-rays, [140] which could have had serious repercussions on their patients' welfare.

9.20 Safety issues seemed to come last

Skin cancer and azoospermia (in males) were reported in X-ray workers at the turn of the century, and by 1905 guidelines for the protection of workers were being put in place.[141] However, doctors continued to expose pregnant women to radiation on the understanding that X-rays were harmless in moderation.[142] This view rested on the premise that infants X-rayed *in utero* appeared to suffer no ill-effects. Coming from a eugenic perspective, German radiologists were more reluctant to expose unborn fetuses to radiation, and never routinely carried out XRP.[143]

In 1935, De Lee added an unsubstantiated rider to a review of a paper in '*The Yearbook*' on the value and limitation of Roentgen rays in obstetrics:

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[138] MacLennan 1944.
[139] Chassar Moir 1946, p. 487
[140] *ibid.*
[141] Anonymous 1905, Morton 1905.
[142] See for example Eden and Holland 1925, pp. 370, 377. They advocated early X-ray before the fetus obscured the view of the pelvis, whilst they still maintained that the fetal head was the best pelvimeter in cases of contracted pelvis.
[143] Hiddinga 1992.

> It is easy to forsake old and tried methods of diagnosis such as a careful study of a case and the use of our hands, eyes and wits and run to the roentgenologists but it may not be safer [144]

In 1937, it was alleged that:

> The amount of roentgen exposure to which mother and fetus are subjected for diagnostic procedures has been found to be free of danger[145]

De Lee showed some concern about the safety of X-rays and added a rider to a paper in the 1937 *Year Book* in which he suggested that junior obstetricians had a 'deplorable tendency to rely too much on the X-ray' [which adds to] 'the scientific management [of] cases' but which may mislead if not fully understood.[146] Secondly, De Lee described the possible danger from radiation shown by a recent study in which beans were irradiated. The first generation of beans exposed to X-rays were apparently unaffected whilst the second generation was hypoplastic and deformed.[147]

In 1938, Thoms published another paper, 'Roentgen Methods for Routine Obstetric Pelvimetry' which was reviewed in the *Year Book* of 1938. Following this review De Lee appeared to emphasise the fallibility of XRP, suggesting obstetricians should not rely on X-ray findings alone or on what 'dear X-ray men' said.[148] He explained:

> As we said previously, the pelvis may enlarge during pregnancy; it may widen or become flexible during labour, providing larger areas for the passage of the baby when the woman is put into differing attitudes [physical positions][149]

He also suggested that X-rays were not easy to interpret:

> ... The real obstetrician uses his hands, his eyes, his brains first, and the roentgenogram as supplementary or corroborative evidence.[150]

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[144] De Lee 1935, p. 36.
[145] De Lee 1937, p. 32.
[146] De Lee 1937, p. 33.
[147] De Lee 1937.
[148] De Lee 1938, p. 33.
[149] *ibid.*
[150] *ibid.*

De Lee began to re-appraise the unpredictable nature of labour, suggesting that pelvic expansion in combination with optimal fetal positioning may undermine any attempts at accurate pelvimetry. Regardless, in 1941-1942, the *American Journal of Obstetrics and Gynaecology* reported on two Roentgenologic studies which involved subjecting children as young as three to radiation in order to explore the development of the pelvis and sexual dimorphism.[151]

9.20.1 Concerns about X-ray use in pregnancy in Britain

As the consequences of the atom bomb attack on Hiroshima in World War Two became apparent, the harmful effects of radiation came to the fore. In 1946, the British obstetrician, Chassar Moir suggested it would be unwise to submit fetuses to early and repeated X-rays, although it seemed to be generally more acceptable to do so nearer to full term when the fetus was more fully formed. In 1956-7 Alice Stewart *et al.* first successfully raised the alarm about the safety of X-rays in pregnancy and possible links with childhood cancer and leukaemia[152].

In 1955, Ian Donald suggested that limiting the number of X-rays women received during pelvimetry to three could act as a safeguard.[153] In his 1959 edition of *Practical Obstetric Problems* Donald reduced this to one lateral X-ray. It was also proposed that X-raying women lying down rather than sitting and in the later months of pregnancy would reduce irradiation of the fetal gonads in a cephalic presentation.

9.21 Caldwell and Moloy's work on the mechanism of birth

Following on from earlier work on the funnel pelvis,[154] Caldwell and Moloy published a fifty-page report of an extensive radiological study which included 1,000 X-ray examinations of the process of fetal engagement in the pelvis, followed by patterns of

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[151] Morton and Hayden 1941; Morton 1942.
[152] Stewart *et al* 1956. Alice Stewart also produced a report for the Medical Research Council in 1965.
[153] Donald 1955, p. 265.
[154] For example Williams 1922, Thoms 1933.

descent and rotation.[155] This work elaborated on previous work which had began in the eighteenth century. More recently a number of researchers, including Herbert Thoms, had studied the effects of pelvic shape upon the birth process, with the aim of increasing the understanding and appropriate management of fetal malpresentations. However, as Hiddinga pointed out, a lack of access to X-ray facilities and appropriate expertise denied most obstetricians the opportunity to confirm the actual pelvic types of their patients.[156] Caldwell and Moloy also used X-rays during labour to monitor the progress of certain cases of borderline CPD and to study asynclitism*. Their work was time-consuming and expensive, and never became common practice. As late as 1975, after grave concerns about the safety of X-rays in pregnancy had been raised, Charles Steer,[157] professor of obstetrics and gynaecology at Columbia University continued to pursue the desire to see all obstetrical departments with:

> ...a room set aside for the routine study of pelvic architecture. It should contain mounted pelves or pelvic models on which can be demonstrated the pelvic planes and diameters and which can be used to illustrate labour mechanisms. It should also be equipped with adequate viewing cabinets for the study of the roentgenological films ... it is here that obstetrical prognoses are made and lines of treatment discussed[158]

This impression of an obstetric utopia, in which the progress of institutionalised births could be remotely monitored by the medical team, appeared to be motivated by a self-serving desire to elevate obstetrics and abolish midwives. The effect on a mother's experiences of birth was given little consideration within a fragmented system of maternity care, principally centred on the needs of the medical team.[159]

By the 1970s, British birth was increasingly taking place in hospitals, as in America. Women were starved and often sedated and increasingly monitored by

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[155] Caldwell, Moloy and D'Esopo 1935.
[156] Hiddinga 1995.
[157] Charles Steer had began further work with Moloy on the recognition of cephalo-pelvic disproportion before Moloy died. Steer published three editions of *Moloy's Evaluation of the Pelvis in Obstetrics*, New York: Plenum Publishing Corporation, in 1951, 1959 and 1975.
[158] Steer 1975, p. 1/
[159] Midwives found themselves accessories to this, being constrained or indoctrinated by medical policies. See also Martin 1989; Davis-Floyd 2003.

technological equipment, which restricted movement in the alien environment of a hospital, where women could be ministered to by a smaller number of midwives and various support staff. The introduction of electronic fetal monitoring and increased rates of induction and augmentation of labour coincided with a rise in levels of operative deliveries.[160]

9.22 An epilogue to pelvimetry

From the late 1950s, following the confirmation of the dangers of X-ray exposure to fetuses, the number of routine X-rays on pregnant women drastically fell.[161] A survey carried out in 1993-4[162] found there were 278 radiology departments in the UK which supported work in obstetric departments. Although the number of pelvimetries was not actually documented, they were likely to have been limited following the Report of the Royal College of Obstetricians and Gynaecologists (RCOG).[163] This report recommended that XRP be abandoned due to lack of evidence of its effectiveness and its potential to increase rates of intervention.[164] By the late twentieth century, it would appear that the old adage, 'the fetal head is the best pelvimeter'[165] remained the most reliable means of predicting a vaginal birth.

Ultrasonography emerged in the 1960s as a new obstetric technology which was to replace radiography in the assessment of fetal growth and development, leading to its routine use in obstetrics.[166] It also supported the development of a new specialism, fetal medicine.

Assessments of fetal wellbeing and maturity made by ultrasound provided obstetricians with more confidence about the appropriate timing of induction of labour, and many more inductions were initiated for fetal causes rather than maternal ones.

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[160] Mander 2002; Inch 1989.
[161] Stewart *et al.* 1956; Stewart and Kneale 1970.
[162] Morrison and Hackett 1995.
[163] Semple D. M., n.d.
[164] A retrospective study suggested that women who underwent pelvimetry underwent more instrumental and operative deliveries than women with similar sized pelves who had not been X-rayed; Russell and Richards 1971.
[165] Kerr 1903
[166] Ultrasonography was adapted for use in obstetrics by Ian Donald in the 1960s and replaced X-rays in the developing field of fetal medicine.

Ultrasound also facilitated the development of cardiotocography; now so commonplace within the hospital setting. Pharmacological advances assisted more effective attempts at induction of labour. Parallels can be seen between the introduction of forceps in the eighteenth century, which became popular with women in high society who desired the service virtually on demand, and with 'nine to five' inductions of labour in the 1980s and caesarean sections on demand in the 1990s.

9.23 Bypassing the pelvis: The caesarean epidemic

Towards the end of the twentieth century, a contracted pelvis became rare in the western world, and if it happened it was no longer an insurmountable problem. The safety of elective and emergency surgery, combined with a population of pregnant women fitter to withstand major abdominal surgery during childbirth, has contributed to the success of the caesarean. The operation has become increasingly popular with pregnant women, unable to cope with the uncertainty of the timing of birth and the nature of the process of labour and the postnatal effects upon the vagina and perineum.[167] In an increasingly litigious society, a new obstetric maxim has emerged, 'when in doubt get it out' making a significant contribution to an increased caesarean section rate in both the private and public health care sectors.[168]

This new aggressive approach to obstetrics has meant that junior obstetricians have been exposed to plentiful experience of caesarean operations but lack experience of complicated vaginal deliveries, creating further reliance upon surgical means.

In the 1950s in Britain around 3% of births were by caesarean, but by 2004 the rate had burgeoned to 22.9% of births.[169] The costs today are also borne by the financially over-

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[167] Caesarean section remains more hazardous then normal birth; Francome et al. 2006.

[168] *ibid.* The text provides a comprehensive account of the CS phenomenon, including recent statistics. CS rates continue to rise, despite greater awareness of the issues. The National Institute for Health and Clinical Excellence (NICE) guidelines suggest that healthy women with a normal pregnancy may halve their chance of receiving a CS by giving birth at home; NICE 2004, p. 39.

[169] For national and international comparisons, see Francome *et al.* 2006, p. 177. Rates in the private health care sector are commonly higher, especially in countries such as Brazil. Interestingly, increased rates of CS have not lowered rates of maternal and perinatal mortality in countries such as Brazil, while in Sweden a reduction in the already low CS rate has not increased perinatal.mortality (pp. 59-60).

burdened National Health Service. In the 1980s it was first recognised that a caesarean rate above 6%-8% did not improve the health of mothers and babies overall.[170]

In the twenty-first century, medical practitioners committed to birth against the clock,[171] are giving women far less time in which to attempt a vaginal birth before intervening to abandon the process.

Although vaginal births are considered to be a safer option, there is a small group of women who have sought caesareans on demand. Some parallels between the ways in which a caesarean culture has manifested itself can be likened to the manner in which the forceps epidemic occurred in the eighteenth century, which in retrospect was rapid and to some extent was against reason. Certain commonalities include the high social acceptability of these procedures and the limited public awareness of their greater risks in comparison to normal birth, which many midwives and obstetricians are concerned about today.

As a consequence of limited medical exposure to a range of vaginal operative procedures, such as forceps, breech and twin deliveries, doctors have also become deskilled and so keener to resort to major abdominal surgery. Once a woman has had a caesarean her chances of having another increase and so increased rates are perpetuated.

The early abandonment of vaginal birth in labours which continue for more than 6-8 hours has meant that caesarean has become so commonplace in Britain it has been described as reaching epidemic proportions. Although CPD has become much rarer today, it is still sometimes used as a justification for a caesarean, leading to its over-diagnosis.[172] The higher cost of caesarean operations has raised financial concerns which have attracted the attention of the government to the problem, and hospital trusts are now expected to report and publish their annual caesarean section rates.

9.24 Conclusion

As alluded to in previous chapters, one needs to consider that caesarean operations took several hours to prepare for in the eighteenth century and the risk of maternal and fetal

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[170] Francome *et al.* 2003, p. 65.
[171] Kitzinger 2005, pp. 15-21, 15-16.
[172] Francome *et al.* 2006 (p. 171), suggest that two-thirds of women are able to give birth vaginally after a CS for CPD. Some delivered a larger baby vaginally, suggesting the primary indication for CS was incorrect. See also Jongen *et al.* 1998.

death was high. The operations were initially carried out only if the mother's own life was under threat. The risks of the operation were high, especially if the mother was compromised before the operation began by exhaustion, anaemia or infection. Therefore, early detection of difficulties before the mother became moribund was preferable, to maximise the mother's chances of survival.

The early work on pelvimetry served to develop midwifery theory but had little bearing on everyday practice. However, doctors aspired to modernise midwifery and make it more scientific and this facilitated a deliberate strategy on their part of limiting midwives' involvement in midwifery care.

Development of the art of touching in a prescribed manner facilitated the communication of tactile findings to others in a meaningful, although slightly subjective way. For this reason it was important for all midwives to learn how to describe and interpret their findings using a common midwifery language. The role of midwives became more constrained as medicalisation progressed and certain aspects of antenatal care became exclusively medical. *The Maternal and Infant Welfare Act* legislated for the setting-up of antenatal clinics by local authorities. The introduction of an initial medical examination and pelvic assessment meant that all women saw a doctor once they became pregnant. By the early 1950s, as Myles, the author of *A Textbook for Midwives* wrote in her first edition:

> The examination of the pregnant woman can be carried out entirely by the doctor, or shared by the midwife. But there are certain procedures which the midwife is not qualified to undertake, and it is only right that every woman should reap the benefit of any investigation or examination that makes childbirth safer for the mother and child.[173]

The exacting process of pelvimetry was considered a specialist medical task, which would determine the management of the woman in labour. As a few fractions of an inch could make the difference between obstructed labour and a normal birth, the accuracy of mensuration was emphasised as an important feature of pelvimetry. Although evidence was mounting which undermined the accuracy of pelvimetry, obstetricians appeared reluctant to address such issues. At best, pelvimetry was a useful adjunct to clinical decision making.

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[173] Myles 1950, p. 101.

However, it could only accurately define one of a number of important elements which contributed to the outcome of labour.

The enthusiasm for maths and geometry led Meigs to suggest that essential knowledge of the curve of the birth canal made the '*scientific*' delivery of a placenta possible. Methods ranged from the use of imaginary lines to divide up and plot the territory of the pelvis during examination, to the use of internal or external callipers. Basic *a posteriori* spatial knowledge was documented as quantifiable scientific knowledge. Rough guides obtained from digital assessments were converted into a centimetre measurement, using a calibrated finger-length guide. These nomenclatures were portrayed as being precise and accurate, but this turned out somewhat of an illusion; at the end of the day, the fetal head was still the best pelvimeter.

At the end of the day, even obstetricians were not prepared to put their complete trust in these new nomenclatures when making clinical decisions. The differences between medical theory and midwifery theory continued to be a matter of male authority, technical prowess and articulacy. It appears that in most cases obstetricians reverted to a broader assessment of pelvic size and, like many midwives, used their intuition before making major decisions. This suggests that pelvimetry was, in the main, a literary exercise on which expert knowledge was constructed, which helped obstetricians to distinguish themselves as superior to their female counterparts and secure their place as experts on childbirth.

Another remarkable finding in this chapter was the persistence of certain practices long after they outlived their clinical purpose and despite evidence pointing to their ineffectiveness. Whilst the pioneers of pelvimetry acknowledged the difficulties of applying rational principles to an enigmatic process (birth) with all its constantly changing physiological facets, they chose to ignore these matters and continued to promote the wider use of birth technology.

Whilst XRP had been described as more accurate than any other form of pelvic measurement, in reality it did not necessarily lead to more accurate predictions about whether a vaginal birth was possible. Results gave 'an idea' of available space and 'allowances' had to be made to account for the impracticalities of the task and the effects of the power of the uterus, position of the fetus, degree of moulding of the fetal skull,

combined perhaps with a slight degree of pelvic expansion, on the possible outcome of labour.

XRP had a scientific quality which was emphasised and assertively presented in the medical press, particularly in America. Its hi-tech profile and the contemporary appeal of technical gadgetry, demonstrated by its rapid adaptations and versatile public, commercial and professional usages, were strong selling points. The literature also revealed the tremendous power editors had in their editorial roles. Apart from deciding on what to publish, they were able to endorse or criticise the material they published, fostering their personal views about the credibility of the material, sometimes irrespective of their scientific (objective) merit.

In an editorial in the *British Journal of Obstetrics and Gynaecology*, a professor of obstetrics, Philip Steer argued that, rather than pleading to return to the 'simplicity of nature', the caesarean should continue to be refined, as it carried potential to provide the human race with a distinct advantage over natural selection.[174] In such a scenario there would be no natural restriction on the size of fetal head in relation to the size of maternal pelvis. He referred to selective breeding of animals such as bulldogs, 60 per cent of which 'have to be delivered' by caesarean. He went on to ponder whether the extra costs of more caesarean births might be outweighed by 'maternal autonomy based upon convenience, avoidance of pain, damage to pelvic structures, and her desire to protect her baby'. He discussed a Scottish study in which 19.8 per cent of women who were given the option of a trial of vaginal birth or a Caesarean section opted for surgery. What he failed to acknowledge was the information and conditions under which the mothers actually made these decisions.

9.24.1 Discriminating nature of the medical publishing system

Some obstetricians appeared to tolerate references to pelvic theory while not necessarily incorporating it into their own practice. Vincent suggests the historical record can sometimes conceal biases or promote the opinions of certain authors:

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[174] Steer 1998.

> If we disbelieve in witchcraft it is despite the evidence. History is about evidence, but we decide, or the general culture of our day decides, what to exclude from evidence ... evidence means evidence we approve of.[175]

Editors of journals and textbooks tended to be established practitioners and teachers, and were generally well regarded. They had control over what entered the public domain via the obstetric and midwifery press. Until the late twentieth century they were also at liberty to impart unreservedly their personal opinions in their texts. The historiographer is required to take a step back from the written word and explore the authors' background and likely intentions, particularly if they appeared to be in conflict with parallel discourses.

Authors of obstetric texts on both sides of the Atlantic were constructively critical of the value of XRP. Some, such as Ian Donald, appeared complacent or resigned to the fact that the profession was leaning towards wider use of XRP. He assumed it would eventually become part of routine practice in Britain, although he personally did not believe it was necessary. The relentless literary campaign for XRP appeared to have had a limited impact upon individual practitioners' personal decision making processes.

Hiddinga's research that suggests work began on pelvimetry when American maternal mortality rates were very high and the quality of obstetric education was of great concern. The time was ripe for the introduction of a technological adjunct. Whilst Herbert Thoms acknowledged that XRP had a weak theoretical underpinning and limited application, he frequently attempted, with assistance from colleagues and editors, to promote XRP to the profession as a means of enhancing their professional kudos. XRP was envisaged as boosting the profile of obstetrics as a modern scientific specialty in medical circles and to the general public, in an age of increasing admiration for technological innovation. Its clinical limitations and resource implications were ignored by its proponents, who heavily criticised those resistant to its use by suggesting they were old-fashioned and not practising to a high standard.

It was disconcerting to note that obstetric researchers were prepared to overlook the possibility that X-rays could cause harm to mothers, fetuses and the young in order to pursue pelvic studies; the intensity of their desire to professionalise obstetrics thereby only too apparent.

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[175] Vincent 1996, p. 29.

In Britain, the subject of pelvimetry was controversial outside the centres of excellence where it was pioneered. So, while in theory, radiological assessment was encouraged, obstetricians accepted that it could not replace clinical assessment. In addition, its complexity required them to work alongside radiologists, which some appeared to resent.

XRP became a routine part of antenatal care for some women in parts of the USA, Britain and the developed world by the 1940s-50s. Concern then grew about the risks of exposing pregnant women and their fetuses to X-rays. From the 1960s, this had the effect of reducing but not totally abolishing its use in pregnancy for a range of indications, some of its previous uses being replaced by the use of ultrasound, pioneered in the 1960s. In twenty-first century Britain, the practice of XRP was finally discredited by the Royal College of Obstetricians and Gynaecologists on grounds of inefficacy.

This exploration demonstrates the symbolic function of X-ray pelvimetry, which went beyond its efficiency and attracted women to hospital and on,to professional territory. X-ray technology extended the notion of risk to all pregnancies and increased uncertainty, reinforcing the medical stance that pregnancy is only normal in retrospect.[176] By necessitating the use of medical technology, the pelvimetry project helped to fulfil another obstetrical ambition, the domestication or taming of traditional midwives or even their possible elimination, mostly strongly expressed in America.[177]

This exploration provides another good example of how technology can permanently affect the landscape of practice in unintended as well as intentional ways; further demonstrated in chapter ten.

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[176] DeVries and Barroso 1997.
[177] See Kirkham 1996, p. 179; DeVries and Barroso 1997.

10 'Give Me the Pelvis; I'll give you The Woman': Pelvic Theory in the Twentieth Century

> *A theory can be false yet still be scientific and a claim can be true without being scientific ... (Bird 1998)* [1]

10.1 Introduction

A knowledge of what has gone before helps with the recognition of the remaining traces of the past.[2] Ideas have evolved considerably since ancient times, and the pan-historical approach has provided knowledge of events in different periods, which allows continuities and differences to be identified. Most midwives and obstetricians do not possess the longevity to recognise certain remnants of the past in their professional epistemology; many ideas have been lost or are now only barely visible in present-day practice. This chapter reveals some of the influences on contemporary practice, with obscured links to nineteenth and early twentieth-century culture. As Fleck claims:

> We can never sever our links with the past, complete with all its errors. It survives in accepted concepts in the presentation of problems, in the syllabus of formal education, in everyday life, as well as in language and institutions [3]

10.1.1 Twentieth-century pelvic theory

Most of the seminal work on pelvic theory of the twentieth century emanated from America. By the time the standard pelvis had been mapped and normal parameters established using X-rays, the problem of rickets was diminishing, and the structure of healthy pelves came under scrutiny.[4]

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[1] Bird 1998, p. 1. Bird defines 'science' as an epistemology which endeavours to explain why things are the way they are and which constructs laws on how nature is governed.
[2] Jenkins provides a discussion on the nature of history; Jenkins 1995.
[3] Fleck 1979, p. 20.
[4] By the 1920s, links between rickets and vitamin D deficiency and the benefits of cod liver oil and sunlight had been discovered; Rajakumar 2003.

The most significant contributions to pelvic classification were again made by Herbert Thoms and his team and Caldwell and Moloy, who both devised competing classificatory schemes.[5] Their work was widely disseminated in scientific journals and communicated to Britain, where British contemporaries critically appraised it and followed this up with their own investigations.

It is now over seventy years since Caldwell and Moloy's system of pelvic classification was first introduced. It was reported to have been 'unanimously' accepted in Britain,[6] and it lives on in some of today's midwifery textbooks, albeit devoid of social and historical contexts. Why this particular classification rather than any other appeared in the texts for so long, given its clinical limitations and outdated socio-political connotations, is unclear.

Other significant events in the development of late twentieth-century pelvic theory included a renewed appreciation of the capabilities of the pelvis to expand in labour and of the effects of maternal birthing positions upon space available to the fetus. Such ideas appear to have made more of an impression upon midwives than upon obstetricians; many of the former embraced these principles and incorporated them into their practice. The condition of spontaneous pubic bone separation (diastasis symphysis pubis) was also re-appraised in the late twentieth century by a small number of physiotherapists and midwives, who sought greater professional recognition of this condition for sufferers.[7]

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[5] Thoms studied particular types of pelvis and their influences on labour and briefly explored cephalometry (measurement of the fetal head size). Caldwell and Moloy completed further work on the mechanism of birth using X-ray techniques.

[6] Nicholson and Allen 1946, p. 192.

[7] In 1994 the late Margie Polden, a superintendent obstetric physiotherapist working at the Hammersmith Hospital asked women to write to her with their experiences of pelvic pain, see Polden 1994. Over a hundred women responded, and in January 1995, The British DSP (Diastasis Symphysis Pubis) Support Group was founded. A year later it had 118 members with personal experience of the condition. Concerns for the health and wellbeing of affected women appeared to be taken more seriously by physiotherapists and midwives: Wellock 2002, Shepherd 2005. Whilst obstetricians focussed on the physiological aspects; see, for example, Jain and Sterberg 2005.

10.1.2 Science and obstetrics

Modern medicine of the nineteenth and twentieth centuries became increasingly reductionist as bedside medicine was gradually eclipsed by laboratory medicine.[8] Nosological classifications of human diseases were in place by the mid-eighteenth century, and gradually the rise of hospital medicine facilitated specialisation, which led to a deeper and compartmentalised knowledge of the human body.[9] By collecting data in an accumulative fashion, it was thought possible to recognise patterns of illness and to make accurate diagnoses.[10] This type of work formed the basis of probability theory and reinforced the benefits of quantification, although,the amount of data collected in the early twentieth century was relatively small by today's standards.[11]

10.1.3 Pelvimetry in the age of scientific obstetrics

The aim of twentieth-century 'scientific' obstetrics introduced in the previous chapter was to push out the boundaries of certainty, based upon the premise that nature acted in a predictable manner and could be understood and managed. The desires to arrive at more precise empirical data and to find patterns or natural laws which could be harnessed to control nature and make predictions were facets of modernity.

Following the earlier success of broad classificatory schemes to classify flora and fauna, scientists strove to define a subtle hierarchical human stratification.

Whereas women could be broadly defined by their sex and race, each woman was unique, and women's pelves, like other physical features, consisted of unique combinations of bone structure.[12] Data from stereoscopic[13] X-ray pelvimetries (XRPs) were interpreted and collated according to brim shape. Initially these brim shapes were linked to overall

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[8]Laboratory medicine evolved to form specific sub-specialities, such as biochemistry, immunology, embryology, hereditary theory (which became genetics), and endocrinology, which were enhanced by improved technology and further work involving animal vivisection; Brunt 2004, Bynum 1994.

[9] Marland 2004.

[10] Thomas Sydenham (1627-1689) described signs and symptoms of types of diseases in order to identify them, similarly to the manner in which botanists had described and identified different types of flowers.

[11] Michaelis was probably the first to collect a large set of data on pelvic size and to assess whether external pelvic measurements were reliable. See chapter six, 6.6.3.

[12] Today, of course,aspirational artificial cloning experiments might challenge this premise.

[13] A three-dimensional X-ray technique.

pelvic shapes; however, pelves were soon found to be multivariate and difficult to classify into just four groups. It was also noted that the depth of the mid-pelvis or pelvic cavity and type of sacrum and coccyx was also subject to variation, irrespective of allotted brim shape, creating the need either for a more sophisticated system of classification or its total abandonment. The postulated causes of different pelvic shapes, while presented as affirmative, were actually speculative, and, as more data were collected, the initial classification schemes became unwieldy.

10.1.4 Seminal work of Caldwell and Moloy on pelvic classification

Modern day readers of obstetric and midwifery texts may still encounter the seminal work of Caldwell and Moloy,[14] which focussed on the overall shape of the pelvic brim rather than pelvic measurements, and classified pelves into four simple descriptive categories.

These four theoretical classifications now appear devoid of social context, and give the impression to modern-day readers of being creative 1930s rankings which have stood the test of time. On closer examination, pelvic classifications were not quite as innovative as they first appeared. Pelvic nomenclatures of the early twentieth century were heavily influenced by nineteenth-century evolutionary theory, which itself drew upon the disciplines of physical[15] and forensic anthropology;[16] anthropometry;[17] and phrenology.[18]

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[14] Fraser and Cooper 2003, pp. 105-7.

[15] Physical anthropology examines the classification of modern races, using mensuration [measurements] and descriptive techniques. It examines *adaptations, variability and human evolution.* As a social science, it examines *these aspects within the context of human culture and behaviour;* American Association of Physical Anthropologists, no date

[16] Forensic anthropology involved assessing age, sex, and stature from skeletal remains. The first complete guide to the identification of skeletal remains was not written until 1939. By the 1950s, owing to discoveries in genetics, forensic anthropologists had moved on from racial typology to adopt more experimental forms of investigation allied to the field of contemporary biological science and genetics; Bramblett 2001.

[17] Anthropometry is the study of human body measurement in anthropological classification and comparison; Carroll 2005.

[18] The eighteenth century practice of physiognomy later gave way to a new, relatively short-lived discipline known as phrenology, a pseudo-science emerging in the 1820s which resulted in the collection of skulls or casts of them; Kaufman 2003, pp. 165-76. Kaufman describes how phrenology explored the unique formation of the cranium and skull prominences and linked this with human characteristics and behaviour. Although these characteristics were believed to be fixed, strengths could be developed. The Edinburgh-based George Combe helped to popularise phrenology in Britain. Research in this field involved the use of various instruments to measure regions of the cranium. Human brains were also weighed and dissected, and intelligence was initially linked to size of skull and brain weight. Such observations were thought to confirm

Ludwik Fleck argued that scientific theories were culturally conditioned and suggested ideas which reflected the prevailing thought style tended to be more readily assimilated into practice.[19]

10.1.5 Cartesian thinking: science versus intuition

As previously mentioned, the weakness of anthropometric[20] quantification and categorisation was human individuality, which frustrated attempts to fit all pelves into relatively rigid artificial groups. In some ways obstetricians were looking for something that was beyond their reach and at best only offered a partial solution. Outcomes of complicated birth remained relatively unpredictable, and problems required an individualised, moment-by-moment approach to their management. In reality this often meant that the philosophy of obstetrics was surreptitiously over-ridden by personal intuition and experience and by a single-minded attitude towards problem solving.[21]

10.2 A tradition of collecting, describing, quantifying, and classifying

The eighteenth and nineteenth centuries were notable periods for collecting, measuring, and classifying species in the western world,[22] and natural history was of great public interest. The Swedish botanist Carolus Linnaeus (1707-1778) became known as the inventor of modern scientific classification in 1735 when he first classified flora and fauna.[23] Botanical and biological classification distinguishes specimens by species, genera or families. Such concepts supported contemporary evolutionary theory. In the early nineteenth century, phrenology emerged as a new popular science. It involved careful

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that men had stronger mental powers than women (although women suffragettes used phrenology to demonstrate women's strengths; Russett 1991, pp. 16-48).

[19] Fleck 1979.

[20] Anthropometry was used in the latter half of the nineteenth century by physical anthropologists and anatomists to develop theories of racial determinism.

[21] See Bynum W. F. (1994) pp. 42-6, on the 'numerical method' which explores the medical desire to quantify and generalise illness, against the merits of recognising the uniqueness of each case of an illness.

[22] Classifications can be used to order nature according to certain membership criteria or distinguishing features. These may not be derived from natural divisions, and entities / data can often be re-categorised using different criteria.

[23] Linnaean societies were established in London and other European cities as forums for discussions of evolutionary theory.

assessments of the nature and relative proportions of the skull bones and temporal and facial bone structure (physiognomy), the latter being a long-established pseudo science).[24] This involved the collection of physical measurements, particularly of the cranial bones of the skull. Numerous measuring callipers were devised for this purpose, which were later adopted by physical and forensic anthropologists.

Throughout the nineteenth century, a debate raged over the origins of life which challenged the biblical version of creation in Genesis with theories of adaptation, natural selection and survival of the fittest. A number of classic texts[25] were published on evolutionary theory, which caused considerable religious angst. In retrospect, despite appearing to be based upon scientific evidence, evolutionary theory was highly speculative.[26]

The British used craniometry to justify racist policies against the Irish and black Africans, implying that class distinctions were God-given.[27] By the 1930s, Mendelian genetic theory was being used to support the concept of natural selection (neo-Darwinism), and craniology and anthropometry were put to further use by social biologists or eugenicists. This ideology culminated in Nazi Germany with the plan to selectively breed a super race, which involved assessing peoples' physical features in order to distinguish Aryans from non-Aryans.[28] Consequently, the masses became attuned to the idea that, in

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[24] See Carroll 2005, Kaufman 2003 and van Wyhe 2002 on phrenology

[25] In 1828 George Combe published *Constitution of Man*, which had a circulation of around 350,000 copies between 1828 and 1900. This was followed in 1844 by an anonymous text, *Vestiges of the Natural History of Creation*, and by the famous work of Charles Darwin, *The Origin of the Species* in 1859. Darwinian theory uniquely claimed that variation amongst species was due to natural selection. Other scientists, such as Alfred Russell Wallace, were also busy working in this area. Thomas Huxley was notable for his work on possible phylogenetic relationships between man and other primates. Controversies regarding evolution were very much brought into the public eye via Huxley's debate with the Bishop of Oxford in 1860 at the British Association. Huxley and John Tyndall were amongst the first generation of Darwinists who kept the support for Darwin and the Darwinian debate alive towards the end of the nineteenth century; van Wyhe 2002-2007; Blinderman and Joyce 1998.. Obstetricians suggested that the change to bipedalism was associated with some of the difficulties around birth which seemed peculiar to the human species. Work on evolution and its effects upon human birth continues; Abitbol 1996; Trevathan 1987; Stewart 1984a, Stewart 1984b; Jordaan 1976; Leutenegger 1972.

[26] Ruse 1993.

[27] Joseph Banks, a botanist and collector who accompanied Captain Cook on his voyage to Australia, was awarded the preserved head of a Tasmanian warrior. During the nineteenth century, around 10,000 aboriginal corpses and body parts were brought to Britain to languish in British museums and university anatomy departments; see Carroll 1995; Langsam 1990.

[28] Stephen Jay Gould claimed that World War II atrocities dampened American enthusiasm for eugenics. Despite this, Susan Lederer maintains that experiments continued to be performed on disadvantaged and

various ways, natural laws might influence the development of society.[29] This thesis argues that from the eighteenth century to the mid-twentieth century, pelvic classification was utilised as a subtle means of maintaining certain social values. In the early twentieth century, the work of Thoms and of Caldwell and Moloy on pelvic classification contained elements reminiscent of white male European racist and eugenicist trajectories.[30]

10.3 Small crania, large pelves: biological proof that women were fit for one purpose only?

Interest in the physical differences between the sexes (sexual dimorphism) was clearly manifested in the medical literature from the eighteenth century onwards. Illustrations of female skeletons and pelves began to feature in texts, alongside enduring images of the male prototype.

Many of the impressions of skeletons from the eighteenth century onwards were also culture-laden. A degree of artistic licence was utilised to emphasise ideal male and female skeletal stereotypes. Illustrations of female skeletons tended to exaggerate certain features such as a relatively small skull, very narrow shoulders and chest and a relatively large pelvis. The artist Samuel Thomas von Soemmerring suggested that anatomists had attempted to 'fix nature' to match contemporary ideals of femininity and masculinity, which led to a lively debate about female proportions.[31] Anatomists retorted that von Soemmerring may have been a good painter but that, when it came to anatomy, they were the experts. One German anatomist, Joseph Wenzel, agreed with von Soemmerring that:

> ...a sharp physiological delineation between the sexes is impossible because the great variation among individual men and women produces

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vulnerable members of society, including black Americans and the mentally impaired; Gould 1996; Lederer 1997.

[29] Social progress was thought to be linked to natural progress and natural laws; this philosophy was derived from French revolutionary and enlightenment thinking. On this, see van Wyhe 2002; van Wyhe 2002-2007.

[30] This was the period of rapid change during which humoralism, which had emphasised female frailty, was being rejected and women began to assert their social equality with men; see Wollstonecraft 1792.

[31] Secondary sources reflecting lively international debates which attempted to justify male supremacy on physical grounds; Schiebinger 1987, p. 63 and Russett 1991, pp. 11-12.

> continuity between the sexes. In fact ... one can find skulls, brains and breast bones of the 'feminine' type in men[32]

From this it can be seen that, while late nineteenth and early twentieth century science claimed to be more precise and empirical,[33] it still exuded subjective bias. The general tendency for females to have smaller-sized skulls was cited as irrefutable evidence of women's smaller brains and (assumed) lesser intellect.[34] Some went as far as to suggest that females were arrested at a lower stage of evolution than men, likening white women to children or 'primitives'.[35] Consequently, contemporary anatomists resented von Soemmerring's positive assertion that female brains were in fact proportionately heavier than male brains if considered in relation to overall body weight.

Whereas nineteenth-century anatomists fulfilled the socio-political need to re-affirm women's natural ability to bear children, paradoxically obstetricians tried to establish reasons why some women might not be capable of carrying out this innate function without their assistance. In 1948 the forthright American obstetrician, Joseph Bolivar De Lee[36] mused that 'so frequent' were problems during childbirth that nature might have intended that women were used up during the reproductive process like '... the salmon which dies after spawning'.[37] Obstetricians also harnessed evolutionary theory to argue that as a result of bipedalism (walking on two feet), *foemina sapiens* (womankind) had more inherent difficulty in giving birth than quadrupeds because the birth canal of the human pelvis was angled rather than straight and tubular.[38] The obstetric project continued to engineer birthing theory socially and biologically; renaming birth 'parturition' and re-constructing

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[32] Joseph Wenzel's foreword to Jakob Ackermann's German text *Ũber die Verschiedenheit*, pp. 5-7, cited by Schiebinger 1987, p. 62.
[33] See Russett 1991, pp. 1-48
[34] Phrenologists had attempted to estimate brain weights, believing that size was equal to intelligence, while others argued in defence of women that in relative terms *women's brains were proportionately heavier than men's*; *ibid.*
[35] Russett 1991, pp. 49-77.
[36] Joseph De Lee was outspoken, suggesting that babies were sometimes *killed* during birth by their mother's physical incompetence and that childbirth was *pathological*, requiring the routine use of forceps; De Lee 1920.
[37] De Lee 1920, p. 41. In the early twentieth century, America had the highest maternal mortality in the developed world.
[38] See Stewart 1984a, 1984b. In 1835, John Roberton, surgeon to the Manchester Lying-in Hospital, appeared to contradict the view that the human pelvis was not as conducive to birth as a quadruped pelvis; Roberton 1835.

childbearing as an illness.[39] This may not have happened out of a conscious male malice, but as a result of contemporary social influences and exposure to an education which endorsed male domination.

Some obstetricians also associated types of labour with social class in a self-serving manner, arguing that birth was more natural for 'robust' working-class women and 'primitives,'[40] who were more suited to 'breeding'; not, however, for the delicate upper class white women who, because of their increased nervous sensibility, would benefit from medical attention.[41]

10.4 Principal uses of anthropometry previous to its use in obstetrics

The travels of eighteenth and nineteenth-century missionaries, traders and explorers created increased interest in foreign races, tribes and cultures. According to Cynthia Eagle Russett, eighteenth-century social scientists acknowledged the effects of enculturation, which could potentially stifle a person's natural abilities. In the nineteenth century, social scientists put increasing emphasis on diversity and personal and group difference (see Figure 10.1), with the implication that certain types were born to lead and others to follow.[42] Human skulls were collected from the far reaches of the British Empire from various tribes and brought to Britain to be examined, measured and compared by physical anthropologists. Meanwhile, parallel activities were going on in other European and American universities and museums of natural history.

The interests of physical anthropologists in sexual dimorphism and racial diversity[44] developed in parallel to theories of human evolution. Race became an issue closer to home as abolitionists, many of whom were women suffragists, campaigned from Britain and

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[39] See Lawrence and Bendixen 1992, pp. 925-34.

[40] The terms *primitives* and *lesser humans* were terms used in the nineteenth and early twentieth century literature to describe non whites.

[41] The corseted and closeted women of the upper classes were thought to have weaker constitutions and lower pain thresholds, because of their nervous sensibility and greater intelligence, see Moscucci 2003, pp.102-8.

[42] Russett 1991, p. 23, explains how interests in foreign peoples led to the question of whether the human species was from one original stock (monogenism) or various ones which existed in parallel (polygenism); see also Gould 1996, Boas 1940.

[44] Knowledge of the female pelvis and sexual dimorphism assisted archaeologists with the sexing of human skeletons.

America for the end of African slavery.[45] During this period, physical anthropology was used to support 'conservative, racist, social and political philosophies'.[46] People were categorised according to type, with different physical constitutions, characters and associated aptitudes. White males perceived themselves as being the most civilised and at the top of the evolutionary tree. Morphology clearly fulfilled a socio-political purpose as a plausible way of justifying contemporary social inequalities and discrimination.

Figure 10.1 Principal varieties of mankind
(The white European male radiates from the centre of the image)
Reproduced with permission: The Science Museum/SSPL

As science and medical research could be employed in a supposedly objective manner to defend social divisions within society, the interplay between politics and medicine increased, boosting the status of doctors as arbiters of society in a period of rising social disquiet. The London Anthropological Society was founded in 1863 to study natural laws in order to explain the diversity of mankind. The Society expressed concern that: 'philanthropists, sentimentalists and politicians promoting women's rights as people …

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[45] The slave trade was abolished in 1807, and the Abolition of Slavery Act was passed in 1833. Slaves were subsequently freed throughout the British Empire. Although slavery was abolished in America in 1865, the Civil Rights Act, to stop all forms of racial discrimination and prejudice, was not passed until 1964.
[46] Russett 1991, p. 6.

refused to be guided by science'.[47] The founders were anti-Darwinist believers in polygenism, and considered 'the negro' to belong to an inferior species.[48]

10.4.1 The influence of anthropology on pelvic theory

In the early nineteenth century, anthropologists had found work on the classification of female pelves of different races unrewarding because female pelves tended to be less varied than male types.[49] The system of classification chosen by Herbert Thoms was derived from a combination of two pre-existing nomenclatures discarded by anthropologists and subsequently adapted and expanded by the anatomist Professor William Turner of Edinburgh.[50]

Caldwell and Moloy produced a competing classificatory scheme, which they argued was easier to use, because it did not involve mathematical calculations. Subsequently, research teams in the United States began studies to ascertain the prevalence of particular pelvic types.

10.5 In search of a comprehensive classification of pelves

The approach to this part of the chapter takes three directions. It starts with a brief exploration of the emerging pelvic theories of the 1930s and 1940s. This is followed by a review of the competing challenges to Caldwell and Moloy's pelvic nomenclature post 1933. This leads to the ultimate question, why are Caldwell and Moloy's four pelvic descriptors, bearing their original labels, still being referred to in contemporary textbooks, given their limited value to practitioners and socio-political connotations?

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[47] Russett 1989.
[48] Stepan 1982; Gould 1996; Russett 1989; see also Anon 2006
[49] Michaelis was probably the first to classify pelves according to shape and size. For a later example see Playfair 1886, pp. 55-84.
[50] Turner 1886; pp. 125-43; see also chapter nine.

10.5.1 Rival obstetric pelvic classifications

Nineteenth and early twentieth-century obstetric pelvic classifications focused on defining pathological types of pelves. With the assistance of Roentgen rays or X-rays, pelvic classification became more ambitious and focussed on a comprehensive description to accommodate all pelves, of which the vast majority were healthy.

Thoms and Caldwell and Moloy kept up a relentless stream of publications in mainstream medical and obstetric journals, such as the *Journal of the American Medical Association* (*JAMA*), the *British Medical Journal* (*BMJ*), and obstetric journals such as the *American Journal of Obstetrics and Gynecology* (*AJOG*). They also published in specialist journals such as the *American Journal of Roentgenology and Radium Therapy*, *Anatomy and Physiology and Physical Anthropology,* and in the 1950s produced short composite texts.

Both parties at Yale and Columbia universities appeared to be locked into a literary struggle to assert the supremacy of their own classificatory scheme over their rival's. The schemes were recited to readers at every opportunity, to the point where most readers would be fully conversant with both systems. However this did not necessarily mean that readers approved of them or used them in practice.[51] Whilst much of the American work focussed upon classification, researchers in other parts of the world had explored possible underlying causes of some of the marked variations in pelvic shape

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10.6 Kathleen Vaughan's views on the female pelvis

In 1931, before Thoms and Caldwell and Moloy published their papers on pelvic classification, Kathleen Vaughan published a report called, *The Shape of the Pelvic Brim as the Determining Factor in Childbirth,* which Thoms briefly acknowledged.[52]

Vaughan had been superintendent at the Diamond Jubilee Zenana Hospital, Srinagar, India. From there, she observed that environmental conditions, rather than geographical location, determined women's abilities to give birth. Women living in the same location, who worked hard on the land, had more success in childbearing than those

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[51] Anja Hiddinga has analysed developments in pelvimetry at both Yale and Columbia Universities in America in relation to scientific knowledge claims. See Hiddinga 1995, Hiddinga 1992.
[52] Thoms 1934b, p. 2076.

who lived in purdah, secluded indoors from the age of eight. Vaughan also noticed that African women fared better in their homelands when compared with their sisters who found themselves in American cities, where they required more help to give birth than white Americans.[53] She observed also that Scottish Highland women working on the land and shores and English gypsies and canal-boat women also had large families with little need for medical assistance, whereas women living in British towns and cities had the greatest difficulty giving birth and the highest maternal mortality.

Sir Keith Arthur had suggested that the 'heads of the race were getting larger but the pelves of the race did not seem to keep pace'.[54] Vaughan acknowledged that the main problem with giving birth had been cephalo-pelvic disproportion (CPD). However, she proposed it was more a matter of pelvic shape and chose to focus on the process of pelvic distortion. She believed a round pelvis more closely reflected the shape of a well-flexed fetal head and that a 'misfit is due to loss of area in the pelvic brim owing to a circle being bent into an oval'.[55] To support her theory that the normal pelvic shape was round or oval and the wider oval pelvis seen in many western women was in fact abnormal, she noted that 'perfect teeth are found with the round pelvis, and this is well understood among primitive people who consider such teeth essential in a bride'. [56]

Vaughan proposed, 'the more primitive the habits of life the more circular the pelvis'.[57] She confidently wrote in the *BMJ* that variation was not influenced by race, although culture may be implicated. She drew on the work of Professor Havelock Charles, *The Influence of Function*, which compared differences in structure and function of the lower limbs and pelvis in association with their daily use. [58] Havelock Charles observed how Panjabi sacro-iliac joints were modified by regular squatting to produce a large articular surface.[59] Writing before the advent of X-rays, he noted how movement of the sacrum between the innominate bones and bone growth in this area in pre-pubertal girls influenced brim shape at maturity.[60] In conclusion, a lack of bone growth in these areas was

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[53] Vaughan 1928; Vaughan 1931, p. 940; Vaughan 1937.
[54] Arthur, cited by Vaughan 1931, p. 940.
[55] *ibid.*
[56] Vaughan 1931, p. 941.
[57] *ibid.*
[58] Charles Havelock 1893.
[59] *ibid.*
[60] Vaughan 1931, p. 941.

usually as a result of disuse of the sacro-iliac joints in the young or from childhood rickets, which distorted the normal circular shape of the pelvic brim.[61] Vaughan proposed that such abnormal features occurred before the age of fourteen, and noted that in England:

> ...the soft pelvis is bent by long sitting at school, and this is not counter-acted as it should be by the proper action of the sacro-iliac joints, which should be used daily if only in the acts of defecation and urination (in a squatting position).[62]

10.7 Caldwell and Moloy's classifications based upon pelvic architecture

A number of physical anthropologists, anatomists and obstetricians were involved in developing pelvic classifications in the nineteenth and early twentieth centuries, although the work of Caldwell and Moloy has probably been the most clamorous. Caldwell and Moloy's work focused mainly upon the examination of healthy as opposed to pathological female pelves, using X-rays. Their seminal work, first published in 1933, proposed four pelvic classifications and was based upon the examination of museum specimens of human pelves of known sex.

Their work included comparisons between human female and male pelves and between female pelves and female chimpanzee pelves.[63] Caldwell and Moloy collaborated closely with physical anthropologists, who advised them on suitable names for their four pelvic categories. Similarly, Thoms drew upon previous anthropological work to devise his own pelvic classification.[64]

Caldwell and Moloy believed variations in shape of pelvis were caused by 'racial, sexual, or other complex inherited influences rather than by pathological changes'.[65] They

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[61] *ibid.*

[62] Vaughan 1931 note 53, p. 941. Vaughan also believed 'civilised' women created further difficulties for themselves in childbirth by wearing high-heeled shoes which altered the distribution of body weight on the pelvis, causing distortion.

[63] Moloy was an experienced anatomist who co-operated with physical anthropologists to develop the pelvic classifications. Comparisons between human birth and parturition in other mammals, particularly primates, combined with evolutionary theory, were used to suggest that bipedalism had dealt a detrimental blow to the mechanical process of human birth. For a discussion of these perceived effects, see Abitbol 1996.

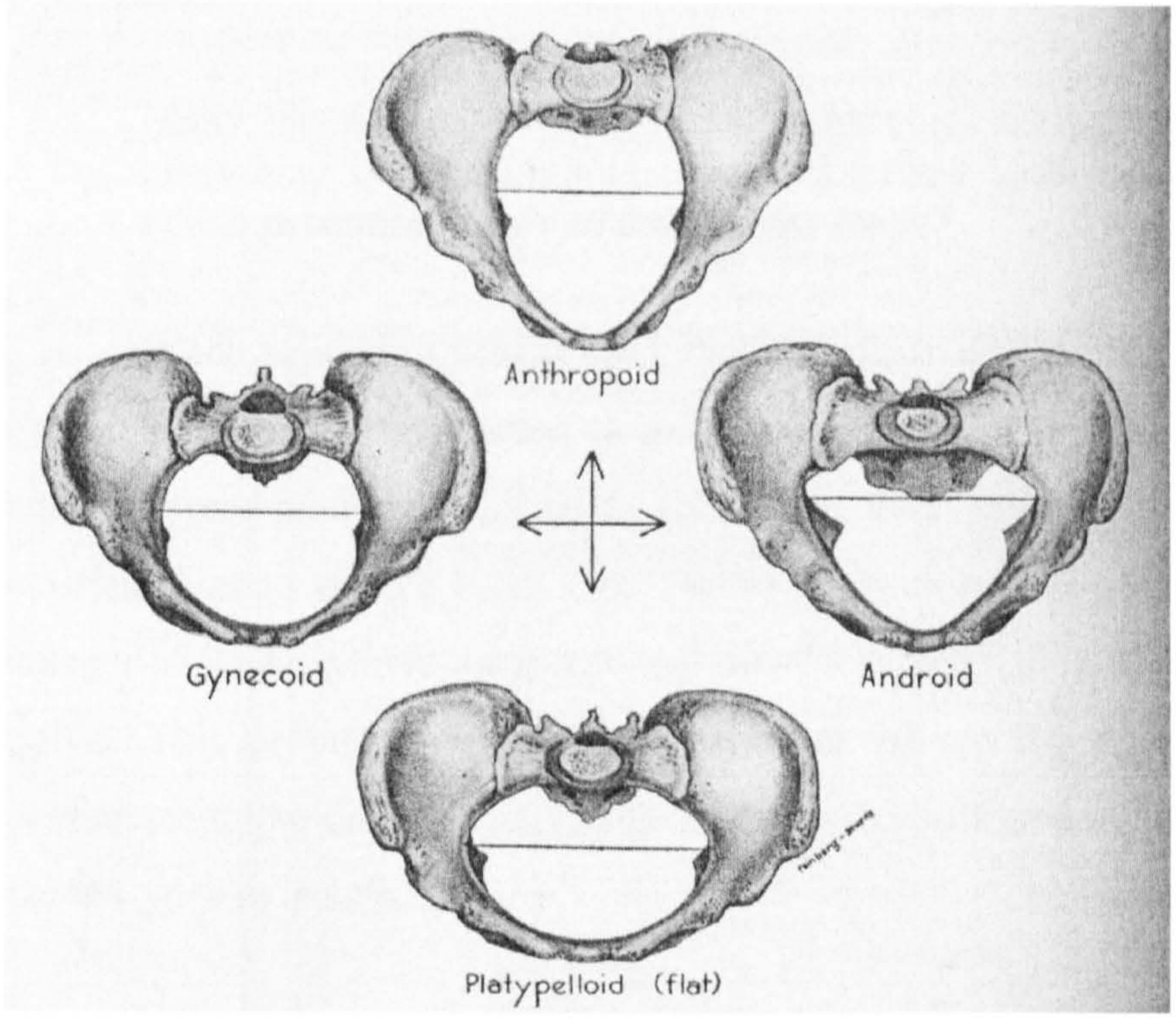
[64] Thoms' pelvic index reflected the principles of the Cephalic Index, first devised by a Swedish anthropologist, Anders Adolph Retzius, refined by Paul Broca and promoted by Paul Topinard of the Paris school of physical anthropology; see Russett 1991, pp. 31-9 and chapter nine.

[65]Caldwell and Moloy 1933, p. 479.

described four standard female pelvic types: gynaecoid; android; anthropoid; and platypelloid or flat (see Figure 10.2).

Figure 10.2

Caldwell and Moloy's Four Pelvic Shapes
Source: Stander H. J. (1945) *Textbook of Obstetrics,* p. 858



Caldwell and Moloy also described an additional sub-group for asymmetrical pelves, the general shape of which conformed to one of the four types (above) with one or more elements being distorted or absent.

Each of the four pelvic brim types was also linked with typical features of the mid-pelvis and pelvic outlet. Later work considered the effects of pelvic architecture upon the dynamics of birth. This involved a series of X-rays being taken before and during labour to observe the manner in which the fetus engaged in the pelvis and negotiated its exit.

10.7.1 Converting the subjective to the objective

A desire to give order to the natural world was a common feature of natural philosophy and early modern medicine. However, man-made classifications were

vulnerable both to the inconsistencies of nature and to human subjectivity. Caldwell and Moloy appeared to define their classifications upon relatively few specimens of pelves. Such limitations became apparent to them as more X-rays were examined and more anomalous data emerged that showed pelves with ambiguous characteristics that did not fit any of the four types. This increased the complexity of pelvic classification. As Fleck (1979) suggests:

> Many theories pass through two periods, a classical one during which everything is in striking agreement, followed by a second period during which exceptions begin to come to the fore. [66]

In the following year (1934), the four classifications had become 'parent types' as they revised their classification to include intermediate (mixed) forms of pelvis, which in addition were graded according to size: large, average or small.[67] Despite expanding the classification to twelve types (see Figure 10.3). pelves continued to fall between these categories or to exhibit 'atypical' or mixed characteristics of the brim, cavity or lower pelvis. This problem was evident in the journal reports, while the textbooks failed to acknowledge the dispute that was going on in the background and often presented the four parent types in isolation.[68]

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[66] Fleck 1979, p 9 .
[67] Caldwell, Moloy and D'Esopo 1934.
[68] There was also the possibility that others would allocate pelves to different categories, especially in anomalous cases.

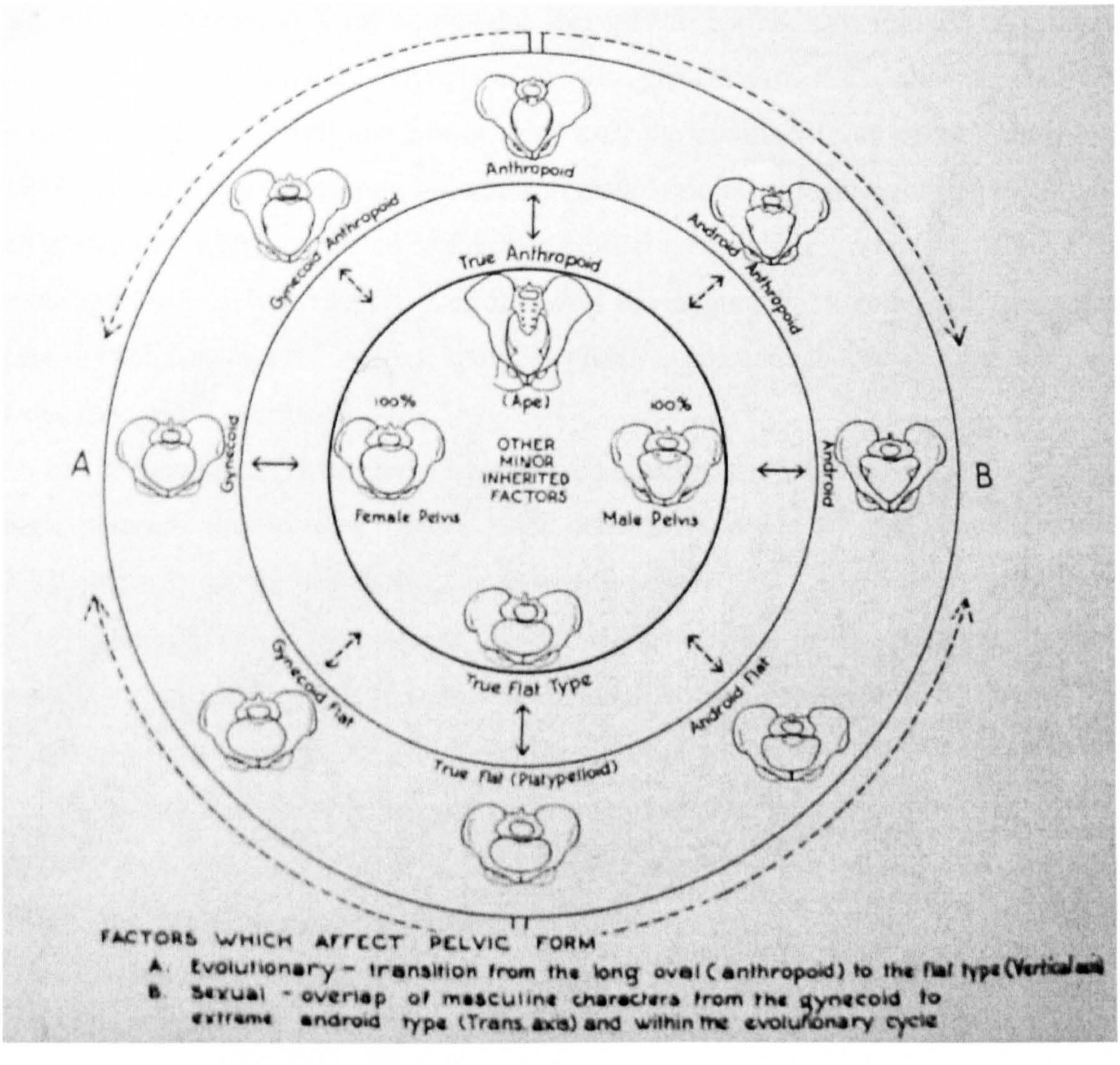

Figure 10.3
Refinement of the four pelvic classifications,
In: Caldwell W E, Moloy H C and D'Esopo D A (1934), 'Further studies on the Pelvic Architecture', *American Journal of Obstetrics and Gynecology*, 28, p. 487.

In Britain, Nicholson and Allen professed the view that Caldwell and Moloy's revised classification:

> … is not only unscientific but results in a classification which is cumbersome and of no practical value[69]

Caldwell and Moloy argued their overall method of approach was valuable because it helped with the description of pelvic shapes, although its practical application was limited

[69] Hastings-Ince and Young 1940, p. 188.

and relied on access to X-ray equipment. Regardless, textbooks continued until the present day to take a simplified approach to the presentation of Caldwell and Moloy's nomenclature.[70] Caldwell and Moloy addressed the complexity of pelvic classification in 1940, referring to a list of morphologic and pathologic classification of pelves compiled by a Dr Standler, which consisted of fourteen normal growth types, nineteen different types of mid- and lower pelvis, two types of abnormal developments, three main types of diseased pelves with various subdivisions, six types resulting from an abnormal spine and two types from abnormal lower limbs.[71]

Meanwhile, Thoms and Caldwell and Moloy continued with their campaigns for each maternity unit to have its own X-ray department where all primigravidae could have XRP routinely performed during the antenatal period. The initial importance of knowing every woman's pelvic brim shape was not clearly set out in the literature. However, by mass X-raying of pregnant women, it was possible for them to use the films to establish trends in pelvic brim shapes. Still searching for physical indexes, Caldwell and Moloy also briefly investigated possible links between pelvic type and overall body shape.

10.8 Pelvic shape and constitution

Constitutional medicine was pioneered in America and based upon the construction of taxonomies which aimed to identify sets of clinical symptoms with certain illnesses. In its purest form, it involved a multidisciplinary approach between physicians, geneticists, physical anthropologists, anatomists, physiologists, psycho-analysts and endocrinologists. One of the leading American advocates of constitutional medicine was George Draper (1880-1959), who, like Caldwell and Moloy, was affiliated with Columbia University.[72]

In 1934, Caldwell, Moloy and D'Esopo proposed that constitutional markers such as height, shoulder width, thickness of waistline, general shape of trunk, distribution of body fat and muscle, and length of legs, could indicate pelvic type.[73] Their paper included a

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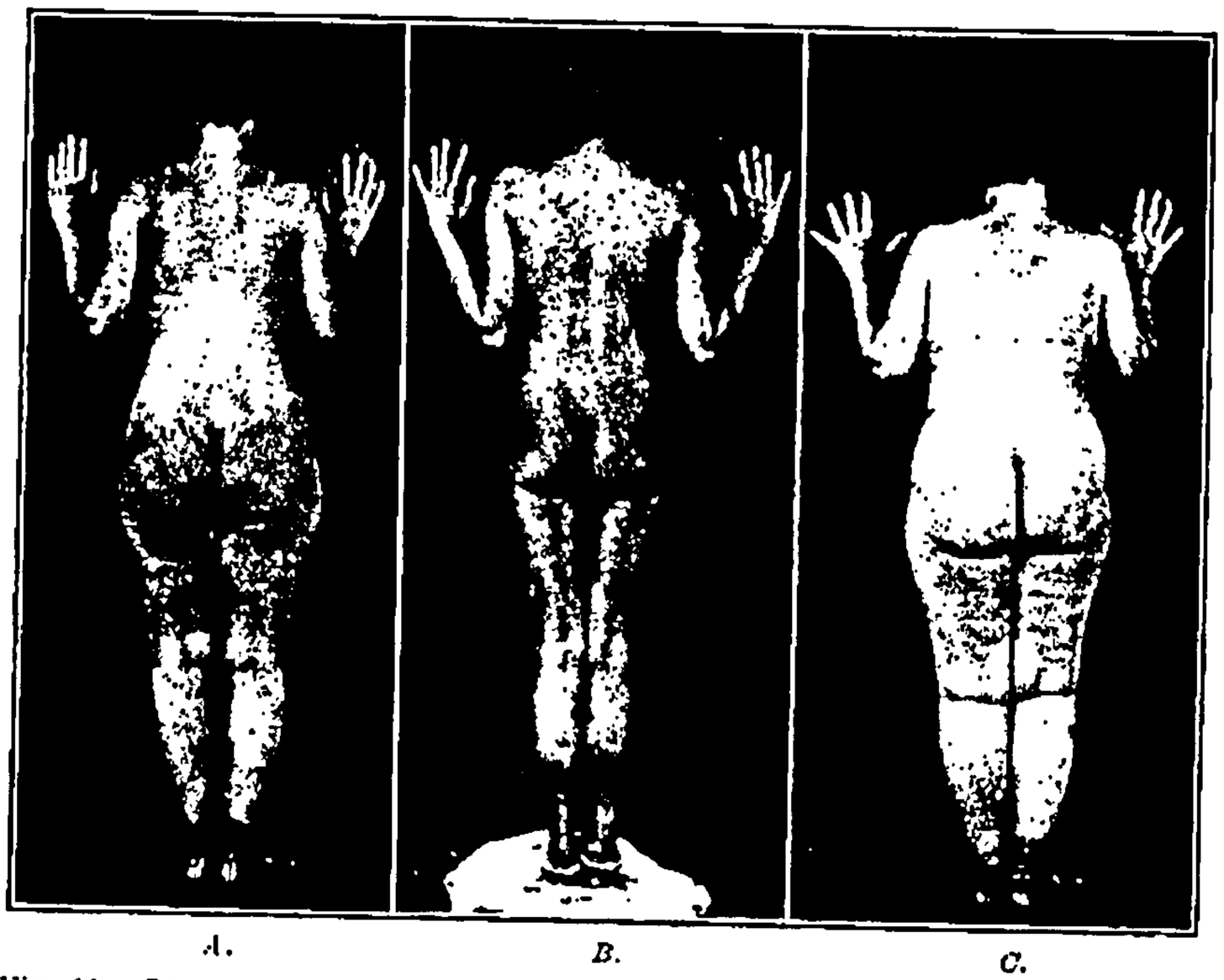
[70] See Baker (ed.) 2006; Fraser and Cooper 2003, pp. 105-7.
[71] Caldwell, Moloy and D'Esopo 1940, pp. 562-4
[72] See Tracy 1992, pp. 56-7.
[73] Caldwell, Moloy and D'Esopo 1934.

photograph of three naked women who were reported to display typical physical forms corresponding to a gynaecoid, anthropoid and android type pelvis (See Figure 10.4).

Figure 10.4
The image shows Caldwell and Moloy's three classic body shapes which they believed correlated respectively with Gynaecoid, anthropoid and android pelves.



A. B. C.

Fig. 19.—*Physical form versus pelvic type.*
A. The gynecoid type. Note the narrow shoulders and narrower waistline. The hips are broad. The lower legs are well curved and tend to be slender.
B. The anthropoid type. The shoulders are broad and the hips narrow. The legs are straight and slender.
C. The android type. Posteriorly the body is square. The waistline is thicker than in the other types. The legs are straight. The thickness of the thigh is preserved throughout the lower legs into the calves, the ankles, and the feet.

The woman selected for the centre panel of the picture with an anthropoid pelvis was black.[74]

Various other possible anthropometric correlations or indexes between height, shoe size, finger size and pelvic size have been explored by Caldwell and Moloy and others since then. In 1939, Thoms reported on a study which included an attempt to compare length of trunk with pelvic type, and maternal skull shape and pelvic shape and facial index with pelvic type. He also tried to match various external diameters with pelvic shape.

The images in the papers of both Thoms and Caldwell and Moloy of semi-naked and naked women[75] resonate with those found in the classical nineteenth-century

[74] As previously discussed, it was later discovered that a significant number of Caucasian women had anthropoid pelves.

anthropological/gynaecological text by Hermann H. Ploss, *An Historical, Gynaecological and Anthropological Compendium,* first translated into English in 1935.[76] In subsequent revisions Ploss's edited text included a large number of photographs of women's naked bodies. Physical differences had been a focus of attention, and races were compared and contrasted from both historical and transcultural perspectives.[77] The text discussed differences in the shape of the Rhomboid of Michaelis between races and refers to the work of Weber of Bonn, who had tried unsuccessfully to classify pelves on an ethnic basis; Oval (Caucasian); Quadrilateral (Mongolian); Round (Amerind) and wedge-shaped or triangular (African). Another author, Prochownick, was reported to have concluded, well before Caldwell and Moloy's seminal work had been published, that 'individual differences were so great that comparative ethnology could not do much with the material'.[78]

In 1940 in Britain, Hastings-Ince and Young (1940) also completed a constitutional study which undermined Caldwell and Moloy's theories, claiming that women with similar body proportions could exhibit quite different types of pelvis.[79] After relatively extensive studies of racial and sexual differences, which focussed on the shape and size of male and female skulls and pelves, anthropologists concurred with Prochownick that individual differences were so great that little could be done with the material.[80]

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[75] Similar work was published by Thoms; Thoms 1939.

[76] Ploss's work explored diversity of female body shape in different races and at different stages of maturity. He classed the pelvis as an *accessory sexual characteristic* (volume 1, p. 79). Chapter one in volume 3 linked pelvic shape with race (p. 286-7). The text provided an historical and visual gynaecological and anthropological cornucopia, which still appears to be classed by the British Library as 'soft' pornography; Ploss *et al.* 1935.

[77] The work on constitutional medicine and pelvic theory reflected Ploss's comparative approach, popular from the late nineteenth century until the 1930s. The text also expressed a white male social bias which influenced the approach to biological labelling. Some of Ploss's illustrations were considered to border on the indecent and exploitative; Weideger 1986.

[78] Prochownick in Ploss *et al.* 1935,volume 3, p. 288.

[79] An earlier anthropological study embarked on a search for links between overall body shape and intelligence. A short trunk was equated with greater intelligence (as white males had a short trunk to leg ratio and Asian races had longer bodies). However, it was discovered that Negroid races also had a short body, so the work was abandoned; Russett 1991, p. 28, also Kenny 1944. Kenny found general consistencies between body shape and pelvis.

[80] Ploss *et al.* 1935 volume 3, p. 288.

10.9 Correlation studies: links with stature, shoe size, and finger size

Probably the most popular index of a contracted pelvis was its association with short stature. This index appeared to be reasonably reliable and was supported by small research studies.[81] Routine assessment of maternal height during the antenatal period became part of antenatal assessment in the mid twentieth century, and women who measured less than five feet in height were often sent to be X-rayed where facilities were available. For several decades of the twentieth century, women all over Britain were probably perplexed at being asked their shoe size on their first antenatal visit to a clinic.[82] Shoe size was believed to give a general indication of likely pelvic size, and any primigravida with a shoe size of less than '5' (38) was greeted with suspicion. In a number of small studies in the late twentieth century shoe size was found not to correlate positively with height, although a wariness of short women and women with small shoe sizes appears to have become part of midwifery folklore.[83] The origins of this idea have not been traced, although, according to the obstetrician,Professor Geofrey Chamberlain it was 'common knowledge' in the 1950s.[84]

Passing comments have also been made in the obstetric literature to a possible association between a small pelvis and stubby fingers, although this 'hunch' appears not to have been fully substantiated.

The quest for useful pelvic indexes based on possible correlations with other physical features continues today, especially in third world countries, where technical resources are limited.[85] In the west where elective caesarean is an option, ways of fast-tracking women for surgery are being explored. In the United States Dr Alice Poe is currently attempting to identify predictors for obstructed labour caused by a rigid pelvis, prior to labour. Her study includes an investigation of the relationship between joint laxity and the potential for pelvic expansion at birth. Joint laxity is indicated by the degree of

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[81] e.g. Mahmood, Campbell and Wilson 1988; Frame *et al.* 1985; Kennedy and Greenwald 1981.

[82] Obstetricians were also aware that some women of short stature managed to give birth to relatively large babies with no problems; Churchill, Savage and Francome 2006, p. 86.

[83] Obstetricians and midwives might still pass this information on to students whilst acknowledging its limitations.

[84] Chamberlain 2004 ...

[85] In an African study, the practice of external pelvimetry, (discontinued over 50 years ago in Britain) was combined with maternal height in order to establish 'cut-off' values for women at risk of CPD: Liselele *et al.* 2000.

general elasticity of the joints assessed by the flexibility of the thumb (how far it can be bent back towards the wrist).[86] An Irish anthropometric study has also recently suggested that a tall father, where both mother and father have large head-to-height ratios, may be an indicator of possible cephalo-pelvic disproportion (CPD). [87] Specialists in the field of maternal and fetal medicine in the USA are also exploring correlations between CPD and altered uterine action in the active phase of labour.[88]

10.10 Caldwell and Moloy's four parent types of pelvis and their fate post 1934

As previously discussed in chapter nine, Thoms and Caldwell and Moloy put up a relentless literary campaign for routine antenatal XRP of primigravidae. In reality, routine pelvimetry appeared to be of limited value. Regardless, Caldwell and Moloy's classification of pelves have survived in textbooks to the present day, despite their revisions and the greater recognition of the multivariate nature of pelves and a continued appreciation of the inestimable fetal and uterine effects upon the process of birth.

Further work in the field appeared to undermine the meaning of the labels initially attached to the four parent types to describe them, and the stability of these four archetypal categories. Regardless, they were widely integrated into obstetric and midwifery theory. There follows an account of some of the findings which occurred after Caldwell and Moloy published their pelvic nomenclature for the first time in 1933 which again appeared to have little effect upon the textbook status of Caldwell and Moloy's four types of pelvis.

10.10.1 The gynaecoid pelvis

The gynaecoid pelvis was described as having a round brim with a slightly wider transverse diameter. The term 'gynaecoid' pelvis was an oxymoron, being first used by anthropologists to refer to female characteristics in a male pelvis. Although Caldwell and Moloy acknowledged the original use of the term, they appropriated it to describe what they believed to be the ideal female pelvis, perfect for facilitating normal childbirth. They

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[86] Poe 2006.
[87] Connolly *et al.* 2003.
[88] Althaus *et al.* 2006.

suggested that it was the most common type, 'ordinarily attributed to the female sex of man'.[89] It also happened to be the type they believed was most commonly possessed by white women. However, almost 50% of women (possibly more) were subsequently found not to possess this elegant female form,[90], while in a social context a gynaecoid pelvis served to reinforce women's 'natural' and social roles in childbearing, for which scientists had argued that women were designed. Following this line of argument, it would appear that a significant number of women fell short of the ideal and were not perfectly equipped to carry out this natural function. There was also mounting evidence that the gynaecoid pelvis was not necessarily the most suitable type for childbirth after all, although this too appears to have been ignored.

10.10.2 The android pelvis: A sign of masculinity in women?

The android pelvis, contrary to its name was a female pelvis with a masculine type of posterior segment.[91] It was associated with a contracted pelvic outlet and narrow pubic arch and had been previously described as a funnel pelvis, a muscular pelvis or an inverted or wedge-shaped pelvis. The association between an android pelvis and painful labour and difficult birth had been discussed in the obstetric literature for many years although its prevalence was believed to be quite rare. Hastings-Ince and Young[92] and Nicholson and Allen[93] argued in Britain that the so called 'male' characteristics of android pelves occurred too often in females to be pathological. It was also generally accepted that size was more important than shape. If a pelvis was large enough, its brim shape would not matter as only pelves which were relatively small in relation to the fetus caused problems.

Caldwell and Moloy acknowledged that anthropologists had found female pelves with male characteristics.[94] However, they seemed to neglect to mention that traits described as typically female (gynaecoid) were also found, albeit not quite as often, in male

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[89] Caldwell and Moloy 1933, p. 480.
[90]Thoms suggested in his study that only 14.9% of 582 female pelves fit the ideal norm for white women as described by Caldwell and Moloy; Thoms 1939.
[91] Caldwell and Moloy 1934, p. 487.
[92] Hastings-Ince and Young 1940.
[93] Nicholson and Allen 1946.
[94] Caldwell and Moloy referred to an excavation in Nubia in which a pelvis with male characteristics was found to contain fetal remains; Caldwell, Moloy and D'Esopo 1933, p. 480.

pelves,[95] which suggested such pelvic features were androgynous and not gender-specific, weakening the significance of the term 'android'.

Nicholson and Allen indicated that Caldwell and Moloy's schemes of pelvic classification were widely accepted in Britain, appearing in most textbooks and being taught to medical students.[96] However they did not believe that android features in female pelves were a genetic abnormality; they did not appear to be under the control of sex hormones, as no other male sexual characteristics existed in such women.

Robert Bernard of Aberdeen University put forward the view that an android pelvis was as rare in men as it was in women and was similar to a flat pelvis (wide with short AP diameter), since they both appeared to be related to shortness of stature and poor physique, and were more commonly found in the poorer classes of both sexes, who were often malnourished.[97] Bernard argued that such pelves were not normal aberrations. He also believed there was much blurring of boundaries between the designated four parent types. The endocrine condition known as Dystocia Dystrophia Syndrome was also linked with an android pelvis.

10.10.3 Dystocia Dystrophia Syndrome

Dystocia Dystrophia Syndrome or DDS was first described in America by Horner in 1927 and named DDS by Joseph De Lee.[98] The features of this syndrome were an abnormal (extended) distribution of pubic hair, co-existing endocrine disorders and an android pelvis. Affected women were believed to experience sub-fertility anda history of miscarriages, and when pregnant they were thought to be more susceptible to toxaemia (pre-eclampsia and eclampsia). This condition is mentioned in British midwifery textbooks in the 1940s and 1950s but then seems to disappear.

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[95] Thoms and Greulich 1940.
[96] Nicholson and Allen 1946, p. 192.
[97] Bernard 1951.
[98] De Lee 1947, p. 599.

10.10.4 The anthropoid pelvis and the paradox of the 'primitive' pelvis

Caldwell and Moloy's description of the anthropoid pelvis[99] was inspired by the anthropological work of Professor William Turner in the nineteenth century. Turner described a pelvis which was round or oval, with a narrower transverse diameter. He was first to draw attention to the resemblance of some human pelves to those found in anthropoid apes. From the late nineteenth century, the anthropoid type of pelvis was also reported as being common amongst 'primitives'; reflecting contemporary socio-political views on evolutionary theory and racial difference.

An enormous number of publications listing sets of pelvic measurements and inter-racial comparisons were produced first by physical anthropologists, then by obstetricians.[100] In their textbook *The Practice of Midwifery*, Galabin and Blacker stated:

> In the most intellectual races the pelvis is most fully developed in area, a difference which must be associated with the greater size of the children's heads. ... In the more savage races ... such as Negroes, Hottentots, Bushmen and Australian Aborigines, not only is the size [of transverse diameter] somewhat less, but the pelvic brim is more round ... and thus shows a slightly greater resemblance to the type of the monkey's pelvis, in which the anterior – posterior diameter is greater than the transverse.[101]

Unfortunately, the idea of associating Negroid races with apes and primitiveness befitted contemporary socio-political attitudes, as it reinforced white supremacy as perceived in the western world at that time. Havelock Ellis's text *Man and Woman* proclaimed that Negroid races were arrested at a lower stage of evolution:

> In some dark races it [the pelvis] is ape-like in its narrowness and small capacity, whereas the European pelvis was the proof of high evolution and the promise of capable maternity[102]

> Based upon the contemporary theory of survival of the fittest, one might have assumed the so called 'lower races' or 'primitive people', who were apparently better at

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[99] Caldwell and Moloy 1933, p. 481.
[100] Jarcho 1933.
[101] Galabin and Blacker 1910, p. 7
[102] Ellis 1894, cited by Russett 1991, p. 29.

giving birth, were actually better adapted for survival, and therefore arguably at a higher stage of evolution, than other races. Regardless, white obstetricians argued that the ability to give birth easily was associated with being less civilised.[103] Accordingly, white women were less able to give birth easily and endure labour because of their greater intelligence and nervous sensibility.[104]

To confound the issue, much inter-racial pelvic diversity was later discovered.[105] It was unexpected and ironic that a significant number of white women were found to have anthropoid pelves, in common with women of the so-called primitive races.

10.10.5 Conundrum of the 'normal' pelvis

In 1934, Herbert Thoms wrote a paper, *What is a Normal Pelvis*?[106] in which he pondered whether the normal pelvis was round or oval, given that fetal pelves of both sexes were round to begin with. Whilst more male pelves seemed to retain a similar round shape in adulthood, there was a suggestion that pelvic shape was a result of nurture rather than nature. Thoms remarked on how aboriginal pelves tended to retain much of their round confirmation, which better accommodated a round fetal head. He claimed that the incidence of round, and round with an elongated anterior posterior shape (anthropoid), was much higher in white women from America (US) than first thought. Wide oval pelves, with a wider transverse diameter, also found in many white women, may have been wrongly assumed to be the ideal female type. In another paper he also found that sexual differences were not as distinctive as first thought and that shape was probably caused by the influences of civilisation rather than race or sex.[107]

Dramatic reductions in rachitic pelves over a twenty-five year period led Thoms to conclude that a change in pelvic shape may be linked with evolving diet and female lifestyles, which included increased outdoor exercise and differences in fashion.[108]

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[103] Most apes and quadrupeds had less convoluted pelves and fewer problems with parturition; Abitbol 1996.
[104] Moscucci 2003.
[105] Pride 1936, p. 500.
[106] Thoms 1934b.
[107] e.g. Thoms and Greulich 1940, p. 56.
[108] Thoms 1934b

In 1934, Thoms, who was familiar with Vaughan's paper in the *BMJ*,[109] appeared to endorse her claim that events after birth influenced future pelvic shape.[110] He duly acknowledged that fetal pelves of both sexes were round or oval with a longer anterior-posterior diameter.

In 1945, O S Heyns referred to a study of Bantu women[111] in which he suggested that the Bantu appeared to be able to deliver good-sized babies through relatively small pelves because they had stronger constitutions than their white counterparts. Unlike white women, they may also have had less access to and less desire to submit to skilled assistance.[112] Doctors were well aware that good uterine action was also important to birth outcome, and tocography (for measuring uterine activity) was being pioneered at the time.

10.10.6 The platypelloid ('ultra-human') pelvis

The fourth category of pelvis described by Caldwell and Moloy was the platypelloid type, previously described by Turner and Thoms. This pelvis was a flat, wide, oval shape. It was once thought to be the normal shape before the gynaecoid shape was described, which is a less flattened wide oval shape. In the nineteenth century it was considered the ideal normal female shape, producing 'childbearing hips'. It was also associated with rickets, but since the time of Professor William Turner (1886) it had been believed to be found in healthy women as possibly a hereditary feature. As time passed and more pelves were examined, it was found to be the rarest of Caldwell and Moloy's four types.

10.11 British challenges to the work of Caldwell and Moloy

A growing number of reports and opinion papers challenged the need for Caldwell and Moloy's pelvic classification by emphasising that it was overall size of the pelvis that was important as a large pelvis, regardless of brim shape, would probably facilitate a vaginal birth, whereas a small, generally contracted pelvis, even of anthropoid or gynaecoid shape, might not.

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[109] Vaughan 1931, p. 941.
[110] Thoms 1934b.
[111] Heyns 1946.
[112] *ibid.*

In Britain, Hastings-Ince and Young were investigating Caldwell and Moloy's claims. They argued in their 1940 paper that Caldwell and Moloy's classifications, and the links between certain shapes of pelvis and the course of labour:

> ... had not yet ... received general acceptance among obstetricians, nor is there any general agreement regarding the precise value of pelvic measurements obtained from X-ray films as an aid to obstetric procedure ...[113]

They suggested that a particular weakness of Caldwell and Moloy's work was the relatively small numbers in their study samples. They also drew attention to the fact that their study samples contained subjects from different racial and social groups, and that some data included was obtained from dried specimens of pelves and was therefore unreliable. Furthermore, they suspected that reported incidences of Caldwell and Moloy's four parent types of pelves may have been skewed by personal perception, which largely controlled the process of classification, compounding the errors made.[114]

Hastings-Ince and Young also questioned Caldwell and Moloy's work on the process of labour in which they had X-rayed women giving birth. They queried the reliability of the correlations made between duration of labour, pelvic inlet shape, true conjugate length, sub-pubic angle size, and the inclination of the pelvic brim to the horizontal, with type of birth.

O. S. Heyns, an obstetric proponent of X-ray pelvimetry in pregnancy, made a plea for the simplification of pelvic theory, claiming that a recently-published paper was too complicated for obstetricians to comprehend:

> In studying the paper even a trained mathematician would have to spend an unjustifiable amount of time and thought on this method - and it has been published in a medical journal! [115]

> XRP required a lot of expert knowledge, time and resources, and all the calculations and possible correlations with outcomes could not provide practitioners with absolute certainty when making clinical judgements. Many women with potentially problematic

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[113] Hastings-Ince and Young 1940, p. 131.
[114] Hastings-Ince and Young 1940, p. 165.
[115] Heyns 1945, p. 169

pelves were closely supervised in hospital during 'trial' labours where everything was on hand to do an emergency caesarean delivery. This type of birth experience was very stressful for the women involved, who laboured 'against the clock' at a time when surgery was less common, less successful and more frightening. Whilst rates of contracted pelvis declined drastically during the 1940s, pelvic assessment remained at the core of antenatal practice until the 1980s.

10.12 The subjugated discourse of pelvic expansion re-emerges

While reports of spontaneous pubic bone separation and movement of the sacro-iliac joints at birth (described in chapter three) were regularly made in the ancient and early modern midwifery literature, they were discounted and suppressed by modern theories of pelvic rigidity and contraction. A small number of practitioners maintained these discourses, which re-emerged in the twentieth century, although they continued to be disregarded in favour of the discourse of pelvic rigidity.

More recently the notion of pelvic expansion around the sacrum and coccyx has been reappraised in the midwifery press, where it has also been acknowledged that it may occur to a lesser extent in non-pregnant women and males at defecation or in certain types of movement.[116] However, such knowledge has made little impact in mainstream midwifery and obstetrics.

In 1930, an American doctor, John Barnes, suggested that, 'in spite of the number of technical and mathematical procedures described', the literature was 'strangely silent regarding some fundamental anatomical and physiological considerations'. He suggested that a more thorough study of this neglected area of pelvic theory promised 'rich rewards' in obstetrics, orthopaedics and endocrinology.[117]

By the 1920s-30s, the time was ripe for studying the possibility of mobility of the pelvic bones in labour, assisted by Roentgenology. By 1930, X-ray evidence demonstrated that a degree of expansion occurred in the area of the symphysis pubis in pregnancy or

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[116] In Africa, midwives have been known to apply pressure to the iliac crests in labour to open up the lower pelvis, commonly described as the 'pelvic press', when descent of the fetal head through the pelvis is delayed. This procedure is described by Davis 2004 and Simkin and Ancheta 2005; see also Russell 1982, p. 715.
[117] Barnes 1934, p. 333.

labour. By 1965, movement had also been found to occur in the lower part of the sacro-iliac joints.[118] Pubic bone separation was thought to occur in as many as 50-60% of pregnancies to various degrees.[119] However, this phenomenon was not peculiar to pregnancy; it could occur in nulliparous women and in men, particularly those with strenuous occupations.[120]

In many cases, the upper pelvis was found to yield to pressure during birth as the fetal head entered the pelvis; with fetal descent immediately prior to birth, the pelvic outlet widened;[121] although such phenomena varied from case to case.[122]

A dramatic spontaneous separation was sometimes accompanied by a loud cracking sound, first described in the seventeenth century by Percival Willughby.[123] The degree of expansion was exacerbated when women were lying on their backs and abducting their hips, a fact of which the pioneers of symphysiotomy were aware. In 1953 the incidence of spontaneous separation of the symphysis pubis was believed to be quite rare, at around 1 in 2,000.[124] As time went on, inconsistencies emerged; for example, the amount of pain and debility women experienced from spontaneous separation of the pubic symphysis was not proportional to the actual degree of separation, and sufferers and their plight were often neglected in hospital.[125]

10.12.1 The theory of joint mollification is replaced by a hormonal theory of joint softening

Hormonal studies began in the 1920s and by the 1950s;[126] the release of a hormone called relaxin was described as being responsible for joint softening and joint mobility in

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[118] Russell 1965.
[119] Barnes 1934, p. 350. A pelvic separation of between 1-9mm was considered normal.
[120] See Abramson, Roberts and Wilson 1934
[121] The coccyx can be spontaneously displaced or disjointed in childbirth, as previously discussed. In the past it was sometimes intentionally forced back or broken to facilitate vaginal birth, resulting in much pain.
[122] Borell and Fernstrom 1957a, 1957b.
[123] Willughby 1863, p. 16.
[124] Callaghan 1953.
[125] However a large gap of more than 8mm was thought to destabilise the joint; see Abramson, Roberts and Wilson 1934.
[126] MacLennan 1991.

pregnancy, which possibly caused spontaneous separation of the pubis in some cases.[127] The levels of these hormones and their effects on the pelvis varied between women.[128]

Pioneers of pelvimetry ignored this area of work, probably because not only did it carry the potential to undermine a vast amount of work on pelvic theory, but also it minimised the importance of the scientific approach to birth.[129] Furthermore, science would subsequently appear to confirm the natural ability of the majority of women to successfully give birth on their own. This would have also necessitated an acknowledgement that, despite a lack of technology, the ancients, who were shunned by the moderns, had to a certain extent been right about the occurrence of pelvic separation. The findings could have equally been used to support midwives' greater confidence in nature to achieve success in the majority of cases without the need for intervention, but again, this would have greatly undermined the obstetric project and its purpose.

10.12.2 Pelvic proportions and facilitation of normal birth

Doctors, like midwives, recognised that lying prostrate or semi-recumbent was not an ideal position in which to labour, although it provided health care professionals with an ideal vantage point.[130] Towards the end of the nineteenth century it was acknowledged that the internal dimensions of the pelvis altered with the position of the mother, facilitated by the rotation of the innominate bones around the sacrum.[131] While the American obstetricians J. Whitridge-Williams and Herbert Thoms[132] both recognised the advantages gained in pelvic capacity from the squatting position, Thoms argued that these positions compromised aseptic techniques used for medical delivery, and so were to be disregarded.

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[127] Heckman and Sassard 1994.

[128] In the 1990s, excitement grew about the possibility of giving the hormone relaxin to women to widen their pelves in cases of mild contraction. However, this hormone was found to also affect uterine contractility, so the idea was abandoned.

[129] Discussed in previous chapter; see also Jarcho 1933.

[130] In the early twentieth century, delivering women on their side with their back to the operator and knees up near their chests was popular with midwives, especially at home births and with some obstetricians.

[131] Duncan 1868.

[132] Williams 1911, p. 119; Thoms 1915. Aseptic technique involves operating within a sterile field created by cleaning and then draping the particular area of the body requiring the procedure.

In 1982 J. G. B. Russell, an English consultant radiologist from Manchester, raised the issue of maximising pelvic capacity again and introduced the concept of 'pelvic moulding'.[133] A change in pelvic expanse in the squatting position was observed to cause compression at the top of the pelvis and a minor separation of the pubis at the bottom. Russell suggested this phenomenon could make the difference between a normal birth and a forceps delivery or caesarean.[134] However, this mouldability was variable, which might explain why some authors claimed the pelvis did not expand whilst others believed it did; both conditions can occur. Russell was able to provide X-ray evidence which showed an increase in diameters of the pelvic outlet by up to 28 per cent when a woman changed from a supine to a squatting position. This of course had been alluded to previously by Vaughan in the 1930s.[135] Russell had also observed that women often had a natural desire to adopt an upright or a squatting position in childbirth, and concluded:

> It must be asked which is the less traumatic, to separate a tight bony outlet with a fetal head pulled through with forceps; or to use the natural forces of gravity, transmitted to the mother's pelvis through the abducted femora.[136]

Russell's paper met with considerable interest in the 1980s from radical midwives, obstetric physiotherapists, the National Childbirth Trust and all those enthusiastic about facilitating normal birth. Efforts were made to improve hospital environments for women and families and to facilitate alternative birthing positions, which met with varying degrees of success. Midwives know that when a mother lies on her back to give birth, the fetus has to ascend around the curve of the sacrum against gravity. However, upright positions have not been endorsed in maternity units as the optimal position in which to give birth.[137] Overall, lying in bed to give birth remains the norm in the UK, and befits the cultural expectations of the majority of English women.[138] English women find it hard to maintain squatting positions

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[133] Russell 1969, p. 817; Ohlsen 1973.
[134] Russell 1971.
[135] See chapter ten, 10.6
[136] Russell 1982, p. 715.
[137] See Simkin and Ancheta 2005, p. 162
[138] Methods of pain control such as pethidine and epidural analgesia, induction of labour, and electronic fetal monitoring, plus a lack of a suitable hospital environment in which to mobilise, have contributed to a situation of women labouring on high and narrow labour ward beds in most hospitals.

for long and find semi-squatting easier, although this requires some preparation and encouragement from midwives.[139] Many midwives still prefer attending women in the conventional manner on the delivery bed with its height adjusted to the health and safety needs of the midwife.

Although some midwives have railed against policies which restrict mobility in labour, many have complied with medical protocols which require women to keep relatively still when strapped to cardiotocography machines or attached to intravenous infusions. The introduction of epidural analgesia [140] has further reinforced the need for women to lie in bed during labour, in a position which compromises the negotiation of the pelvis by the fetus and affects progress in the second stage of labour.[141]

10.12.3 Current significance of the pelvis to midwives.

Very little research appears to have been published within the last five years on the pelvis and its role in childbirth.[142] The Association of Radical Midwives journal, *Midwifery Matters*, recently published an article which reported on the value of measuring the rhomboid of Michaelis to estimate pelvic shape and size, assigning these measurements to the four pelvic classifications of Caldwell and Moloy.[143] The reporter suggests that little work has been done since 1933 on the incidence of the four types of pelvis but refers to an independent midwife who is offering midwives instruction on how to measure the rhomboid of Michaelis.

The author of the discussion paper gives the impression that midwives are unaware of the wider debates and limited benefits of pelvic classification, probably because midwives are usually taught about pelvic classification in their pre-registration course. She expresses an enthusiasm for knowledge of pelvic type, suggesting that women with big pelves labour fast, although the evidence for this claim was not substantiated and size of pelvis is only

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[139] See Simkin and Ancheta 2005
[140] Mander 1993.
[141] Simkin and Ancheta 2005,pp. 156-161
[142] A recent search on the Maternity and Infant Care (MWIC) and Allied and Complemetary Medicine (AMED) bibliographic databases using the keyword search strategy '(pelvic or pelvis or pelves) and (childbirth or labour)' for the period 2001 -2007 produced only one report on cephalo-pelvic disproportion and altered uterine contraction shape, Althaus 2006.
[143] Montagu 2007.

one part of the complex phenomenon of birth. She seemed equally aware that negative opinions about pelvic size formed at the outset of labour may have a detrimental effect on progress and on the woman's morale, similar to the effects of women being told by obstetricians that they are to have a trial of labour. The midwife, using her knowledge of birth and basic skills,[144] would be able to detect such difficulties without need for external pelvimetry. At the end of the paper, she reflects on the capacity of birth to surprise. [145]

10.13 Mid-pelvic and pelvic outlet contraction

The problems of mid-pelvic and outlet contraction were addressed in a number of papers in the twentieth-century medical literature. It had long been believed that if the fetal head could enter the pelvis, it could also exit it.[146] Several single or combined causes of delay have been proposed in the twentieth century to include a narrow pubic arch, prominent ischial spines, a long sacrum and prominent coccyx, all of which may be detectable on vaginal examination. However, modern obstetricians suggest that mid-pelvic and outlet contraction resulting in a problem described as 'deep transverse arrest' is probably over-diagnosed. They claim that often the fetal head is delayed as it descends into the pelvis in the transverse diameter; delay at this point is not caused by the bony pelvis but by a lack of effective uterine action, causing a delay in the rotation of the fetal head from the transverse position to an occipito-anterior position. If the delay cannot be managed by augmentation of labour, increasing the strength of contractions, or the head is too high to perform a forceps or vacuum extraction, a caesarean section is usually performed.

10.14 Summary and Conclusion

Rachitic dwarfs and diseased and grossly-abnormal shaped pelves became rarer as the twentieth century progressed. Obstetricians began to refine their interest in pelvic

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[144] Simkin and Ancheta, 2005, pp. 178-87.
[145] *ibid.*
[146] For a summary of outlet contraction see Morris 1947. Cases were often associated with an occiptio-posterior position of the occiput and a funnel or android pelvis. Many cases were resolved by forceps, accompanied by considerable perineal trauma; alternatively the pelvis was bypassed by performing a caesarean. Sometimes there may have been serious effects on the wellbeing of the fetus before or as a result of this.

theory with a view first to systematically classifying healthy pelves by shape, and secondly to observe any links with particular birth mechanisms. However, the whole process of birth remained quite unpredictable and depended upon two other important factors, strength of uterine action and the position of the fetus in relation to the pelvis, which were not fully recognised or incorporated into their schemes.

10.14.1 The political pelvis

In the mid- to late nineteenth century there appear to have been attempts to oppress women and to extinguish their aspirations of attaining equal rights with men. It would appear that the pelvis was used by anthropologists and medical men to reinforce the traditional belief that a woman's primary function was reproduction. However, obstetricians appeared to contradict this by proposing that women needed medical help with this innate function.

Pelvic classification followed a long tradition of collecting, describing and quantifying from the eighteenth century onwards. Physical anthropology and evolutionary theory influenced the direction of pelvic classification. This lingered on into the early twentieth century, when attempts were made at bio-labelling pelves according to race. Anthropometry was used extensively in the field of physical anthropology, and continued to develop as a discipline in the early twentieth century, along with evolutionary theory and eugenics, until the Second World War.[147] Its application in pelvic classification reflected contemporary social sentiments.

Evolutionary theory had caused public controversy in the early and mid-nineteenth century, but it also went some way to increasing public understanding of the study of morphology. By recourse to themes in physical anthropology and in constitutional medicine, social divisions of sex, race and class were rationalised in ways which implied that they were natural divisions.

Ludwik Fleck[148] highlights the importance of knowledge being embedded in prevailing thought styles in order for it to be acceptable, and suggests that:

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[147] The first course in physical anthropology was offered in 1913 at Harvard University.
[148] Fleck 1935.

> ... the more systematically developed, the richer both in detail and in its relations to other branches of given branch of knowledge are, the fewer will be the differences of opinion in it [149]

The pelvic classifications of Caldwell and Moloy incorporated a contemporary blend of acceptable social and biomedical norms. They chose to publish their work at an early stage of the project, perhaps mindful of the competition from Herbert Thoms and colleagues. However, as data continued to mount, the utility of their initial scheme was undermined and the theoretical underpinning of their scheme was eroded. As Fleck suggests, some theories outlive their original context and survive elsewhere, void of context.[150]

The significance of the labels assigned to the four parent types of pelvis by Caldwell and Moloy was soon undermined by further work in America and England. However, these challenges did not depose the invincible literary discourse of Caldwell and Moloy's pelvic classification, which has lingered on in its initial form, even though the sub-classifications which had made the system complex and unruly were not fully embraced. This persistence has occurred despite the inappropriateness of the labels used in the nomenclature, which seem very out of step with present-day society's 'politically correct' views, and which carry very little influence in contemporary practice. Throughout this thesis examples have been highlighted of tangible evidence being ignored or used selectively to support contemporary medical practice.

Most midwives and obstetricians will not have had opportunity to consider Caldwell and Moloy's system of pelvic classification in its historical context, although the majority will be familiar with the names of the four parent types. It would appear that most practitioners will not be aware of the fragile underpinnings of this theoretical system.

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[149] Fleck 1979, p. 9. External pelvimetry and the theory of angles of pelvic inclination discussed in the previous chapter also predominated for considerable time despite their fragile theoretical underpinnings, and also continue to appear in present-day textbooks.
[150] Fleck 1979.

10.14.2 Social construction of the pelvis

Astonishingly, the venerated gynaecoid pelvis, initially considered the ideal female form, was only found in around 50% of women, although many more women gave birth spontaneously. While the android pelvis was portrayed as a small, male-type pelvis, it was in fact an androgynous pelvis, and also much less common than Caldwell and Moloy claimed.

Unexpectedly, the anthropoid pelvis, which was associated with the 'lower races' or 'primitives', was found to be present in a significant number of white women, again undermining medical speculation.

In retrospect it appears that the studies were published in excessive haste, and that the entire project of studying pelvic classification using XRP was needlessly expensive and fundamentally misconceived. As Professor Havelock Charles contended in 1894,

> It is wise to distrust opinions till proved by facts, and to avoid the common error of making the facts conform to preconceived hypotheses. This would be best done by avoiding hasty generalisations, and by careful observations ...
>
> This would have avoided reaching the wrong conclusions.

10.14.3 The rhetoric of pelvic theory versus practice

Much time was spent collecting data from large numbers of maternal pelves to create these formulaic categories of pelves, which in reality few women actually possessed.. The amount of funded research and the sheer volume of published material on X-ray pelvimetry, produced mostly by Thoms and by Caldwell and Moloy, is astounding. There was a considerable element of competition between the two research teams and an apparent reluctance of either team to agree on one system. Caldwell and Moloy's scheme appears to have become the most successful, since it was the one incorporated into obstetric and midwifery textbooks, thereby ensuring its authority and wide dissemination.

At the same time, it was possible for midwives safely to assist women giving birth without reference to any of this textbook knowledge. All midwives are taught pelvic anatomy and pelvic theory, but this knowledge can be offered in a much more applied manner as demonstrated in the *Labor Progress Handbook*[151] Indeed, all that is needed in practice, just as Elizabeth Nihell suggested in the eighteenth century, is a good working knowledge of the internal contours of the maternal pelvis and of the desirable relationship between this and the dimensions of the fetal skull. This is learned by exposure to practice, and in particular through experience of performing abdominal and vaginal examinations. The smooth progress of labour can be monitored, and deviations from normal detected, without further tests being made to establish the mother's pelvic architecture. Pelvic shape is unique to each mother, and the relationship between the individual maternal pelvis and each separate fetus is dynamic in nature. This makes Caldwell and Moloy's system of pelvic classification largely redundant in modern midwifery and obstetrics.

[151] See for example Simkin and Ancheta 2005, pp. 178-87.

11 Summary and Conclusion

11.1 Introduction

The pelvis had important symbolic and functional roles in the development of midwifery within the Western medical tradition. As an anatomical entity its trajectory began in ancient times, when it was considered to be facilitative of childbirth. This stance remained predominant until the sixteenth century when its potential to be hazardous to childbirth began to emerge. By the end of the twentieth century, obstructed labour caused by cephalo-pelvic disproportion was no longer a major cause of operative intervention, and the efficacy of the caesarean section meant that the pelvis was circumnavigable, hence its importance in obstetrics and midwifery accordingly declined. The ability of the pelvis to expand very slightly in pregnancy and childbirth has also recently been re-acknowledged.

This final chapter offers a thematic overview of the discourses on pelvic function which emerged from the study, to reflect the multifaceted nature of pelvic theory. Many of these themes existed in parallel but were interdependent, in that predominant discourses relied upon subjugated ones for their authority.

The chapter concludes with a discussion of some of the underlying influences on the production of literary and scientific ideas.

11.1.1 Summary of main findings

The author's primary interest in the pelvis concerned its evolving anatomical status as perceived in relation to its function in childbirth. It was assumed in ancient times that the pelvis opened up to permit the birth of the child. Causes of delay in labour were often ascribed to metaphysical causes, which were later de-emphasised and replaced by the principles of rational medicine.

The role of the pelvis in childbirth was accentuated in the early modern period by the new direct approach to human dissection established by Renaissance anatomists. Developments in the post-Vesalian period contributed to a growing literature on abnormal birthing theory, in which the pelvis was pathologised. With the assistance of science, mathematics and technology, a birthing route map was superimposed on the contours of the bony pelvis, each centimetre of which was carefully measured and

logged. Both physical anthropologists and obstetric researchers encountered difficulty in establishing what constituted a 'normal' pelvis, owing to the vast range of individual types. A number of attempts have been made since the eighteenth century to group pelves according to shape and size and to identify causes of difference. Much of this work was culture-laden and evinced the contemporary views on sex, race and class, held by white middle-class medical scientists. The underlying causes of pelvic variations were ascribed by doctors to a range of effects, mainly of sexual, hormonal, nutritional, environmental, cultural, or genetic origin. After much time, effort and expenditure, it was concluded that influences on pelvic form were complex and multifactoral. Regardless, this process of developing pelvic theory, of 'commandeering' the pelvis as it were, helped doctors to carve a niche for themselves in midwifery practice and assisted obstetricians in becoming powerful mediators between the woman and her fetus during pregnancy and birth.

The growth of midwifery/obstetric practice was assisted by a growing economy and by developments in medicine, science and technology. New or improved methods of inducing labour, performing forceps deliveries and destructive operations, operations to separate the pubic bones, plus the caesarean operation, all contributed to increased rates of medical intervention. While medical men pointed at the incompetence of midwives as practitioners and women as nurturers of the male seed, there is considerable evidence that new medical techniques were over-used to the extent that they began to have a negative effect on pregnancy outcomes.

Medicalisation led to criticism of traditional midwifery practice in medical treatises and obstetric journals. These criticisms were, of course, based upon medical standards, of which many midwives effectively worked in ignorance. However, the midwife-authors discussed in chapter seven demonstrated that they possessed sufficient knowledge of anatomy to present a competent challenge to medical malpractice. They also recognised the need for all midwives to be educated and able to articulate their practice using medical language, in order to establish a dialogue with doctors and to convince the public of their worth. The essentials of good practice included a working knowledge of the anatomy of the bony pelvis and of the reproductive system in general, and skill at vaginal assessment. Regardless, as women offering low-technology care, midwives became less appealing to a rich and influential minority who believed that male medical care was superior.

11.2 The evolving status of anatomical knowledge of the pelvis

Variations in childbirth culture over time and location resulted in different emphases being placed upon the relevance of anatomy to birthing theory. The ancients viewed human anatomy and physiology through a different lens; anatomy was peripheral to ancient birthing theory.

For the Mesopotamians and Babylonians the spiritual and cultural aspects of birth resulted in a fatalistic approach towards birth and death. These processes were in the hands of the gods, mediated by religious healers who worked on the mother's psyche.

Hippocratic theorists, whilst embracing metaphysical explanations for birth, turned to explore the physical workings of the body, which provided alternative theories to provide reasons for complications such as prolonged labour. Basic treatments of long labour varied according to the doctrine of the physician. However, the pelvis was perceived as facilitative of birth and not as a threat. Delay was often put down to physical obstruction caused by fetal malpositions, idiosyncrasies of the womb or soft tissue 'stiffness'.

It has been argued that theories such as the discourse of the active fetus and expanding pelvis enjoyed a long reign because of the religious ban on human dissection in the Greco-Roman period, maintained by the Christian church.[1] However, ancient medicine was not reliant upon anatomical theory, and and therefore banning human dissection would not have had a major impact upon medicine or birthing theory. Regardless, contemporary anatomists relied upon the comparative approach, which may have encouraged the belief in spontaneous separation of the pubic bones, as seen in small mammals. It is of note that Galen's brief account of birthing theory was at odds with the dominant discourse of the active fetus and expanding pelvis theory put forward earlier in the Hippocratic corpus and by Soranus. Soranus' *Gynaikeia* continued to be recognised as a detailed text on childbirth, and was very effectively disseminated across the Latin West.

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[1] While human dissection was a separate field from medicine, it was of importance to members of the Dogmatist sect.

11.2.1 Persistence of the ancient discourse of pelvic bone separation

The new anatomy emanating from Italy in the sixteenth century was based upon direct observation of the contents of the human body at dissection, leading to the conclusion that the female pelvis was a rigid structure. This new idea ran in parallel to the existing discourse of the active fetus and expanding pelvis. The ancient tenets finally gave way to rationality and the new anatomical discourses, which began to predominate by the mid-eighteenth century.

The transition had taken so long because of resistance to the new discourse, sustained by support for ancient birthing theory by pre-eminent persons such as Ambroise Paré and William Harvey and by the circulation of printed material based upon ancient wisdom. Additional support for pelvic separation was provided by theories of pelvic joint mollification in the seventeenth century. Such traditional views were pitted against the newer anatomical theories of pelvic rigidity and concavity, which had a limited circulation outside medical circles.

From the Italian renaissance period onwards, the human body became of great interest not just to anatomists and physicians, but from an aesthetic perspective to a wider public. This interest was endorsed by the church, which was also involved in the development of medicine. These cultural shifts resulted in a greater general interest in human anatomy, which gradually helped to dispel ancient birthing theory. As events continued to unfold, the relationship between medicine and religion and beliefs about health, illness and death also evolved.

Sexual dimorphism of the pelvis and skull size were interpreted from the eighteenth century onwards, successively by physical anthropologists, by doctors and later by obstetricians and gynaecologists, in a manner which reinforced male superiority and emphasised the female role in life of procreation.

Paradoxically, the aforementioned arguments of gender difference and male supremacy were conveniently reconstructed by gynaecologists and obstetricians who contended that the pre-ordained female function of birth was a potentially pathological and dangerous process. The coincidental and contradictory nature of these medical claims highlighted the ways in which medical science was used for social purposes. At the anatomical level, the pelvis was presented as both functional and designed for childbirth, and at the same time by men midwives as potentially hostile, necessitating close surveillance.

The obstetric project was highly successful in constructing an apparently value-free set of biomedical definitions of normality and pathology, which appeared objective and reasonable and which continue to prevail to this day.[2]

11.3 The patholigisation of the pelvis in the post-Vesalian period

From the sixteenth century onwards, a growing number of medical experts portrayed the bony pelvis as rigid and hazardous in childbirth. In the eighteenth century, when developments in midwifery were taking place rapidly, the pathological pelvis became emblematic of abnormal birthing theory. Hendrik van Deventer suggested that most problems could be relieved by working on the lower pelvis and manually pressing back the coccyx and sacrum.

A number of French and English men midwives argued that most major problems emanated from a contracted pelvic inlet, commonly caused by rachitic disease, which required operative medical intervention of some sort. From the mid-1730s, English midwifery texts exhibited illustrations of the most severe cases of pelvic distortion and advocated the use of forceps.[3] However, sufficient overall pelvic capacity was a prerequisite to the process they advocated of accessing the fetus, applying forceps and removing it intact.

11.3.1 Mortality and survival in relation to contracted pelves

Early vital statistics were crude gauges of maternal mortality. The figures suggest that death rates from pelvic obstruction were relatively low in comparison to deaths from puerperal fever. Two gauges of the likely incidence of obstructed labour, obtained from surviving hospital records and personal notes, were reported numbers of craniotomy or destructive operations and numbers of caesareans.[4] In the eighteenth century there was restricted access to surgeons confident enough to perform a caesarean operation, and some medical men were opposed to it because of the high maternal mortality rates associated with it. Caesarean rates steadily increased in the nineteenth

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[2] Findlay 1993.

[3] Destructive instruments have been referred to since ancient times. Alternative methods of removing the fetus by the head are described by Hibbard (Hibbard 2001) and by Wilson (Wilson 1995). These works provide an in-depth study of the use of instruments in childbirth in the eighteenth century.

[4] Discussed in chapter six: 6.5.2.

century as more men acquired skills and desired experience, but numbers remained very low by today's standards.[5]

The estimated incidence of severely contracted pelves appears to have been around two per cent in the late eighteenth and nineteenth centuries, though this figure was possibly inflated by over-diagnosis.[6] Moreover, it was the size of the pelvis in relation to the size of the fetus that was most important; a small pelvis may allow the passage of a small fetus; a normal pelvis may not facilitate the birth of an abnormally large fetus. Nonetheless, for a small minority of women suffering from severe pelvic contraction,[7] the only faint hope of survival was early induction of labour, craniotomy or caesarean.

From the midwifery perspective, the testimonies of the eighteenth century midwife authors who worked in both rural and city locations suggested that few women needed the assistance of a man midwife. It seems quite possible that men midwives as young as twenty-one, with only months of experience and specialist training in midwifery,[8] ran into difficulties which more experienced traditional midwives could have averted. Sarah Stone contended that junior traditional midwives were keen to call upon doctors for assistance for the slightest problem, whereas men midwives argued that, in their ignorance, midwives delayed calling for them until it was too late for them to retrieve the situation. In some cases, the decision to summon a doctor rested with the person who footed the bill. Nevertheless, Sarah Stone, Elizabeth Nihell and Margaret Stephen suggested that increasing demand for medical intervention created a high incidence of premature interference in labour and boosted instrumental delivery rates, alongside maternal and fetal injuries and death rates.[9]

Although by taking up certain medical concepts, the midwife-authors may be suspected of denying their midwifery status and buying into the same rational dichotomies as medical men,[10] it would seem this was the only approach available to them. It allowed them to enter into a dialogue with doctors and impress upon society their capacity as women to engage with medical men on an intellectual level. In Nihell's case, medical critics homed in on the emotional overtones of her berating of William

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[5] Thomas Radford's records, discussed in chapter six, suggested that rates of contracted pelvis and Caesarean were low in relation to overall birth rates. On this issue, see also Kaufman 1995.
[6] Chapter six.
[7] The rarity of cases is perhaps affirmed by the fact that reports of them were published individually in the medical literature.
[8] Thicknesse 1764.
[9] As discussed in chapter seven.
[10] See chapter seven.

Smellie as evidence of the psychological frailty of the female sex, thereby ridiculing her and distracting readers from the part of the text which demonstrated her clinical credibility.

11.3.2 Rickets defeated

Rickets and mollities ossium were considered major causes of pelvic deformity in adult life.[11] However, the diagnosis of rachitic disease as a cause of severe pelvic contraction could only be confirmed in severe cases or at post mortem. By the early twentieth century, infant and child welfare became a national priority. Following the discovery of vitamin D, cod liver oil was liberally administered to children. Changes in culture and fashion, and improved diet and sanitary conditions, all contributed to improved general health and physique, which meant that women were better able to give birth successfully. Maternal mortality fell significantly by the mid-twentieth century, although rates of medical intervention continued to escalate as attention turned to the fetus.

The next part of the chapter examines more closely some of the underlying influences which helped to shape the pelvic discourses.

11.4 The application of mathematics, science and technology to obstetrics

> Ownership of the artefacts necessary to manage labour ... defines and displays ... who possesses authoritative knowledge and decision-making power. [12]

Mathematics and geometry helped engineer early pelvic screening. The obstetric applications of technology such as X-rays and ultrasound, mediated by the medical profession, established the need for antenatal monitoring and surveillance. Developments in laboratory medicine and greater social provision for pregnant women and children fostered drastic changes in the manner in which childbirth was conducted in modern Western society. Following implementation of the *Midwives Act* (1902), the *National Insurance Act* of 1911 and the *Maternal and Child Welfare Act* of 1918, and the introduction of medical protocols for midwifery care, providers of maternity

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[11] See Chapter six.
[12] Jordan 1997, p. 61.

services were given a stronger sense of purpose, albeit at the price of their professional autonomy.

11.4.1 Pelvimetry and its part in the early technologisation of childbirth

Eighteenth- and nineteenth-century research into ways of assessing pelvic capacity suggested a need for antenatal pelvic assessment, since women could supposedly be harbouring contracted pelves within apparently normal bodies, their physical appearance being an unreliable indicator of pelvic size and shape. Vaginal examinations could be used to assess the space within the pelvis, complemented from the nineteenth century onwards by an abdominal assessment of the relationship between the fetal head and the pelvic brim.

However, as Jean Astruc (1684-1766)[13] had pointed out, despite increased clinical precision and diagnosis, birth was not simply a geometrical certainty; a matter a fetus of certain dimensions passing through a pelvis of a certain size; it was a multifactoral process, which continued to occasionally remain unfathomable.

English men midwives were unenthusiastic about the early instrumental forms of pelvimetry used in Europe, believing they had limited scope. Most embraced William Smellie's digital method of assessment of the diagonal conjugate for detecting inlet contraction, and later the use of external callipers. The scope for exaggeration or miscalculation of pelvic size was inevitable,[14] since methods of pelvic assessment were not as precise as they were professed to be, although they may have provided a 'best guess' of pelvic capacity. Hull suggested that degrees of contraction were sometimes exaggerated by operators in order to boast of their skill at difficult deliveries.[15] Nevertheless, the use of pelvimetry symbolised a new scientific approach to midwifery and provided another way of asserting how indispensable medical men were within the field. The introduction of X-ray pelvimetry took this a step further, re-energising work in the field of pelvic mensuration.

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[13] Chapter nine.

[14] The unpredictable effects of uterine contractions, the position of the fetus and size and the degree of moulding of the fetal head all had an impact upon the situation. This may explain why some women, who were allegedly suffering from severely contracted pelves according to X-ray evidence, still managed to give birth vaginally; see chapter nine.

[15] Chapter eight : 8.6

11.4.2 Refinement of the caesarean operation: the solution to pelvic obstruction and a panacea for dysfunctional birth.

As maternal mortality rates declined, and new diagnostic technologies made the fetus visible and audible, the fetus became the obstetricians' new priority.

In the late twentieth century, the introduction of the partogram on which the progress in labour was graphically plotted and the wide acceptance of time limits for the first and second stages of labour contributed to an increase in medical intervention.[16] Induction of labour further committed doctors to delivering women by one means or another within a limited time frame. The caesarean section rate was subsequently fuelled by defensive practice and by the fear of litigation, which has escalated since the 1960s. The social anthropologist Robbie Davis-Floyd has suggested that:

> Without their routines, birth attendants would feel powerless in front of nature, conceptually adrift in a category-less sea of uncontrollable and un-interpretable experience[17]

Hospitals greatly facilitated medical innovation, and the twentieth century saw in Britain the introduction of free antenatal care and a massive increase in in-patient maternity beds.[18] Alongside government health policies, this helped to convey to community practitioners and the public the message that hospital was safer than home.

While medical interventions and surgery certainly saved lives, the link between reduced mortality and obstetric interventions had been over-promoted. In 1990 the medical statistician Marjorie Tew, reflecting on the downward trends in maternal mortality in the 1930s and 40s, claimed that:

> The coincidence of the improving health status of mothers (and fathers) and the increasing practice of obstetric interventions in maternity care has had the disastrous consequence of perverting the scientific understanding of what essentially makes birth safe. The professional bias of obstetricians and their medical colleagues, not surprisingly, is to attribute the decline in associated mortality which has already taken place mainly to the results of

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[16] Kitzinger 2005, pp. 15-21.
[17] Davis-Floyd 1990, p. 181.
[18] See Marland 2004, p. 39, Table 2.1, 'Number of beds in hospitals by type of institution for England and Wales'. Maternity beds increased from 139 voluntary beds in 1861 to 10,029 voluntary and public beds by 1938. For later statistics, see Campbell and Macfarlane 1994.

> their treatments. This has suppressed any lingering doubts about the rightness of their philosophy, that nature unassisted is a poor obstetrician[19]

11.4.3 Birth by numbers

Like many successful advances in scientific knowledge, pelvic mensuration and classification were influenced or constrained by pre-existing theory. In the late seventeenth and eighteenth centuries, mathematics and technology promised to offer increasing scope and precision to obstetric theory.[20] Mathematics played an important part in scientific rationalism, and in medical speculation and more sophisticated theory-building. Quantitive data, while appearing to be objective, could also be complex and biased in its selection and interpretation.

The measurements of pelves, obtained with callipers or radiologically, gave impressive, seemingly objective arithmetical results. This contributed to an *artificial landscape* of pelvic theory, and contributed to a wider scheme of *social* labelling[21] which was later used to underpin social arguments. This made certain potentially controversial sexual, racial and class-related explanations for pelvic shape and size palatable.

Twentieth-century philosophers have widely demonstrated that reality exists independently from our conceptions, which are derived from our exposure to education systems and accepted social norms. Contemporary critics of obstetrics point out the essential subjectivity of the type of science[22] which became omnipotent in western culture and which permeated medical philosophies. Theodore Porter suggests:

> A decision made by numbers (or by explicit rules of some other sort) has at least the appearance of being fair and impersonal. Scientific objectivity thus provides an answer to a moral demand for impartiality and fairness. Quantification is a way of making decisions without seeming to decide. Objectivity lends authority to officials who have very little of their own [23]

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[19] Tew 1990, p. 35.
[20] Advances in mechanical rationality, such as astronomy, mechanics and optics led to a more mechanistic outlook. Economic attitudes and the assimilation of the fruits of voyages of discovery around the world led to new approaches to botanical and animal classification.
[21] Bowker and Star 1999, p. 26.
[22] Murphy-Lawless 1998.
[23] Porter 1995, p. 8.

Although an exclusively scientific view of the world was liable to narrow our vision of it unduly, rationalists ignored the need for human diversity and focussed only on the scientific perspective. Jo Murphy-Lawless observes that specialist knowledge works to 'preclude and exclude any interpretation of the female body which lies outside its area of expertise'.[24] This meant that midwives' and women's alternative paradigms of birthing knowledge were increasingly disparaged, while the scientific medical discourses became highly respectable and authoritative.

As previously discussed, scientific obstetrics was not as objective as it professed to be,[25] and its claims were premature. The rules it attempted to impose regarding pelvic types were undermined by subsequent research which emphasised the multivariate nature of individual pelves and the uniqueness of each person.[26]

The systems of pelvic classification, as modified over the years between the eighteenth century and the early twentieth century, gave the impression that science was describing nature. This work was naturally embedded in contemporary social contexts, most clearly exposed by the exploration of the work of Caldwell and Moloy on pelvic classification.

11.4.4 The human subject and claims to scientific objectivity

Confidence in rationalism grew from the fact that mathematical calculations, assuming they measured what they intended to measure, could facilitate prediction for example in astronomy. In spite of this ideal of scientific precision, it would appear that different researchers came up with slightly different sets of pelvic measurements and specifications for the elusive 'standard pelvis'.

The practical difficulties of obtaining accurate and consistent measurements meant that at some point the internal diameters of the inlet, cavity and outlet were rounded off to make them easier to describe.[27] This made the description of measurements no more meaningful than the description of shapes and contours.

The desire for standardisation led to a denial of the complexity and diversity of the phenomena being observed and an over-simplification of the human condition and

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[24] Murphy-Lawless 1998, pp. 4-5.
[25] Gould 1996.
[26] Gebbie 1981, pp. 124-38; chapters nine and ten.
[27] Chapter nine, section 9.5.

the limits of its amenability to prediction or manipulation.[28] This problem was not addressed in the obstetric press, probably because it went against the contemporary ethos of obstetrics as a scientific, progressive and authoritative discipline.[29]

Information about the ideal standard pelvis was therefore of limited clinical use, although obstetricians argued that it could help them make decisions about the safest place for birth and about how to manage labour. Whilst pelvic classification produced a useful insight from a theoretical perspective, in reality its application was limited because this work could not easily be applied to an individual.[30]

11.4.5 Numerical vs nominal data ...

Numerical data had facilitated the quantification of pelvic capacity in a manner which could be communicated and easily understood by others. Finding forms and arrangements, such as the identification of geometrical figures or analogies, enabled visible structures to be transcribed into language.

As J Rosser Mathews[31] argues, sets of figures which replaced analogy and deduction in medical texts were no more useful or certain than the calculations they supplanted.[32] Solutions based on the 'average man' were not appropriate for all individuals, and treatment not truly amenable to standardisation[33]:

> [defining averages reduces the] ... physician to a shoemaker who after having measured the feet of a thousand persisted in fitting everyone on the basis of the imaginary model [34]

In the case of X-ray pelvimetry, numerical systems of description necessitated the assistance of physicists, highlighting the complexity of the work. However, reports

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[28] Enkin *et al.* 2006.
[29] Murray Enkin (*ibid.*) suggests that it is time to 'think outside of the box' and to recognise the limitations of orthodox obstetrics.
[30] Oakley 2000.
[31] Mathews 1995.
[32] A modern example is the estimation of blood loss after delivery, which is extensively proven to be miscalculated and of little significance in the absence of a thorough clinical profile of the individual person.
[33] Haskell 1984, pp. 21-22. In recent times patient protocols have aimed to push people with particular diagnoses down particular routes of treatment, in the name of efficiency. However, while evidence based practice claims to ensure that each individual has the right to the best and most appropriate treatment, this has been tempered by a post code lottery approach to medical care, where certain treatments are only freely available in certain areas or parts of the UK.
[34] Mathews 1995, p. 29.

suggested obstetric practitioners were disinclined to use intricate systems which required a degree of reliance on other health care professionals. The other great obstacle was its cost.

Obstetricians in USA and Britain were later able to convince health care providers of the need for the use of X-ray equipment in their specialty for pelvimetry and for a number of other uses in pregnancy. In America these developments occurred in the wake of the Flexner report[35] on the state of medical education and with the awareness of the Government that America had one of the highest maternal mortality rates in the West. English obstetricians appeared to allow their American counterparts to take the lead with work on pelvimetry.

11.4.6 The acceptability and appeal of classifications and constitutional medicine

Nominal classifications of plants and animals led to the possibility of human classifications; however the allocation to groups could be subjective and contentious, and was unavoidably linked with contemporary social attitudes and politics. The process of pelvic categorisation, initially used by physical anthropologists, was arbitrary, and as obstetricians found out when the amount of available X-ray data increased, was compounded by the discovery of a wide range of small but significant variations in pelvic architecture. The ambitious labels that Caldwell and Moloy used to categorise 'normal' women's pelves reflected contemporary social values.[36] Ironically, their underpinning theories, hastily prepared, were erroneous.

Much of the work on classification was simply adapted from pre-existing work in the field of physical anthropology. Overall, classifications and constitutional medicine appealed to obstetricians because of their flexibility and their pre-existing status in medical and scientific theory. Resistance to new ideas might be reduced, it was thought, if projects appeared not to threaten or subvert an established system and its politics. The most highly-acceptable of the new schemes were embedded in a pre-existing structure, aligned with social arrangements and technologies. The likelihood of successful integration of pelvic theory into obstetrics was high. The scope and transparency of such classifications based as they were upon existing conventions and

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[35] Flexner 1910

[36] Caldwell and Moloy openly acknowledged the influence of social anthropologists upon their identification of four main pelvic types.

embodying standards built on a pre-existing base familiar to the profession, appeared to assist their rapid assimilation into obstetric theory.[37] Scientists appeared unaware of the thought constraints put upon them as members of a particular discipline, trained to think in a certain way whilst other ways of interpretation were rejected. Thought constraint, according to Fleck,

> ...determines what cannot be thought in any other way, what is to be neglected or ignored, and where, inversely, redoubled effort of investigation is required. [38]

Opportunities for cross-fertilisation of scientific ideas occurred at what Fleck described as the 'inter-collective level'.[39] Changes of thought style and new possibilities often occurred as the result of a cross-fertilisation of ideas, for example between obstetricians and physical anthropologists,[40] or from differences of opinion and conflict.

As previously stated, science cannot be absolutely objective, and many things were ignored in order to construct obstetric theory. Some findings were inconvenient or were found not to support medical predictions. As Fleck stated, 'no logic exists between conceptions and evidence'[41] concluding that:

> To recognise a certain relation, many other relations must be misunderstood, denied or overlooked.[42]

For example, radiological findings appeared to support the ancient belief that the pelvic joints often expanded in labour, albeit a small amount. To have embraced this finding would to some extent have compromised the work done on pelvimetry.

The aforementioned work of Kathleen Vaughan in India in the 1930s suggested that squatting was beneficial to pelvic development. Squatting in labour was overlooked by Thoms because it would have compromised asepsis. As previously discussed in chapter ten, squatting in labour was often seen in the west as a primitive behaviour, and it was of little interest in the sterile world of obstetrics.[43] Russell's radiological studies from the 1960s to the 1980s again provided evidence for the benefits of squatting, but

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[37] Bowker and Star 1999, pp. 33-50.
[38] Fleck 1979, p. 123
[39] Fleck 1979, p. 162.
[40] In this respect pelvic theory is perhaps not as creative as it might have appeared to some in both the esoteric and exoteric circles.
[41] Fleck 1979, p. 28.
[42] Fleck 1979, p. 30.
[43] See chapter ten, Section 10.12.3

have been largely ignored in Britain, where, to this day, most women still give birth in bed in hospital. Squatting was of course less conducive to fetal monitoring, and denied doctors and midwives easy access to the perineum. It also reinforced women's control over their own bodies, and made them, if only symbolically, less vulnerable to interventions in hospitals.

11.5 The production of authoritative knowledge

Ludwik Fleck's theory of the production of scientific thinking was written in 1935 around the time when pelvic classification was being pioneered, and still has a resonance today. His work precedes that of other well-known philosophers of medicine and science such as Michael Foucault, Thomas Kuhn and Ivan Illich. Fleck described the process of theory-building as a layered structure, which can be applied to the development of obstetric birthing theory.

His model consisted of an inner exclusive 'esoteric circle' of knowledge where expert science was produced[45] which would be where expert (senior) obstetricians might be located. This was delimited by an 'exoteric circle' of knowledgeable scientists, for example, hospital doctors, general practitioners, radiologists and anthropologists, who were situated within the wider medical and scientific community. This group understood the general principles of expert knowledge. Expert knowledge was made available to a wider public readership in the 'exoteric circle' through textbooks.

Fleck proposed that within the central exclusive or esoteric circle, knowledge in all its complexity was only intelligible to those with highly specialist comprehension; the experts. The new knowledge they produced was designated as 'journal science', which was made up of individual contributions. However, to Fleck, ideas were not simply attributable to one person as an individual, because that person had been prepared to think in a scientific way and their ideas modified by the feedback and nurturing of the respective 'thought collective.'[46] Expert scientists share opinions of

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[45] Trenn and Merton, in Fleck 1979, pp. 160-3.

[46] Experts, according to Fleck, were at the intersection of a number of *thought collectives*. Thought collectives consisted of groups of individuals which actively exchanged and critiqued intellectual ideas. A particular expert thought collective might 'brainstorm' problems until perhaps an individual came up with a new idea or solution. They also gave credit to new ideas or criticised them. The present-day editors of Fleck's text, Trenn and Merton, suggest that the function of the collective was to engender a creativity which was not attributable solely to the individual contibutions of its members, a collective being more

what scientific thought consists of within the thought collective. These ideas are imbibed by neophytes, leading them to think in a particular manner and to adopt the distinctive 'thought style' of the thought collective. Fleck describes the function of a thought style as:

> ... constraining, inhibiting and determining the way of thinking. Under the influence of a thought style one cannot think in any other way. It also excludes alternative modes of perception. Accordingly, no proper communication can arise between different thought styles. A thought style functions at such a fundamental level that the individual generally seems unaware of it. It exerts a compulsive force upon his thinking, so that he normally remains unconscious both of the thought style as such and of its constraining character. Yet such a style can be revealed in practice by an examination of how it is applied. The existence of stable thought collectives suggests the presence of a rather permanent thought style.[47]

Once a thought style has been acquired in this way through academic and professional socialisation it then serves almost subconsciously as a means of discerning good ideas from those which are perceived as being inconsistent with it:

> Once a structurally complete and closed system of opinions consisting of many details and relations has been formed, it offers enduring resistance to anything that contradicts it.[48]

Only members of a specialist scientific thought collective were qualified to pass judgement about new work, which, to gain acceptance, must be congruent with existing knowledge:

> Good work done according to style instantly awakens a mood of solidarity on the reader. It is this mood which, after a few sentences, compels him to regard the book highly and makes the book effective. Only later does one examine the details to see whether they can be incorporated into a system,, that is, whether the realisation of the thought style has been consistently achieved and in particular whether procedure has conformed to tradition [to traditional training]. These determinations legitimize the work so that it can be added to the stock of scientific knowledge and convert what has been presented into scientific fact. [49]

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than the sum of the individuals within it. A larger, general thought collective was described as a 'thought community', pp. 158-160.

[47] Trenn and Merton, in Fleck 1979 , p. 159.

[48] Fleck 1979, p. 27.

[49] Fleck 1979, p. 145.

Fleck suggested that ideas had a pre-history within a thought collective, where they were constructed and refined by group discussion. Some knowledge remained 'journal knowledge', whereas other ideas became textbook knowledge. Professional experts within the esoteric centre (such as obstetricians in our case), build up a 'vade mecum' from selected pieces of journal science from within the esoteric centre to provide guidance for future researchers.

According to Fleck, the 'exoteric circle' of general experts (in our case these would be general practitioners, doctors from other disciplines of medicine, radiologists and medical scientists) might be designated as critics of specialist knowledge, providing feedback on it. In some cases the exoteric circle would extend to midwives and the general public.[50]

11.5.1 When theories disintegrate

Whilst some theories evolve, others disintegrate. Examples from the work of Joseph De Lee and Caldwell and Moloy in chapter ten exemplify Fleck's theory of the process of theory disintegration. De Lee desired to keep the practice of external pelvimetry alive by ignoring emerging evidence which undermined it. His response matches Fleck's description of scientists' attempts to prolong the existence of particular theories in the face of contradictory evidence. The response comprises several stages.

In the first stage a contradiction is 'unthinkable'.[51] In subsequent stages an attempt is made to conceal or 'keep secret' the aspect which is challenging the system. De Lee failed to omit external pelvimetry from the next edition of his textbook after research on its inadequacy had been published in journals, which should perhaps have led to a revision of his text.[52] An alternative response to the situation, also described by Fleck, might have been to emphasise views which corroborated and substantiated the failing system. In De Lee's case, he emphasised the benefits to students of knowledge of external pelvimetry simply as a means of reminding them about the importance of pelvic size.

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[50] Fleck 1979, p. 161.
[51] Fleck 1979, p. 27.
[52] *ibid.* Theories need to be replaced by new theories; in the case of external pelvimetry, this appeared to be replaced by X-ray pelvimetry.

Alternatively, efforts might be made to 'explain the exception in terms which do not contradict the system',[53] as for example when Caldwell and Moloy discovered that their four categories of pelvic classification were inadequate. As a means of resolution, they reinstated their system by expanding the numbers of categories and describing the original four categories as 'parent types'. Thomas Kuhn propounded the view that an 'essential tension' created by the emergence of anomalies was part of the natural process of scientific development.[54] For example, in Ptolemaic astronomy, introducing another epicycle to make the data fit the predictions.

The question of why certain theories survived whilst other, equally credible ones faded into oblivion was also addressed by Fleck, who held that theories needed to reflect contemporary values. If ideas fell outside the existing thought style of a collective such as the scientific community, they were not as persuasive and compelling to the majority, and often faded into insignificance. Providing there was sufficient support for a completely new way of thinking, a paradigm shift[55] could occur, supported by a whole new set of associated principles,[56] emphasising how 'truth can vary with time and culture'.[57]

11.6 The pelvis palaver: midwives' views on the pelvis project

> *Knowledge is power...if you take away the notion of absolute truth, maybe knowledge would be just what a group of people get together and decide is true.*
> Fillingham 1993 [58]

Medicine was a male fortress which embraced science, something which women were actively discouraged from contributing to by men who considered themselves more able and worthy.[59]

> ... the attributes of science are the attributes of males; the objectivity said to be characteristic of the production of scientific knowledge is specifically identified as a male way of relating to the world. Science is

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[53] Fleck 1979, p. 27.
[54] Kuhn 1996.
[55] Kuhn 1996
[56].Marks-Maran 1999.
[57] Fleck 1979, p. 156.
[58] Fillingham 1993, p. 6.
[59] Hunter and Hutton (eds) 1997. The socialisation of males meant that their cultural experiences and interactions, education, and social status contrasted favourably with the socialisation of females.

> cold, hard, impersonal, objective; women by contrast are warm, soft, emotional subjective.[60]

Medical views were invariably male views, based upon male cultural experiences which were innately and socially different to female midwives' views. This led to fundamental differences between male and female discourses on the pelvis and birth: both had an intrinsic worth and could have been complementary. The problem lay in the imbalance of power and the greater recognition of the achievements and capabilities of medical men who were linked to the scientific community.[61] From the eighteenth century until the closing years of the twentieth century, the public tended to hold doctors and medicine in high regard.[62]

The users of midwifery services ultimately decided whom to support, and an increasing number of affluent families employed men midwives because they considered their care to be the best. Peter Dobkin Hall suggests;

> Credibility is a product of the symmetry between description and prediction only in a culture in which that material relationship is embraced as valid by fundamental social groups. "Science" is of no value to social groups whose power structure and internal equilibrium is based on other criteria[63]

As far as the midwife-authors were concerned, between 1671 and 1795 dystocia caused by a narrow pelvis was uncommon.[64] Other difficulties referred to by midwives, such as uterine obliquity and misalignment of the fetus in the uterus, were not considered important by men midwives.

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[60] Fee 1981, p. 381.

[61] Henry 2002. Contemporary societies have valued the fruits of medical and technological science and their economic benefits to society as a whole, sometimes for the personal gratification they have provided. Technology was not entirely welcomed by the poor, whose jobs were replaced by machines during the period of the industrial revolution.

[62] Midwives as women in society were expected to be subservient to doctors, who were predominantly male. Margaret Myles, the author of *A Textbook for Midwives*, emphasised to midwives in the mid-1950s their role as intermediaries or brokers between doctors and 'their' patients, acting as the doctor's eyes, ears and hands; Myles 1950..

[63] While Peter Dobkin Hall was commentating on the foundations of professional scientific credibility from an American perspective, his claim has wider resonance: see Haskell 1984, p. 134.

[64] Margaret Stephen called in a man midwife only eight times in her thirty years of practice.

11.6.1 Midwives' perceptions of the problem of obstructed labour caused by severely contracted pelves

Midwives attended most of the poor, and although they claimed to have observed women suffering from the effects of childhood rickets and mollities ossium, they rarely mentioned the need to refer such women to men midwives or to barber surgeons. In fact the link between a narrow (contracted) pelvis and rachitic disease appeared to be a tenuous one, with some deformed women giving birth briskly and normally. Similarly, if severely contracted pelves were common, midwives would have witnessed or heard about this problem and would no doubt discussed it in their texts. The midwives did, however, make copious references to the use of forceps by medical men, which they claimed were sometimes used inappropriately, causing serious injuries to mothers and death to infants. There may also have been some difficult forceps cases which progressed to craniotomy.

The midwife authors recognised the need for midwives to have access to midwifery education and to a working knowledge of applied anatomy, to be able to recognise and deal with minor complications effectively, to better articulate practice, to read medical literature in a discerning manner, and to recognise the boundaries of their role. These aspirations have not changed over the last two centuries, but they are now more easily attainable. Midwives, however, remain a disparate group; some are willing to take on medical roles, while others continue to rail against medicalised birth.

11.7 The political pelvis

The new approach to anatomy of the Renaissance led to descriptions of sexual differences between female and male pelves. By the eighteenth century, intellectual women began to challenge their repressed social status in contemporary society, alongside a slight shift in opinions on the social status of women, with the emergence of the first wave of feminism.[65]

Inferences about male and female pelvic and intellectual capacities based upon anatomical descriptions were used to deter women from taking more active roles in society, claiming that they would endanger their femininity and fertility, and that in any case they lacked the intellect. Biology was used as a tool to reinforce their 'pre-

[65] Phillips 2004, pp. 1-15.

ordained' role as homemakers and as mothers. Anne Digby suggests that women's bodies defined their 'character, position and value', which created 'a man-made biological straitjacket' where natural laws became 'social conventions that reinforced restrictive gender roles'.[66]

In an examination of the social uses of scientific discourses, Barry Barnes suggests that some beliefs were constructed to serve 'concealed purposes'.[67] He gives as an example the theories of heredity, evolution and eugenics, which could be taken as biological theories but which might also be regarded in an equally intelligible light as a solution to the problem of the 'threat' of the London destitute.[68]

11.7.1 Social Darwinism and Caldwell and Moloy's pelvic classification

In the late nineteenth and early twentieth centuries the minority white middle-class society began to feel the need to assert itself against the masses. A parallel theory, known as social Darwinism was devised which explained contemporary human social hierarchies, providing an 'evolutionary' explanation for the social stratification of society along the lines of survival of the fittest.

Barnes has argued that it is 'incongruous to expose the writings' of these times as racist, since these concepts were part of the fabric of society and fitted it 'naturally and securely in the taken for granted world of the time'.[69] It needs to be acknowledged that issues such as sexism and racism have evolved with contemporary society. The introduction of eugenics affected social attitudes and permeated scientific thinking, Caldwell and Moloy's classification of pelves being an excellent example of this.

White male middle-class American scientists, like their European peers, considered themselves superior to the poor, to non-whites and to womankind.[70] America had a history of slavery and racial discrimination.[71] Following liberation of the slaves after the civil war, racial segregation continued until the civil rights movement in 1968,

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[66] Digby 1989.
[67] Barnes 1974, p. 143.
[68] Barnes 1974, p. 144.
[69] Barnes 1974, p. 145.
[70] Social Darwinists believed that white Protestant Europeans had evolved the most and were superior to other races. They used social Darwinist theory to claim that survival of the fittest equated with survival of the richest.
[71] Slaves were used as guinea pigs in medical experiments, including experimental gynaecological surgery; McGregor 1998. The well-known Tuskegee syphilis experiment continued until 1972; Lederer 1997.

encompassing the period in which Caldwell and Moloy developed their scheme. The structure of the American health care system reflected these sentiments.[72]

Caldwell and Moloy's pelvic classifications, while seeming to fulfil the social needs of white middle-class Americans, were not absolutely essential to the practice of good midwifery. Others in America and England wished to put Caldwell and Moloy's pelvic theory to the test, and made their own contributions in this field. It was only a short time before the restricted utility and inappropriateness of Caldwell and Moloy's four-principle classifications became evident. Meanwhile, their scheme had been promoted to 'textbook knowledge' status, where it has been presented to thousands of obstetricians and midwives as an essential part of pelvic theory. Fleck suggests:

> '... a great deal has to be omitted to preserve the idealised main line. Instead of a description of dynamic interactions, one is left with a more or less artificial scheme' [73]

After several decades, the culture-laden classifications which conveyed contemporary white male attitudes towards women, children and people of non-white races were subject to some profound twists of fate. A considerable number of challenges overturned theories of 'primitiveness', the shape of the ideal female pelvis for childbearing and the prevalence of android pelves. Whilst these revisions were documented, they did not appear to enter the realms of textbook knowledge, where the four parent types of pelvis have resided, devoid of revision, for over fifty years now.

Less skilled midwives also saw themselves as the medical profession saw them, as subcontractors to the obstetric service. They increasingly looked to doctors as mediators of the birthing experience and for professional inspiration. Once ensconced in the maternity care system, they found it difficult to get their concerns taken seriously and were increasingly restrained by obstetric policies.

Despite evidence that women were getting healthier and the initial indication for caesarean section, a severely contracted pelvis, had become a rarity, medical intervention rates continued to soar, to the extent that for the year 2003-4 only 46 per cent of deliveries were described as normal (without surgical intervention, use of instruments, induction, epidural, or general anaesthetic).[74] From a cultural perspective,

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[72] Perkins 2004
[73] Fleck 1935, p. 15.
[74] Department of Health 2005.

women's lack of confidence in their ability to give birth naturally was in part created by a sense of disempowerment and an alienation from their own bodies as a result of the medicalisation of birth. This created a dependent state between women and doctors in which many women believed they required the doctor to interpret for them what was happening to their own bodies during the childbearing process. This often led to women's rejection of their own self-knowledge or embodied knowledge.

In the 1950s approximately three per cent of births were by caesarean, by 1973, CS rates were running at 5.3 per cent[75] Francome, Savage and Churchill suggested that the rate of six per cent in 1980 was acceptable and that any rise above this would not improve the health of mothers or babies.[76] In 2005, The World Health Organization recommended a caesarean rate of between 10-15 per cent .[77] In England and Wales the average rate per region at this time was 21.5 per cent, around 1 in 5 births, whereas in London, Wales, and Northern Ireland, rates were nearer to 1 in 4 births.[78] The inconsistencies between nations, and indeed between British hospital trusts, have suggested that rates are linked with subjective medical decision making. Further investigations into vaginal births after caesarean sections also suggest that obstetricians may still sometimes be capable of misjudging pelvic capacity or of using CPD as an excuse to perform a CS.

On a positive note, Murray Enkin recently predicted that obstetrics might be about to reach another intellectual revision, 'a clinamen', in which 'the complexity of childbirth is acknowledged and birth is regarded as a life event to be experienced rather than diseases to be managed'.[79] In the process, recognition will be given to the complexity of certain aspects of childbirth currently outside the parameters of obstetric thinking.[80]

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[75] Churchill *et al.* 2006.
[76] Francome *et al.* 1993, p. 65.
[77] Churchill *et al.* 2006.
[78] *ibid.*
[79] Enkin *et al.* 2007, p. 268.
[80]Enkin *(ibid.)* describes three types of conditions. Some treatments are *simple* and the outcomes predictable, *like cake recipes.* Other problems are more *complicated*, and *require high levels of expertise.* The third type of problem *is complex and multifactoral* with uncertain outcomes, because certain facets of the problem are not amenable to the medical approach.

11.8 Concluding remarks

This thesis aimed to contribute to the body of knowledge on the history of midwifery and was primarily intended for the illumination of those, who like this author, are from a clinical background. It has explored changing perceptions on the function of the pelvis in childbearing as presented in contemporary texts from ancient times until the present day. Some revisionist readings of the texts have offered new insights into the ostensibly mundane topic of the anatomical pelvis and its alleged roles in childbirth; which have evolved considerably over the past two thousand years or more. What happened to the pelvis reflects what happened to midwifery as a whole. The literature has revealed much about power relationships, dominant and subjugated discourses and the limitations of textbook discourses to reflect practices. It has also demonstrated the influence of culture and society over developments in scientific thinking and the influence of dominant groups and epistemologies over the path of history.

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