CHAPTER FIVE

The Prospects of ESP in Iraq

Chapter Five

The Prospects of EST in Iraq

5.1 Introductory Note

Having dealt with the principles and techniques in the first three chapters of this study and some of their implications in Chapter Four, I will now turn to deal with the prospects of the EST teaching/learning situation in Iraq. The background and the present EST situation will be touched upon but emphasis will be placed on developing reading skills. The emphasis on reading is, actually, motivated by my conviction that reading is (and will be) playing the major role among other English language skills which Iraqi students in science faculties need to develop in order to cope with their academic studies and keep abreast of the latest advances in their field of specialisation before and after graduation.

5.2 Students' Background

5.2.1 The Linguistic Situation

Our views of language learning would be affected by the linguistic situation in which the target language and its skills are to be developed. Presumably the development of reading skills in a certain country where the language acquired in infancy is the same as that to be used for formal reading would be easier to achieve than in, say, a diglossic situation of Arabic as the one in Iraq.

The Iraqi child is first introduced to the Iraqi Arabic dialect and it is the vocabulary and structure of this dialect which the child acquires as he matures. Formal reading in this school is done in the standard Arabic language[1] which is different mainly in structure and lexicon but slightly in phonology from the Iraqi Arabic dialect. The first and second years of the primary school (Grades 1 and 2) are spent in familiarising pupils with the standard Arabic vocabulary, structure and phonology. In essence, it is a way of establishing in them new linguistic expressions since standard Arabic has only slight morphological inflections, and this will be added to his linguistic load.

Iraqi students are required to understand and master standard Arabic language for social and political purposes. Standard Arabic constitutes one aspect of the Arab unity. Therefore to comprehend and eventually produce standard Arabic by the Iraqi students is one of the main aims of the educational system in Iraq (cf. Holmes, 1978:135). However, the development of the main communication media in Iraq, i.e., the radio, television, newspapers, etc. have contributed a great deal to the exposure of Iraqi pupils to the form of standard Arabic which would incite them to deal with standard Arabic at school, presumably. However, an elementary mastery of reading and mechanical writing skills in standard Arabic by Iraqi pupils would not be established before Class Three (around end of age seven[2]).

Hence, the complex linguistic situation in Iraq would presumably embody a problem for the Iraqi reader of his native language which would, in one way or another, have a negative impact on developing adequate reading skills in the target language.

5.1.2 English in the Iraqi Curriculum

5.1.2.1 Preliminary Note

Education is free [3] in Iraq at all levels. All children must go to school at the age of six (see ft. 2 in this Chapter). The nursery stage is still optional. Special modern and reasonably equipped schools for the handicapped are also available. All schools and universities in Iraq are state educational institutions.

Before the 1970s English in Iraq fell victim to what was regarded as a supposedly valuable form of English language teaching. The tendency in both general education (education before university level) and higher level education (university level) was towards prescriptive grammar, linguistic correctness, the pre-eminence of written language and literary studies and linguistic analysis.

Therefore teaching was based on classical learning objectives and thus formal knowledge of language rules, and heavy demands on memory capacity and story-retelling whereby a large number of students feared English and learned to fail in both the English class and language communication.was the prevalent learning atmosphere.

Iraq is now in the process of speeding up educational development at all levels. English, the major official foreign language in Iraq, is being paid much attention. An institute for the development of English language teaching in Iraq has been founded, and new English textbooks for primary, secondary and teacher training colleges and institutes based mainly on the structural approach have been in use and experimented with since 1973. Audio-visual aids are beginning to find their way into schools, and examinations in English are in continuous reform (Al-Hamash and Abdul-Rahim, 1977: preface).

In collaboration with Lancaster University, U.K., M.A. Courses in English language (Linguistics, language teaching and literature) in the English department, Baghdad University have commenced graduating students since, approximately, 1975. Mousil University and Al-Mustansiriyia University have started their own M.A. Courses in English language and Literature. Basrah University has started a diploma course in "Methods of Teaching English". To my knowledge, a reasonable number of Iraqi students and student teachers of English are studying for M.A., M.Ed. and Ph.D degrees in various fields of English language, particularly in EFL and ESP courses in English-speaking countries, mainly in the United Kingdom.

Therefore, the educational scene, as far as English language is concerned, is promising.

5.1.2.2 English at Pre-University Level

5.1.2.2.1 The English Programme

In order to further our understanding of the students' needs, it is important to reveal background information in the target language (cf. Cziko, 1984:73), as this factor would shed some light on the causes behind students' problems in learning strategies.

The English programme in Iraq at the pre-university level extends over eight years. Iraqi pupils start learning English at the age of ten, when they are in their fifth primary school year, and go on learning it for the next eight years. Thus English covers the last two years of the primary school, which consists of six years; the three years of the intermediate and the three years of the preparatory (Al-Hamash, 1973:14). This means that secondary schools fall into two successive parts: intermediate and preparatory. Preparatory schools are divided into academic and vocational. Academic preparatory schools are further divided into literary and scientific sections. Vocational schools are further streamed into commercial, industrial and agricultural schools. There are, however, some professional schools, namely medical and arts-orientated institutes, and primary school teacher training colleges. The graduates of the teacher training colleges, which are three years after the intermediate school, teach in primary schools(4).

Table 71 below shows the distribution of hours of English in primary, intermediate and preparatory schools in Iraq. Table 72 shows the distribution of hours of English taught in vocational schools and teacher training colleges (Al-Hamash, 1978:7-8).

Grade	Number of hours per week (30 weeks)	Average number of hours per year
Primary 5th primary	4	120
6th primary	4	120
Intermediate		
1st intermediate	6	180
2nd intermediate	5	150
3rd intermediate	5	150
Preparatory		
4th preparatory	5	150
5th preparatory (literary branch)	6	180
5th preparatory (scientific branch)	5	150
6th preparatory (literary branch)	6	180
6th preparatory (scientific branch)	5	150

Table No. 71

English is taught as one of many different subjects in the curriculum. Instruction in other subjects is carried out through the standard Arabic language.

Type of School		Number of hours per week (30 weeks)	Average number of hours per year
Commerce	1st year	4	120
	2nd year	4	120
	3rd year	4	120
Agricultural	1st year	2	60
	2nd year	2	60
	3rd year	-	-
Industrial	1st year	2	60
	2nd year	3	90
	3rd year	3	90
Primary School Teacher Training College	1st year	5	150
	2nd year	5	150
	3rd year	4 (20 weeks)	80

Table No. 72

Preparatory school leavers who are eligible to attend science faculties, namely faculties of medicine, engineering, pharmacy, etc. should be graduates of the scientific section. A small minority, however, of the vocational school leavers are eligible to attend some relative science faculties but not the faculty of medicine (see Central Admission Bureau, 1982).

It is to be noted that the optimum age for beginning English teaching in Iraq is a topic about which there has been much debate in Iraq. To my knowledge, there is strong evidence that pupils that commenced learning English at grade three[5] of the Iraqi

primary school have been doing well in English. However, a study of the effects of early instruction in English was carried out by Jiyad (Jiyad, 1973:VI) for the purpose of comparing the performance of third-grade pupils with that of fifth-grade pupils in English. The study has shown that third-grade pupils have achieved significantly higher mean scores than fifth-grade pupils.

As far as ESP courses at pre-university level are concerned, the Institute for the Development of English Language Teaching in Iraq has been responsible for developing ESP programmes for vocational schools in Iraq (Al-Hamash, 1978:1). So far, textbooks for some vocational schools, namely,industrial and commercial, , have been produced. These textbooks are based on the structural approach and they are the product of joint effort on the part of a team of specialists in English language teaching and the learner's speciality. The main activity in these vocational courses is reading comprehension (see Ibid:130-4). But how much success these ESP courses in Iraqi vocational schools have achieved cannot be answered without experimental data. It is too important a matter to be decided arbitrarily.

5.1.2.2.2 <u>The Teacher of English</u>

Teachers who are graduates of Primary School Teacher Training College (three years after the Intermediate level) and Teacher Training Institute (two years after the Preparatory School level) (see ft.4 in this Chapter) are eligible to teach in primary schools.

Secondary school teachers of English are graduates of the Faculty of Education, English Department and sometimes graduates of the Faculty of Arts, English Department (four years after the preparatory level) are eligible to teach English in secondary schools and vocational schools (Al-Hamash, 1973:7).

It is to be noted that teachers of English for primary schools in Iraq still have no specialisation in English (Al-Hamash, 1978:7). This situation, in effect, demands serious consideration on the part of the personnel responsible for teacher training in Iraq. The English syllabuses used in Iraqi primary school teacher training college and institute are reasonably rich with heavy emphasis on English phonology and methodology (see Ibid: 141-55), yet much work lies ahead in this field and other fields related to teacher training pedagogy.

With regard to teachers of English for secondary schools, there is, in fact, clear specialisation in English. But ESP courses in vocational schools are still taught by non ESP teachers. Therefore the teacher is thrown upon his own resources, usually with a heavy preparatory ESP load which requires skill and knowledge in the special field of the student that the Iraqi teacher in vocational schools will be very lucky to possess. Presumably, the teaching of ESP requires an ESP teacher who knows how to handle ESP materials as the teacher, no doubt, forms a cornerstone in the ESP programme, particularly in EFL situations (cf. Swales, 1978:41). The ESP

programme would be ineffective if the teacher is not well-acquainted with the value of the materials he is teaching, and the relative methodology he is adopting as Hawkins (1977:127) has put it ".... good materials die a natural death at the hands of inexpert or uninterested teachers".

As far as the Iraqi teacher training of English is concerned, presumably more efforts are still needed for more improvement of English teachers' courses both at pre-service and in-service programmes despite the care and attention paid by the Iraqi Ministry of Education and Ministry of Higher Education to the training of the Iraqi teachers of all subjects, including English.

Presumably, a teacher of EFL should be trained to understand and master the 'why', the 'what' and the 'how' of the language he is teaching (Strevens, 1980:58). Such a theoretical element would demand a high level of intellectual training, an adequate period of training and a high standard of teaching situation in the EFL teachers' pre-service and in-service courses. Presumably, the teacher's professional skill is mainly dependent on his proficiency in the target language and his understanding of the methods and techniques of foreign language teaching and learning. Virtually the teacher's task would be difficult if he himself were ill-trained and hardly able to use the target language for real communication, as it is undoubtedly the teacher's command of language which would set a principal model for his students,

particularly in a non-English speaking milieu. Hitherto, a teacher who himself had no adequate command of the target language would not succeed in helping his students to achieve what he himself found difficulty in achieving. This would imply that Iraqi secondary school teachers of English would require English language courses whereby their English language performance would be developed as well as their professional attainment.

5.1.2.2.3 The Teaching Method

Generally speaking, the whole objective of teaching English in Iraq at pre-university level is that it shall serve as a medium of international communication. Therefore, all English courses are geared to achieve this aim (Al-Muttalibi, 1974:122). But the problem with these oral courses is that they have no particular authentic uses in mind such as English workshops or English clubs and the like. Moreover, there are no valid procedures for assessing students' performance in listening and speaking skills on a national scale. Therefore students' evaluation and assessment, particularly in preparatory schools, would give much weight to the written form. Hitherto, students have probably concentrated much more on the written word than on the spoken word. This, however, should not rule out the fact that the assessment in schools of students' progress in oral English is in continuous reform.

In Iraqi vocational schools where English vocational courses with special objectives directed at apprentices, nurses, trainee professionals, the demands made on the teacher and the objective set are unrealistic under the present textbooks, teaching techniques and unrealistic time-limit which is two contact hours of English a week. These courses are, in fact, set up on principles predicted so as to meet the needs of the students in the relative vocational schools, but close examination of the language materials of the textbooks on technical subjects (see, for example, Ministry of Education, 1979) betrays ignorance in almost all areas of English but their own specialised vocabulary and some structural exercises while ignoring emphasis which should be placed on the common remedial problem presented by the students' fractured and incomplete competence in English which would help them cope with their real needs as ESP students.

In addition to the use of contrived language materials, which is mainly at the sentence level, in the Iraqi vocational schools, the teaching method adopted is one which places heavy emphasis on pattern practice technique. Consider the following recommendations made to the Iraqi teachers in vocational schools regarding the teaching of reading (see Al-Hamash, 1978:127):

i. The teacher should read the paragraph aloud once or twice and then conduct a choral repetition for the whole class.

ii. When doing comprehension questions, the teacher should ask the question and have his pupils answer either chorally or individually. As much as possible, he should insist on full answers, not short answers.

Presumably, the recommendations above would contradict people's language attitudes in normal communication. However, as argued rightly by Thomas (1983:91-3), one disadvantage of non-communicative approaches to language teaching is that they ignore the development of people's ability to use language effectively in order to achieve a specific purpose. Presumably, pre-communicative language practice would be full of drills which would be devoid of new information. Imparting information would be one of the significant factors which would make a piece of language communicative. Therefore, no genuine interaction takes place in language practice which is devoid of new information.

> We cannot expect listeners to approach interactions in a state of readiness...., nor can we expect them to evaluate incoming information against a speaker aim, unless we provide them with a speaker aim (Johnson, 1982:150).

However, by examining the Iraqi preparatory school textbooks, one would discern that the teaching of English at preparatory level, particularly in the sixth academic grade (see Ministry of Education, 1980), tends

a blending of notional and structural approaches rather than a purely structural one which is being adopted in primary and intermediate levels (see Table 71 on page 401).

However, from observing Iraqi secondary school leavers in different walks of life including the university, I feel that their performance in English is still much behind the objectives of teaching English as a foreign language in Iraqi secondary schools as cited by Al-Hamash (1978:41), which aim at enabling students at the end of the secondary stage to:

i. manipulate the four language skills effectively in their daily life in case they do not intend to continue their higher education;

ii. develop self-confidence in understanding written and spoken English used outside the school limits;

iii. participate effectively in discussions and conversations carried out in English - especially those related to their country and those dealing with political, economic and cultural issues;

iv. study some or all university subjects in English and express opinions, analyses and information in clear and idiomatic English;

v. use English effectively for the purpose of pursuing higher education abroad or for purposes related to tourism and similar functions.

Generally speaking, success or failure of any teaching/learning process does not depend on one single factor, but on diverse factors related to the language teaching situation. A foreign language teaching method may succeed in a certain country or with a certain type of student, yet it would prove a complete failure in another country or with a different type of student (Strevens, 1977:6). Therefore, a fruitful method is one which suits the very learners, fulfilling their objectives and preparing them to be effective in their future career within the limitation of their own abilities, and educational and social settings. No doubt the language teaching/learning process is a many-sided educational problem; therefore tackling problems in EFL teaching would not be so easy to deal with. But whatever the objectives behind the teaching of English in a country whose national language is not English, the need for realistic goals which would fit into the framework of the country's goals for national development should be taken into consideration in planning any EFL teaching course.

However, as far as Iraqi secondary schools are concerned, it seems to me that the following suggestions would benefit the teaching/learning process there:

i. more attention would be given to communicative performance rather than mere grammatical correctness;

ii. a communicative rather than audio-lingual approach would be adopted;

iii. teaching methodology would be less rigidly prescribed, as classroom techniques are insignificant compared with the attitudinal and motivational impact of the teacher's personality;

iv. more emphasis would be placed on the preparation of students for individual work with self-instructional techniques, group work activities and encouraging practice with no fear of error; and

v. less emphasis on the teacher being the centre of the teaching activity.

5.1.2.2.4 Reading Skills

A close look at the English syllabuses in primary and secondary schools in Iraq would show that reading skills have not been given due attention in the English programme (see Al-Hamash, 1978:13-48). 10% of the class time is given to reading skills in the fifth and sixth primary year and the first year intermediate. 15% is given in second and third year intermediate, 20% is given in the fourth year secondary, 25% in the fifth year secondary and 30% in the sixth year. As far as private reading at home is concerned, this starts in the fourth secondary. Students are given 'literary readers' - an abridged novel has been chosen for the fourth year and a simplified novel for each of the fifth and sixth secondary grades. Students are asked to read selected chapters at home, then the contents can be discussed orally in class, probably every fortnight. This would indicate that

students are required to read one small 'Literary Reader' during the whole year. No reference to the use of the school library is indicated in the syllabuses.

Actually, in the typical Iraqi classroom situation, the two years of English in primary schools (Grades 5 and 6) are devoted mainly to the study of the mechanics of reading: the orthography is taught, and students learn the reading and writing skills more or less simultaneously (Al-Hamash, et al, 1978:6-7). As students advanced in the educational ladder, English reading would be viewed largely as a vehicle for vocabulary enrichment rather than developing global reading strategies.

Generally speaking, reading skills in the Iraqi programme are not looked upon as communicative skills to be developed in the students, but to serve as reinforcement of other language skills and a great stress has been placed upon the fostering of the oral skills from the very early stages of learning the target language (see Ministry of Education, 1980a).

As far as 'reading skills' in vocational schools are concerned (see Table 72, p.402), the teaching method adopted, albeit emphasises reading comprehension, involves outdated structural techniques in teaching reading skills. These techniques are as follows (Al-Hamash, 1978:131):

i. materials are presented orally to students;

ii. the teacher explains the new words listed;

iii. explaining the words may include the use of the vernacular;

iv. silent reading, either in class or at home;

v. reading aloud by teacher and students;

vi. question students orally or in writing on points in the text.

This would imply that reading skills are looked upon as auxiliary skills to oral skills, although they are supposed to be the main teaching/learning activity as indicated in the syllabuses (see Ibid:131). No mention for the use of library references is seen in the English syllabuses of the vocational schools as well.

However, other problems which would hamper the development of Iraqi students' reading skills in English is their reading experience in their native language which is almost restricted to a classroom procedure; thus the student would have had very little practice in the more normal activity of reading for his own information or entertainment. This in turn would hamper students' reading skills in a foreign language, as it would make them feel insecure every time they dealt with a new text (Edge, 1983:93).

Presumably, to develop students' reading skills in preparatory schools, reading activities would be developed with the following aims in mind:

i. training students to make use of their reading skills by emphasising the teaching of study skills;

ii. developing students' reading sub-skills such as (Munby, 1978:121f, 129f):

   a. extracting salient points to summarise,
   b. skimming to obtain the gist of the text, and
   c. scanning to locate specifically required information;

iii. motivating students to read widely in English by providing interesting reading materials;

iv. exposing students to a variety of literary forms;

v. providing students with reading information about the culture of the people of the target language in a way which should avoid political and religious clashes. Presumably orientating reading materials to the culture of the people of the target language would improve motivation by making language study more meaningful and alive as well as promoting a positive attitude towards the people of the target language. It would also enlarge students' educational scope;

vi. supporting reading texts with the use of audio-visual and visual aids as these aids would help understanding of the text, and

vii. making students aware of the benefit of reference books and train them to make the most of their private study at home.

5.1.2.3 English at University Level

5.1.2.3.1 Introductory Note

To begin with, there is a very large discrepancy between Iraqi students' attainment in English on entry to the university and the attainment required to use English at the university level. Presumably, one of the major problems to students who are admitted to science faculties is that the kind of English Iraqi students have studied in primary and secondary schools has very little relevance to the English of science materials. Another problem would be relative to the teaching and learning strategies many Iraqi teachers and students have developed during their educational experience in learning a foreign language. For example, in written examinations, which are still the dominant features of evaluation in Iraqi schools and educational institutions as far as English language teaching is concerned, the ability to reproduce teachers' notes, lectures and information in the textbook would still be more highly rewarded than the ability to reason, evaluate and deduce, etc. Therefore, we can see students both in schools and early years at university level learn by heart whole passages and memorise lists of lecturers' notes and definitions in order to get high scores in examinations. Hitherto, one can easily discern that such students would be unable to observe the main points of a reading text because of their weak deductive strategies of authentic texts.

Indeed, the general opinion which the English teaching fraternity would conceive in Iraq is that students plough through secondary-school English curriculum, spending large amounts of time on materials irrelevant to their pursued studies (cf. Swales, 1978:43). Thus, on university entry, the students are thrown straight into orientation and subject-specific programmes, in which the English and the skills involved would be almost like another language to them. Actually, even if motivation is sometimes high at first, it drops off very quickly when students feel that they are not progressing as fast as they expect.

Another problem comes from the university itself. Iraqi universities, particularly in non-foreign language departments, take it that foreign language improvement is the concern of primary and secondary schools but not their own. Therefore, these universities would pay lip service to it and may see it as a cause for regret and a sign of lowering standards. They might believe that this state could not be cured and students have to live with it. This would minimise the importance of the foreign language and demotivate the students to foreign language learning.

5.1.2.3.2 The ESP Programme

The English course at the university level in Iraq varies from one university to another and sometimes from one faculty to another. In English departments in faculties of Education and Arts where students are to be

specialists in English, English is taught for the four years of the faculty and it is the medium of instruction (Al-Hamash, 1973:7), whereas in non-English departments in the same faculty or in other faculties such as the physical education and jurisprudence faculties English is taught for the first two years. In the faculty of medicine, although English is the language of instruction there, it is taught for only one year. The type of English taught in these faculties and institutions is still selected by ad hoc committees, but it is supposed to be relevant in content to the students' type of study, i.e. ESP. But how relevant and effective those materials are to students' specialisation cannot be assessed without experimental data.

5.1.2.3.3 The EST Programme

To start with, Iraqi faculties of science in the various universities in Iraq, namely Baghdad University, Al-Mustansiriya University, Mousil University, Basrah University, Salah El-Deen University, the Administration of Technical Institutes, etc. accept and graduate thousands of students of scientific and technological disciplines every year. These include faculties of engineering (civil, mechanical, electrical, chemical, architecture, etc.), medicine, veterinary, dentistry, pharmacy, science (physics, chemistry, mathematics, biology, botany, geology, etc.), etc.Students begin to specialise in their subjects from the first year. Teaching EST in these faculties covers either the first two years or the first year of the students' academic study.

However, the EST situation in these faculties and institutes is somewhat complex. The medium of instruction, except in the faculty of medicine where English is the medium of instruction, is a combination of English and Arabic. Most specialised textbooks and reference books are still in English, but examinations are carried out either in English or Arabic or in a combination of the two. This depends upon the department concerned, material taught and type of lecturer as shown in Tables 73 and 74, which are the responses to a questionnaire[6] given to subject teachers in Iraqi faculties of medicine and other science faculties respectively.

Table No. 73

Percentage of language of instruction used in medical faculties in Iraq

Language of instruction	Lectures %	Text-books %	Supple-mentary mate-rials %	Exami-nations %	Refe-rences %
English	95	100	100	75	100
Mixed	5	-	-	25	-
Arabic with English terminology	-	-	-	-	-
Arabic	-	-	-	-	-

Table No. 74

Percentage of language of instruction used in science faculties in Iraq

Language of instruction	Lectures %	Text-books %	Supple-mentary mate-rials %	Exami-nations %	Refe-rences %
English	9	56.8	35.2	34	77.2
Mixed	68.1	31.8	25.71	38.6	18.1
Arabic with English terminology	34	11.3	44.7	15.7	5.2
Arabic	-	-	5.8	15.7	-

However, I have gathered from the results of the questionnaire that the use of English-medium lectures varies from subject to subject and sometimes from one faculty to another, but in general, medicine and engineering-orientated faculties and institutes use English-medium lectures more than other science faculties. In other science faculties, a certain amount of lecture instruction takes place in English, either from foreign lecturers or from L2-speaking lecturers who have got their higher degrees from English-speaking countries. In the faculty of medicine, even Iraqi lecturers use English as a medium of instruction. But the vernacular is used outside class as a means of communication, and some may use the vernacular in class in very rare cases in order to clarify ambiguity and avoid a breakdown in communication, particularly in laboratory work.

Some subject teachers in science faculties have mentioned in their replies that in their faculties it was compulsory that one subject at least be taught in English.

Finally, it is to be mentioned that there are no service English departments in Iraq committed to an ESP policy, but M.A. degrees relative to ESP are carried out in the general English departments. Mousil University, however, has been involved in an ESP programme which is specified for recruiting EFL teachers to be ESP teachers, but it seems that the programme is still facing formidable troubles (Pattison, 1978:8).

5.1.2.3.3.1 The Student of EST

Generally speaking, students' standard in English at university entry varies considerably, but is generally low on the communicative level. Although many can repeat grammatical structures in a pattern practice technique, few if any can produce appropriately a continuous discourse in a real situation. Most of the students would be unable to comprehend the total meaning in pieces of EST discourse despite the fact that they understood most of the words in each sentence and/or most of the sentences in the very piece of discourse. They also would not be able to sum up the general meaning of that discourse in their own words. My hypothesis is that these students lack those abilities which would allow them to gain access to the discoursal information of the scientific text because of being trained at the pre-university level to understand and respond mostly at the

sentence level. Therefore, they would lack the abilities that the experienced native speaker/reader of English possesses.

Additionally, students' predisposal view of English as a content subject rather than as a means of self-expression and communication no doubt affects their attitudes to English at university level. Another problem related to motives and incentives in learning English at university level is that students' motivation is purely 'extrinsic', i.e. directed towards academic attainment rather than communicative needs in the domains of activities inside and outside the university.

However, in Iraqi science faculties in nearly all situations students would be required to read notes or textbooks, write reports and results of experiments in English. This implies that, probably, in many cases, failure to cope adequately with visual texts in English would lead to failure for the individual concerned and for the educational institution at the university.

I have gathered from the subject teachers in science faculties, including the faculty of medicine, that students have acquired a knowledge of basic science in their L1 during their secondary level education and are now fit to build on new scientific information relative to their specialisation.

Students are also expected to use English at the textual level for a particular purpose. But do Iraqi students at university level have the required competence in English to cope with their studies? In fact, the

majority do not. Corollary to this, we find those students exhaust themselves in a very hard schedule of study to raise their standard in scientific English so as to match the standard required to function as university students.

As far as students of the faculty of medicine are concerned, I would be able to say that in the first place the general English proficiency of the students was clearly inadequate for the demands put on them as medical students.

One has also to bear in mind that those students would face major problems in their studies because they would not normally have developed efficient reading strategies in their L1 of non-classroom materials, and their specialised knowledge of their subject-matter is restricted and thus would not help them to predict content efficiently, and they are not efficient at study skills procedures to be exploited in the course. Moreover, their time for L2 learning is very limited.

5.1.2.3.3.2 The Teacher of EST

What is happening in the Iraqi EST classroom in science faculties today is that most EST teachers are arts-trained language teachers with little more than a layman's knowledge of subject areas outside humanities. Indeed, they are generally employed in a language services department, with most of their attention and effort having been to English language and literature during their undergraduate and postgraduate studies. Training courses

for these teachers would place no emphasis, or very little, on instruction as to how to cope with the teaching/learning problems of the Iraqi advanced students who may require English for a specific purpose of a high quality of specialisation. Consequently, EST materials which are of the academic type would be a difficult task on their shoulders. This would lead ESP teachers to emphasise language structures and ignore communication activities which would require them to deal with students' academic information.

Thus classroom work would get bogged down if the EST teacher does not know enough about students' subject matter to stimulate real communication,as dealing with scientific texts would require the EST teacher to stray beyond the actual text being studied (Hutchinson and Waters, 1980:8).

Presumably, one of the main problems which has been threatening ESP teaching at university level is that English teachers in Iraqi universities still,unfortunately, hold the belief that teaching English in the English departments is more academically respectable than English for specific purposes in non-English departments. This, no doubt, would hamper the development of the ESP course in Iraqi universities, as well-trained and highly-qualified English lecturers would be reluctant to teach in non-English departments (cf. Swales, 1980a:62).

5.1.2.3.3.3 The EST Materials

The EST course in science faculties and institutes in Iraq have often been done by ad hoc committees, and sometimes it is left to the ingenuity of the EST

teacher who runs the course. Often these EST materials deal with arbitrarily-chosen exercises dealing with grammatical points and/or vocabulary aspects which are rarely relative to the students' needs and aspirations (see appendix, 8). In short, the design of the students' EST materials in these faculties seems to take account of only traditional attitudes to learning and would reflect complete ignorance of the fact that students were attending English classes in order to be helped to acquire communicative skills relative to their field of specialisation in English.

The EST materials have simplified content and students are forced to deal with subject-matter which they already know, or which is irrelevant; therefore, very little genuine communication takes place. Virtually, without new information in the content, the materials would cease to hold any authentic communicative value. Indeed inappropriate, conceptually naive, incorrect according to current views and not directly relevant to students' field of specialisation, will demotivate students towards their EST course and the English language students learned would be narrow and restricting and even counterproductive.

Such language materials as those used in Iraqi science faculties would deprive students of freedom and unpredictability which is noticed in real life interaction (Xiaoju, 1984:3).

Generally speaking, there is a need for the EST materials in Iraqi science faculties to be investigated by certain specialised committees, so as to be rectified in a way which can present them in a format which would be useful for both students and teachers.

5.1.2.3.3.4 The Method of Teaching

The method of teaching EST in Iraqi science faculties is completely the responsibility of the EST teacher in each faculty. There is actually no officially advocated method. No study has been carried out yet of the method or methods used by EST teachers in these faculties. But generally speaking, and as I have gathered from the graduates of these faculties and from some of my colleagues who teach EST in Iraqi science faculties, a combination of the direct method and structural approach is employed.

Indeed, the majority of the EST teachers in Iraqi science faculties nowadays are graduates of the mid-sixties and early seventies. In effect, since the mid-sixties, official enthusiasm for the direct method has abated. In the 1970s the structural approach was officially adopted for the teaching of English in Iraqi secondary schools (Al-Hamash, 1973:10). No doubt, the general English language teaching situation has been affected by the adoption of the structural approach and by the orientation of teacher recruiting towards this approach by the IDEITI.

Finally, there are other problems relative to the status of the EST course in science faculties in general. The EST teachers in Iraq, at large, feel that the EST course is still being considered in science faculties as an ancillary but ineffective subject which is inserted in the students' timetable because it is there in the curriculum and not because it will help students to perform effectively in their special subjects. Therefore in most cases it is considered an unwanted load on the faculty administrative staff's shoulders. Consequently, it will be looked upon as a filling gap subject and the distribution of the EST teaching hours in the students' timetable, in most cases, is done arbitrarily. Therefore, the two EST teaching hours would be inserted successively to be taught in one go, and in most cases they occupied the late teaching hours of the day wherein students would be too tired to deal with a 'theoretical' teaching period. This would certainly do a great deal of damage to the EST course in these faculties.

Only very recently, teaching began to draw the attention of the personnel responsible for higher education in Iraqi universities. The ESP teaching/learning situation would require some people from within the very situation to shoulder the responsibility for developing it, and gearing others' attention to the useful role which the ESP teaching/learning activity would play in developing Iraqi students' communicative skills in English in their field of specialisation.

5.3 Suggestions and Recommendations

5.3.1 Preliminaries

Having conceived a preliminary view of the EST situation in Iraq, one would feel that there will be a need for a wider perspective from which to view the various aspects of the EST teaching operation in Iraqi science faculties wherein syllabus design, methodology, teacher training, etc. are to be viewed not only in relation to each other but also within the framework of Iraqi students' needs and the country's national educational goals. It is only in relation to such perspectives that the Iraqi educational fraternity would be able to recognise any inconsistencies in the EST teaching/learning process and enhance EFL curriculum development.

Actually, many of the problems of motivation, materials and methods are common to English language teaching situations in general and not peculiar to EST. EST has to recognise and overcome them from its own perspective (Kennedy, 1980:119).

Therefore EST in Iraq has to bear in mind that it is part of the EFL curriculum and is affected in one way or another by sponsoring authorities in the Ministry of Higher Education or the Ministry of Education. What an EST approach should do is recognise this factor and realise its effect on student motivation, the design of materials and methods of assessment.

Indeed, the rationale behind the tendency towards developing the ESP course in Iraq would be related to the consensus in the Iraqi educational

fraternity that the course is not up to the required standards to help students in transferring their language skills to other subjects and adapting them to meet their specialised demands (Al-Hamash, 1978a:1; Pattison,1978).

Iraqi science students have already been trained to deal with English structure at the sentence level. I feel that an approach to text is needed which lays emphasis on longer stretches of discourse and textual information. Students would also be in need of encouraging techniques to build in them more confidence in dealing with the target language.

5.3.2 A Need for 'Needs Analysis' in the EST Course in Iraqi Science Faculties

Language learning within a communicative curriculum is seen as a process achieved through an interaction among the components of the teaching/learning process, namely, learners, teachers, materials and techniques. For instance, the production of learning materials for an EST course is an intermediate stage in a long process which depends mainly on needs analysis and ends with field testing plus the gleaned feedback from its application (Maria and Horzella, 1977:34).

In analysing students' needs, the EST programmer should include all points of view - the learner, the language teacher and the subject specialist should all be consulted so that some consensus can be arrived at.

It is important when undertaking needs analysis to bear in mind the distinctions that can be made amongst various types of needs. A practical needs analysis should cover present needs and future needs (Alderson, 1980:135). If we put the Iraqi medical students in this perspective , we would find that although these students would graduate in the faculty of medicine even if they found it difficult to express themselves in English orally, they would, however, need this skill for future purposes. I have gathered from my fieldwork in KFM that subject teachers did not, in principle, expect their students to speak English well and it seemed they have been used to living with it, but these students would be much better students and professionals if they did.

Since many Iraqi science students, particularly medical students, are likely to continue their higher studies in an English-speaking country, they would be in need of 'social English' which would help them to cope with understanding spoken English (cf. Jordan, 1977:14; Kennedy, 1980:120). Medical students would also be trained to take clinical notes and write case histories in English, so that when they began to practise, they would be in the curious position of interviewing a patient in Arabic while perhaps simultaneously taking down notes and then writing prescriptions in English.

The afore-mentioned argument would imply that students' needs differ from one country to another. Therefore, in trying to suggest an adequate language

course, we have first to specify the actual needs of the learners to whom the EST course is to be adopted in the country concerned, and the Iraqi EST course is no exception.

> What is suitable for one group of students in one institution in one country preparing for one particular profession or course of study cannot be immediately usable (or usable at all) by another group in another country (or even in the same country) (Robinson,1983:162).

5.3.3 A Need for a New Look at the Iraqi Learner

Iraqi EST students should not be looked upon as only recipients of knowledge but also contributors to the learning activity. They should be esteemed to develop their own personal strategies for effective language learning. This would be achieved by encouraging them to use reference books, appreciate the usefulness of pair and group work as well as individual work.

A common problem which might be faced in the EST situation in Iraq is that some students may react against their special academic studies because they wanted to study other subjects but their exam grades were not high enough for entrance to that field. This might lead them to react against the EST course, putting it into the same perspective as the subject discipline they resented.

The EST teacher in this case has no direct solution to this problem. But he may be able to help students change their attitude towards their field of specialisation. Students sometimes overestimate their skills and educational abilities. A teacher can do a great deal to convince them that one would better place oneself in a situation which matches one's abilities rather than in a situation where one would face study problems which one might not be able to cope with.

EST students in Iraq could be helped to commit themselves to their studies by developing new incentives, testing techniques and administrative procedures.

5.2.4 A Need for Suitable Training for the Iraqi EST teacher

Since trainee teachers' courses in Iraq concern themselves with training teachers of English with only a general educational and cultural subject of the target language, the teachers of English called upon to deal with scientific English in the classroom face special problems. They have to acquaint themselves with the scientific concepts used in the students' field of specialisation, be aware of the nature of teaching scientific materials and be able to construct their own teaching materials (cf. Strevens, 1980:129).

Indeed, the difficulty of the profession of the EST teacher stems from the assumption that he is carrying a delicate and highly specialised task (Early, 1981:44).

Modern pedagogical developments have, in effect, burdened the EST teacher with new responsibilities such as the analysis of learners' needs, syllabus design, writing teaching materials, developing tests, etc. These responsibilities do require new training for the EST teacher (Strevens, 1981:7). Therefore the EST teacher should ideally be, not a passive recipient of research, but actively able to synthesise information from a number of sources for the solution of pedagogical problems and establishment of procedures and techniques relative to his students' field of specialisation.

> .... even though his (the ESP teacher's) task is ostensibly to teach language and not content, it is difficult to separate the two and it becomes necessary to understand content if the language is to be effectively taught (Kennedy,1980:122).

However, it is to be stressed at this point that whatever knowledge and information related to the students' field of study the EST teacher has access to, he should in principle continue to look on himself as a facilitator of learning rather than a source of information (Crocker, 1981:10).

In fact, training of EST teachers in Iraq has become an urgent matter, since the number of EST students has increased vigorously and the demand for a new approach whereby the needs of learners studying science would be

met. Therefore, the problems facing students at present and the demand put on them require genuine steps to be taken to establish effective EST programmes and provide them with effective EST teachers.

When we talk about the training of EST teachers we have, in effect, to take into account a number of factors such as knowledge of and interest in science, native or non-native, motivation, training (Kennedy, 1979:42).

I feel that the teacher of EST should master the language of science and should be well-acquainted with the scientific terminology of the language materials in the language he is teaching. I think if we want to have successful EST teachers in Iraq, such teachers should be graduates of scientific sections of the preparatory schools (see Table No. 71, p.401). Such secondary school leavers would be trained to teach EST relative to their career in the English department in the Faculty of Education, where they study professional English as teachers of EFL and at the same time attend scientific lectures and seminars with students of science and technology in order to build more competence in scientific discourse and terminology. Graduates of such training would be eligible to teach EST in Iraqi vocational schools (see Table 72, p.402). But those who are to teach EST at university level should further their EST education in an English-speaking country in English departments which are committed to train ESP teachers such as the language unit in Aston University in Birmingham in the United Kingdom.

From my experience in teaching EST in the Faculty of Education, Physics Department, University of Baghdad and KFM, I found my limited knowledge in science (biology, physics, chemistry and mathematics), as a graduate of a preparatory school scientific section, of much help in understanding scientific texts and dealing with scientific discussion in the classroom. Some of my colleagues, who were graduates of the literary section and taught similar materials to mine in other science faculties, complained that one of the formidable problems they faced in their task was to initiate a genuine scientific discourse. They said that they used to avoid dealing with scientific topics they found difficult to deal with and their emphasis was mainly on language materials, particularly grammatical structures.

I feel that Ewer (1976:250) is right to pose the following problems for literary-based teachers when teaching EST.

i. It is difficult for non-EST teachers to deal with scientific material because they will not understand the concept of science.

ii. The structure and the special lexical features of scientific English is unfamiliar to them as it is different from the literary-based English material.

iii. They lack training in methods of teaching the EST language itself and they lack experience in dealing with the special material forms in which EST appears, e.g. scientific charts, illustrations and formulas.

Ewer (Ibid:254), however, suggests a procedure for training EST teachers. He calls for incorporation of trainee teachers and practising teachers into intensive EST programmes. I believe that it would be a waste of time and money to train literary-based teachers of English to teach EST in Iraq. This could be a temporary phase to answer the demand on EST teachers at present. But it should never be a permanent programme. I think I have to confirm my suggestion (see p.433) that if we want to have effective EST teachers in Iraq, we have to select secondary school leavers of the scientific section and train them as EST teachers. Such a kind of teachers would have the following benefits over the ones suggested by Ewer:

i. they would have already grasped well the concept of science which makes them self-confident when they discuss scientific materials in class;

ii. they would be interested in teaching scientific English because they have chosen their own way right from the beginning; and

iii. they would have ample time (4-5 years) to train themselves in both ESP departments and science departments in order to master both methods of teaching EST as well as scientific language.

5.3.5 Towards a Communicative Syllabus and Methodology in the Iraqi EST Course

The problem with EST syllabuses used in Iraqi universities is that they have been selected according to

predicted needs of Iraqi students. The syllabuses used, as far as I know, are not directly relevant to students' needs nor are they obvious sources of communicative activities. Therefore, designing relevant syllabuses which meet students' real needs on both academic and communicative levels would be one of the major steps in developing the EST courses in Iraq.

Traditional language teaching courses are devoted to teaching the language of reporting rather than the language of doing (Wilkins, 1977:5). Communicative language teaching would cater for both activities. The type of scientific discourse which would be fruitful to use in the Iraqi EST syllabus is that related to the illocutionary acts of defining, explaining, reporting, classifying, asserting, hypothesising, predicting, etc. (cf. Mountford, 1976:147). The syllabus should be concerned to a greater extent with the problem of making students aware of the structure and organisation of English above the sentence level - of contextual meaning used in discourse.

It is to be noted that the Iraqi EST students may be resentful to the EST course because of their previous negative experience of learning English. What is needed in these cases is EST materials and teaching activities which would show the students the link between English and their studies so as to make apparent the fact that English can be useful. This would be achieved by designing relevant and interesting materials whereby

students would have a positive attitude towards the EST programme and the learning of English.

Contrary to Alptekin and Alptekin (1984:14), who purport that in order for the EFL materials in non-English-speaking countries to become effective and realistic, course designers should place emphasis on international contexts which are culturally neutral rather than on contexts from the English-speaking world, I assume that socio-cultural norms and values of the target language as well as the students' nationality-bound cultural contexts would be the basis on which any EFL course is to be designed if our aim of the EFL teaching is communication between the learners and the speakers of the target language as appropriate performance in the target language would not be achieved without the learners' awareness of the culture of the language they are learning, which in turn would develop socio-linguistic appropriacy to be integrated with linguistic appropriacy.

Indeed, something reflecting the culture of the speakers of the target language and the way they interact in social conversational discourse would be of potential significance for Iraqi university students, many of whom assume that what is true of their vernacular is a norm for the L2 and that might lead them to be in a great sensitivity if they became involved in cross-cultural communication (Richards and Sukwiwat, 1983:124).

It is to be noted that the development of reading skills should be of prime importance in the EST syllabus in Iraqi science faculties, particularly if we notice that the reading span of Iraqi students in scientific discourse is very limited, and how this discrepancy will affect students' motivation and standard in the target language when we see that these students are facing a problem of shifting from the deep-rooted habit of solely using Iraqi textbooks and lecture notes in Arabic to relying more and more on English textbooks and periodicals as well as drawing themselves away from memorisation by heart to reading with decoding and evaluating scientific materials. The syllabus should also cater for the gap between the students' English and that required for dealing with their scientific texts. Exercises suggested should help manipulate the students' previous knowledge of English and their field of specialisation.

I have gathered from the fieldwork in KFM that when students had a foreign lecturer, they sometimes found themselves in a foreign audience where the subject teacher made no concessions to them. They were constantly pressurised by 'once-only' chance of understanding. When they missed a point, it was rarely repeated. It was also difficult for them to select what was important for noting down and to eliminate points of secondary value.

Therefore, it seems to me that a course on study skills, particularly on note-making and note-reconstruction related to reading and listening skills should be incorporated in the ESP course in the faculty

of medicine and other faculties where English is still the language of instruction and/or where there are still English-speaking lecturers. A course which emphasises study skills related to reading skills should be incorporated in science faculties where English is not the language of instruction.

It is worth mentioning here that syllabuses for Iraqi medical students should include information about the medical system and the use of colloquialisms for parts of the body in the country where they would further their studies. Such a material will help them get more communicative information when they read up-to-date medical journals, indulge actively in peer-teaching, lessons and, of course, will help them when they sit for practical examinations where real cases are to be diagnosed by them.

In the U.K., for example, the use of medical abbreviations such as F.H. (family history), Rx (treatment prescribed), GP (general practitioner) (doctor who is not a specialist or consultant), and so on, would increase students' competence of medical spoken and written English (Edwards, 1974:248). Someone who is studying medicine in English needs to know English medical words and expressions. If at some stage he is going to be talking to native-speaker patients, then some knowledge of colloquial terms that occur in doctor-patient discussions may also be necessary (Wallace, 1982:11).

The syllabus should also cater for students' vocabulary enrichment. If we examined the types of words which would cause difficulties to Iraqi science students, two groups would emerge with great consistency - the sub-technical vocabulary, and the specialised vocabularies directly relevant to particular science subjects. In fact, both types of these vocabularies would be fundamental to the process of vocabulary learning in the EST course in Iraq. However, a study made by Skehan (Skehan, 1981:116-7) has shown that the sub-technical words formed a higher percentage of the total number of words in the economics texts he processed in the computer. This would imply that students' familiarity with the sub-technical words related to their field of specialisation would help them a great deal in understanding science texts.

Contrary to Smithies (Smithies, 1976:128), who purports that EST students in EFL situations would never need writing skills "except in very unusual circumstances" (Ibid), I believe that the writing skills would be one of the main channels whereby Iraqi science students and scientists would communicate with the English-speaking world, particularly in scientific conferences and journals. Many of the scientific projects are still written in English in most Iraqi branches of science.

Practically speaking, EST syllabuses would produce better results if they were constructed and executed by a team operation where a battery of specialists support the EST teaching programmes.

As far as methodology is concerned, the communicative approach which I would like to see adopted in the EST course in science faculties in Iraq should integrate aspects of both communicative performance and grammatical performance. As rightly argued by Richards (Richards, 1983:112), both are prerequisite for communicating complex meanings as the ones exemplified in highly-specialised scientific texts.

The teaching view in EST situations in Iraq should give up the traditional and limited sense of learning techniques which is confined to texts and grammatical exercises and will need to think again in terms of a set of comprehensive classroom procedures for use in the classroom of which printed materials would be a sub-set.

As far as reading skills are concerned, teachers should encourage the use of classroom techniques which would induce in the learners strategies for the understanding of texts which can then be transferred to other instances rather than requiring them to understand one particular text on one particular occasion (Chambers and McDonough, 1981:79).

Group-work activities whereby matching peer ideas and classroom discussions would help students gain effective communication attainments not only for developing reading skills, but also in dealing with their specialised studies in a proper way and in tutorials and seminars.

Group-work activities would be an effective way of developing backward students as they would be influenced by their peers when they saw them receive rewards for their performance (Kazdin, 1981:129).

> Research has clearly demonstrated that simple arrangements of reinforcement contingent upon group effort will result in spontaneous, academically and socially productive helping behaviour (Gerber and Kaufmann, 1981:183).

It is to be emphasised that peer teaching or group-work activities should not be proposed as an alternative to frontal teaching in Iraq universities, but it would be viewed as one of a number of techniques that the teacher uses in class.

It seems to me that the EST course should also cater for a systematic treatment of vocabulary teaching, particularly scientific terminology. Lexical factors are basic to the comprehension process as understanding would be the output of semantic processing strategies which help in text assimilation via guess using activity which is based on some of the text's lexical elements (Clark and Clark, 1977:73).

Contrary to Waters and Hutchinson (1981:65), who claim that foreign students should be given specific training in the use of scientific charts, diagrams,graphs, plans, maps, flow-charts and other mathematical conventions, I have noticed in the fieldwork I conducted in KFM and from

the information I gathered from Iraqi science faculty graduates, students and subject teachers in science faculties that such scientific conventions constituted no difficulty to the students. On the contrary, they were a good guide for understanding medical texts. Therefore, I do not see that teaching activities should put emphasis on these scientific conventions in EST science faculties in Iraq.

Teaching activities should also include the use of video-taped components. A lecture in the students' specialised subjects would be recorded using a television camera and a video tape recorder. This would be a useful material on which an EST lesson can be prepared.

One way of bridging the gap between science and EST classes would be to rely on team teaching (Hansen and Hammen, 1980:92). But one should not overgeneralise the success of team teaching, as its success in most cases depends on the relationship between teachers, type of students, teacher personalities and general teaching context (Henderson and Skehan, 1980:41). However, experiments carried out so far in team teaching (see, for example, Adams-Smith, 1980:80) has shown that co-operation between the EST teacher and specialist subject teacher proved to be feasible, fruitful and interesting for student and teacher alike.

Notes Related to Chapter Five

1. Standard Arabic is the variety of Arabic used on radio, television and newspapers. It is the language of modern Arabic books, conferences and instruction which is understood by the Arab people all over the Arab homeland.

2. Iraqi children start their education in primary schools at the age of six.

3. Free education was a result of a decree issued by the Revolutionary Command Council in Iraq on 7th February, 1974.

4. There is another type of teacher training colleges in Iraq, namely 'Teacher Training Institutes'. These institutes cover two years in methodics after the preparatory school certificate, academic section. English in these institutes is also taught as one of the subjects in the curriculum. The English syllabus in 'Teacher Training Institutes' is more or less similar to those of 'Primary School Training Colleges' (see Al-Hamash, 1978:155).

5. Three hours of English a week used to be taught in some special and state schools, namely 'Model Primary Schools' (Al-Hamash, 1978:3). This system is abolished now.

6. The questionnaire was answered by fifty-two Iraqi subject teachers [8 from medical faculties (medicine and dentistry) and 44 from other science faculties

(pharmacology, veterinary, engineering and science)]. Most of the subjects were postgraduate students furthering their studies in the United Kingdom. The questions asked in the questionnaire were about what language of instruction is being used in their faculties in Iraq regarding classroom lectures, textbooks, examinations, reference books and supplementary materials (see the English version of the questionnaire in appendix 23).

Conclusion

Conclusion

The teaching era of the late seventies and the beginning of the eighties has witnessed, as is well known, radical changes in EFL syllabus design, methodology, and in the philosophy of language teaching from a structural-grammatical basis to a functional/notional and communicative emphasis. This has, undoubtedly, been a fruitful development which has influenced the diverse aspects of the language teaching fraternity.

I believe that a characteristic of TEFL is its enormous diversity and variability under which sugar-coated solutions cannot achieve success. However, success could be achieved if we closely examine analyses of causes which are behind failure to learn and teach, and those of the conditions in which success is most often obtained. Apparently, success in the language teaching profession depends, in effect, upon achieving the maximum harmony between a number of variables which are closely linked to the achievement of the teacher, the learner, the educational conditions and the political system in a certain country.

However, as far as this study is concerned, I am dealing with the ESP situation in Iraq, specifically the EST reading skills in science faculties with special emphasis on the faculty of medicine.

To begin with, this study confirms that the present EST course in science faculties in Iraq, particularly in the faculty of medicine, which is supposed to provide students with the language skills they need for their

academic studies and their future professions, seem to provide no such service. One reason for this apparent lack of effectiveness of the EST course would be the insufficiency of the time allotted to the course, being two hours a week, and the problem of student motivation because of the irrelevant language material of the course which students see as irrelevant and an infringement on their valuable time as well as the ineffective language learning activities adopted there.

From the results of this study, one may discern that there is a clear need for salient studies and investigations into refining the readability of the EST materials in Iraq, particularly facets related to the conceptual level of the subject matter, its relevance and interest for the students and its appropriateness for the students' specific purposes.

Indeed, the results of the fieldwork carried out in KFM confirms the afore-mentioned hypothesis. The fieldwork is concerned with the effect of the EST materials and teaching techniques which were conducted for the purpose of monitoring and comparing the achievement of students in an experimental group and two control groups in KFM. The factors related to teacher and educational background were controlled. I feel that I have also convinced the students that the EST course requires serious preparation and attention, so that it would help them cope with their study in the faculty. I must also mention that students were not told that the course was experimental, neither

were they aware that I was a research worker. I believe that this attitude made students work hard and take the course seriously. Students' feedback, however, via various[1] channels in the faculty has convinced me that the course has been very well received by students and staff alike.

However, a comparison of test results has shown that the teaching/learning activities adopted and the materials used in the EST course for the first term of the academic year 1982/83 have made a significant difference in the students' level of English between the experimental group and the control groups. The experimental group went through authentic medical materials and communication teaching/learning activities and exercises,whereas the control groups went through contrived and general science materials as well as structural teaching/learning activities and exercises. All groups, however, went through similar study skills activities such as note-making and note-reconstruction, laboratory report writing,reference using and essay writing. The experimental group went through speed reading classroom training, but the control groups did not.

The results showed that there was a significant difference between the experimental group and each of the control groups in their reading skills, reading speeds, term test, language performance at the discourse level, self-confidence as well as differences in students' motivation towards the EST reading materials, which was significantly higher in the experimental group than in

the control groups. No such difference was noticed between the two control groups. Therefore, it can be said that the experimental group training scheme could have caused the difference.

From the performance of the students on the above language activities, classroom observations and the results of the last questionnaire in which most of the students of the experimental group reported that they have benefited a lot from the material as well as from the EST course adopted, whereas the majority of the students of the control groups were not satisfied with their EST textbook material, but most of them have reported that they had benefited a lot from the course in general, one would conceive that authentic and directly relevant materials would be more convenient to use and therefore are preferred to the contrived and general science material in the EST course in the faculty of medicine in Iraq; and presumably, this assumption would hold water with other science faculties in the country.

Probably, one reason for the apparent lack of effectiveness of the EST material used and teaching techniques employed with the students of the control groups would be the problem of students' motivation. Many of the students who were anxious to get on with their studies would see the language content of their textbook as irrelevant and, of course, would be an infringement on their valuable time.

It would be discernible from students' response in the last questionnaire (see 4.2.12.5) and from discussing students' problems outside classroom hours, that if students had the opportunity to study materials which they felt relevant and interesting, they would be impressed by what they would take to be their potential and they would be anxious to try to get more benefit out of them. Furthermore, the results gleaned via this study may imply that communication activities can help solve the motivation problem in the Iraqi EST classroom situation by making students feel they are getting good service out of their EST courses.

The study also suggests that it would be of great benefit for the students in KFM if they could be incorporated in an intensive EST pre-medical course for at least a term.

However, I have to concede that I have no concrete and positive evidence, apart from students' claims, that the material and approach adopted with the experimental group have led to significant improvements in the students' level in their medical studies. The English contact hours in the faculty might not have been enough to let proof of this kind come to the fore. Actually, it would not be so easy to get at observable results with all aspects of educational courses within a short period of time. A learning course is not a 'drug course' whose effects might be observed within perhaps three days. Even

a 'drug course' may not show observable effects in certain diseases and sometimes within different kinds of patients. As Brumfit (1983) rightly said, a teacher would not be able to perceive how far his students have progressed, but it would, in most cases, be difficult for him to prove to others the students' true performance in the classroom via results of tests.

Another limitation to this study is that the sample consisted of medical students who are supposed to be highly motivated towards their study and of a very high intellectual ability as well. This would imply that experiments carried out in EST courses in other science faculties in Iraq where administrative requirements did not insist on students of similar qualities might run into motivational problems (2) , and thus modification of teaching techniques would be required.

At the end of the term I also felt that the students did not receive sufficient listening and speaking activities which the students actually required , probably due to lack of language teaching equipment in the faculty such as language laboratory and audio-visual language teaching apparatus which are usually installed in FL departments in the Faculty of Arts and the Faculty of Education in the university main building in Baghdad. There was, however, a video system in one of the lecture rooms, but with no suitable English language teaching materials. I also felt that spelling skills, in which students in KFM seemed to be incompetent, did not receive special emphasis. The other area which, I felt, did not receive enough emphasis

was the area of terminology. The teaching of terminology would require a separate and well-thought-out course as far as Iraqi students of medicine are concerned. Iraqi secondary school leavers seem to me to be trained to deal with language structures at the sentence level with very little emphasis on meaning. Therefore, medical terminology which basically deals with meaningful concepts seems to be an alien field to them which requires due attention.

I should make it clear here that when I talk about the limitations of the EST course in KFM, I am not only talking about students' coping with the present EST situation there, but I also have in mind aspirations which would help students cope with their future professional life as doctors who would make use of their academic study and knowledge of English language related to their field of specialisation as a starting point for a better self-education.(cf James, 1974:76).

Finally, I must mention that after discussing my fieldwork with the Dean of the Faculty and his assistant, and then with the teaching staff before the course commenced, they all showed interest and willingness to co-operate with the project at all times. This proved to be a valuable arrangement because I could constantly check the accuracy and validity of the materials and could use the ancillary facilites for photocopying,typing and duplicating machines freely for the purpose of the EST course. Via my relationship with the faculty staff, a more specific perspective of students' needs and servicing requirements emerged.

Within the first weeks of using the experimental material I received a request from a first year student, who was repeating the year but was not required to attend the English course, to attend classes with the students of the experimental group. Other requests came from fifth year students to have copies of the reading materials which were used by the experimental group. They said that they had seen the reading material with their colleagues and found out that it was of interest and benefit to them. This actually was an experience which increased my motivation towards the course and made me feel more secure that the reading materials of the experimental group were really of interest and benefit to the students in the faculty of medicine.

Therefore, the results of the fieldwork imply that a course in developing students' reading span is crucial for EST Iraqi students, as it would have a great effect on their performance as readers of a foreign language.

The EST course should also help students to be trained to deal with the following study skills:

i. using libraries and other resources for study,

ii. making notes in class,

iii. making notes from books,

iv. reconstructing notes,

v. planning and writing experimental reports and short essays, and

vi. participating in tutorials and seminars.

The fieldwork carried out in KFM may imply that a teaching approach which emphasises the following tenets

would be a fruitful approach to be used in developing reading skills in Iraqi science faculties:

i. looking on reading as a communicative activity wherein the reader has an active role in reading, not a passive one,

ii. reading skills are best developed via dealing with authentic texts which are directly relevant to students' fields of specialisation rather than contrived sentence level materials of a broad science base.

iii. employing textual level materials as a vehicle for both communication as well as a linguistic object,

iv. employing learner-centred classroom activities such as group-work techniques, and

v. integrating reading skills with other language skills in the EST course.

It seems crucial that the EST course in Iraq requires joint committees of EST personnel, EST teachers and respective science specialist teachers who should be involved in research projects to work together to analyse the language demands of the students that go in line with their subject areas and design appropriate EST courses for them.

Judging by the number of EST teaching hours in science faculties in Iraq, it seems that the EST course is not being taken seriously. I feel that if students' needs and aspirations were taken into consideration, the EST course

should be taken seriously and thus be given a minimum of four hours a week. In the faculty of medicine, a one-term pre-medical EST course is urgently needed (see Table 65, p.369), and the EST course should cover the six years of study of the faculty.

Given that the tendency in Iraqi science faculties, except the faculty of medicine, is towards the use of the vernacular as the language of instruction, stress in our syllabus and methodology should be placed on developing reading skills in the EST course as that will be the most required skill needed by the Iraqi EST students. As far as the faculty of medicine is concerned, students will need urgently the skills of reading, listening, writing and speaking in English in that order, just to stand on their own feet within the educational framework. But if we wanted those students to do very well in their medical studies, the four language skills should be given equal emphasis.

As far as teacher training is concerned, there seems to be a consensus in the ELT fraternity that it is time that the ESP teaching in Iraq adopted commitment to training ESP professional expertise in ESP in order to place the profession on the right line (see, for example, Al-Hamash, 1978a).

An acceptance and productive solution as far as EST teacher training in Iraq is concerned seems to me to be to select EST teachers by taking into consideration their

scientific background and train them in both basic science and English simultaneously. This kind of training would help EST teachers in Iraq possess the necessary intuitions to deal appropriately with scientific texts.

In the meantime, an 'emergency plan' should be devised and put into practice immediately as far as EST teacher training is concerned. A group of teachers with a reasonably good command of English and who have a fairly acceptable basis in science would be recruited to be workable EST teachers.

I would like to see EST teacher training in Iraq geared towards implementing the following tenets:

i. paying a great deal of attention to the selection of EST teachers, taking into account their scientific background, level in the target language and motivation,

ii. preparing trainee teachers to emphasise the communicative properties of the target language without ignoring the significance of the linguistic aspects of the language,

iii. helping trainees to adapt themselves to non-frontal teaching, group-work activities and team teaching, and

iv. giving trainees practice in communicative materials preparation and evaluation.

We must also concede that the students' earlier reading experience would enhance or hinder the development of present reading skills (Edge, 1983:93). One of the major problems which would hinder the development of reading skills in Iraq would be related to the fact that students read relatively little (cf. Swales, 1980), often only under compulsion, and reading is associated with work rather than with interest and pleasure.

There seem to be three ways in which positive steps can be taken to improve the situation . These ways could be summed up as follows:

i. Teachers', students' and parents' attention should be drawn to the importance of developing reading skills as a vehicle of knowledge and maturity at all educational levels. This actually is the responsibility of the media as well as the educational institutions.

ii. Students' reading should not be limited to textbooks. The library facilities should be used on a large scale and subject teachers, in order to be sure that library books are read, should give students short quizzes on particular sections of the borrowed books. Students should also be asked to write summaries of some of the books they read as some students would not read books if not required to write about them; others would be encouraged to read more books by this process.

iii. Iraq has recently improved a great deal the situation of the Iraqi libraries (Kareem, 1984:54), therefore it is important that parents, schools and universities should see that students are both encouraged and required to read and use books. Students should be aware that on graduation they need to be fully aware citizens able to keep up with change in their lives and specialist fields; and to do this they must have acquired and sustained the reading skills.

Finally, I have also tried in this study to provide some tentative answers to the important questions which I have noticed in the Iraqi ESP/EFL fraternity, and I hope my comments will in turn prompt further discussions. In fact, some problems are still lingering there; we do need more research into many aspects of the ESP work in Iraq. Research into the Iraqi classroom discourse structure of both spoken and written English is badly needed, so that we may have something approaching a model on which to base methods and materials. And, indeed, more effective language measurements need to be developed so that English language teaching programmes may be more efficiently and convincingly evaluated.

These, then, are some of the areas in which more work is needed in the EFL fraternity in Iraq, but this should not obscure the fact that TEFL in Iraq has been under constant revision and modification since the 1970s. Thanks to the IDELTI, which has effected a rewarding amount of research and innovation in syllabus and material design in Iraqi primary and secondary schools, which has

its noticeable influence on the English teaching/learning process in the country.

However, I am optimistic that the communicative language teaching/learning process will prove successful in Iraq because of the nature of the Iraqi learner and his motivation and desire for knowledge.

It seems to me that the results of this study would be of use to other countries in the Arab world which are with a common cultural, historical and linguistic background, which may be facing nearly similar problems in developing the education and scientific competence of their people.

Notes Related to the Conclusion

1. By channels I mean all the opportunities which the teacher has access to when he teaches a course in a learning situation, i.e. observing students in a classroom situation, talking with them outside classroom hours, quizzes, tests, via other teachers, observing students' work in the library, etc.

2. Indeed, it was pointed out by Waters and Hutchinson (Waters and Hutchinson, 1983) that an experiment has shown that one of the problems which faced the ESP course of students of the Faculty of Agriculture in Saudi Arabia was that the students were not motivated to their subject of specialisation.

Appendices

Appendix 1

An outline of an integrated syllabus for a basic teacher training course

(after Brumfit, 1979:4)

BASIC SCHEME FOR METHODS COURSE

N.B. *These stages show an order but they are not time units.*

Phase 1
PRACTICAL TECHNIQUES
A. Listening & Speaking; B. Reading; C. Writing

Stage	Practical Experience	Basic Theoretical Concepts	Student Activity
	A.—LISTENING & SPEAKING		
1	'Lesson' in a foreign language with presentation, choral, individual and pairs practice shown	Three levels of language: sound grammar meaning	They are 'taught' the lesson and will *discuss* it in groups, guided by controlled questions.
2	Organizing choral and individual class practice	L_1 & L_2 differences	a *Practise* using choral and individual techniques. b *Discuss* learning method.
3	Pairs activity: a) separate pairs b) simultaneous pairs	'Communicative' teaching	a *Practise* techniques, and b *Discuss* rationale for the procedure.
4	Presentation skills	The teachers' use of the classroom and available resources (media)	a *Prepare* presentations in group. b *Practise* on peers or on a real class.
5	Contextualizing meaning, including introducing dialogues	The nature of a context	*Practise* introduction of appropriate language sequences.
6	Remedial techniques: pronunciation a) recognition	Phonological problems	*Practise* techniques.
7	Remedial techniques: pronunciation b) production	Phonological problems (continued)	*Practise* techniques.
8	Remedial techniques: oral structure	Audio-lingual learning principles	*Practise* drilling techniques.
9	Communication: Aural comprehension	Varieties of language: accent/dialect	*Practise* reading and writing questions for oral passages.
10	Communication: games	Motivation in the language class	*Play* games.
11	Communication: discussion/conversation	Fluency vs. accuracy. Aims of oral work	*Devise* and *practise* techniques.

Phase 1 continued

	B. READING		
12	Applying oral techniques to reading stimuli	Correspondence of English sound and writing systems contrasted with Spanish	Student practice.
13	Remedial techniques for reading aloud	Correspondence of English sound and writing systems contrasted with Spanish	Student practice.
14	Basic reading procedures. Sentences and longer sequences	Skills or lack of skills. Transfer to English	*Practise* effective reading aloud of longer passages; voice projection.
15	Using oral questions on reading texts	Nature of comprehension	*Draft* part of lesson plan with questions on a given text.
16	Using written questions on reading texts	Possible causes for comprehension errors	*Prepare* and *test* and *revise* questions on a given text.
	C. WRITING		
17	Techniques for introducing writing at sentence level	Writing as a learning device	*Play* memorisation games with and without help by being allowed to write.
18	Techniques based on textbook materials	The role of the textbook in class activity	*Teach* mini-lessons in small groups with textbook.
19	Oral preparation techniques (for writing)	Integration of skills	*Plan* preparation in groups. Some to *demonstrate* to whole class.
20	Controlling techniques	Justification for controlled work	*Write* several types of controlled writing exercises.
21	Guiding techniques (planning for class)	Methodological sequencing	*Draft* complete lesson plan for guided composition lesson.
22	Techniques for pupils' correction	Cognitive versus behaviorist language learning theories	*Answer* one writing exercise (Stage 20), anticipating typical errors, and *propose* pupil-centered correction technique.
23	Remedial techniques for written errors	Error analysis	*Correct* and *classify* errors in a given passage. *Discuss* in groups.

Phase 2
APPROACHES BY TEACHING LEVEL

Stage	Practical Experience	Basic Concept	Student Activity
24	Presentation of lesson plan (Part A) Pre-class activities	Selection sequencing	*Discuss* and *prepare* Stage A of a lesson plan by group.
25	Presentation of lesson plan (Part B) In-class activities	Objectives	*Discuss* and *prepare* Stage B of a lesson plan.
26	Division of a lesson plan into class plans	Motivation through variety of activities	*Divide* lesson plans into class plans.
27	Application of practical techniques (Phase I) to first grade syllabus	The Role of a Syllabus	*Prepare* lesson plans for the structures in the first grade syllabus with reference to existing textbooks.
28	Application of practical techniques to second grade syllabus content. (Additional and more complex techniques: pupils prepare dialogues, dramatization of dialogues, communicative activities, picture-story composition.)	Objectives	*Prepare* lesson plans for the structures in the second grade syllabus with reference to existing textbooks.
29	Application of practical techniques to third grade syllabus content. (Additional, more complex communicative activities. Extensive reading, written composition: messages, letters, etc.)	Self-evaluation in relation to lesson planning	*Prepare* lesson plans for the structures in the third grade syllabus with reference to existing textbooks.
30	Teaching adults	Age factor	*Discuss* use of appropriate materials.
31	Advanced work: more complex techniques	E.S.P. and English for Vocational Purposes	*Discuss* appropriate materials.
32	Evaluation and testing pupils' performance	Purpose and function of evaluation	*Practise* evaluation techniques in relation to syllabus and available materials.

Phase 3
ANALYSIS OF METHODOLOGICAL PROCEDURES

Stage	Basic Theoretical Concepts	Reference to previous Practical Stages	Student Activity
33	Different Methods Eclectic Method	I-A-1	Assignment in reading on different methods. Group discussion of techniques pertaining to each method. Summary by teachers.
34	Aims and goals of Language. Reasons for teaching English related to aims and goals of language work	II-28, 31	Group discussion of Basic Concept. Summary by teacher. Reading assignment.
35	Problems of language teaching in Mexico. Mixed-ability groups	I-A-2, 4, 6, 7, 10 I-B-12, 13, 14, 15, 16 I-C-23 II-26, 30, 31	Reading assignment (Resoluciones de Chetumal) Group discussion and conclusions.
36	Pupil's characteristics (variables)	I-A-10 II-26, 30	Reading assignment. Group discussion and summary.
37	Differences in learning L_1 and L_2. (Individual differences in learning)	I-A-2, 6, 7, 10 I-C-17, 21, 22 II-24, 25, 26, 28, 30	Reading assignment. Group discussion and summary.
38	Need for standard model	I-A-9, 11 II-24	Listening to different forms of standard English (native speakers). Group discussion and conclusions.
39	Differences between Surface and Deep Structure	I-A-3, 5 1-B-15, 16	Analysis of text and dialogues. Discussion on meaning.
40	Syntactic Analysis of L_2	I-A-1 I-B-16 I-C-23 II-24, 27	Analysis of basic structures and systems of language description.
41	Error Analysis of Syntax	I-A-1, 2 I-B-16 I-C-20-23 II-24	Reading assignment. Error analysis of their own compositions and speech and that of pupils.
42	Error Analysis of phonological problems both of pupils and students	I-A-1, 2, 6, 11 I-B-12, 13 I-C-20 II-24	Reading assignment. Error analysis of their own speech and that of pupils.

Phase 3 continued

43	Phonetics. Its use in the classroom	I-A-1, 2, 6, 7, 11	Discussion and conclusions.
44	Direct method. (Use of L_2 in the classroom)	I-A-3, 4, 5, 11 I-C-18, 21, 22 II-24, 25, 28	Reading assignment. Group discussion on the Direct Method and its contribution to foreign language learning.
45	Rationale for the use of Audio-lingual techniques	I-A-3, 4, 5, 8, 11 I-C-18, 21, 22 II-24, 25, 28	Reading assignment. Group discussion on the Audio-lingual Method and its contribution to foreign language learning.
46	Influence of teacher's personality and attitude. (Basic characteristics)	I-A-4, 10 II-26, 29	Group discussion and conclusions after observation of real classes.
47	Textbooks Analysis	I-A-3, 4, 5, 10 I-C-17, 18, 19, 21, 22 II-24, 26, 27, 31	Comparative analysis based on criteria of textbooks in use in secondary schools.
48	Language as Communication	I-A-1, 3, 5, 9, 11 I-B-15 I-C-19 II-25, 28, 31	Group discussion and conclusion.

Phase 4

ORGANIZATION AND BACKGROUND INFORMATION

49	The role of English and English teaching in Mexico.+—Statistics.
50	International support of the Teaching of English as a Foreign Language. Organization of English Language Teaching information. Bibliography.

+ This is to be changed to the respective country.

Appendix 2

(after Strevens, 1980:133)

Some prefixes, roots, and suffixes of Greek and Latin origins, with examples and approximate 'meanings'

1. *Prefixes:*

a-	atypical	a = not
ab-	abnormal	ab = away from
ad-	adhesion	ad = to, towards
anti-	antiseptic	anti = against
ante-	ante-natal	ante = before (in time)
auto-	automotive	auto = from within itself
bi-	biennial	bi = two
co-	cohesion	co = with

N.B. *co-* has others forms: *con-* as in *connect*; *com-* as in *communicate*; *cor-* as in *correlate*; *col-* as in *collaborate*.

contra-	contra-rotation	contra = opposite
de-	defuse	de = take away, undo
dia-	diathermy	dia = through
dis-	dismember	dis = undo, un-make
dys	dystrophy	dys = out of order, functioning badly
ex-	extract	ex = away from, out of (or formerly)
extra-	extra-sensory	extra = outside
in- (a)	inject, inflame, etc.	in = (a) into
(b)	inoffensive, incapable	in = (b) not

N.B. *in-* has other forms: *il-* as in *illogical*; *im-* as in *immovable*; *ir-* as in *irregular*.

inter-	international	inter = from one to another
intra-	intra-uterine	intra = within
macro-	macro-economics	macro = relatively large
micro-	microwave	micro = relatively small
mono-	monotonous	mono = single
non-	non-toxic	non = not
poly-	polyvalent	poly = many
post-	postpone	post = later
pre-	prehistoric	pre = before

re-	re-cycle	re = again
sub-	sub-zero	sub = below
super-	superficial	super = upon, above
syn-	synthesis	syn = together

N.B. *syn-* has other forms: *syl-* as in *syllogism*; *sym-* as in *symmetrical.*

trans-	transmission	trans = across, from place to place
un-	unstable	un = not
uni-	unitary	uni = single

2. *Roots:*

(a) Examples where the root is word-initial

bio-	biology, biotic	bio = life
calor-	calorific	calor = heat
chrono-	chronological	chrono = time
cycl-	cyclic	cycl = repeating
geo-	geophysical	geo = the Earth
magni-	magnifying	magni = large in size
meteor-	meteorology	meteor = the atmosphere
tele-	telemetry	tele = at a distance
zoo-	zoology	zoo = life

(b) Examples where the root is non-initial

-derm	epidermis	derm = skin
-gon	polygonal	gon = angle, corner
-ion	thermionic	ion = electrical particle
-lumen, -lumin	illuminate	lumen = light
-mini	diminish	mini = small
-therm	diathermy	therm = heat
-tox	intoxicate	tox = poison

3. *Suffixes:*

-able	intractable	-able = cable of having some-
-ible	inexhaustible	-ible = thing done
-al	oral	-al = an adjective
-ate	vibrate	-ate = to carry out a process or action
-ation	vibration	-ation = the process of doing something
-ator	vibrator	-ator = the object or person carrying out a process or action
-ic	electric	-ic = having a particular quality
-ise (or US -ize)	computerise	-ise = to apply a process or bring about a particular change
-logy	psephology	-logy = the study of a particular field of knowledge
-meter	calorimeter	-meter = measuring device

APPENDIX 3

Answers to exercises related to section 3.9.2

3.9.2.1.1. ☑ pertaining to heat

3.9.2.1.2. universe; our; temperature; Most; the; however; in; this; wavelengths; astronomy; must; rare; to; first; all; is; mass; which; It; strongly; while; now; star; for; seen; place; some; that; even; found; that.

3.9.2.1.3. ab = not, re = again, anti = against
di = compound, de = remove.

3.9.2.2.1. Which = the idea of evolution; one = idea; it = the idea of evolution; it = to have an idea; it = to produce a proof; that = the correctness of that idea; his = Darwin's; He = Darwin; Those = animals; their = the animals'; which = good qualities; them = animals; their = animals'; This = animals were best at surviving their environment passed on the good qualities; this = all animals had a struggle to survive; its = an animal.

3.9.2.2.2. intravenously or intramuscularly = within a vein or within a muscle.
administered = managed, controlled
build up = form
derived from = taken out of
to combat the effects of the bite = to fight the poison of the snake.
since = as
are likely to cause a reaction = probably lead to side-effects.
cover the injection = act against the side-effects of the serum.

with discretion = after careful consideration.

3.9.2.2.3. how; so; As an example; If; then; In order to; If; However; that is; when.

3.9.2.3.

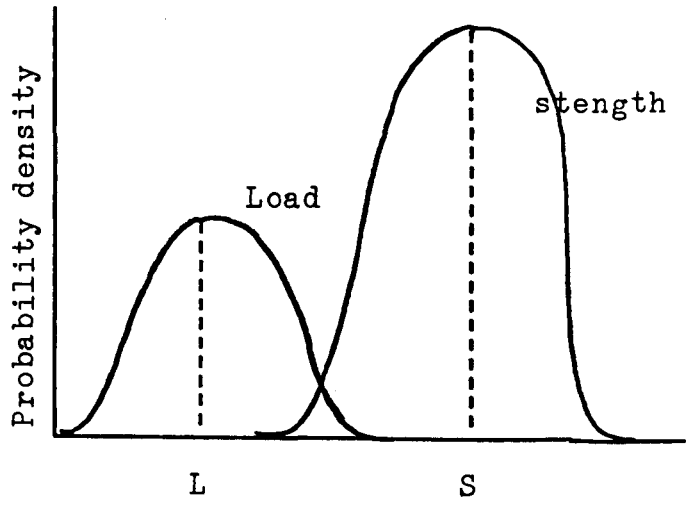
1. b; 2 a; 3 c; 4. b; 5 d; 6. b; 7. d; 8. d; 9. a; 10. b

3.9.2.4

a. The water is compressed when the piston is raised. Therefore atmospheric pressure causes the water to enter the cylinder via valve A. Compression inside the cylinder causes the water to enter the piston via valve B. Valve B prevents the water from returning past the piston down to the well. When the piston is lowered the air pressure is reduced and the water raised up.

b. Photosynthesis is a chemical process in which a chemical reaction occurs. This reaction results in the conversion of carbon dioxide and water to carbohydrates and oxygen. This is brought about by the input of the sun's light.

c.



d. The daily requirements contained in a half pint of milk supply 8% of calories, 15% of protein, 30% of calcium, 5% of iron, 8% of vitamin A, 11% of vitamin B, 30% of riboflavin, 5% of nicotinamide and 10% of vitamin C.

3.9.2.5.1

b. When zinc combines with sulphuric acid, zinc sulphate is formed and hydrogen is given off.

Appendix 4

Oller's essay scoring method (Oller,1979:388)

Protocol 1

Score: (124-24)/142 = .70

(An advanced ESL student at Southern Illinois University)

I was going ~~to~~ my home from ~~the~~ school. When I was standing ~~before~~ a red light at the corner, a yellow car ~~passed~~ the ~~red~~ light and hit a blue car ~~pushing~~ the ~~corner~~. Obviously the driver of yellow car was at fault. It was about noon and there was heavy traffic. The blue car was almost ~~damaged~~. The driver of yellow car was calm. He came to the other driver and begged his pardon. But the driver of blue car was nervous. Someone called the police. After five minutes a police car came and towed the two cars away The guilty driver was ~~taken a~~ fifty dollar ticket. The blue car had ~~many~~ damages ~~that~~ estimated about five hundred dollars. Though I was late ~~to my~~ home that day, ~~but~~ I had an interesting story to tell my parents.

Rewrite of 1

I was going home from school. When I was standing at a red light at the corner, a yellow car ran the light and hit a blue car going through the intersection. Obviously, the driver of the yellow car was at fault. It was about noon and there was heavy traffic. The blue car was almost destroyed. The driver of the yellow car was calm. He came over to the other driver and begged his pardon. But the driver of the blue car was nervous. Someone called the police. After five minutes a police car came and towed the two cars away. The guilty driver was given a fifty dollar ticket. The blue car had a lot of damage estimated at about five hundred dollars. Though I was late getting home that day, I had an interesting story to tell my parents.

Appendix 5
The Arabic version of the faculty timetable of curriculum.

رئاسة الجامعة المستنصرية
عمادة كلية طب الكوفة
قسم التسجيل

جدول الدروس الاسبوعي للصف الاول
للعام الدراسي ٨٢/ ١٩٨٣

	٨	٩	١٠	١١	١٢	١	٢	٣	٤
السبت	كيمياء	تشريح	فسلجة	ثقافة قومية		انسجة عملي أ انكليزي ب كيمياء عملي ج			
الاحد	انسجة	كيمياء	فسلجة			تشريح عملي أ ، ب ، ج		انسجة عملي ب انكليزي ج	
الاثنين	تشريح	كيمياء	انسجة	ثقافة قومية		فسلجة عملي أ انسجة عملي ج			
الثلاثاء	فسلجة	انسجة	كيمياء	تشريح			تشريح عملي أ ، ب ، ج		
الاربعاء	فسلجة	كيمياء عملي ب انكليزي أ فسلجة عملي ج					كيمياء عملي أ فسلجة عملي ب		

الدكتور ظافر داود سليمان
عميد الكلية

السيد //

Appendix 6

Reading Texts and Exercises for the Experimental Group.

Skin and skin diseases

We never think of it as such, but the skin is an organ – in fact the largest we possess. It not only protects us from injury and infection, it keeps the body's temperature and moisture content stable at all times.

The skin is much more than a simple wrapping around our bodies. It is an active and versatile organ which is waterproof so that we do not dry up in the heat or melt in the rain, and it protects us from the damaging radiation of sunlight. It is tough enough to act as a shield against injury, yet supple enough to permit movement. It conserves heat or cools the body as required, thus keeping our internal temperature constant.

Skin diseases may be a nuisance and an embarrassment, but they are seldom dangerous and are very rarely fatal. They cause a vast amount of ill health, however, by their frequency and persistence.

Structure of the skin

The skin is made up of two main parts. The outermost part – the epidermis – consists of several layers of cells, the lowest of which are called the 'mother' cells. Here the cells are constantly dividing and moving up to the surface, where they flatten, die and are transformed into a material called keratin which is finally shed as tiny, barely visible scales. It takes three to four weeks for a cell in the lowest layer to reach the skin surface.

This outer protective layer is firmly attached to an underlying layer called the dermis. Tiny, finger-like bulges from the dermis fit into sockets in the epidermis, and this waviness at the junction of the two layers of skin gives rise to ridges, which are most obvious at the fingertips and give us our fingerprints. The dermis is made up of bundles of protein fibres – called collagen – and elastic fibres. Embedded in the dermis are sweat, sebaceous and apocrine glands, hair follicles, blood vessels and nerves. The nerves penetrate the epidermis but the blood vessels are confined to the dermis. The hairs and ducts from the glands pass through the epidermis to the surface.

Your skin type as well as your colouring are determined by heredity. Hair and nails are formed from skin cells and these too are determined by genetic factors.

Steve Bielschowsky

Q Why are skin conditions always made worse by emotional upsets?

A Most ill health is made worse by emotional upsets and the skin is no exception, but because it is visible patients with skin disease are more disturbed by their complaint than patients with other disorders. Emotion can alter the state of the skin's irritability and sweating mechanisms. Conditions where these factors are particularly important, such as eczema, will be aggravated by unhappiness, anxiety or depression.

Q I have developed an allergy to nickel through wearing cheap jewellery. Will I always be allergic?

A Allergy to nickel is fairly common in those who either wear or handle it. There is always an interval between first contact with nickel and the development of the allergy. Traces of nickel are absorbed through the skin and the body reacts by forming antibodies so that any further contact results in an itchy skin rash. If no further contact occurs there will be a gradual lessening of the allergy, but usually it remains to a degree throughout life.

Q I have bald patches on my scalp and beard area. Will they re-grow in time?

A The commonest cause of bald patches is a condition called alopecia areata, which frequently starts in childhood and may run in families. Hair is lost over clear-cut round areas often a few weeks after stress or shock. It usually settles down, and in most cases the hair has re-grown in three to six months so that treatment is not necessary.

Q My husband is only 20 and is already going bald. Is this normal?

A Yes. Loss of hair in men may begin any time after puberty, and is a result of higher male hormone levels. Often there is a strong hereditary factor as well. Treatment is best avoided since there is at present no certain method of stimulating hair growth.

Sally and Richard Greenhill

Young International

How does the smooth, firm skin of a baby become the wrinkled skin of an old person? It is a gradual process dependent on two changes – with time the lubricating glands produce less moisture, and the skin's supporting fibres lose their natural elasticity. As cell growth slows down, an old skin cannot heal as quickly as a young one, and hair colour and skin bloom fade.

Glands and nerves

Each sweat gland is formed of a coiled tube of epidermal cells which leads into the sweat duct to open out on the skin surface. The sweat glands are controlled by the nervous system and are stimulated to secrete either by emotion or by the body's need to lose heat.

The sebaceous glands open into the hair follicles and are made up of specialized epidermal cells which produce grease or sebum. They are most numerous on the head, face, chest and back. Their function is to lubricate the hair shaft and surrounding skin and they are controlled by sex hormones.

The apocrine glands develop at puberty and are found in the armpits, breasts and near the genitals. They are odour-producing and are a sexual characteristic. When they begin to function they secrete a thick milky substance.

There is a fine network of nerve endings in both layers of skin, and they are particularly numerous at the fingertips. They transmit pleasurable sensations of warmth and touch, as well as cold, pressure, itching and pain which may evoke protective reflexes.

Hair and nails

Hair and nails are both specialized forms of keratin. Although nails are produced by living skin cells the nail itself is dead and will not hurt or bleed if it is damaged. The visible part of the nail is called the nail body and its shape is partly determined by genetic factors. The bottom part of the nail – the root – is implanted in a groove in the skin. The cuticle overlaps the root, which is the site of active growth. As the cells divide and move upwards they become thickened and toughened with keratin, and when they die they become part of the nail itself.

Hair is formed by cells in the hair follicles and there are two types: fine, downy hair which is found over most of the body except the palms of the hands and soles of the feet, and thick, pigmented hair which is present on the scalp, eyebrows, beard and genital areas.

Hair grows in cycles, a long growing phase being followed by a short resting period. Hairs in the resting phase constitute up to 15 per cent of the total 100,000 hairs on the scalp. The normal daily hair loss is between 20 and 100 hairs. Scalp hair grows about 0.8 cm (⅓ in) per month and continues to grow for up to three years. The rapid growth of scalp hair makes it more susceptible to damage from disease, toxic drugs and hormones.

The shape of our hair follicles is inherited and this determines whether hair is straight or curly, together with the angle of the hair bulb in the shaft. If it lies straight, the hair will be straight, if bent, the hair will curl.

Skin colour

Skin colour is due to the black pigment melanin which is produced by pigment cells in the lowest layer of the epidermis. There is the same number of pigment-producing cells in the skin of all races but the amount of melanin produced varies. In dark-skinned people there is more melanin than in light-skinned people.

Other factors contributing to skin colour are the blood in the blood vessels of the skin and the natural yellowish tinge of the skin tissue. The state of the blood within the blood vessels can greatly change skin colour. Thus we become 'white' with fear when small vessels close off, 'red' with anger due to an increased blood flow, and 'blue' with cold when most of the oxygen in the blood moves out to the tissues as the blood flow slows down.

Wound healing

All wounds heal by scar formation unless they are very superficial, such as a graze. Children heal faster then adults but they also produce a larger quantity of scar tissue. However, scars in young people tend to resolve in time. Dark pigmented races heal with an excessive amount of scar tissue compared with light-skinned people as a general rule.

The healing process involves many changes. First the wound bleeds and becomes filled with a blood clot which dries to form a scab. Blood vessels and fibrous tissue grow in from the cut surfaces of the wound, and the end result is a scar which gradually becomes paler in colour with time.

Skin conditions in children

Birthmarks (see pp 163-64) are marks which are present on a baby's skin at birth or appear soon afterwards. They include strawberry marks, moles and port wine stains. Many birthmarks do not require treatment and disappear of their own accord. Strawberry marks, for instance, appear a few weeks after birth and grow rapidly for a while, but the majority disappear completely by the time the child goes to school.

Moles are not usually present at birth but develop in childhood, gradually increasing in size during adult life and possibly disappearing in old age. They are formed from collections of the pigment-producing cells in the skin and their significance is that they may very occasionally become malignant.

Babies and children have their own particular complaints – these include infant cradle cap, nappy rash and chilblains. Cradle cap is a normal collection of scales and grease which stick together and adhere to the scalp. It can be removed by gentle shampooing after the scales have been softened with olive oil the night before.

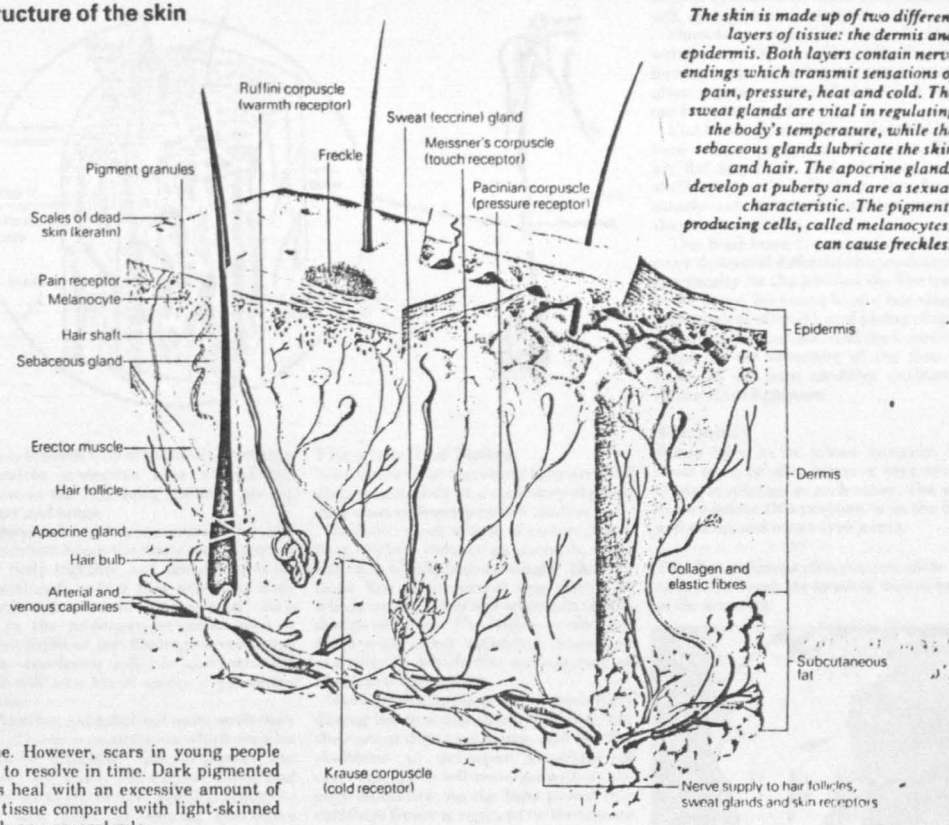
Nappy rash (see pp 1321-22) is a red rash in the nappy area which can spread to involve the thighs and lower abdomen. It results from irritation produced by the bacterial decomposition of urine and faeces. Since it is caused by the friction of a wet or soiled nappy, it is essential to change nappies frequently, leaving them off whenever possible and avoiding the use of plastic pants. The skin should be washed with emulsifying lotions rather than soap, and water-repellent ointments which act as a barrier should be applied. Sometimes mild steroids with anti-infective agents are necessary.

Chilblains are common in children who live in countries like Britain where the winters are cold. They occur on the toes, especially if tight-fitting shoes are worn, and on the fingers and ears. Sudden extreme changes in temperature should be avoided – although it is tempting to warm cold feet in front of the fire this only aggravates the condition. The affected area should be kept warm at all times.

Infection of the skin frequently occurs in childhood since the skin's natural defences have not yet been built up against bacteria, viruses and fungi. Impetigo is a bacterial infection of the superficial layers of skin which is parti-

Structure of the skin

The skin is made up of two different layers of tissue: the dermis and epidermis. Both layers contain nerve endings which transmit sensations of pain, pressure, heat and cold. The sweat glands are vital in regulating the body's temperature, while the sebaceous glands lubricate the skin and hair. The apocrine glands develop at puberty and are a sexual characteristic. The pigment-producing cells, called melanocytes, can cause freckles.



Aziz Khan

Bones

Q I have an extra little finger on one hand. It has never bothered me until now that I'm pregnant. Will my baby have it too?

A Yes, probably. This is an inherited characteristic: in other words, it can be passed on from parents to children. Your ancestors probably had it too. However, it is a harmless bone defect and can be removed by a simple operation, leaving the hand perfectly normal. You may feel that this is worth doing if the extra finger gets in the way.

Q My husband has had a bony lump on his skull for years. We've never thought anything of it, but with all the talk we hear on the television of malignant lumps, we did just wonder. What shall we do?

A Don't worry. What you describe is most likely to be an acceptable exostosis—a benign bone tumour which will do no harm. Exostoses can occur on bones elsewhere, and are always hard, pain-free lumps which grow very slowly. Your husband's can probably be removed without difficulty in a minor operation if it is unsightly or irritating.

Q I had what the doctor called a 'chip' fracture of my finger three months ago. It was splinted by the hospital for a few weeks, but is still swollen. How long will it be before the swelling goes?

A Any finger injury produces the condition you describe, known as 'spindle finger'. It is caused by the body's tendency to produce more new bone than is needed to mend the break. It will slowly return to normal.

Q I notice my baby has two soft patches on his skull. What are these?

A They are known as fontanelles, part of nature's way of ensuring a safe delivery. They allow the skull to be squashed a little as it passes through the pelvis. After birth, the rapid bone growth quickly closes the gaps within a few months and the skull becomes complete.

Bones are light, extremely strong, and joined so that the human body is highly mobile. There are few serious bone diseases and these are usually treatable.

Most people think of bones simply as a stiffening framework deep inside the body. As far as it goes, this is true—but the reality of bones and why we have them is somewhat different.

They are, in fact, a reminder of the fight for survival which all animals faced in the earliest stages of life on earth. They were protection from damage or attack, and almost all primitive land creatures of any importance carried their bones outside the body—as the bony armour-plating commonly called shells. Only later did some groups of animals develop so that their shells grew partially, then wholly inside the body, forming bones as we know them.

In man, of course, bones reach their highest form of development, each of the hundreds of different bones in the body being joined to the next to create a fantastically strong and yet agile framework: the skeleton.

Why we have bones

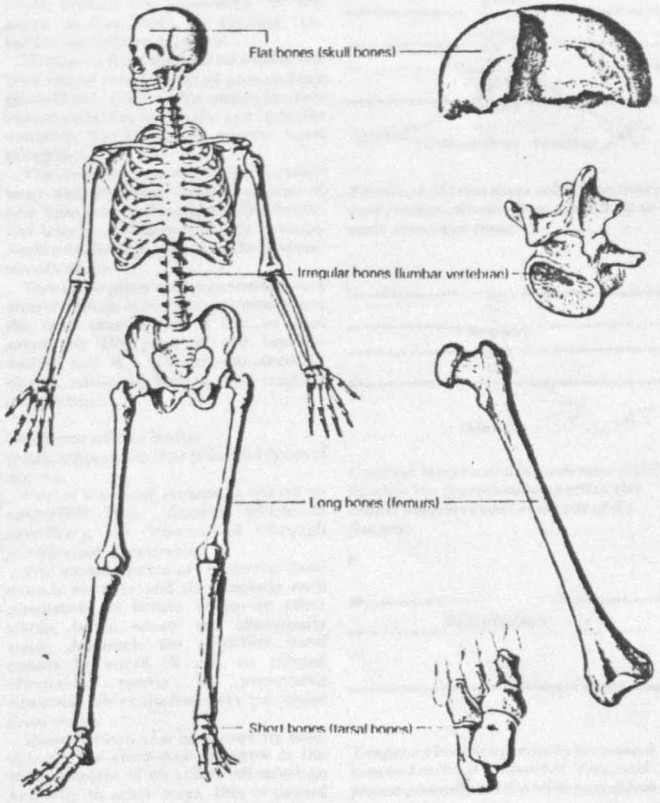
The primitive function of bones as armour-plating is still obvious today in certain parts of the human body. One needs to think only of the skull, forming a complete protective case around the brain, or the ribs doing the same for the heart and lungs.

Bones also, of course, provide the support which keeps the many components of the body together and upright. It is interesting to reflect that when the body thinks support is no longer needed—such as in the prolonged weightlessness of space flight or just the experience of bed rest—the bones will lose their strength and will also break easily if put under strain.

Another vital, but not quite so obvious use of bones is as girders to which muscles may be attached. Muscles provide the power by which the various limbs and body parts are moved, and this is done in the first place by moving the bones relative to each other.

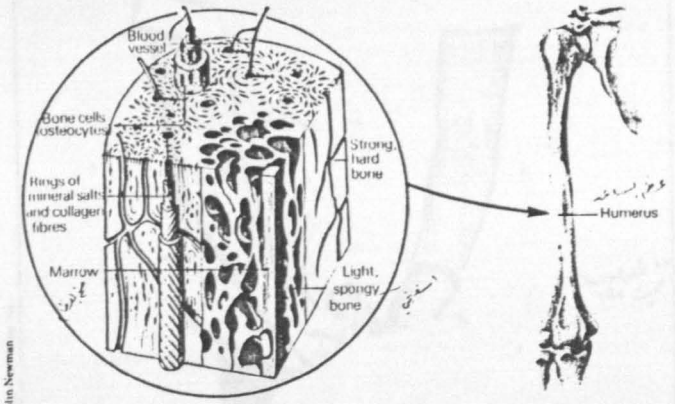
The insides of bones are hollow, and the body, with great economy of space, uses these cavities for the manufacture of blood cells. They also manufacture another vital substance for the body—calcium.

Different types of bones



Mike Courtney

Cross-section of a long bone



Colin Newman

What bones are made of

Like everything else in the body, bones are made up of cells. They are of a type which creates what is technically called a fibrous tissue framework, a relatively soft and pliable 'base' material.

Within this framework, there is a network of harder material, which gives a result something like concrete, with lots of 'stones' (i.e. the hard material) providing strength to a 'cement' base of fibrous tissue. The end product is an extremely strong structure, with considerable flexibility.

The growth of bones

When bones begin growing they are solid all through. Only at a secondary stage do they start to develop hollow centres.

Hollowing out a tube of material only very slightly reduces its strength, while very much reducing its weight. This is a basic law of structural engineering of which nature takes full advantage in the design of bones. The hollow centres are filled with a soft substance, known as marrow, in which the manufacture of blood cells takes place.

Bones start forming in a human baby during the first month of pregnancy, but they are at this stage made—just like the skeletons of primitive creatures—of cartilage, quite soft material with a rubbery flexibility. As the baby grows, this cartilage frame is replaced by the fibrous tissue, with little or none of the hardening agent. Hardening of the bones is a gradual process taking place throughout childhood and is only completed by the end of puberty.

Keeping in shape

Another important, and remarkable feature of bones is their ability to grow into the right shape. This is especially important for the long bones which support the limbs. They are wider at each end than at the middle, and this provides extra solidarity at the joint where it is most needed. This shaping, technically known as modelling, is specially engineered during growth and goes on all the time afterwards.

Different shapes and sizes

There are several different types of bone, designed to perform in varying ways.

Long bones, forming the limbs, are simply cylinders of hard bone with the soft, spongy, marrow interior.

Short bones, found, for example, at the wrist and ankle, have basically the same form as long bones, but are more squat to allow a great variety of movement without loss of strength.

Flat bones consist of a sandwich of hard bone with a spongy layer between. They are flat to provide protection (as in the skull) or a particularly large area for the attachment of certain muscles, as with the shoulder blades.

The final bone type, irregular bones, come in several different shapes designed specifically for the job they do. The bones of the spine, for example, are box-shaped to give great strength and plenty of space inside for the marrow. And the bones that make up the structure of the face are hollowed out into air-filled cavities to create extra lightness.

The joints

Bones have to be joined securely, but some must be able to move very extensively in relation to each other. The way nature solves this problem is in the ball and socket and hinge type joints.

This X-ray shows a clear fracture of the tibia (shin bone), the larger of the two bones in the lower leg.

Derek Bunn

Q I saw an X-ray of my ten-year-old son's arm, and there seemed to be lots of breaks in it. Yet the doctor said it was not broken. Why?

A The breaks you saw were gaps between the growing points of the long bones. They join together after puberty, but in a ten-year-old can give quite a confusing picture.

Q The doctor says my son has osteomyelitis. How did he catch it, and is it serious?

A Osteomyelitis is a bone infection. It seems to occur in an area where there has been a previous injury—perhaps a break. Stray bacteria in the bloodstream from a cut or chest infection then multiply in this area where the bones' natural defences against infection have been reduced. It can almost always be cured.

Q Why do bones in the elderly break so easily?

A Because with increasing age they often have a tendency to become less solid and thus more brittle; that is called osteoporosis. They get generally thinner and weaker with a loss of both mineral and fibrous tissue components. The condition can be improved by treatment. Other bone diseases are common in the elderly and predispose them to fractures. These include Paget's disease and cancer. Patients on long-term steroid therapy may also develop thinner bones.

Q The skeleton seems to be a remarkable piece of engineering, very light but also strong and manoeuvrable. But why does man suffer so much from backache?

A When man started walking on two legs instead of four, he did so using the same skeleton as had been evolved for four-legged animals. Unfortunately, we didn't develop any further and man is stuck with his spine. This worked well horizontally, but in the vertical posture great strains occur at our centre of gravity or balancing point which is situated at the bottom of the back, often giving rise to pain there.

The ends of the bones are lined with a pad of soft cartilage so that in movement and weight-bearing they do not damage each other. The joint is also lubricated by specially produced fluids. Tying the whole structure together are tough thongs known as ligaments.

Self-maintenance

Like many other parts of the body, bones have the extraordinary capacity to maintain themselves if infected or damaged. The most obvious example of this is the ability to repair themselves when broken—even completely in two.

People often find it hard to imagine how this can happen. The key to it, in the first place, is the fact that when a bone breaks, blood vessels running through the bone automatically break, too. Quite a large blood loss results (and needs to be replaced in many cases) but it is this blood, lying around the area of the break, which creates the scaffolding for the repair of the break by clotting (i.e. hardening) into a solid mass.

Next, cells from the broken ends of the bone spread into the clotted area and lay down fibrous tissue. This unites the two broken ends, but before the join is really complete, the hardening process must take place.

The finished join is actually rather large and unwieldy, forming a mass of new bone around the place of the break. But later on, the bone's ability to shape itself remodels the area into the original smooth shape.

This takes place over a period of years after the break is completely mended and the limb once again in use, so that eventually the place of the break—doctors call it a fracture—is unrecognizable, except by X-rays, from original smooth bone.

Diseases of the bone

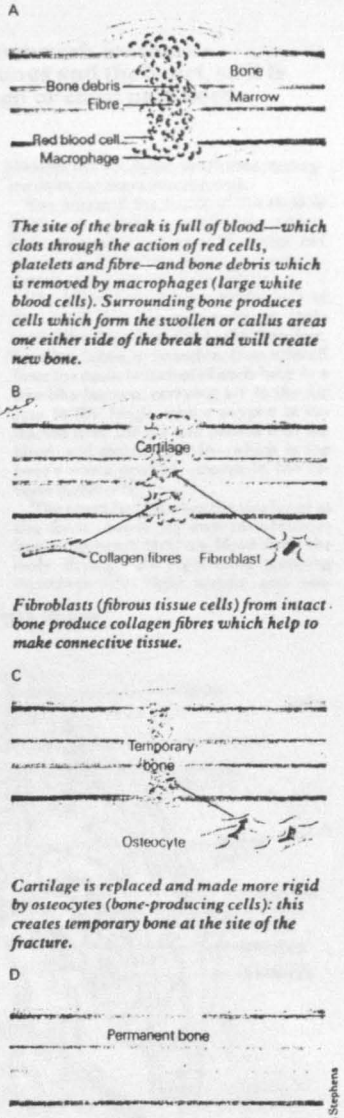
Bones are prone to four principal types of disease.

One of the most serious is known as congenital bone disease which is hereditary, or transmitted through families and is incurable.

The various forms of congenital bone disease are rare and they include such complaints as brittle bones—in other words, bones which are abnormally weak. Although the condition itself cannot be cured, it can be treated effectively, mostly by preventing situations where the bones are put under great strain.

Dwarfism can also be caused by bone disease. If a child does not grow to the normal height of an adult, but develops normally in other ways, this is caused either from failure of bone growth or a failure of control over the bone-growing process.

Repair of a fractured bone



The site of the break is full of blood—which clots through the action of red cells, platelets and fibre—and bone debris which is removed by macrophages (large white blood cells). Surrounding bone produces cells which form the swollen or callus areas one either side of the break and will create new bone.

Fibroblasts (fibrous tissue cells) from intact bone produce collagen fibres which help to make connective tissue.

Cartilage is replaced and made more rigid by osteocytes (bone-producing cells): this creates temporary bone at the site of the fracture.

Temporary bone is replaced by permanent bone and callus is re-absorbed. This total process generally takes a minimum of four to six weeks.

Department of Medical Illustrations, Royal Liverpool Hospital

Even very young infants may have need of physiotherapy. Here the physiotherapist is demonstrating to this child's mother the technique of stretching a mild club foot.

The final, least serious type of inherited bone problem is the misshapen bone—perhaps an in-curving little finger, or the existence of an extra finger or toe. Such deformities, if they can be called that, are often present in several generations of a family and practically never cause serious problems.

Chemical problems

Then there are what are known as the biochemically-caused bone diseases; this means a failure of the body's chemistry to supervise bone formation properly.

One of the best known is now virtually a disease of the past—rickets. It used to be caused by a lack of certain essential vitamins due in turn to bad or insufficient diet experienced in poor living conditions. Weakening of the bones occurs, giving the legs especially a characteristic, bowed look. Although rare, it is sometimes seen in strict vegetarians and treatment is by vitamin D supplements.

Another disease in this category is called osteomalacia, and again gives rise to abnormally weak bones. Its underlying cause is actually a disease of certain parts of the stomach, and it can be treated.

Rickets and osteomalacia may also occur in association with kidney disease. This is probably due to failure of the kidney to activate vitamin D. Treatment is aimed primarily at the kidney failure itself, along with supplements of specially 'activated' vitamin D.

Infection

Bones can become infected by invading bacteria (i.e. 'germs') just like any other part of the body. Probably the best known such infection of the bones is called osteomyelitis. This can usually be cured by treatment with high doses of antibiotics. Tuberculous osteomyelitis can also occur, producing a much slower development of symptoms. It is very rarely encountered nowadays.

Polio is often classed as a bone infection, though it is not, strictly speaking, one. It is actually an infection of the nervous tissue which in turn means that the nerves and muscles controlling the bones in the affected area do not work in a way they would normally do.

This causes the mechanisms encouraging growth and maintenance of the bones to break down, so that weakened and shortened bones may result. Quite a lot can be done for the patient by encouraging him or her to keep the affected limb in use. And, of course, polio is now virtually a disease of the past due to mass vaccination programmes.

Bone tumours

Bone lumps, or tumours, may be a more serious cause for concern. Quite often they have been present for years, for example as a hard lump (exostosis) on the skull, and cause no trouble at all. But some lumps are malignant (in other words, cancerous), and these grow quite quickly and invade other tissues.

Bone cancer, occurring of its own accord, is rare. However, cancer occurring from the spread of a tumour elsewhere is more common.

Bone cancer is always a serious matter, but these days it is controllable to a very considerable extent. The types of treatment available are extremely effective, totally eliminating the pain of the swelling causd by the growth in the bone.

The spread of cancer to the bones does not mean the patient has to retire to bed. On the contrary, there are likely to be many pain-free, active years ahead.

Other types of bone diseases

Further types of bone diseases are osteoporosis and hyperparathyroidism. The first means 'thinning, and weakening' of bone and occurs mostly in the elderly. It can be helped by treatment. The second is a problem caused by excess production of a certain type of hormone—the body's chemical controlling agents. It may be diagnosed by x-ray and testing for high blood calcium levels. Again, it causes weakness of the bones, but can be effectively cured by removing, in an operation, the parathyroid gland, or part of it, which is responsible for producing the hormone in these excessive amounts.

One type of bone disease, Paget's disease, seems to be on the increase. It affects the elderly, its cause is unknown and it causes haphazard growth of the bones. Treatment with a hormone that stimulates the production of bone-hardening substances seems to be successful.

The future

Considering how extensive and how complicated the human skeleton is, it is prone to comparatively few problems, and today, most of them are curable, or controllable. So bone diseases need no longer be dreaded in the way they used to be before the advent of modern medicine.

Chest

Q I am a keen gardener, but I find that I get pains in my chest after I have been digging. Could this mean that I have strained my heart?

A Probably not, because in fact most chest pains are related to muscle strains in the chest wall. After all, this not only is a cage for the lungs, but also provides the 'platform' from which our arms and shoulders do all their muscular work. It is not surprising that we sometimes get strained or 'pulled' muscles in the chest. The clue is usually the fact that a specific movement or set of movements will bring on the pain. However, to put your mind at rest, do go and see your doctor about this problem.

Q When I broke my ribs playing rugger, I was not strapped up, or given any treatment. Why was this?

A Apart from the discomfort of broken or cracked ribs, their main danger is that the chest movement will be reduced, producing less air flow in and out of the underlying lung. This can cause pneumonia—and it is for this reason that it is unusual to strap up broken ribs.

Q My doctor says I am pigeon-chested. What does it mean? And am I more likely to get ill from chest infections?

A Some people have minor deformities of the chest wall, which are often referred to as a pigeon chest. The commonest is a hollowing of the centre of the chest at the front—but this does not mean that you are more liable to chest infection than anyone else.

Q Can people still die of pneumonia like they did in the old days?

A Unfortunately yes. Pneumonia used to be a common cause of death not so many years ago, even in fit young people, but this is generally no longer the case. However, in people who are seriously ill for some other reason, or the elderly, pneumonia is often the final illness that carries them off.

The chest is the protective framework for those life-maintaining organs, the lungs and the heart, so it is essential to know when a cough or chest pain needs medical attention.

The chest is a bony cage that contains two of the most important organs in the body: the lungs and the heart. The basic function of these is to transfer oxygen from the air to the tissues, where it is essential for the continuation of life.

Structure

The rib cage is located just under the skin of the chest. It totally encloses the lungs and heart on all but their lowest surface, and resembles a bell in shape. It is attached to the spine at the back, and its base is sealed off by the diaphragm, which is the thick muscular sheet separating the contents of the chest from the abdomen.

In between the ribs there are further muscular sheets called the intercostal ('between the rib') muscles. The chest wall therefore consists of a bell-shaped muscular bag—having the ribs as struts—which by expanding and contracting is able to suck air in and out through the windpipe, or trachea, emerging from the chest into the neck.

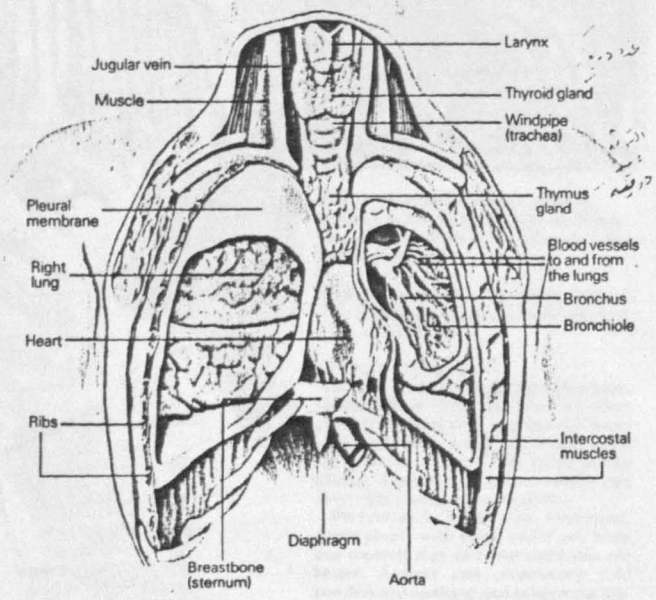
The whole of the inside of the chest is lined with a membrane called the pleura. Similar membranes cover the lungs and the heart. When the pleura becomes inflamed this gives rise to pleurisy.

The left and right lungs fill the bulk of the chest and are connected by their tubes, the main bronchi, to the tranchea. Smaller, tubes, or bronchia, then split off from the main bronchus of each lung in a tree-like fashion, carrying air to the air sacs in the lungs, where oxygen is extracted from the air and passed into the blood, and carbon dioxide—which is the body's waste product—moves in the reverse direction.

The heart lies between the two lungs at the front, inside its own membranous bag. The heart receives blood from the body through its right-sided pumping chambers (the right atrium and ventricle) and pumps it into the lungs. Blood returns full of oxygen to the atrium and ventricle on the left side of the heart from where it is pumped out into the main artery of the body—the aorta.

Apart from the heart and lungs, the chest contains the gullet, or oesophagus which carries food from the mouth into the stomach which lies just below the diaphragm. There is also a gland called the thymus, which lies at the top of the chest in front of the windpipe. This is important in controlling the body's defence mechanisms.

Organs of the chest



Advertising Arts

Chest problems

There are three main groups of symptoms arising from problems in the chest; these are pain, cough and breathlessness.

Pain in the chest area may arise from the chest wall itself, as a result of pleurisy, or from the heart. Finally, the oesophagus as it passes through the diaphragm into the stomach is often the source of pain; the acid contents of the stomach may wash back upwards and cause inflammation.

What happens in pleurisy is that the two layers of pleura lining the inside of the chest and outside of the lungs become inflamed and cause pain when they rub together. The pain of pleurisy is therefore worse on breathing or coughing.

Since the lungs themselves do not give rise to pain, coughing is an important lung symptom. Doctors call a cough 'productive' when it produces phlegm or sputum from the chest. This may indicate infection, particularly if the sputum that is spat from the mouth is coloured green or yellow rather than white. Most coughs, however, do not produce sputum and are simply the result of inflammation of the upper airways, rather than a sign of lung disease. Usually, such coughs follow on from a cold.

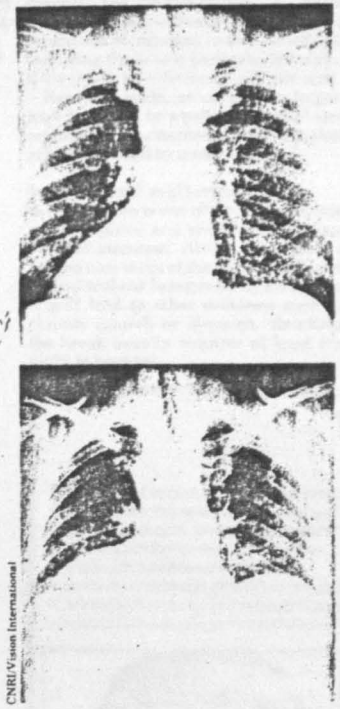
Breathlessness may be the result of disease of either the lungs or the chest. Asthma is a common cause, particularly in younger people and children, and is accompanied by the characteristic wheezing.

When the heart gives rise to breathlessness, this is because the pumping of the blood has become a little imperfect; it is as though the lungs are a little stiff to move, because they are somewhat distended with blood. This situation is known by the rather over-dramatic title of 'heart-failure' and is in fact quite common in the elderly.

Dangers

If you have a new, severe pain in the chest, shoulders or arms, especially if this is accompanied by breathlessness, nausea and sweating, medical advice is urgently needed. This also applies if the pain is worse on breathing or coughing.

A doctor should also be consulted for a new cough if it produces phlegm or is accompanied by wheezing, also, if blood is being coughed up or if there are bloody streaks in the sputum medical advice should be sought.



CNRI/Vision International

These X-rays show how the muscular walls of the chest expand when air is inhaled (top) and contract when it's exhaled (above).

Pain in the chest—when to see your doctor

Type of pain	Other signs	Causes
Central pain, pressing and dull in character	Breathlessness, nausea, or sweating lasting more than 20 minutes	Angina (heart disease) Heart attack Pericarditis (inflammation of the membrane lining the heart) Indigestion
Central gripping pain spreading to the neck, shoulders or arms	Brought on by exercise or emotional excitement	Angina Pericarditis
Anywhere, worse on inspiration (breathing in) or on coughing	May well be associated with a cough or an attack of bronchitis	Pleurisy Pericarditis
Central, burning. Worse after food or on bending forward, may be worse at night	Foods may bring it on, and it may be relieved by milk or indigestion tablets	Oesophagitis (inflammation of the gullet, a form of indigestion)

When a cough needs medical attention

Type of cough	Cause
Green or yellow sputum coughed up	Bronchitis (inflammation of the lining of the bronchial tubes in the lungs) or pneumonia (inflammation of the lung)
Cough and/or wheezing	This may be true asthma or wheezy bronchitis
Coughing up blood or bloody streaks in sputum	There are many causes of this, but the most serious are TB or lung cancer

Lotions for soothing a cold
2 g (½ tsp) sodium bicarbonate
2 g (½ tsp) borax
4 g (¼ tsp) sugar
250 ml (½ pt) rose water
Mix a small amount with an equal quantity of hot water before use
or
½ tsp sodium bicarbonate
½ tsp salt
Add to a glass of warm water.
Application
Apply the chosen lotion to the inside of nose, using a hand spray or nasal syringe, morning and night. This will relieve the inflammation

Sneezing is the natural way of clearing the nose—but it must be done into a tissue or handkerchief. As the old saying goes, 'Coughs and sneezes spread diseases.' Children must be taught good manners and healthy habits in this matter of hygiene.

The nose is a sensitive organ. Here an explorer in Alaska has his nose and lower part of his face fully protected against the freezing cold.

leads to the middle ear, which explains why we sometimes get earache when we have a sore throat.

Colds and hay fever

A cold, an acute inflammation of the nose, is caused by a virus. Hay fever, an allergic form of head cold, is generally more unpleasant than a cold but disappears if the patient can avoid the cause of the allergy. Dust and irritating smells can also trigger nasal inflammation.

Prevention is better than treatment. Avoid people with colds, and if you have one yourself stay at home until you are better. Aspirin and proprietary cold powders are soothing and relieve the discomfort and inflammation. A nasal douche (see box) will relieve the pain, and inhalation of menthol is also beneficial. Douching the nose is particularly helpful if dry crusts have formed inside the nose.

Repeated colds, or colds that linger, may be caused by a polyp, by a displaced septum or sinus trouble—conditions that can be corrected by minor surgery.

Injuries and malformation

A broken nose is one of the most common sports injuries and requires immediate medical attention. Almost invariably a broken nose is out of shape. If it is allowed to heal without being reset by a surgeon, it will lead to other problems such as chronic catarrh or sinusitis. Resetting the break usually requires at least one night in hospital.

The cavities on either side of the septum are rarely of equal size as the septum usually leans to one side. If the septum actually touches the conchae, irritation may arise and perhaps lead to asthma or catarrh. It can be corrected by an operation.

Adenoids

If adenoids become infected they will block the exit of the nostrils, so that the sufferer is forced to breathe through his mouth. Chronic mouth-breathing in children is usually caused by adenoids and must always be treated.

An adenoidal child, because he breathes through his mouth, snores at night and is liable to bronchitis. The point of the nose is pinched and the nostrils narrow, because so little air passes through. Because mouth-breathing requires less effort than nose-breathing, the rib muscles develop poorly. As a consequence, the child will be round-shouldered and stooping, and may also be pigeon-chested. He may also be slightly deaf. Removal of the adenoids will bring tremendous benefit.

Polyps

Although harmless, polyps are a nuisance and interfere with breathing. These soft growths of a jelly-like texture, usually on a short stalk, are generally found in the middle concha. They rarely occur singly, and when a polyp is removed other polyps nearby may enlarge. Because of this, it may take several trips to the doctor or ear, nose and throat clinic to treat polyps. It is worth persevering,

Treating nosebleeds

FIRST AID

A nosebleed occurs when a small blood vessel inside the nose is ruptured by a blow, for example, through picking the nose or a bout of sneezing. Yet it can happen for no apparent reason, especially to teenage girls who have just started their periods. Some people have a nosebleed with a nasal infection or an attack of hay fever. Although the blood loss looks great it is not in fact copious and it is rarely very serious. It will generally clear up in 5 to 15 minutes-in other words, the time it usually takes blood to clot.

Very heavy bleeding may follow damage to an artery at the back of the nose. In this case the nose has to be packed in a special way by a doctor. Nosebleeds that occur within a week of a tonsil or adenoid operation are particularly serious and should be treated immediately. Tell your doctor if the bleeding was caused by a blow. Otherwise:

- Sit the patient down, loosen his or her clothes around the neck, and incline the head slightly forward so the blood drips into a bowl
- Try to prevent him swallowing too much blood

- Get him to breathe gently only through his mouth and lightly pinch the nostrils closed for a full 5 minutes

- If the bleeding seems severe, put a small packing of sterile absorbent cotton gauze into each nostril. Make sure the packing is tight, and press the nostrils together for 10 minutes
- If the bleeding persist for 20 minutes call the doctor or take the patient to hospital
- Once the bleeding stops make sure the patient leaves his nose alone
- Remove the packing 12 to 24 hours later

Nose

Q I've had a stuffy nose for weeks. What could be the cause?

A There could be hundreds of causes. The three most common irritants are dust, alcohol and tobacco. These are followed by cosmetics (especially face powders, talc and perfume), smoke and gases. You should consult your doctor, who may refer you to a specialist.

Q We call them bogeys in our family; other people call it snot. Where does it come from and what is its purpose?

A The inside of the nose is constantly being washed with mucus and swept with cilia. Any dust is wafted towards the nostrils and gets covered with the dried-up mucus.

Q My son has begun to pick his nose. When should I start being severe with him?

A Nose-picking is unhygienic and anti-social, and you should put your foot down early on. Train him to carry a hanky or tissue and to always use it when he sneezes or wants to get rid of a bogey.

Q My next-door neighbour says that a nosebleed is a sign of pressure on the brain. One of my sons has had several nosebleeds in quick succession. Is this serious?

A Nosebleeds are common in children, perhaps because they are so active and are likely to suffer sudden knocks and blows. However, some children are more prone to them than others. The most frequent cause is when the blood vessels just inside one or both nostrils burst, after having become weakened and enlarged through rubbing and picking, or perhaps because of previous nosebleeds. Pressure on the brain is not a cause, but as recurrent bleeding from the nose can be a symptom of disease you should consult the doctor. Certainly, if a nosebleed is caused by a blow to the head you should see the doctor as soon as possible because it could indicate a fractured skull.

As well as being one of the most distinctive features of the face, the nose is a highly sensitive organ. And through its links with the eyes, ears and throat it has a wide-ranging influence on our sense of well being.

The nose is one of our most important sensory organs, although we probably rather take it for granted. It has three main functions. It is the natural pathway by which air enters the body in the normal course of breathing. The air is warmed, moistened and filtered there before entering the lungs. The nose also acts as a protective device. If irritants such as dust enter, they are expelled by sneezing and do not have a chance to damage the lungs. Finally, of course, the nose is the organ of smell.

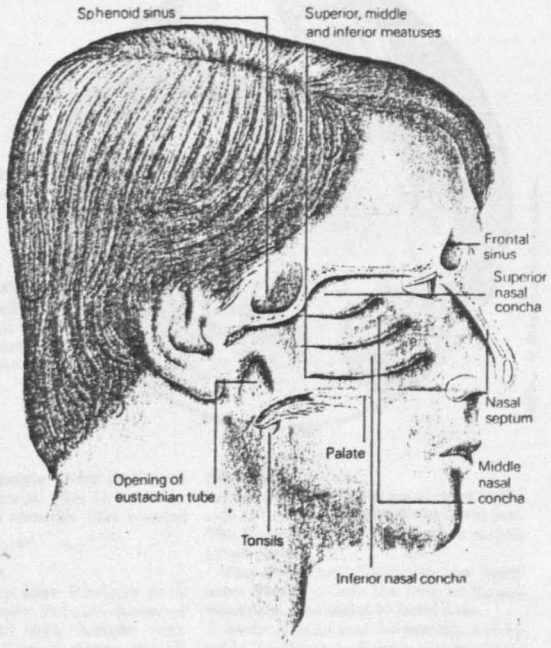
Structure

The external nose consists partly of bone and partly of cartilage. The two nasal bones, one on each side, project downward and also form the bridge between the eyes. Below them, the nasal cartilages and the cartilages of the nostrils give the nose firmness, shape and pliability.

Inside, the nose is divided into two narrow cavities by a partition running from front to back. This partition, the septum, is made of bone and cartilage. It is covered with a soft, delicate membrane called a mucous membrane, which is continuous with the lining of the nostril. The nostrils themselves are lined with stiff hairs that grow downwards and protect the entrance. They are quite noticeable in some people, especially men.

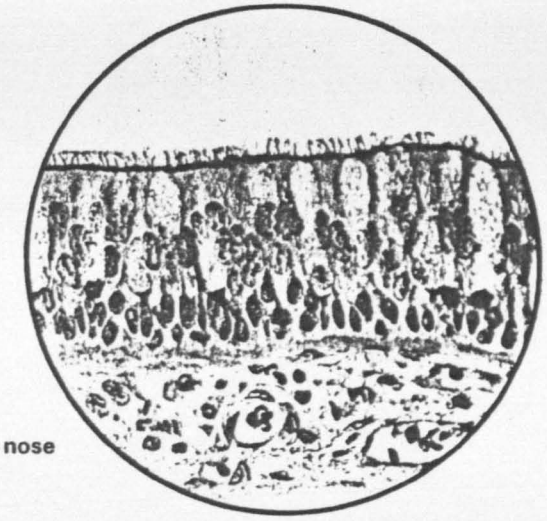
The two cavities created by the septum are called nasal fossae. They are very narrow, less than 6 mm (¼ in) wide.

Side view of the nose



Mike Courtney

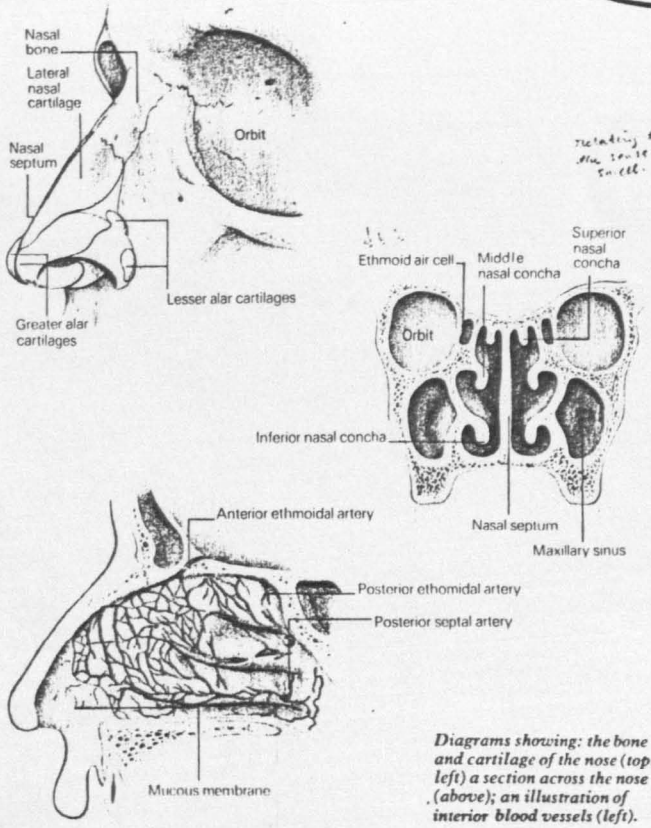
This cut-away portrait of the face shows the important parts of the nose and how it is linked to other areas of the face.



London Scientific Films

Nasal membrane showing the tiny hairs, or cilia, which trap and filter dust particles and so protect the lungs from pollution.

Sections of the nose



Diagrams showing: the bone and cartilage of the nose (top, left) a section across the nose (above); an illustration of interior blood vessels (left).

At the top of the fossae are thin plates of bone with numerous small receptors from the olfactory nerve. When we have a cold, these receptors get covered in thick mucus, which reduces our sense of smell and taste.

Warming and moistening the air

The cavity at the back of the nose is divided into sections by three ridges of bone called the nasal conchae. They are long and thin and run lengthwise, sloping downwards at the back. The passage between each concha is called a meatus. It is lined with mucous membrane having a very rich blood supply, and it is this which moistens and warms the air that is inhaled.

This membrane secretes 0.5 litres (just under a pint) of mucus every day and is covered with thousands of tiny hairs called cilia. The mucus and cilia trap dust particles, which are moved on by the cilia and usually swallowed.

Sinuses and tear ducts

The sinuses—spaces in the front of the skull—are connected with the inside of the nose. They are located behind the eyebrows and behind the cheeks, in the triangle between the eyes and the nose. Sinuses will help cushion the impact of any blows to the face.

Two other passages lead off the meatuses. Tear ducts carry away tears from the eyes (which is why we have to blow our nose when we cry). The other, the auditory tube, is at the back of the nose near the junction with the throat. It

Q I have had a crooked nose ever since I broke it playing football at school. Although it doesn't bother me, my wife says it spoils my appearance. Could it be the reason my left nostril is permanently blocked, and should I do anything about?

A It is almost certainly the cause of your blocked nostril. An operation to reset your nose will mean only a day or two in hospital. It will improve your breathing—and increase your wife's appreciation of you.

Q I have been advised that my daughter, aged 12, should have an operation for adenoids. My friend says that she will grow out of them without needing an operation. What do you think?

A Although she will grow out of them in time, she will also develop bad posture, round shoulders and all the other problems that adenoidal children have. An operation, followed by a period of physiotherapy, will have an immediate and beneficial effect.

Q Why is it that when my nose is blocked I get a pain behind my eyes and can't speak properly?

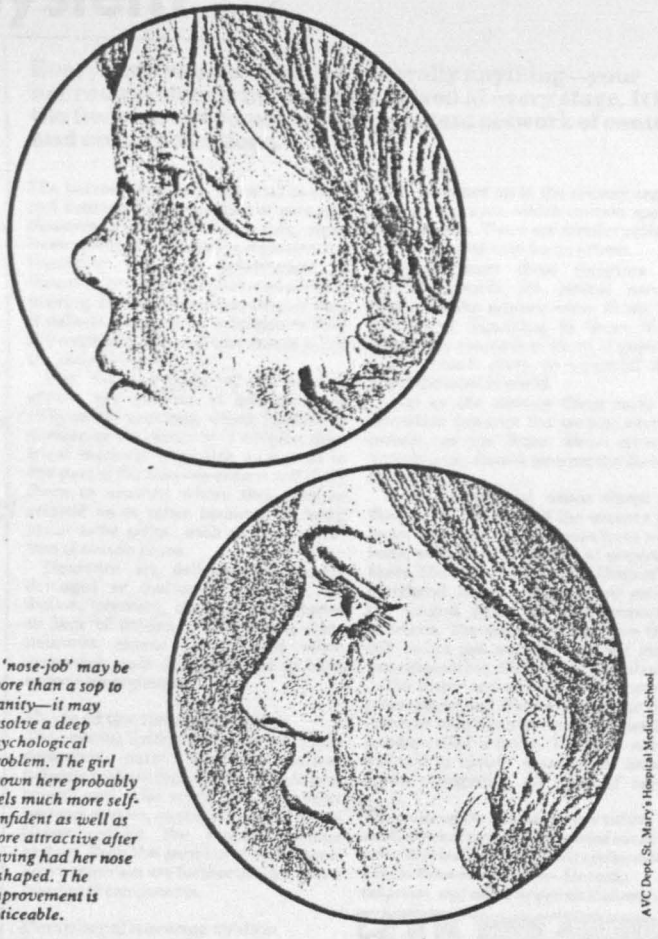
A When your nose is blocked, pressure builds up inside your sinuses, which may also contain some mucus. The pressure and the inflammation cause the pain. They also affect the way sounds vibrate because the sinuses act as 'vibrators' when we speak.

Q I keep getting polyps in my nose. Are they cancerous?

A Definitely not! Nasal polyps are benign tumours, but it often takes several operations to get rid of them all.

Q My grandmother used to put a cloth soaked in witch hazel across my nose when it bled. Is this an effective cure?

A While some herbs may have properties that help to stem the flow of blood, it is more likely that the treatment acted as an effective cold compress.



A 'nose-job' may be more than a sop to vanity—it may resolve a deep psychological problem. The girl shown here probably feels much more self-confident as well as more attractive after having had her nose reshaped. The improvement is noticeable.

AVC Dept. St. Mary's Hospital Medical School

however. Some people worry that these polyps are cancerous. This is not true. They are benign tumours that respond well to surgery.

Foreign bodies

Small children are often likely to push objects up their noses. Peanuts, lumps of foam from stuffed toys, buttons, wax crayons, peas and small stones are all used. They may cause no symptoms at first, but eventually swelling, discharge, headache and facial pains will result.

If you think a child has stuffed something up his nose, try to make him sneeze while blocking the opposite nostril. If this doesn't work, take him to a doctor.

Sinusitis

Infection is common in the sinuses at the side of the nose and above the lower jaw. The frontal sinuses are not often subject to infection.

The symptoms of sinusitis are headache, discharge into the nose or throat, weakness, toothache, or facial pain.

Acute attacks may be precipitated by colds, hay fever or damp weather. Acute sinusitis needs treatment to avoid the remote danger of the infection spreading upwards causing meningitis.

Sinusitis usually responds to menthol inhalation, but more severe cases may need antibiotics or an operation to wash out the sinus.

Nervous system

Every time you do anything—literally anything—your nervous system is intimately involved at every stage. It is the body's most complex and important network of control and communications.

Q My friend says I'm a nervous wreck. Could this be because of some disturbance in my nervous system?

A Highly unlikely—although there are a few physical illnesses which can cause generalized anxiety.

More often, anxiety and nervousness such as you suffer from are caused by fear, or fears, which may be unconscious: possibly that one is about to lose one's job, be shouted at, or even find a large spider in the bath. Being nervous is a perfectly normal response to such stresses or threats, and need only be a cause for concern if the stress and the nervousness are ever-present.

Many forms of anxiety can be relieved, sometimes by changing one's circumstances and sometimes with the help of medical or psychological therapy, but first you may have to identify exactly what it is you are worried or frightened about.

Q Do 'pins and needles' have anything to do with nerves?

A Yes. If a nerve containing sensory fibres is slightly compressed, its individual fibres may fire off a number of random signals, perceived by the brain as a tingling sensation. For example, pressure on the nerves running from one's foot up the back of the thigh—due for example to sitting cross-legged—may be felt as the familiar 'pins and needles' in the foot. Continued compression may completely prevent the nerve fibres from transmitting signals, resulting in a loss of sensation, or numbness. Sensation returns fairly rapidly when the pressure is relieved.

Q Does heavy drinking damage the nerves?

A Yes. Heavy consumption over a number of years may cause a permanent disturbance in the conduction of signals by nerve cells.

It can, in addition, speed up the rate at which nerve cells in the brain die, causing a progressive deterioration in mental functioning. Chronic alcoholics often suffer from vitamin B_1 deficiency, too, because of not eating properly, and this may also disturb nerve functioning.

The nervous system is essential to sight and hearing, our perception of pain and pleasure, control of movements, regulation of body functions like digestion and breathing and the development of thought, language, memory and decision making. Putting it another, simpler way, it collects and receives information from the outside world, and uses this to adapt the body's response.

The 'working parts' of the nervous system are millions of interconnected cells called neurones, whose function is similar to the wires in a complex electrical machine: they pick up signals in one part of the nervous system and carry them to another, where they may be relayed on to other neurones or bring about some action, such as the contraction of muscle fibres.

Neurones are delicate cells, easily damaged or destroyed by injury, infection, pressure, chemical disturbance or lack of oxygen. Furthermore, since neurones cannot be replaced when destroyed, such disorders tend to have serious consequences.

Parts of the nervous system

The nervous system falls into two interdependent parts. One, the central nervous system, consists of the brain and spinal cord. The other, the peripheral nervous system, consists of all the nerve tissue outside the central nervous system. Both the peripheral and central nervous system are further divided into a number of components.

Peripheral nervous system

The peripheral nervous system has two main divisions: an outer system called the somatic nervous system and an inner one, the autonomic nervous system.

The somatic system has a dual role. First, it collects information from the body's sense organs and conveys this to the central nervous system. Secondly, it transmits signals from the central nervous system to the skeletal muscles, thus initiating movement.

The autonomic nervous system is concerned with the regulation of our internal organs and glands, such as the heart, stomach, kidneys and pancreas.

The somatic nervous system has two main components, the sensory and motor systems. Information about the outside world is picked up in the sensory organs such as the eyes, which contain special receptor cells. There are similar cells for pain, touch and skin temperature.

Signals from these receptors are carried towards the central nervous system in the sensory nerve fibres. The pattern of signalling in these fibres, which may mount to millions of impulses every second, gives us essential data about the outside world.

Just as the sensory fibres carry information towards the central nervous system, so the motor fibres transmit signals away from it towards the skeletal muscles.

Both sensory and motor fibres are themselves just part of the sensory and motor neurones. All neurones have a cell body, as well as a number of projecting fibres. The motor and sensory fibres of the peripheral nervous system are merely the longest fibres of their respective neurones. The sensory fibres have their cell bodies just outside, and the motor neurones within, the brain or spinal cord.

The motor and sensory fibres carrying messages to and from a particular body organ or area are gathered together in a bundle called a nerve. Different nerves are said to 'supply' a particular area or organ. Altogether, 43 pairs of nerves emerge from the central nervous system: 12 pairs of cranial nerves from the brain and the remaining 31 pairs—called spinal nerves—from either side of the spinal cord.

The cranial nerves mainly supply sense organs and muscles in the head, although a very important cranial nerve, the vagus, supplies the digestive organs, heart and air passages in the lungs. Some cranial nerves, such as the optic nerve to the eye, contain only sensory fibres.

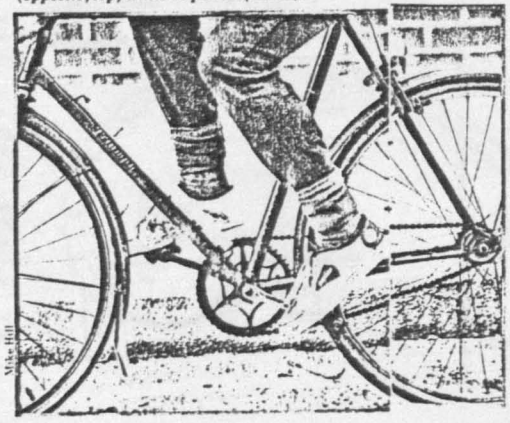
The spinal nerves emerge at intervals from the spinal cord and always contain both motor and sensory fibres. They supply all areas of the body below the neck. Each spinal nerve is attached to the spinal cord by means of two roots, one of which carries motor fibres, and the other sensory fibres. At a short distance from the spinal cord, each spinal nerve splits into a number of branches.

So the peripheral nervous system acts only to relay sensory and motor messages between the central nervous system and the body's muscles, glands and sense organs. It plays virtually no part in the analysis of sensory signals, or the initiation of motor signals. Both these activities, and much else between, occurs in the central nervous system.

The central nervous system

The brain and spinal cord form the central processing unit of the nervous system. They receive messages via the sensory fibres from the body's sense organs and receptors, filter and analyze it, then send out signals along the motor fibres which produce an appropriate response in the muscles and glands.

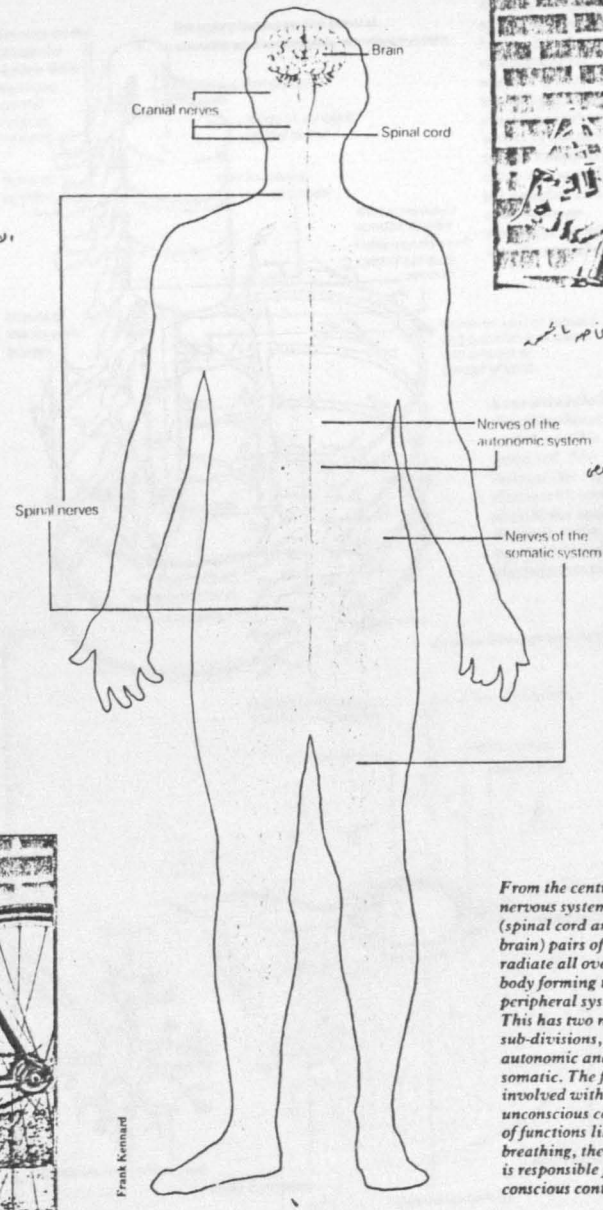
The analytical, or processing aspect, may be relatively simple for certain functions carried out in the spinal cord, but analysis in the brain is usually highly complex, involving the participation of thousands of different neurones.



Mike Hill

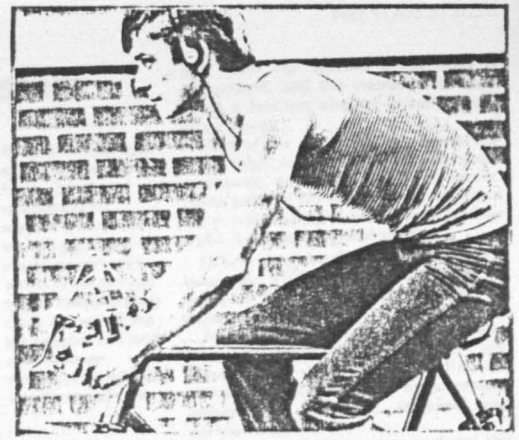
The action of the somatic system which enables two activities to be carried out at the same time is illustrated by this cyclist who is able to listen to music from his radio (opposite, top) while he pedals (below).

Layout of the nervous system



Frank Kennard

From the central nervous system (spinal cord and brain) pairs of nerves radiate all over the body forming the peripheral system. This has two main sub-divisions, the autonomic and the somatic. The first is involved with unconscious control of functions like breathing, the second is responsible for conscious control.



Mike Hill

Q What is it about the 'funny bone' that causes that strange and painful sensation if I knock it?

A The sensation hasn't much to do with bone at all, but is due to a 'funny nerve' called the ulnar nerve. This nerve passes behind the elbow on its way to the forearm, and is rather prone to injury at this point. A slight knock will cause a volley of signals in the nerve's sensory fibres and this can be excruciatingly painful.

Q A friend of mine said the pain in my hands and arms could be a trapped nerve. What's that?

A At some point along their length, many nerves have to pass through a rather restricted space—especially near joints. Any swelling or anatomical displacement in this space may squeeze or 'trap' the nerve, and the pressure may cause pain, muscle weakness, numbness or a tingling sensation.

The nerve most commonly affected is one running through the wrist. This may be squeezed between the ligaments and tendons in the wrist and the wrist bones, causing numbness and tingling in the index, middle and ring fingers, pain from the hand to the forearm, and weakness in the thumb.

This condition is called the carpal tunnel syndrome, and middle-aged women, or people with various types of hormonal imbalance, seem particularly susceptible to it.

If you have any of the symptoms, you should see your doctor—an operation to free the nerve may be necessary.

Q Two months ago I had a foot amputated. Why do I still feel the foot is there, and even have pain from the missing toes?

A Although your foot has been amputated, the sensory fibres that used to send messages from your feet to the brain are still present in the remaining part of your leg, and have their endings in the stump. If these endings are stimulated, the fibres send messages via the spinal cord to the brain, which from past experience interprets the message as having come from the foot.

It takes some time for the brain to overrule these illusions with the knowledge that the foot is not there.

The spinal cord

The spinal cord itself is a roughly cylindrical column of nerve tissues, about 40 cm (16 in) long, which runs inside the backbone from the brain to the lower back. It has two main functions.

First, it acts as a two-way conduction system between the brain and the peripheral nervous system. This is achieved by means of sensory and motor neurones whose fibres extend in long bundles from parts of the brain. They run varying distances down the spinal cord, and at their ends furthest from the brain they come into contact with the fibres or cell bodies of sensory and motor neurones belonging to the peripheral nervous system. Messages can be transmitted across the gaps, called synapses, between the peripheral neurones and the spinal neurones.

The second function of the spinal cord is to control simple reflex actions. This is achieved by neurones whose fibres extend short distances up and down the spinal cord, and by interneurones, which relay messages directly between the sensory and motor neurones.

If, for example, you accidentally put your hand on a hot stove, pain receptors in the skin send messages along sensory fibres to the spinal cord. Some of these messages are relayed immediately by neurones to motor neurones that control the movements of the arms and hand muscles, and the hand is quickly, and 'automatically' withdrawn. Other messages travel up the spinal cord and are relayed by interneurones to the motor neurones that control the neck's movements. In this way, the head is automatically turned towards the source of the pain. Further messages are carried all the way up to the brain and cause the conscious sensation of heat and pain.

The brain

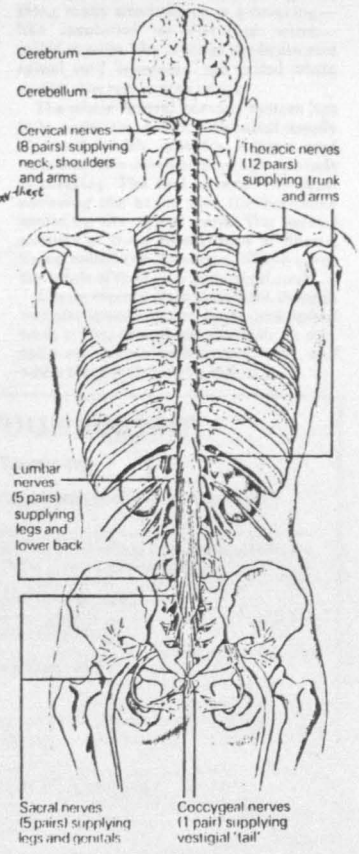
This has three main parts. The stalk, or brainstem, is a continuation of the spinal cord and supports the brain's large 'cap', called the cerebrum.

Below the cerebrum is the cerebellum. Although many sensory neurones terminate, and many motor neurones originate in the brain, the majority of the brain's neurones are interneurones, whose job is to filter, analyze and store.

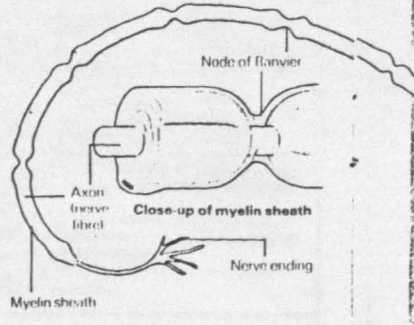
One of the brain's most important functions is to memorize information received from the sense organs. Later, the information may be recalled and used in decision making. For example, the pain

The hardware required to duplicate even a relatively simple bodily function proves the superb compactness and efficiency of the human nervous system.

Arrangement of the central and peripheral nervous system

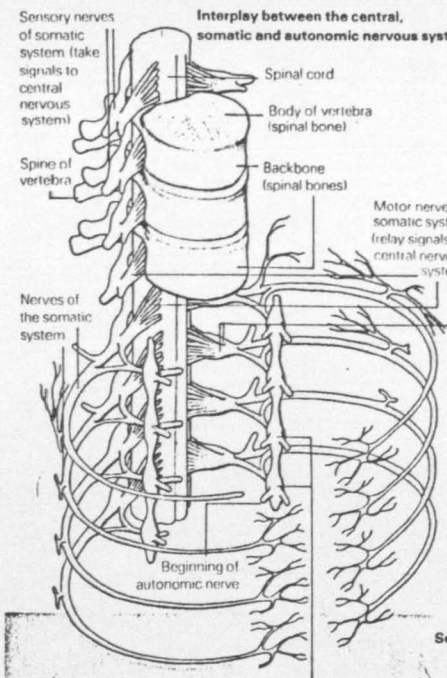


Anatomy of a neurone (nerve cell)



Layout of the Nervous System

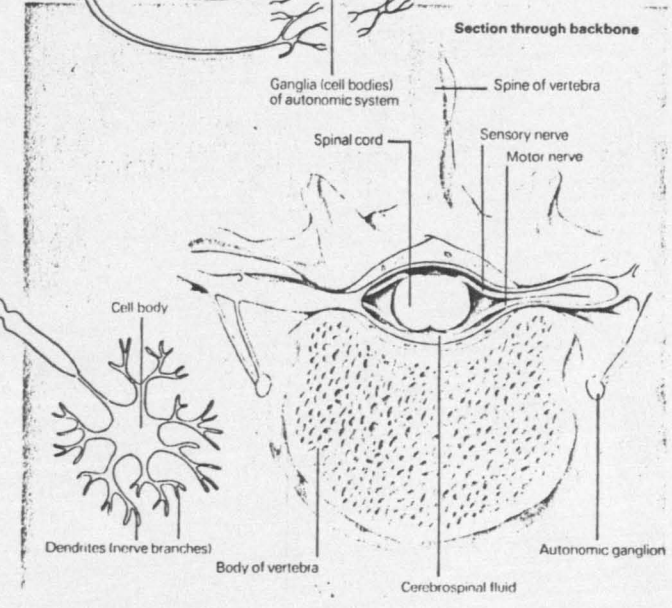
Interplay between the central, somatic and autonomic nervous system



A rear view (far left) of the interconnecting brain, spinal cord and peripheral nervous system. Their interplay is extremely complex (left) with nerves of the somatic system linked to those of the autonomic via the ganglia, and both with common pathways out of, and into the spinal cord.

A cut-away (below) of the spine shows how well the cord is protected. The neurone (far left) is shown with its myelin sheath; the nodes of Ranvier aid the transmission of electrical impulses.

Section through backbone



Frank Kennard

felt when one touches a hot stove is memorized, and the memory will later affect a decision whether or not to touch other stoves.

Most of the conscious activities of the brain take place in the upper part of the cerebrum, called the cerebral cortex. Some parts of the cortex are involved in the perception of the sensations—such as sight, hearing, taste and smell.

Others are involved in speech and language, while others are the starting point of motor pathways and govern muscle movements.

Between these motor, sensory and language areas of the cortex are associated areas consisting of millions of interconnected neurones. These are connected with reasoning, emotions and decision making.

The cerebellum is attached to the brainstem just below the cerebrum and is mainly concerned with motor activities. It sends out signals which produce unconscious movements in muscles so as to maintain posture and balance, and acts in concert with the motor areas of the cerebrum to co-ordinate body movements.

The brainstem itself contains a number of different structures with a variety of roles, by far the most important of which are the 'centres' which control the lungs, heart and blood vessels. Similar functions like blinking and vomiting are also controlled here. Others are concerned with the perception of basic sensations such as pain. Yet others act as relay stations for messages arriving from the spinal cord or cranial nerves.

One of the smallest parts of the brainstem, the hypothalamus, controls the chemical, hormonal and temperature balance of the body.

The neurones

These cells, so central to the working of the whole nervous system, deserve a closer look.

Actually, they are not the only type of cell to be found in the nervous system; another type, called neuroglia (simply meaning 'nerve glue') are present in large numbers. Their job is to bind, protect, nourish and provide support for the neurones.

Neurones come in various shapes and sizes, but they all have the same basic structure. Like all cells, they have a nucleus, or 'centre', which is contained in a roughly spherical part of the neurone called the cell body. From the cell body, a number of fine, root-like fibres project. These are called dendrites. Also projecting from the cell is a single, long fibre called the axon. At its far end, it divides into a number of branches, each of which

ends in a number of tiny knobs.

Each knob is in close proximity, but not actually touching, a dendrite from another neurone. This gap is called a synapse and messages are transmitted across these gaps by means of chemicals called nerve transmitter substances.

Every neurone is bounded by a thin, semi-permeable wall called the neuronal membrane, which plays an important part in the transmission of signals. Signals are always started by the excitation of one or more of the neurone's dendrites, and are first carried towards the cell body. They are then transmitted away from the cell body along the membrane of the axon.

When a signal reaches the knobs at the end of the axon, it may, under certain circumstances, jump across the synapse to the dendrite of an adjacent neurone and so continue its journey.

People with artificial limbs can be trained to use them deftly, but they may sometimes experience 'phantom pain'—pain that seems as if it comes from the lost limb.

To speed the transmisson of signals, along many axons there is a covering—like insulation on electrical wires—called myelin. The areas of the brain and spinal cord 'insulated' are called white matter: the rest is grey matter.

The whole central nervous system has to be maintained with a plentiful supply of blood which provides oxygen and nutrients. It is also protected by two kinds of covering. The first is bone: the skull enclosing the brain, and the backbone enclosing the spinal cord. The second consists of three membranes of fibrous tissue called the meninges. These cover the whole of the brain and spinal cord.

Cerebrospinal fluid circulates through various spaces in the brain and spinal cord, acting as a shock absorber. It contains substances such as nutrients, and white blood cells to fight infection.

Common diseases of the nervous system

Disease	Symptoms	Treatment
Brain tumour	Severe headaches, nausea, neck pain, fits, odd behaviour, personality change, progressive paralysis	Surgical excision of tumour, radiotherapy
Dementia	Memory loss, inability to concentrate, confusion, loss of interest, untidiness	No cure except where a specific cause is known. Vitamin therapy sometimes helps
Epilepsy	Convulsive fits or temporary loss of consciousness	Anticonvulsant drugs
Menière's disease	Ringing in ear, giddiness, nausea, vomiting	Antinauseant drugs
Meningitis	Fever, headaches, neck and back muscle spasms, intolerance of bright lights, convulsions, vomiting	Antiobiotic drugs
Multiple sclerosis	Weakness in one or more limbs, numbness, 'pins and needles', visual disturbances, walking difficulties. Symptoms vary, may improve for a time then reappear	No cure. Various drugs may bring a temporary recovery
Neuropathy	Muscle weakness, numbness, pain, 'pins and needles'	Underlying cause treated
Parkinson's disease	Tremors, uncoordinated movements, facial rigidity	Anti-Parkinsonian drugs
Poliomyelitis	Headaches, spinal pains, stiff neck, followed by fever, muscle weakness and paralysis	Prevention through vaccination during childhood
Sciatica	Back and leg pain along course of sciatic nerve	Spinal manipulation, pain-killing drugs
Shingles	Fever, pain, skin blistering along the course of affected nerve fibres	Ointments for skin blisters, analgesic drugs for pain and fever
Spastic paralysis	Spasms, partial paralysis, lack of co-ordination, uncontrolled movements	No cure; special education to make best use of unaffected areas of brain
Stroke	Effects depend on area of brain affected: partial paralysis, speech impairment, severe headaches, visual disturbance, deafness. Sometimes fatal	Anticoagulants to help prevent blood clotting. Surgery to remove clots or seal weak blood vessels
Trigeminal neuralgia	Severe pain in the side of face lasting for about a minute. Recurs every few hours, days or weeks	Injection of alcohol into nerve, drugs, surgery to allow more room for nerve
Vestibular neuronitis	Vertigo, vomiting, uncontrolled eye movements	Treatment with drugs

1. SKIN AND SKIN DISEASES

Exercise 1

Read the following paragraphs replacing the underlined words with expressions from the reading text which have the same meaning as they are used in the text.

Paragraph A

The skin is much more than a simple wrapping around our bodies. It is an active and versatile organ which is waterproof so that we do not dry up in the heat or melt in the rain, and it protects us from the damaging radiation of sunlight.

Paragraph B

All wounds heal by scar formation unless they are very superficial, such as a graze. Children heal faster than adults but they also produce a larger quantity scar tissue. However, scars in young people tend to resolve in time. Dark pigmented races heal with an excessive amount of scar tissue compared with light-skinned people as a general rule.

Exercise 2

Read the paragraphs about "Hair and Nails" in the reading text again and write down notes about it.

Exercise 3

Read the paragraph about "Structure of the Skin" again and answer the following questions.

A. What does "Which" in "the lowest of which are called ... ." refer to in the text ?

B. What does "It" in "It takes three to four weeks for a cell in ....." refer to in the text ?

c. What does "Which" in "a material called Karatin which is finally shed as tiny ....." refer to in the text ?

D. Does "This outer protective layer" in "This outer protective layer is firmly attached to an underlying layer called ....." refer to

(1) dermis (2) epidermis (3) subcutaneous fat ?

Exercise 4

Read the paragraph about "Glands & Nerves" and try to draw an illustration to show where abouts they are located in the skin.

Exercise 5

Complete the following list with reference to the paragraph about "Skin Colour" in the reading text.

A. The factors behind skin colour are:

1. 2. 3.

Exercise 6

Tick the most appropriate answer A, B, C, or D after reading the text carefully again.

1. Some people get curly hair because ...

A. the norm daily hair loss is between 20 and 100 hairs

B. hair grows in cycles

C. hair is formed by cells in the hair follicles

D. that is determined by genetic factors

2. The dermis is formed of .....

   A. several layers of pigmented cells

   B. tiny finger like bulges

   C. protein fibres and elastic fibres

   D. hair follicles, blood vessels and nerves

Exercise 7

State if the following statements are true or false.

Correct the false statements according to the text.

A. Hairs and ducts are called Collagen

B. The skin keeps the body's temperature and moisture content stable at all times.

C. Adults wounds heal quicker than childrens

D. The Sebaceous glands open into hair follicles

E. Nerve endings are particularly numerous at the finger-tips.

exercise 8

According to the text there are certain differences between each of the following pairs mentioned in the text. Try to write down those differences.

A. "epidermis" and "dermis"

B. "sebaceous glands" and "apocrine glands"

C. "downy hair" and "thick pigmented hair"

D. "dark skin" and "light skin"

E. "wound healing in children" and "wound healing in adults"

Exercise 9

Read the following words aloud and write down their meanings in Arabic as they are used in the text.

Collagen	Keratin
Sweat	Cuticle
Sebaceous	Scalp
apocrine	Cranium
follicle	granule
secrete	melanocyte
sebum	subcutaneous

2. BONES

Exercise 1

Fill in the following text from the words supplied.

Each of the _____ of the skeleton is _____ to do a particular job. The _____ or cranium protects the brain, _____ also the eyes and _____.

(1. Skull 2. ears 3. and 4. parts 5. designed).

The lower jaw and _____ are attached to it, _____ us to eat. There _____ holes for the eyes, _____ nose and mouth and _____ one in the base _____ the skull where it joins _____ spinal column; the spinal _____ passes through this, connecting the _____ to every other part of the body.

(1. Cord 2. ears 3. of 4. the 5. enabling 6. are 7. teeth 8. brain 9. also).

Exercise 2

Read the paragraph about "What bones are made of" and write notes about it.

Exercise 3

Read the paragraph about "self-maintenance" in the reading text and try to answer the following questions;

A. What would "other parts of the body" refer to in the text ?

B. "The most obvious example of this ..." - Examples of what?

C. "People often find it hard...." - Find what hard ?

D. "how this can happen ...." - What can happen ?

E. "The key to it ....." - The key to what ?

Exercise 4

Read the paragraph about "Chemical problems" and try to translate it into Arabic.

Exercise 5

Write True or False after these statements. If false write the statement you believe to be correct according to the information in the text.

A. Bones can become infected by bacteria, but cannot be cured.

B. A patient whose bone cancer has spread must directly retire to bed.

C. A broken bone will take a year or two to be cured.

D. Congenital bone disease can easily be cured.

E. Because bones are hollow, they are light but strong.

F. Bones start forming in the human body during the first month of pregnancy.

G. Blood cells and calcium are manufactured inside bone cavities.

Exercise 6

Read the following [1] and try to select the most appropriate title for it from the ones beneath.

The skeleton of a child is made not only of bone, but also of cartilage which is much more flexible. Gradually this hardens into bone - a process, known as ossification, which continues well into adulthood. It is not until the age of about 20 that full skeletal maturity is reached.

The Titles are:

A. How the skeleton develops

B. Bone hardening in children

C. Cartilage formation

D. Bone formation in adulthood

Exercise 7

Read the text again and try to complete the following;

A. Dwarfism is caused either from .....

B. Rickets is usually caused by .....

C. Polio is actually an infection of .....

D. The bones of the face are hollowed out into air-filled cavities in order to .....

E. Osteoporosis means .....

F. Hyperparathyrodism is a problem caused by .....

Exercise 8

Read the following words aloud and give their meaning in Arabic.

mobile	hinge	osteoporosis
pliable	shin bone	parathyroid
marrow	scaffolding	congenital
spongy	tuberculous	hereditary
humerus	exostosis	osteomalacia
shoulder blade	osteotomy	osteomyelitis
		polio(poliomyelitis)

3. CHEST (Thorax)

Exercise 1

Read the reading text carefully and try to tick (✓) the most âppropriate answer A, B, C, or D.

1. The basic function of the heart and the lungs is to.....
   A. cause coughing and wheezing
   B. produce phlegm or sputum from the chest
   C. transfer oxygen from the air
   D. expand and contract to suck air

2. Pleurisy is .....
   A. an inflamation of the membrane lining the outside of the lungs and the inside of the chest.
   B. breathlessness and sweating
   C. an inflamation of the oesophagus
   D. the body's defence mechanisms

Exercise 2

Complete the following lists with reference to the texts.

A. The chest encloses two important organs in the body. They are;

1. 2.

B. The three main groups of symptoms arising from problems in the chest are;

1. 2. 3.

C. Medical advice is urgently needed if the pain in the chest, shoulder or arms is accompanied by;

1. 2. 3.

Exercise 3

Read the following paragraph, and say what do the underlined expressions refer to.

The chest is a bony cage that contains two of the most important organs in the body: the heart and the lungs. The basic function of these is to transfer oxygen from the air to the tissues where it is essential for the continuation of life.

Exercise 4

Complete the following with reference to the text.

A. The muscular sheets which are located between the ribs are called .....

B. The right-sided pumping chambers through which the heart receives blood from the body are known as .....

C. The oesophagus is also called the .....

D. The windpipe through which air passes to the lungs is also called .....

E. The situation in which the pumping of the blood has become a little imperfect and the heart gives rise to breathlessness is known as .....

Exercise 5

Fill the blanks in the following text (2) from the words supplied.

The lungs have an essential purpose - it is here that a vital exchange of _____ takes place, when life maintaining _____ is absorbed into the bloodstream from the _____ we breathe and waste _____ is removed from the body.

(1. air 2. carbon dioxide 3. gases 4. oxygen)

The lungs themselves form little _____ than a dense latticework of tubes _____ containing blood mingling with another system of tubes containing air; the _____ structure is suspended on a framework of elastic strands _____ fibres.

(1. and 2. more 3. whole 4. those)

The entrance to the bronchus is _____ by a flap valve, the epiglottis. When we _____, this shuts, preventing food from entering the lungs. Should this mechanism _____ and food get into the trachea, violent coughing _____.

(1. guarded 2. results 3. fail 4. swallow)

Exercise 6

Read the following text [3] and try to draw an illustration which demonstrates an approximation of the process reflected in it.

When the chest expands the lungs are pulled out and air is taken into the alveoli - millions of tiny air sacs in the lungs, each surrounded by fine capillaries (blood vessels) where the exchange of oxygen and carbon dioxide takes place.

In the alveoli, the exchange of oxygen and carbon dioxide takes place in less than one-tenth of a second. Oxygen is taken up by haemaglobin in the blood and the red cells discharge their load of carbon dioxide back into the alveoli, to be exhaled by the lungs.

Exercise 7

Read the paragraph about "Chest problems" in the reading text and try to write notes about it.

Exercise 8

Read the text again, and state if the following statements are True or False. Try to correct the false ones according to the information in the text.

A. The inside of the chest is lined with pleura

B. The heart receives blood from the left atrium and ventricle

C. The diaphram separates the heart from the right lung

D. A cough is 'productive' when it does not produce phlegm from the chest

E. Coughs which do not produce sputum are the result of inflamation of the upper airways, rather than a sign of lung disease.

Exercise 9

Read the following words aloud and give their meaning in Arabic.

trachea	aorta
tracheitis	oesphagus
tracheobronchitis	gullet
pleura	sputum
pleurisy	asthma
air sacs	asthmatic
atrium	pneumonia
ventricle	tracheotomy
	tracheostomy

4. NOSE

Exercise 1

Tick the most appropriate answer A, B, C, or D after reading the text carefully.

A. From reading the text we understand that .....

1. a broken nose requires immediate medical attention
2. resetting a broken nose leads to catarrh
3. resetting the break requires at least one month in hospital

B. According to the text, the air is moistened and warmed in the .....

1. nasal cartilages
2. mucous membrane in the nasal conchae
3. nasal septum
4. throat

Exercise 2

Complete the following lists according to the text.

A. Before entering the lungs the air in the nose is....

1. 2. 3.

B. The external nose consists of .....

1. 2.

C. There are two other passages which ..... lead off the meatuses. They are.....

1. 2.

D. The sinuses are located behind the

1. 2.

E. The symptoms of sinusitis are .....

1. 2. 3. 4. 5.

Exercise 3

Read the paragraph about "Polyps" and write down notes about it.

Exercise 4

Say if the following statements are True or False.
Try to correct the false ones.

A. Severe cases of sinusitis may require antibiotics or an operation to wash out the sinus.

B. Polyps in the nose are always cancerous

C. An adenoidal child may be liable to develop bronchitis

D. The mucus and cilia trap dust particles and prevent them from entering the lungs.

Exercise 5

Fill the blanks in the following text[4] from the words beneath.

The nose and sinuses are _____with special cells which produce _____ to combat an initial infection, for _____from a cold or influenza virus.

(1. example 2. lined 3. mucus)

When the virus enters the body _____mucus production increases _____ makes the lining of the nose and _____swell and block up the _____channels between them.

(1. sinuses 2. this 3. communicating 4. which)

The mucus can no_____ escape, pressure builds up and the _____in the sinuses is trapped. _____which normally live in the nose and sinuses now _____, and the sinuses become filled with _____or green pus which _____pressure creates the symptoms of sinusitis.

(1. infection 2, multiply 3. Bacteria
4. longer 5. being 6. yellow)

Exercise 6

Read the following words aloud and give their meaning in Arabic.

pliability	earache
fossae	proprietary
olfactory	douche
ridges	displaced
nasal conchae	malformation
meatus	catarrh
membrane	sinusitis
cilia	meningitis
tear ducts	

5. NERVOUS SYSTEM

Exercise 1

Read the text again and try to tick (√) the most appropriate answer A, B, C or D.

1. It seems from reading the text that the nervous system ...
   A. is a very simple network
   B. has nothing to do with sight and hearing
   C. consists only of the brain and spinal cord
   D. is the body's most important network of communication and control.

2. The text implies that .....
   A. neurones are delicate cells which can easily be replaced
   B. damaged neurones cannot be replaced
   C. neurones cannot be destroyed by injury or infections.
   D. Chemical disturbances or lack of oxygen cannot be a source of damage to neurones.

3. From reading the text one understands that most of the conscious activities of the brain take place in the .....
   A. cerebral cortex
   B. axon
   C. cerebellum
   D. spinal cord

Exercise 2

Read the following text [6] carefully and say what do the underlined expressions refer to.

Nerve cells are the tiny bodies which either transmit or receive message or sensations. The fibres, known in medical science as axons, are the 'wires' along which the impulses, or stimuli, travel to and from the control centres of the brain and spinal cord.

Axons are not actually connected with nerve cells. There is a gap between the ending of an axon and the cell itself called a synapse, across which the 'message' is carried by means of a chemical. And this gap, with its chemical bridge, is what enables doctors to control the system. For, as will be seen, the action of these chemical transmitters can be imited with similar, man made chemicals.

Exercise 3

Fill the blanks in the following text [7] with the words supplied.

_____, the automatic nerve system may cease to work either _____ or in part. A disease of the automatic nerves may occur on its own, and it is not simple to treat _____, the most common cause of serious problems is diabetes (the production of _____high sugar levels in the body) and this condition can normally be _____controlled by modern drug therapy.

(1. dangerously 2. wholly 3. occasionally
4. effectively 5. however)

Exercise 4

Complete the following lists with reference to the text.

A. The brain has three main parts. These are .....

1. 2. 3.

B. The job of the interneurones of the brain is to ....

1. 2. 3.

C. Some parts of the cerebral cortex is involved in the perception of the sensations such as ....

1. 2. 3. 4.

D. The brain stream is responsible for a variety of roles such as controlling ....

1. 2. 3. 4.

5. 6.

E. The hypothalamus which is one of the smallest parts of the brainstream controls.....

1. 2. 3. 4.

F. Neuroglia means "nerve glue" and their job is ....

1. 2. 3. 4.

Exercise 5

Read the following text [8] and write notes about it, then arrange these notes to form a fifty-word summary of the text.

The brain is at the centre of the complex network of nerves that runs through the body, and together with the spinal cord it makes up what is known as the central nervous system.

The central nervous system controls the whole body by means of messages which are continually passing up and down its pathways.

All the information we receive about our surroundings comes from our five senses. The nerves carrying this sensory information up to the brain are known as sensory nerves. Once the brain makes a decision, it sends its instructions for action down other nerve cells called motor nerves.

Exercise 6

Read the following words aloud and give their meaning in Arabic.

neurones	Cranial nerve	membrane
neuritis	synapses	meninges
peripheral	cerebrum	cerebrospinal
skeletal	cerebellum	nausea
spinal cord	cerebral	dementia
somatic nervous system	hypothalamus	ganglion
automatic nervous system	dendrites	lumbar nerves
pancreas	axon	vestigia
sensory nerve fibres	myelin	nutrients

Allergies

Q I have been suffering from a food allergy for years and sometimes it really gets on top of me. What I want to know is can there be a lasting cure?

A There are several ways of relieving the symptoms of allergies, but they are not cures. Whatever treatment you receive, it is not going to change your basic sensitivity to the particular food in question.

Q My daughter's best friend has just developed an allergy to penicillin, and has terrified my daughter by claiming that she will die at the onset of the first disease she catches, as she won't be able to take penicillin to fight the infection. Surely there must be some alternative drugs to pencillin?

A There is really no need to worry. Although a penicillin allergy does reduce the number of antibiotics which a doctor might consider prescribing, there is still a range of antibiotics available for those people with this type of allergy.

Q My son of four is allergic to cats and touching them brings him out in a nasty rash. Will he grow out of this problem or will it remain with him for life?

A Possibly. Children who suffer from either allergic rashes or eczema often do grow out of those problems though they may suffer from other forms of allergy (asthma for example) when they are older because they have a basic tendency to be allergic.

Q I suffer terribly from hay fever and, as I am now pregnant, I am anxious to know whether my child could possibly inherit this condition from me?

A Unfortunately, this could happen, although it is by no means a certainty. Research shows that children of allergic parents are more likely to suffer from an allergy than other children. But there are still not enough facts available for us to fully understand why this should be so.

Allergy-sufferers sometimes have to bear considerable discomfort and inconvenience, but although there are at present no cures for allergies, medical research is making encouraging progress in discovering the many causes and alleviating the symptoms

An allergy is a sensitivity to a substance which does not normally cause people any discomfort or harm. Hay fever, which is caused by a sensitivity to pollen, is a well-known example. Asthma, eczema, rashes and a variety of other complaints can be caused partly or entirely by an allergy. In fact, allergies can affect almost any part of the body and be caused by a vast range of natural and artificial substances.

They are seldom life-threatening, though they can be dangerous, and are often very uncomfortable for the sufferer. They are also a great puzzle to medical science, because although many allergic conditions can be relieved by medical treatment, we still have very little idea of their basic cause.

Allergies are a reaction to allergens, a name given to those substances (such as

Allergies are a common complaint. Distressing though the symptoms are, quite a lot can be done to improve the situation. Running eyes and sneezing are typical of hay fever.

Appendix 7

Reading texts used in group work activites

pollen) that spark off symptoms of an allergy in someone who is sensitive to it. Among the commonest allergens are foods (notably eggs, milk and fish), pollens, spores, insect bites (especially bee and wasp stings), animal fluff (such as cat's hair) and chemicals. One type of allergy is caused by contact with metals, which explains why some people get a nasty rash from wearing certain pieces of jewellery.

A common allergen in the home is the dust mite, a tiny creature, invisible to the naked eye, which lives in bedclothes, carpets and curtains. Some people are allergic to heat or cold so that their hands swell when plunged, for example, into hot or cold water.

Symptoms

As a general rule, the symptoms of an allergy tend to show up in those parts of the body which are exposed to the allergen. So an airborne allergen, like pollen, makes its severest impact in the eyes, nose and air passages. Food allergies reveal themselves through swollen lips, stomach upsets or diarrhoea.

An allergy to a metal would affect the skin, and an allergy to rubber would result in a rash on part of your body where, for example, the elastic of your underwear came into contact with your skin. But this is only a general rule, because if an allergen gets into the bloodstream it can cause reactions almost anywhere.

This is particularly true of food allergens, which are absorbed through the digestive tract into the blood. Because of this, food allergens can cause a wide range of reactions in sufferers, including eczema, nettlerash, asthma and even mental disorders.

Skin allergies: There are really three basic forms of allergic reaction affecting the skin. The most common, particularly among children, is eczema and this appears as a rash or as scaly skin, to be found mostly on the hands, face, neck and the creases of the forearms and behind the knees.

Contact dermatitis, often caused by metal jewellery or by chemicals in washing powders, is a blistery, itchy inflammation of skin which has come into direct contact with the allergen.

Then there is urticaria, best described by its popular name, nettlerash. This is a red, irritating swelling which often has a small white point in the middle which makes it look like a nettle sting.

Eye and ear allergies: Allergic reactions can also affect the eye, and these generally show up as irritation and redness in the white of the eye. Severe swellings can occur, but generally the symptoms are watering and soreness.

The ears, too, are sometimes the target of allergens; when this happens fluid will build up inside the ear and may temporarily affect your hearing.

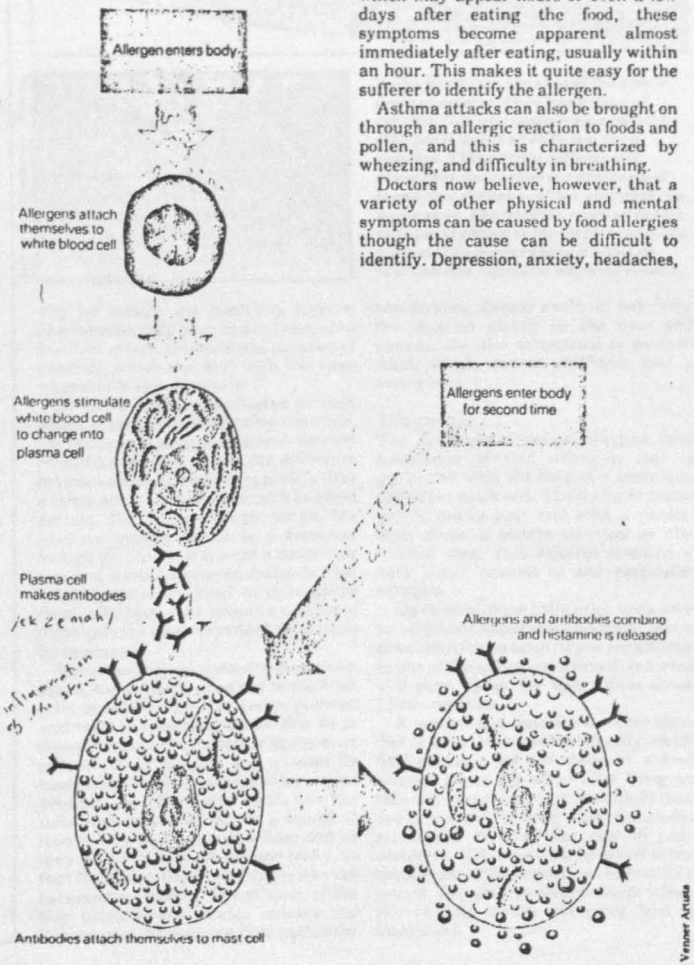
Hayfever can affect the eyes and ears, though its principal target is the nose, which becomes stuffy, runny or sneezy. Unlike a common cold, which should clear up after four or five days in an otherwise healthy person, hayfever will last for as long as you are exposed to the particular pollen to which you are allergic.

Food allergies: These have a wide variety of symptoms. The most obvious symptoms of an acute food allergy are a stomach upset followed quickly by nausea, vomiting or diarrhoea. People who are acutely sensitive to a food may also get a swollen tongue and lips. Sometimes the sufferer gets two kinds of symptoms; for instance, a child who is allergic to cow's milk may get diarrhoea and a skin rash. Apart from skin rashes, which may appear hours or even a few days after eating the food, these symptoms become apparent almost immediately after eating, usually within an hour. This makes it quite easy for the sufferer to identify the allergen.

Asthma attacks can also be brought on through an allergic reaction to foods and pollen, and this is characterized by wheezing, and difficulty in breathing.

Doctors now believe, however, that a variety of other physical and mental symptoms can be caused by food allergies though the cause can be difficult to identify. Depression, anxiety, headaches,

How allergy-producing histamine is released



Vanoni Arruda

Common allergies

Allergy	Allergen	Symptoms	Treatment	Prevention
Asthma	Dust mites Animal hair Pollen Some foods and food additives	Difficulty in breathing; wheezing	Prick test for diagnosis. Bronchodilator if breathing problem severe. Course of injections	Keep house dust-free Avoid pollen; keep clear of allergic foods
Contact dermatitis	Contact with allergen, e.g. jewellery, chemicals in washing powder	Itchy, blistery inflammation	Steroid creams given on doctor's prescription	Avoid contact with allergen
Eczema	Some foods, especially cow's milk, flour, eggs; possibly some seafoods	Rash on hands face, neck, arms and legs; looks like scaly skin	Antihistamine tablets and creams given for skin condition	Take diet precautions to avoid allergen
Food allergy	Could be caused by almost any food–more commonly milk, flour, eggs; also strawberries, shellfish, nuts; some food additives	Upset stomach and general nausea; acute reaction produces swollen tongue and lips, as well as diarrhoea. If food is absorbed into bloodstream, it can produce skin rashes like eczema	Prick test. Elimination test. Provocation test for diagnosis of the allergen	Keep to diet; avoid allergenic foods
Hay fever	Pollen; may react to just one pollen or to several different types	Sore, itchy eyes, runny or stuffy nose, prolonged sneezing	Prick test to confirm allergy. Course of injections and antihistamine tablets to relieve symptoms	Course of injections before season begins Listen to pollen count on weather report Avoid open air Wear dark glasses
Migraine	Usually caused by cheese, red wine, yeast extract, but not only caused by an allergy	Blinding headache	Elimination diet test if complaint due to food allergy	Avoid allergen foods
Nettlerash	Foods Handling certain plants Hot and cold water	Red, irritating swelling with with small white point in centre	Skin condition treated with with antihistamine cream, if necessary	Avoid the allergens

schizophrenia, hyperactivity in children and even convulsions have been attributed to food allergies. There have also been cases of bedwetting and cystitis which have been blamed on food allergies.

Migraine can also be caused by certain foods. Like yoghurt, chocolate, cheese, meat extracts, yeast extracts and some kinds of red wine which contain a substance called tyramine. Most people's bodies can deal with tyramine, which is not an allergen or poison in itself, but some migraine sufferers appear to lack a vital enzyme which breaks tyramine down. So when they eat these foods, tyramine builds up in their blood and sets off a chain of chemical events in the body which eventually results in the migraine headache.

Another complaint which is not strictly speaking an allergy but which is caused by food intolerance is coeliac disease. This is a disorder of the digestive system and its symptoms are wind and pain in the stomach after eating. Soft, smelly faeces (which are full of undigested fat) and weight loss, results from the sufferer's inability to absorb food properly. Coeliac disease is basically an intolerance of gluten, one of the proteins found in wheat. Sufferers therefore have to avoid foods which contain this substance.

The most severe–though fortunately, quite rare'–symptom caused by allergy is anaphylaxis. In this instance, the patient's air passages swell and close and the blood pressure falls abruptly. This is an acute and life-threatening condition. though it can be reversed very quickly by an injection of adrenalin.

Causes

The basic difference between people who suffer from allergies and those who do not is still not known. Allergies do tend to run in families, and this may be due to an inherited characteristic in the cells which make up the immune system, which is the body's defence system against disease. But this is theory rather than proven fact.

However, it is known that most allergies are the result of an error in the immune system. The body's defence forces react to the allergen as if it were a dangerous infectious organism.

White blood cells called lymphocytes are one of the most important elements of the immune system. These cells are constantly on the look-out for foreign substances such as bacteria, viruses and proteins which are different from the body's own proteins and which may present a threat. When these white blood cells come across a potentially dangerous foreign protein they form a substance called antibody, which combines with the foreign protein and neutralizes it.

A slightly different antibody is created to deal with each foreign protein, but once it has been formed the body is able to produce it again to deal with any future 'attack' by that protein. This explains

Q I am worried that I may become addicted to the drugs I am using to treat an allergy. Could this happen?

A No. Nor do these drugs lose their effect if you have to keep taking them. However, they may have side-effects (antihistamines, for instance, can make you drowsy) and, like all drugs, should be treated with respect and caution.

Q Whenever my father is near my mother her eyes run and she can't stop sneezing. Can you be allergic to people, places or animals?

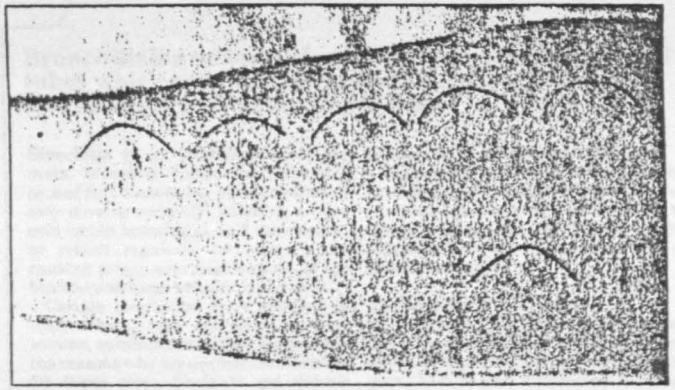
A No, you can't be allergic to a person, but there have been cases of wives who were allergic to their husbands' sperm. Some people who are acutely allergic to fish can get swollen lips from kissing someone who has just been eating fish. Allergy to animals is common, though it is the fine pieces of hair or fluff from the animal or bird which are to blame. You can only be allergic to a place if your are allergic to something found in that place—e.g. pollen.

Q I sit next to a girl in the office who has eczema and sometimes the rash is really bad. I can't help wondering if it is infectious.

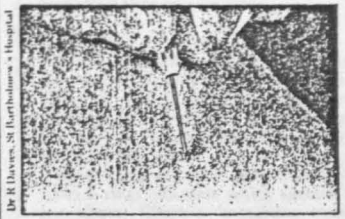
A The simple answer is that allergies are not infectious. You cannot catch an allergy from another person, nor can you pick up a symptom—in this case eczema—of that allergy.

Q My husband and I have both suffered badly over the years from food allergies. Our two children have shown no signs of developing allergies, but we wonder whether they can be prevented.

A Some specialists say there is little that can be done, while others believe that some allergies can be prevented. The risk of becoming allergic to milk, for instance, may be reduced by breast-feeding rather than weaning on to cow's milk at an early age. Some specialists believe that you can reduce the risk of other food allergies by eating a more varied diet.



Ken Moreman



Dr R Davies, St Bartholomew's Hospital

In the prick test, the skin of the arm is pricked several times and a drop of solution (see left) containing a possible allergen is dropped on to test for a reaction. This allergy sufferer (see above) has undergone the process and found that the cause of her allergy is the house mite. The positive reaction to this allergen is shown in the large weal at the bottom. The marks above it show no reaction and represent negative results.

why we usually get infectious diseases like measles only once in our lives: after the first attack the body has supplies of antibody which can deal with the virus whenever it appears again.

By some highly complicated process, which is not yet understood by scientists, the immune system of a normal, healthy person knows how to tell the difference between a dangerous foreign protein (like a virus) and a harmless one, such as a food protein. But in an allergic person the immune system reacts to a harmless foreign protein as if it were a dangerous one, and starts forming an antibody. This antibody attaches itself to cells called mast cells. Mast cells contain a number of chemicals the most important of which is histamine.

When the body is exposed to the protein again, the antibody attached to the mast cells combines with the foreign proteins and tries to neutralize them. But in so doing it upsets the structure of the mast cell, which falls apart and releases its load of histamine. The surge of histamine produces an effect very much like the inflammation which follows a wound: it makes tiny blood vessels dilate, and as they dilate their walls become leaky, so that fluid from the blood escapes into the surrounding tissues. The dilation of the tiny blood vessels causes redness and itching, and the escaping fluid makes the surrounding tissues swell. In hay fever the mucous glands in the nose and sinuses are also stimulated to produce fluid, which causes stuffiness and a runny nose.

Diagnosis

The diagnosis of pollen allergies (and sometimes of food allergies, too) is performed with the help of a technique called the prick test. The doctor or nurse gently pricks your arm with a needle, then drops a watery solution on the pricked spot. This solution contains a very small amount of one particular allergen.

Up to 40 of these little prick tests may be performed at one session without much discomfort for an adult. If you are allergic to one of the allergens, a round, red weal will show up on the spot within about fifteen minutes.

A special diet called the elimination diet is sometimes used to identify which food or foods are the cause of a food allergy. If you get better after being on this diet for several days, it is likely that one or more of the foods which have been eliminated will be the cause of your problems. You may then be asked to try these foods again to see if your symptoms return. This process of elimination is how the identity of the allergenic food is discovered.

As elimination diets can take a long time, some doctors now use provocation tests, in which a weak solution of various foods is either injected under your skin or dropped under your tongue to see if it will provoke symptoms. As well as testing for food allergies, the doctor may also test your reaction to chemicals which are commonly found in the home or used as flavouring, colouring or preservatives in food.

Treatment

If you have the acute kind of allergy which makes you sick whenever you eat say, strawberries or shellfish, you hardly need a doctor to diagnose your complaint. The cause and the effect are obvious, and the simplest way to deal with the allergy is to avoid the allergen.

Having discovered which pollen you are allergic to, the doctor may then prescribe a course of injections. These injections also contain small amounts of the allergen, and their aim is to desensitize you by encouraging your immune system to produce a harmless 'blocking antibody'. This kind of antibody intercepts the allergen before it sets off symptoms by alighting on the mast cell antibodies.

Courses of injections can be given during the pollen season, but this method is less reliable than giving the injections before the pollen season begins. These injections do not work for everybody, but they can give about 70 per cent of sufferers protection which lasts right through the summer.

Several kinds of drug are prescribed to deal with the symptoms of allergy. Antihistamines combat the inflammatory effects of histamine when it is released. They come as tablets, liquid medicine, nose drops or eye drops, and there are injectable antihistamines which can be used to deal with serious attacks. These drugs, however, do tend to make you feel drowsy.

Another drug, disodium cromoglycate (better known by its brand name Intal), works by preventing the mast cells from exploding. It therefore has to be taken before the symptoms occur; it can do nothing about histamine once it has been released. This drug can be given in the form of an inhalant (for asthma), eye drops (for allergic symptoms in the eye), tablets (for stomach allergies) or via another device called the insufflator, which lets you sniff it up your nose.

Dr Lewis

A soothing cream can often relieve the symptoms of a skin allergy such as eczema. This should always be prescribed by a doctor.

Corticosteroid drugs like cortisone, which are very powerful and anti-inflammatory, are sometimes prescribed for skin allergies or, via an inhaler, to combat asthma. Asthma can also be controlled by a group of drugs known as bronchodilators, so called because they dilate (open up) the bronchi (the air passages around the lungs).

It should be stressed that these drugs are not cures; they simply relieve the symptoms. Nor are they without problems. Corticosteroids have to be used sparingly and not for prolonged periods, and it is even possible to develop an allergy to antihistamines! It is important to let your doctor know if you are experiencing unpleasant side-effects from a medicine. There are many brands of anti-allergic drugs, and the doctor should be able to prescribe one which suits you better.

Food allergies can sometimes be relieved by drugs, but some doctors prefer to recommend diets which ensure that you eliminate all foods to which you have an allergic reaction.

Self-help

There is quite a lot that sufferers can do to help themselves. Obviously, if you suffer from a food or chemical allergy you should make every effort to avoid your allergens. This means that you should read the labels on food packets carefully to see whether the product contains even small amounts of the substance causing your particular allergy.

Hay fever sufferers should be careful about going out in the open air during the pollen season, especially in mid-afternoon when the pollen count is highest. Dark glasses can protect your eyes against pollen or spores, and it might be worth thinking about buying a small air conditioner for your home or car which can extract pollen from the air. Some cars now have filters in their ventilation systems which are designed to catch pollen before it enters the car.

If you are going on holiday in the late spring or early summer, bear in mind that there is usually much less pollen in the seaside air than in the middle of the countryside.

Dust mites are difficult to eliminate altogether from the home, but regular vacuum cleaning of carpets and curtains and washing of bedcovers will reduce their number. Artificial fibres in pillows and duvets are less likely to harbour dust mites than feathers.

Bronchitis

Q I have recently developed a very chesty cough. Could it be bronchitis?

A No. To have bronchitis you must actually bring up sputum, which is then either spat out or swallowed. Chronic bronchitis is defined as a cough productive of sputum on most days of the week, for three months of the year, for more than two years.

Q I always feel a little better after coughing in the morning. As I smoke, does that mean that I am in the early stages of bronchitis?

A Heavy smokers will always tell you that they need a cigarette to 'cut the phlegm' in the morning. This is complete nonsense, and generally serves as an excuse to continue the smoking habit. Thus it is not in itself a sign of bronchitis, but smoking does contribute to the disease.

Q My uncle has difficulty in walking very far—even to the bottom of the garden. He blames this on his bronchitis. Is he right?

A Yes. Generally speaking, the worse the bronchitis, the less exercise the person can tolerate. Doctors tend to divide bronchitis into four stages: 1, a slight cough in the morning but no other trouble; 2, breathless on exertion; 3, so breathless that the patient is unable to leave the bounds of the house; 4, so breathless that the patient is unable to conduct a normal conversation.

Q Does bronchitis cause cancer?

A No. But the smoking which causes chronic bronchitis is a potent cause of cancer. If you smoke more than 20 cigarettes a day, you increase your chances of developing lung cancer 20 times, and your chances of getting chronic bronchitis 50 times.

Q If I give up smoking tomorrow, will my chronic bronchitis get better?

A The course of the disease is slowed and in some cases actually arrested by giving up smoking, but it is never reversed.

Bronchitis is a serious infection of the lungs and bronchial tubes which can become chronic. Breathing polluted air and smoking are mainly responsible.

Bronchitis is an inflammation of the main bronchial tubes—the bronchi—caused by a bacterial or viral infection. It may develop suddenly, following a head cold (acute bronchitis), or it may persist or return regularly for many years, causing progressive degeneration of the bronchi and lungs (chronic bronchitis).

Certain people are more susceptible than others; men are more so than women, outnumbering them ten to one—the reasons why are unclear. Smokers are 50 times more likely to get chronic bronchitis than non-smokers.

Causes

Generally, bronchitis occurs with greater frequency in winter, in damp, cold climates, and in heavily polluted environments. Chilling, overcrowding, fatigue and excessive smoking are contributory factors.

Most cases of acute bronchitis arise from a viral infection, which spreads to the chest. Chronic bronchitis causes irritation and coughing, which leads to the lining of the bronchi being damaged and narrowed by scarring. The lungs lose their elasticity, and the exchange of vital oxygen, which is breathed in, and waste carbon dioxide which is breathed out, is impaired. The bronchial tubes become permanently inflamed, and this results in an increased production of mucus from specialized cells in the walls of the bronchi, called goblet cells. The mucus coughed up is called sputum (phlegm).

Because it is difficult to look at the bronchi directly, doctors rely on the chief symptom, sputum production, in order to make a diagnosis. The colour of the sputum shows how serious the form of chronic bronchitis is.

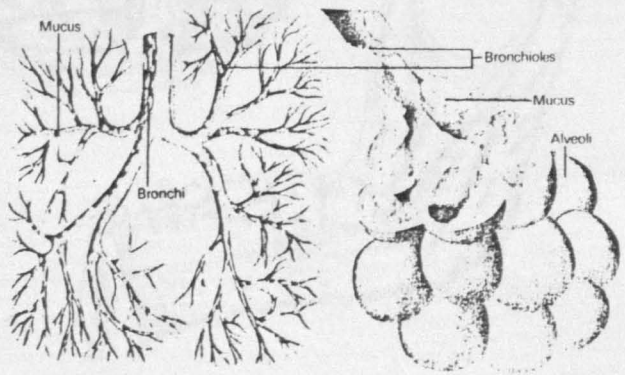
Symptoms

In acute bronchitis, the initial symptoms are a head cold, running nose, fever and chills, aching muscles and possibly back pain. This is soon followed by the most obvious feature: a persistent cough. At first it is dry and racking, but later it becomes phlegmy. It is worse at night, and when the person breathes in smoke and fumes.

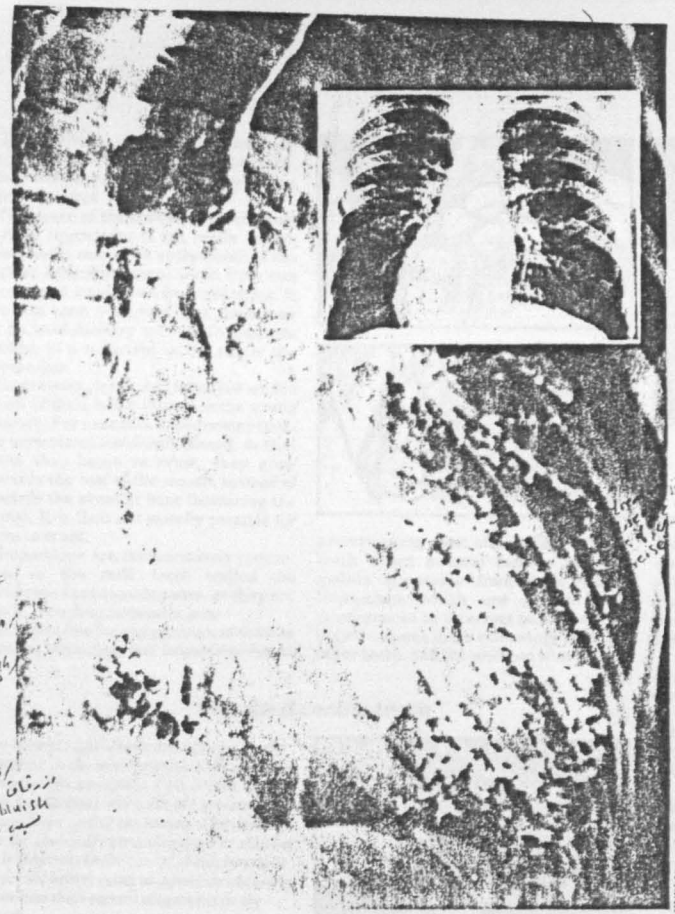
The main characteristic of chronic bronchitis is, again, a cough, with sputum, often occurring in paroxysms. Other symptoms depend on how much, or how little, emphysema is present. This disorder causes the lungs to become overstretched, making breathing out more difficult.

The chronic bronchitic with no emphysema tends to be overweight and have a bluish tinge to his lips due to cyanosis (a bluish colour in the blood caused by lack of oxygen). Shortness of breath only occurs during exercise. The bronchitic with a great deal of emphysema, who has lost a lot of his or her oxygen-exchanging ability, due to the condition, is short of breath at all times. Bronchitics with emphysema tend to be underweight and, as the disease worsens, develop a barrel chest. The chronic bronchitic also wheezes because of the obstruction.

How bronchitic mucus affects the respiratory system



Venner Artists



Note the grossly swollen alveoli in this lung of a chronic bronchitic. A normal, clear lung is inset (right).

CNRI Vision International

Treatment

The best treatment for acute bronchitis is bed rest in a warm room. Aspirin will reduce the fever, and cough medicines will relieve the cough. Antibiotics may be needed if the cause is bacterial.

Treatment of chronic bronchitis is more difficult. The patient's lungs are already damaged, and the obstruction of the airways is not easily reversible.

Bronchial dilator drugs may be given to relieve any such obstruction, while physiotherapy will help the patient get rid of any sputum. Postural drainage can also be tried: the patient lies on a bed, a large cushion raising the groin, and smaller pillows supporting the chest. Tapping the chest in this position causes the patient to cough up sputum. Yoga, and breathing exercises generally, may assist shortness of breath. In severe cases, urgent hospital treatment may be required. Oxygen might have to be given through the course of the illness.

However, the best form of relief is to try to remove as many bronchial irritants as possible. The patient should stop smoking immediately: although chronic bronchitis cannot be reversed, it can be arrested. Chronic bronchitics should try to avoid environments where there are irritants as these can bring on attacks.

Outlook

With acute bronchitis, the fever may last as long as five days, and the coughing for weeks afterwards, but if the patient receives treatment and takes sensible precautions the illness will simply run its course and outlook is good.

Chronic bronchitis is far more serious. It is a degenerative disease, particularly when combined with emphysema, and can result in death due to respiratory failure when there is insufficient oxygen in the blood.

One of the most important complications due to this problem is carbon dioxide narcosis (stupor), together with increasing breathlessness, ankle swelling, and even heart failure.

Treatment must therefore commence as soon as possible, beginning with giving up smoking. Frequent acute attacks only worsen chronic bronchitis, and make it harder to deal with. For these reasons, preventive steps must also be taken to stem the progress of chronic bronchitis.

Types of bronchitis

	Symptoms	Treatment
Acute bronchitis		
Bacteria or virus infection, often following a cold Smoking	Head cold, running nose, fever and chills, aching muscles Persistent cough: initially dry and racking, later loose and producing sputum	Bed rest in warm atmosphere; aspirin; cough medicine; fluids; antibiotics Stop smoking
Chronic bronchitis		
Persistent irritation of the bronchial tubes; bacterial infection; irritation to damaged bronchial tubes and lungs. Smoking; wet, cold climates; pollution, low resistance and fatigue	Sputum, cough, wheezing Bronchitis with emphysema: shortness of breath, weight loss, barrel chest Bronchitis without emphysema: shortness of breath, when exercising, weight gain; bluish tinge to lips	Stop smoking. Bronchial dilator drugs; physiotherapy of chest, postural drainage, yoga and breathing exercises; antibiotics. Severe cases may require hospitalization. Avoid bronchial irritants

Impacted teeth

Q Do impacted wisdom teeth cause the other teeth to become more crowded in front?

A Generally, wisdom teeth only become impacted if the mouth is already overcrowded. It has, however, been shown that impacted wisdom teeth do contribute to a small extent to the incisor crowding which affects many young adults.

Q My husband has an impacted upper canine tooth. His dentist says that this could be transplanted. Does this always work?

A Canine transplantation provides an 'instant' method of moving a misplaced canine tooth which has failed to erupt into its correct position. The tooth is taken out and then fixed into the jaw again. About 70 per cent of such transplanted teeth are still in place after ten years—the remaining 30 per cent having been removed or fallen out because of some complication.

Q I am a professional boxer and I am worried in case having an impacted tooth removed weakens my jaw.

A It is certainly possible that the jaw may be weakened for a few months after a lower wisdom tooth is removed, and this generally entails some removal of bone. After that time, however, the bone will have repaired itself and the jaw may actually be stronger than before, since an impacted wisdom tooth in position represents an interruption in the continuity of the jaw, so forming a natural 'weak spot'.

Q My son has an impacted wisdom tooth that never causes him any trouble. He is about to go to Africa on voluntary service. Should he have it removed before he goes?

A There is always the risk of complications occurring with an impacted wisdom tooth, and unless it is very deeply placed, your son would be advised to have it removed. This is a matter which he should discuss with his dentist, who may refer him to an oral surgeon.

Impacted teeth are those which have failed to grow into the mouth correctly. You may not be aware that a tooth is impacted, and therefore a potential cause of trouble, until your dentist discovers it. This is one reason why regular dental check-ups are so important.

Impacted teeth occur either because the path for their emergence is blocked, or because they have formed in the wrong position in the mouth.

Causes

The eruption (emergence) of teeth into the mouth is not fully understood, but it is probably the result of rapid multiplication of the cells which form the tooth root, the pressure of which thrusts the tooth through the overlying bone.

In cases of impaction, the problem is not usually one of failure within the developing tooth itself, but either of its position or of its relation to the other teeth nearby. Where there is crowding, that is, inadequate space in the mouth for all the teeth, the last teeth to erupt often have insufficient room, because the space available has all been taken by the teeth which have already emerged. Under these circumstances, the later erupting teeth may grow through, but out of line, or alternatively, they may be unable to emerge fully. When a tooth fails to erupt, either fully or partially, it is described as being impacted.

The cause of the crowding which leads to most impactions is not really understood, but it may arise as the result of the patient inheriting large teeth from one parent and small jaws from the other. It has also been suggested that there may be an evolutionary process in progress leading to a reduction in the size of the human jaw.

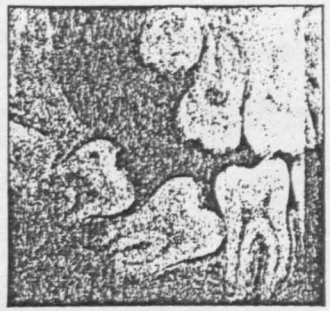
Sometimes, teeth are impacted as the result of their being formed in the wrong position. For example, upper canine teeth are sometimes too deeply placed, so that when they begin to erupt, they grow towards the roof of the mouth, instead of towards the alveolar bone (bordering the gums). It is then not usually possible for them to erupt.

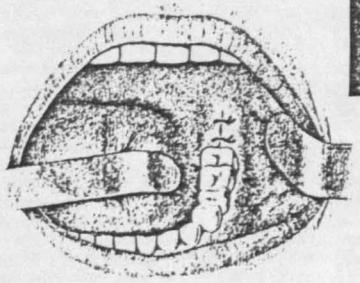
Impactions are comparatively uncommon in the milk teeth (called the deciduous dentition) because, as they are small, crowding is usually less.

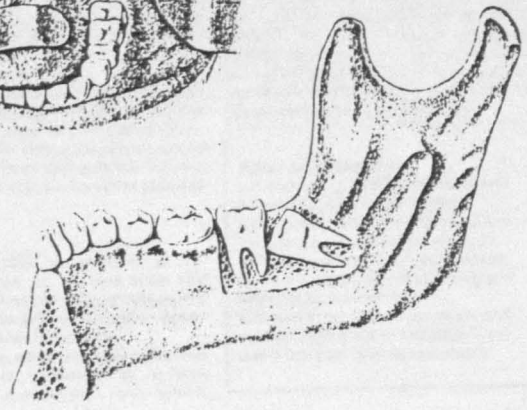
It is possible for any permanent tooth to become impacted, but impaction due to overcrowding most often affects wisdom teeth (third molars) canines and premolars (situated in front of the molars). Impactions which are due to tooth development in incorrect positions affect upper canines more commonly than any other teeth, and the problem often runs in families, showing that it is inherited (that is, genetically caused).

Impacted wisdom teeth

The X-ray picture (right) shows a wisdom tooth that has become impacted, behind an impacted molar. The tooth (below, right) is also impacted and has insufficient space to come through. The only course of action for the dentist is to remove the tooth. Either a general or a local anaesthetic is given, depending on how difficult the tooth is to remove. Afterwards the gum is stitched (below).



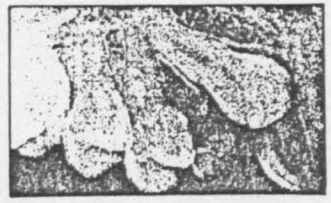


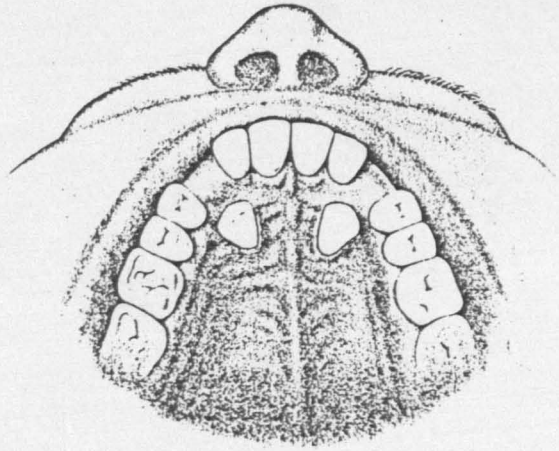


Mike Courtenay

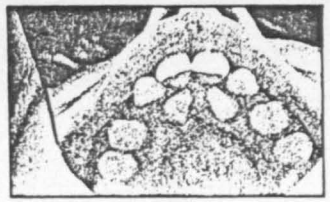
Impacted canine teeth

The X-ray (right) shows how canine teeth can grow in the wrong position, in spite of having sufficient space. This is seen in the drawing (below), the teeth are growing towards the roof of the mouth. The dentist has the choice of extracting them or shifting their position. In the case of child, he might prefer the latter, using an appliance to bring them into their correct alignment in the mouth.





Mike Courtenay



Zefa

Impacted canine teeth (top, left) can be corrected by a fixed appliance (bottom, left). Although this is cemented in place, the teeth can still be cleaned satisfactorily. The treatment takes about two years, but produces good results (above).

Symptoms

Many people have impacted teeth without being aware of it, since there are often no symptoms. The condition may only come to light as the result of a visit to your dentist. He or she may discover in the course of your dental examination that a certain tooth is missing, without ever having been extracted. If that tooth is impacted, it will be seen on an X-ray of that particular area of the jaw.

Some patients may experience pain as the result of impactions of teeth. In most cases, the pain occurs when an infection develops round an impacted tooth, which has partially emerged into the mouth. This problem most often affects lower wisdom teeth. The patient is likely to experience tenderness and pain around the tooth concerned, and also pain may be felt on biting. Sometimes a swelling may develop below the angle of the jaw, involving the side of the face, and the patient may be unable to open his or her mouth to the normal extent.

Usually, teeth which are completely enclosed within the jaw cause no pain, and problems only arise if the tooth is partially through the gum, allowing access for infection. A completely buried tooth is, by contrast, sealed off from sources of infection.

The only way in which your general health is likely to be affected by impactions is when an infection commences round an impacted tooth that has

partially emerged. If this pain is sufficiently intense, you may feel ill and develop a raised temperature.

Treatment

Impacted teeth which have become infected should be removed, so that recurrent bouts of infection are prevented.

Another reason for removal of impacted teeth is that it is generally inadvisable for an impacted tooth to be left in position indefinitely, as occasionally it may grow in such a way as to damage the roots of adjacent teeth that are normal. Another complication is a cyst (a type of swelling filled with fluid) which may develop round an impacted tooth. There are, however, some cases where impacted teeth are so deeply placed that their removal may endanger other teeth, and these are generally left alone for this reason. In these cases, your dentist will feel it is advisable for an X-ray to be taken occasionally, to check that there has been no change in the position of the impacted tooth.

Cosmetic correction

One other reason for the treatment of impacted teeth is to avoid having a gap due to the tooth being in the wrong position. This problem often occurs in relation to upper canines. When an upper canine becomes impacted, the milk tooth may last for many years, but will eventually be lost. In these cases, your dentist may consider it worthwhile to bring the impacted tooth into its correct position. This can be done by cementing a small hook on to the impacted tooth and pulling it into line by an orthodontic appliance. (Orthodontics is the correction of irregularities in the position of teeth). Alternatively, the buried tooth can be surgically taken out and transplanted into its correct position.

Removal

Teeth which are impacted are often more difficult to remove than normally erupted teeth. In general, the procedure takes the form of a minor surgical operation on the jaw. The gum is cut and peeled away from the underlying bone. A certain amount of bone is then removed, to provide a pathway through which the impacted tooth can be taken out. The gum is then stitched back into position and left to heal up again.

The removal of an impacted tooth can be carried out either under a general anaesthetic, which sends the patient to sleep, or under a local anaesthetic, whereby the appropriate section of the jaw is made numb by an injection.

The choice of anaesthetic is a matter for discussion between patient and dentist. Usually if the patient is very nervous, a general anaesthetic would be used, but in other cases, a local anaesthetic is preferable, as general anaesthetics carry more risks than local anaesthetics.

Modern dental techniques can help everyone to have healthier, more beautiful teeth.

In cases where infection is present round an impacted tooth, this must be eliminated prior to extraction, to avoid spreading the infection. This can usually be achieved by a combination of antibiotics, local application of antiseptics and the use of a warm salt mouthwash.

The removal of impacted teeth under a general anaesthetic is usually done in hospital because of more extensive facilities for recovery from the anaesthetic. The patient will usually stay in the hospital for two nights. When a general anaesthetic is used, all impacted teeth to be removed are taken out at the same operation, in order to avoid having to repeat the anaesthetic.

When impacted teeth are taken out using a local anaesthetic, the extraction can often take place in a dental surgery. Usually, only one side of the jaw is treated at a time and when that side has healed, any impacted teeth on the other side are then removed.

Outlook

It is unlikely that the problem of impacted teeth can be avoided since the main cause—overcrowding or unnatural position—are largely genetically determined and present from birth.

In some cases, when teeth are extracted for orthodontic purposes, to relieve crowding, this may provide space which can prevent wisdom teeth becoming impacted, although this will depend upon the degree of crowding.

It is possible for impacted teeth to be removed in childhood, when it is often easier to do. This is not, however, frequently done since it would subject the child to a surgical operation.

As with other aspects of dentistry; regular check-ups are invaluable in avoiding problems with impacted teeth. By this means, future problems can be anticipated, and treatment carried out at the most suitable stage. Also, in those cases where impacted teeth might be brought in line, regular check-ups provide the opportunity for treatment to be carried out at an age when it is most acceptable to the patient and before the impaction causes serious trouble.

After an extraction

- Avoid eating on the part concerned.
- Maintain good mouth hygiene.
- Use warm salt water mouthwashes—1 teaspoon of salt to glass of water.
- To stop any bleeding—take a clean white handkerchief, roll up tightly and bite on it for ten minutes.
- Return to the dentist for removal of stitches after three to five days—and also if there are any complications.

Painkillers

Q Is it true that taking low doses of aspirin is good for the heart and circulation?

A Yes, there is an increasing amount of evidence to suggest that aspirin may help to prevent heart attacks if taken in very low doses. However, the value of aspirin is not definitely established and since it can cause stomach trouble it should not be taken for this purpose at the moment. Doctors are hoping to solve this question as a result of the large studies which are being carried out. Half the doctors over 55 in this country are taking it as part of a trial!

Q Does acupuncture really work as a painkiller?

A It certainly does work, although we are not yet sure why. In China, dentists will drill and fill teeth on people anaesthetized by acupuncture – a good test of its effectiveness. It is possible that the physical effects are aided by a 'placebo' effect, that is, when the patient believes the treatment will work and so it does.

Q I'm pregnant – should I use painkillers for backache or headache?

A Because pregnant women ingest so many drugs during their pregnancy in the normal course of things – caffeine in tea and coffee, nicotine in cigarette smoke, alcohol – it is often very difficult to point a finger at a particular drug and blame it for a particular abnormality, especially when a problem can arise from a combination rather than an individual drug. While new drugs are now tested very carefully for effects on the foetus, we do not know for sure the effects of many over-the-counter painkillers. Any substance taken by a pregnant woman will pass to the foetus, especially during the first three months. After that, some drugs will be screened out by the placenta, but not all. As a general rule, then, drugs – even mild painkillers – should be avoided during the first three months of pregnancy. After that, try to take only medicines prescribed by your doctor.

Most of us take pain-killing drugs at some time or other. How do they work and should we use them every time the stress of modern living causes discomfort?

The medical term for a pain-relieving drug is an analgesic. Doctors usually divide pain-killing drugs into two categories – narcotic and non-narcotic. Narcotics, such as morphine and heroin, which are derived from opium, and their synthetic relations like pethedine and methadone, act principally on the brain and often produce drug dependence. Non-narcotic drugs, such as aspirin, are rarely addictive as such and act on the site of the pain. Narcotic drugs are usually used in highly controlled conditions such as in hospital, to give relief for pain in internal organs. The non-narcotic drugs are used to control pain felt in the joints, muscles, bones or skin.

Pain relieving drugs were once obtained from natural sources—morphine, for example, from the opium poppy. Purified opium preparations are still used, but drugs are now usually prepared synthetically.

The best known painkillers are aspirin, paracetemol, codeine and morphine. Non-narcotic drugs such as the first two are available over the counter and are commonly used to relieve headaches or pains like premenstrual stomach cramps. The painkillers we buy from chemists are all combinations of aspirin, paracetemol and codeine, sometimes with the addition of a stimulant such as caffeine. But they have different effects on our bodies and are far from simple in their operation.

Aspirin

Aspirin is probably the best known and most widely used drug (see page 104). Not only does it relieve pain, it also reduces fever and has an anti-inflammatory effect on joints. This is why doctors often prescribe aspirin for influenza – not necessarily to kill any pain the patient may be feeling – which is often more discomfort than pain—but to reduce the temperature and to help ease the aches in joints often experienced in such an illness. Aspirin is used for rheumatism, often over extended periods, for this anti-inflammatory property.

However, aspirin can be extremely dangerous to some people in certain circumstances. It is an irritant and can cause stomach pain, with nausea and vomiting. But far more important, if swallowed whole, an aspirin tablet will not just irritate the stomach lining but may even cause bleeding. For this reason, aspirin should never be taken on an empty stomach without a drink of water. Aspirin can be extremely dangerous to old people on poor diets, especially if they are low in iron, and to patients who are weak from an illness. You can even develop superficial ulcers in the stomach from aspirin use without realizing it, and this in turn can lead to blood loss and anaemia.

If you do take aspirin, always take the soluble form, dissolved in warm water and with plenty of liquids, and preferably not on an empty stomach. Aspirin in soluble form is not only more easily absorbed through the stomach lining into the bloodstream without causing irritation; it also is absorbed far more rapidly so producing the desired effects far more quickly. Some of the commercial preparations contain sodium bicarbonate and 'fizz' when dissolved in water. This is not just a commercial gimmick: sodium bicarbonate is an alkali and so helps to prevent irritation.

Some people may react badly to aspirin, and others may have a definite allergy. Since aspirin is present in many commercial drugs, either as aspirin or under chemical compound terms such as acetylsanide, it is important to read the list of ingredients on preparations you buy for mild illnesses, to check that you are not giving it by mistake to someone who is allergic to it, or to someone who suffers from indigestion.

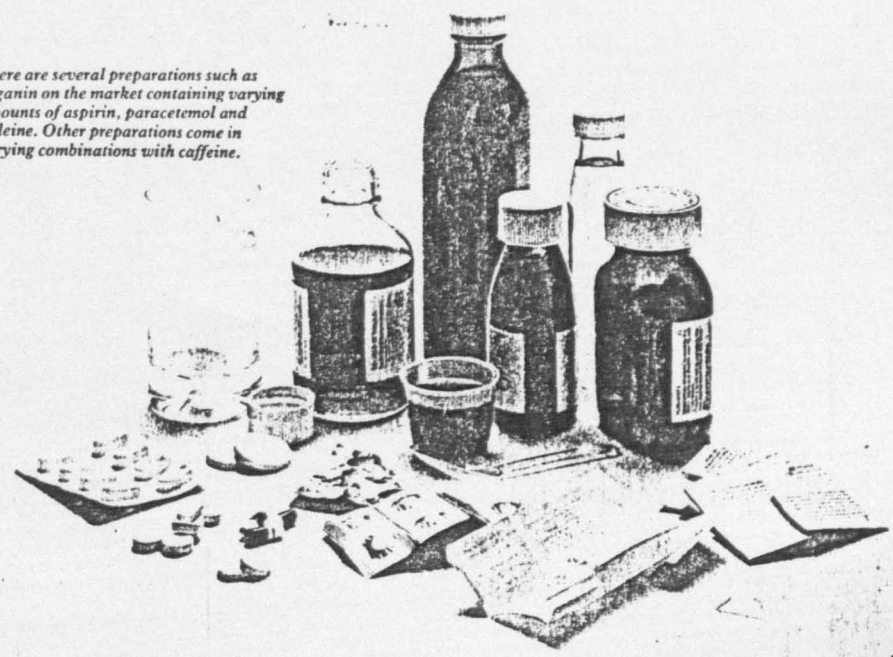
Other common analgesics

If, for any reason, a patient should not take aspirin, paracetemol is often a good alternative. Paracetemol is also a mild pain reliever and can reduce the temperature, although it has no effect on inflammation and this is of little use in rheumatism. It does not irritate the stomach lining and so can be used for abdominal pain. However, paracetamol can affect the function of the kidneys and the liver and so should not be taken in very high doses over long periods.

Codeine is an opium-derived drug, often used as part of anti-diarrhoea and cough suppressant medicines. As well as being a mild pain reliever, it slows down the action of the bowel and supresses the cough centre in the brain. Codeine is rarely used on its own but is often combined with other drugs, commonly

Common painkillers

	Uses	Dangers	Long term use	Contra indications
Aspirin	Mild painkiller brings down temperature and reduces inflammation. Good for headaches, discomfort from colds and influenza or simple pains like backache.	Irritates stomach lining; can cause ulcers and bleeding.	Not addictive but do not take regularly without doctor's advice.	Should not be taken by people with stomach problems. Do not take on an empty stomach or without water.
Paracetemol	Mild painkiller. Used similarly to aspirin; can also be used for stomach aches.	Can cause kidney damage if taken in high doses for a long time.	Use of large doses can cause kidney damage.	Should not be given to sufferers from kidney problems.
Distalgesic	Painkiller available on prescription; contains paracetemol and morphine-derived dextropropoxyphene. Stronger than the above.	Can cause kidney damage.	Can be addictive and cause kidney damage.	Should not be given to patients suffering from liver or kidney problems.
Veganin	Mild painkiller containing aspirin, paracetemol and codeine. Can be used for Influenza, rheumatism and period pains.	As with aspirin and paracetemol.	Contains codeine, so heavy and long-term use could be addictive – but the codeine contained is in very small amounts.	As aspirin and paracetemol.



There are several preparations such as veganin on the market containing varying amounts of aspirin, paracetemol and codeine. Other preparations come in varying combinations with caffeine.

Phil Babb

Q I occasionally get blinding headaches that make me feel ill. A couple of aspirin have no effect. Should I take a larger dose?

A A blinding 'headache' with nausea is quite a good description of migraine. It is often difficult to tell the difference but the classic symptoms of migraine are a headache on one side of the head accompanied by nausea and vomiting. There are often visual disturbances (flashing lights of 'rippling' effects) and slurred speech.

Migraine may respond to aspirin or paracetamol, but often these drugs fail. There are other preparations which, if taken as soon as possible after the migraine starts can help, but they should not be taken without first seeing a doctor.

Q In the case of an overdose, is it enough to make the person vomit, to get rid of the painkilling drugs?

A While immediate action is often, obviously, necessary in the case of overdose, never try to look after the patient on your own – always call an ambulance. You may be able to void the drugs before they are absorbed, but after some painkillers have entered the bloodstream (and depending on the state of the person and how they were taken, this can be very quickly indeed) the damage can be widespread and only amenable to medical help. Paracetamol, for instance, can cause liver damage that kills several days after the overdose. The sufferer can show very few signs of damage for many hours before lapsing into coma.

Q My husband refuses to take drugs for a headache – he insists alcohol is much better painkiller. Is he right?

A Alcohol does work as a painkiller to some extent. It relaxes and sedates many parts of the brain, and so can mask the signals of pain being sent from one site of an injury. A headache caused by tension can be relieved both physically and emotionally by a drink, as the alcohol relaxes the drinker. But in cases of injury or shock, alcohol can be positively dangerous and should never be used as a painkiller.

Phil Rubb

Raspberry tea is sometimes claimed to be beneficial for relieving pain associated with childbirth or menstruation.

aspirin and paracetamol. It increases their effects, and adds a mild pain-relieving action on the brain while aspirin or paracetamol on the other hand affects the site of the pain itself.

Morphine is made from opium. If taken repeatedly it becomes addictive, and the pain-killing effect lessens as the patient builds up a tolerance to the drug. Despite this problem morphine is the most effective pain-killer available to the doctor, and is used to treat almost every sort of disease.

Pain should be looked on rather like a burglar alarm. It would be foolish and harmful to switch off the alarm and then leave the burglars rampaging through your house; so in most cases the cause rather than the symptom should be sought and cured. But, just as many burglar alarms go off because of passing interference we sometimes feel pain for temporary and passing reasons which do not need the care of a doctor. In these cases, the right painkiller is necessary and beneficial. However, it is not advisable to continue taking over-the-counter painkillers for longer than two to three days. If the pain persists, medical advice should be sought.

TAKE CARE

Points to watch with painkillers

Ron Sutherland

- All analgesics cause a certain amount of drowsiness—you must be careful if you are driving or handling machinery while taking them.
- Analgesics can be harmful if taken over a long period of time. If you are in constant pain consult a doctor.
- All tablets, including analgesics, should be kept in childproof containers and locked in a medicine chest, children are notoriously curious about pills.
- Be careful about taking painkillers if you are already on other drugs.
- Do not take painkillers with alcohol.
- Always take painkillers with water and, if possible, not on an empty stomach.
- Check with a chemist or doctor if you are in doubt about the correct dose for children. Soluble painkillers, dissolved in water, are the most suitable and easily administered for them.

Cold sores

Q Whenever I get anxious, I feel a prickling sensation in my lower lip—and a cold sore comes up. Is there any connection between cold sores and stress and anxiety?

A Possibly, but stress itself will not necessarily produce a cold sore, unless your body has somehow learned to use such situations as a trigger. Such a response is more likely to occur when you are run down, which could account for the feeling of not being able to cope which probably accompanies your anxiety.

Q I always seem to get a cold sore in time for a special occasion, just when I want to look my best. Is there any way I can stop this?

A Unfortunately not. Once the blisters have appeared, they have to run their course. The only thing you can try to do is to avoid catching a cold at such a time, which could either act as the initial trigger or simply aggravate the existing condition.

Q Do cold sores have a tendency to run in families?

A It has not been proved that this is so, though it is possible that the inability to develop a sufficient immunity to the virus that causes it is hereditary.

Q My mother suffers from cold sores and she will insist on kissing my baby whether she has them or not. Can they be passed on in this way?

A The cold sore virus can probably be passed on to very young children like this. So, when your mother has a cold sore, you should very tactfully persuade her not to kiss your baby until the sore is better.

However, most children will have come into contact with the virus by the time they are five and have developed their own immunity to it.

People over this age, therefore, are unlikely to catch a cold sore from anyone else through kissing. Neither will kissing trigger off a cold sore in anyone who periodically suffers from them.

A cold sore is an unsightly nuisance but not a serious health hazard. In fact, many people become naturally immune to them, and symptoms can be alleviated in those who are affected.

A cold sore is the term used to describe the blisters that form around the mouth and inside the nose; they most often appear towards the end of a cold—hence their name.

These sores can be irritating and unsightly, and cause a lot of local discomfort, but they are not dangerous. They are produced by a virus called herpes simplex, to which most people have been exposed by the time they are five years old; but the majority of us build up a natural immunity that is so effective that we never produce cold sores. Unfortunately, for the minority who suffer from them, they are a real nuisance.

The herpes simplex virus is related to the one that attacks the genital area. That virus, however, is a sexually transmitted disease and an immunity to the cold sore virus is not proof against genital herpes.

Causes

Once the herpes virus has infected the skin, it remains hidden there, lying dormant between attacks. The body produces a partial immunity that controls the virus for most of the time, until a certain 'trigger' causes it to flare up. This can be a cold, a bout of flu, a chest infection or a sore throat.

Exposure to sunlight or harsh winds can also act as triggers. Some women have a tendency to produce the sores during menstruation.

Institute of Dermatology

The typical cluster of tiny blisters forming a cold sore: these feel itchy and hot, then become painful. The healing process starts when they begin to dry up.

Symptoms

People who suffer recurring attacks of cold sores soon learn to tell when one is starting: there is a sudden itchy tingling in the skin in the affected area, which can begin up to two days before the cold sore erupts.

When this has happened, an inflamed cluster of tiny blisters develops; these fill with a yellowish-white fluid and feel itchy and hot, a sensation which is followed by tenderness and some pain.

Occasionally these inflamed blisters will burst within two to four days of appearing, but in all cases they start to heal by drying up. During this process, if the sore is left well alone, a crust forms which will eventually fall off.

Dangers

There is very little danger of scarring, except in severe cases. However, it is important to touch the sore as little as possible, or it will spread.

The crust should never be picked before the cold sore is fully healed and dried out, or it could become reinfected and the whole healing process would then be prolonged unnecessarily.

Treatment

Once the virus has infected the skin, there is no cure for it but patience. Some doctors have used smallpox vaccinations in an attempt to immunize sufferers against severe attacks, but the value of these is doubtful.

If a cold sore recurs constantly, your doctor might prescribe an antibiotic ointment.

In the early stages, before the sore has erupted, but the skin is itching and tingling, an anti-viral solution may be painted on, which can stop the sore from developing further.

Some people have found that applying ice cubes to the tingling area at this stage is also of some use.

Once the cold sore blisters have appeared there is no treatment that will stop it from running its course. There are preparations on the market, however, that will relieve the itchiness and pain, even though they will not shorten the healing period.

Outlook

Most cold sores will heal naturally within a fortnight or so—three weeks at most.

1 The Origin of the Sun and Planets

1. The suggestion that the material of the earth was indeed derived from an exploding star—a supernova, is supported by strong evidence. The shower of stars must have been surrounded by a cloud of gas—the cloud from which the stars had just condensed. A supernova, undergoing violent disintegration, must have expelled gases that went to join this cloud, the material from the supernova thereby getting mixed with the large quantity of hydrogen of which the cloud was mainly composed. Our problem is then to explain how both the sun and the planets were formed out of this mixture of materials.

2. It is a characteristic of a good detective story that one vital clue should reveal the solution to the mystery, but that the clue and its significance should be far from obvious. Such a clue exists in the present problem. It turns on the simple fact that the sun takes some 26 days to spin once round on its axis—the axis being nearly perpendicular to the orbits of the planets, which lie in nearly the same plane. The importance of this fact is that the sun has no business to be rotating in 26 days. It ought to be rotating in a fraction of a day, several hundred times faster than it is actually doing. Something has slowed the spin of the sun. It is this something that yields the key to the mystery.

3. Stars are the products of condensations that occur in the dense inter-stellar gas clouds. A notable cloud is the well-known Orion Nebula whose presence in the 'sword' of Orion can easily be seen with binoculars. Stars forming out of the gas in such clouds must undergo a very great degree of condensation. To begin with, the material of a star must occupy a very large volume, because of the extremely small density of the inter-stellar gas. In order to contain as much material as the sun does, a sphere of gas in the Orion Nebula must have a diameter of some 10,000,000,000,000 miles. Contrast this with the present diameter of the sun, which is only about a million miles. Evidently in order

to produce a star like the sun a blob of gas with an initial diameter of some 10 million million miles must be shrunk down in some way to a mere million miles. This implies a shrinkage to one ten-millionth of the original size.

4. Now it is a consequence of the laws of dynamics that, unless some external process acts on it, a blob of gas must spin more and more rapidly as it shrinks. The size of a condensation and the speed of its spin keep an inverse proportion with each other. A decrease of size to one ten-millionth of the original dimensions leads to an increase in the speed of spin by 10 million. But the rotation speed of the sun is only about 2 kilometres per second. At a speed of 100 kilometres per second the sun would spin round once in about half a day, instead of in the observed time of 26 days.

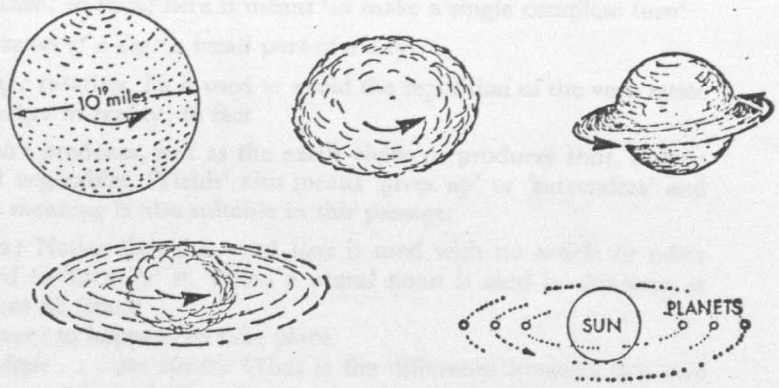
5. Only one loophole remains. We must appeal to some external process to slow down the spin of the solar condensation. Our problem is to discover how such an external process operates. First we must decide at what stage of the condensation the external process acts. Does it act while the condensing blob still has very large dimensions? Or does it operate only in the later stages, as the condensation reaches the compact stellar state? Or does it operate more or less equally throughout the whole shrinkage?

6. A strong hint that the process must act mainly in the late stages of the condensation comes from observations of the rates of spin of stars. It is found that the rates of spin have a very curious dependence on surface temperature. Stars like the sun, with surface temperatures less than 6,000° C., rotate slowly like the sun. But stars with surface temperatures greater than 7,000° C. rotate considerably more rapidly, their equatorial speeds of rotation being usually greater than 50 kilometres per second. Although this is still much less than what we should expect if no external process were operative, it is considerably greater than the equatorial rotation speed possessed by the sun.

7. This shows that while the external process must be operative in all cases, it is operative to different degrees that depend on the surface temperature of the final star. Now the difference between one star and another can scarcely show at all during the early stages of the shrinkage. Certainly the difference between two condensations, one yielding a star of surface temperature 6,000° C. and the other yielding a star of surface temperature 7,000° C., must be very small indeed during the early stages: much too small

for the stars to come to have markedly different rotation speeds if the external process were of main effect during the early stages. The inference is that the process operates mainly during the late stages of condensation.

8. Now what was the external process? We have mentioned that rotary forces must have become important during the late stages of condensation. The effect of these forces was to cause the condensation to become more and more flattened at its poles. Eventually the flattening became sufficient for an external rotating disc to begin growing out of the equator. The sequence of events is illustrated in figure 1.1.



1.1. Rotating ball of gas develops a disc

9. Once the sun had thus grown a disc the external process was able to come into operation. The process consisted of a steady transference of rotational momentum from the sun to the disc. Two birds were thereby killed with one stone. The sun was slowed down to its present slow rate of spin and the disc, containing the material out of which the planets were subsequently to condense, was pushed farther and farther from the sun. The solar condensation probably first grew its disc when it had shrunk to a size somewhat less than the orbit of the innermost planet, Mercury. The pushing outwards of the main bulk of the disc explains why the larger planets now lie so far from the sun.

10. It may be wondered why such an obvious theory was not put forward long ago. The answer is that there seemed to be such grave objections to it that not until very recently has it been examined

at all seriously. And now it turns out that the objections are not so grave as was previously believed.

(Extract taken from Chapter VI of *Frontiers of Astronomy* by FRED HOYLE.)

Notes

LINE

1 *the suggestion:* the idea put forward by scientists
the material of the earth: the material of which the earth is made
indeed: in fact

2 *derived from:* drawn from
an exploding star—a supernova: The words *exploding star* describe the kind of star we are talking about. The *supernova* is the technical or scientific name for a star of this kind. This is how writers often introduce technical words to a reader. In such a construction we say that the second part ('a supernova') is *in apposition to* the first part ('an exploding star')

3 *The shower of stars:* the material mentioned in line 1
The shower of stars must have been surrounded by a cloud of gas: It is very likely that the shower of stars was surrounded by . . .

4 *the cloud from which* is in apposition to *a cloud of gas*
The author first uses the *indefinite* article in *a cloud of gas* because he is not yet stating *which* cloud of gas; then he uses the *definite* article because he is going to tell us which cloud of gas he means. The definite article shows that the author is telling us which cloud, of all possible clouds of gas, he is referring to—he is *identifying* it for us

5 *undergoing violent disintegration:* This is another way of saying 'disintegrating violently'
to disintegrate: to split up; to burst apart
must have expelled: see note on *must have been surrounded* (line 3)
to expel: to send out

7 *thereby:* in that way; by that means

9 *then:* therefore; consequently
formed out of: formed from

11 *a characteristic:* a thing or quality that is part of the nature of something
vital: essential

12 *clue:* a piece of information, or a fact, which suggests the answer to a problem
the solution to the mystery: the explanation of the mystery

13 *far from obvious:* not at all easy to find or see
Such a clue: A clue of this kind

14 *the present problem:* the problem which we are now discussing
It turns on: a wheel *turns on* its axle and a door *turns on* its hinge. The wheel therefore depends on its axle and the door depends on its hinge. The clue depends upon the simple fact that . . .

15 *some 26 days:* about 26 days
its axis: the earth's axis is an imaginary line drawn through the earth from the north pole to the south pole.

16 *which lie in . . . :* which are in nearly the same plane; whose plane is nearly the same

18 *has no business to be:* ought not to be
to rotate: to turn; here it means 'to make a single complete turn'

19 *a fraction of a day:* a small part of a day

20 *doing:* rotating. *Do* is used to avoid the repetition of the verb *rotate.*
actually: in reality; in fact

21 *yields:* produces, just as the earth yields or produces fruit, flowers and vegetables. 'Yields' also means 'gives up' or 'surrenders' and this meaning is also suitable in this passage.

22 *Stars:* Notice that the word *stars* is used with no article or other word to 'identify' it. When a plural noun is used in this way, it means *all* (stars)
to occur: to happen; to take place
the dense . . . gas clouds: What is the difference between this and *dense . . . gas clouds?* In other words, what is the meaning of the definite article *the*? It means: 'Those dense inter-stellar gas clouds (all of them) whose existence we all know about.' Without the article, it would mean 'In *any* of those things that we call dense inter-stellar clouds'
dense inter-stellar gas clouds: Astronomers believe that space is filled by matter which consists mainly of hydrogen atoms. These atoms are spread thinly through space, but sometimes they collect together to form thick or dense clouds. These are the dense inter-stellar gas clouds referred to. *star* (noun) → *stellar* (adj.)

23 *notable:* deserving to be noticed

24 *Nebula:* a group of very distant stars or a mass of gas which looks like a patch of light in the sky at night
Orion: a group of stars. The 'sword' is formed by the stars which are in the middle of Orion's belt

25 *binoculars:* an instrument for use with both eyes and which makes distant objects seem nearer

25 *Stars forming out of the gas:* Stars which form out of the gas

26 *must undergo a very great degree of condensation:* must condense to a very great extent. Compare *undergoing . . . disintegration* (line 5)
To begin with: In the first place

28 *density:* According to Hoyle the density of a star like the sun is about ten million million million (or 10^{19}) times that of the inter-stellar gas

29 *as the sun does:* as the sun contains. cf. *doing*, line 20
a sphere: a round ball

31 10,000,000,000,000 *miles:* In speech we say *ten million, million, miles* or *ten billion miles*
(IMPORTANT: In British English a *billion* is a million million
In American English a *billion* is a thousand million only)
Contrast: This is the imperative form of the verb *to contrast*

32 *Evidently:* Apparently; It seems that. It does NOT mean—**obviously*

33 *a blob:* a mass of no special shape
with an initial diameter of: possessing at first a diameter of

34 *be shrunk down:* be reduced in size (from the verb *to shrink*)

35 *mere:* small or unimportant compared with something else, e.g. here, its own previous size
implies: suggests without saying so in words. Two statements are made: (*a*) The initial diameter was 10^{19} miles. (*b*) The final diameter is 10^{6} miles. These two statements *imply* that there was a reduction in size from 10^{19} to 10^{6} miles although the fact is not stated.
shrinkage: to shrink (verb) → shrinkage (noun)

36 *original:* first; initial

37 *it:* here *it* refers forward to the clause *that a blob of gas must spin more and more rapidly as it shrinks*
laws of dynamics: rules which apply to moving bodies. *dynamics* = mathematical study of moving bodies

38 *some external process:* some outside event (which has not been considered in studying shrinkage)
acts on it: has some influence on it; produces a change in it
it: here *it* refers forward to *a blob of gas* only

40 *inverse proportion:* When two quantities are in inverse proportion their product is constant. The simplest example is Boyle's Law—Pressure × Volume is constant, or pressure is inversely proportional to volume. In the case of a star the speed of spin or rotation should increase as it gets smaller in such a way that size × speed of spin is constant

42 *leads to:* results in; causes

44–46 *at a speed of, etc.:* The actual speed of rotation is 2 km. per second and the diameter of the sun is one million (10^{6}) miles. The circumference is π times the diameter and should be multiplied by 1·6 to change miles to kilometres. This gives a circumference of about 5 million (5×10^{6}) kms. The sun spins round once on its axis in 26 days or about 2¼ million ($2{\cdot}25 \times 10^{6}$) seconds. The speed of spin or rotation is therefore about 5 million km. in 2¼ million seconds, or roughly 2 km./sec.

47 *one loophole:* one possible way out of our difficulty
We must appeal to: We must look for help in
external process: The sun does not appear to obey the laws of dynamics and it can only be because an external process acts upon it (see lines 38–40). This external process is the loophole or way of escape from the difficulty.

48 *slow down:* reduce the speed of

50 *at what stage of the condensation:* when, during the condensation

52 *operate:* act; work; function

53 *compact stellar state:* 'compact' means 'closely packed together'. The atoms of a gas blob are widely scattered at first. As the blob of gas shrinks the atoms become tightly packed like the atoms in the sun. This is the *compact stellar state.*

54 *more or less equally:* about equally
throughout the whole shrinkage: during the whole time that it is shrinking

55 *hint:* suggestion; indication; piece of evidence clue

56 *comes:* Note that the subject of *comes* is *hint*
rates: speeds

57 *It is found that:* We find that . . .
have a very curious dependence on . . . : depend in a strange way on . . .

58 *curious:* strange
surface temperature: the temperature on the surface
Stars like the sun: Stars which are like the sun

59 6,000° *C:* In speech we say 'Six thousand degrees Centigrade'.

61 *their equatorial speeds of rotation:* their speeds of rotation at their equators

63 *less than what we should expect if:* less than we would expect it to be if

64 *operative:* active; in action

66 *while:* although
in all cases: every time; that is to say, every time the shrinking process takes place in a star or blob of gas

67 *to different degress that depend on:* to a greater or lesser extent according to

68 *the final star:* the star in its final state
Now: This word introduces a sentence which gives certain information in the development of a discussion or explanation. It does not refer to *time* at all.

69 *can scarcely show:* can scarcely be seen or observed

71 *yielding a star of surface temperature 7,000° C:* producing, or resulting in, a star with a surface temperature of 7,000° C. See note, line 21

74 *to come to have:* to reach the state of having
markedly different: noticeably different; very different. In speech markedly has three syllables: mar-ked-ly, pronounced ˈmɑːkadlɪ

75 *of main effect during the early stages:* of effect mainly during the early stages

76 *The inference is:* We infer from this; We conclude from this

78 *Now:* This introduces the next step in the author's discussion. cf. note, line 68
We: An author often prefers to use *We* instead of *I* when he is referring to himself, especially in scientific writing

79 *rotary forces:* forces of rotation

80 *to cause the condensation to become:* to make the condensation become...

81 *more and more flattened:* increasingly flattened

82 *Eventually:* In the end; After a certain time; *eventually* does *not* mean *perhaps*

83 *The sequence of events:* The order in which the events happened

85 *thus:* in this way
grown a disc: produced a disc from

86 *come into operation:* start operating

87 *transference:* the noun from the verb *to transfer:* to pass from one place or thing to another
momentum: All moving objects possess momentum. The amount of momentum in a moving object depends upon the speed and the mass or amount of matter contained in the object. The amount of momentum is given by the product of the mass of the object and its speed.
rotational momentum: Rotational momentum is given to a stone tied by a piece of string and swung around in a circle by a small boy. If the string breaks, the stone flies off in a straight line and moves away from the boy. The atoms of gas which make up a star possess rotational momentum. As the star shrinks the velocity of rotation increases until the atoms move so fast that they overcome the force of cohesion which acts just like the string holding the stone. The atoms then fly out of the shrinking star and form a rotating disc around it. See fig. 1.1

87 *Two birds were killed with one stone:* Two things happened as a result of one process or action

88 *thereby:* cf. note, line 7
The sun was slowed down: The sun's rotational momentum was reduced because the fastest atoms escaped into the newly formed disc. The speed of rotation of the sun therefore slowed down.

90 *were . . . to condense:* Note the use of the past tense of the verb *to be*. It is used when we know that an event took place at a time later than the other event or events we are talking about. Here is another simple example:
John met Mary in 1950. *They were to get married in 1956* but at that time they did not know this.
subsequently: later

91 *the solar condensation:* the condensation which produced the sun

92 *somewhat less:* rather less; a little less

93 *the innnermost planet:* the planet nearest to the sun
The pushing outwards of the main bulk of the disc explains why: The fact that the main bulk (part) of the disc was pushed outwards explains why
The main bulk of the disc gained rotational momentum and so broke away from the body of the sun. The disc then broke up into a number of separate blobs of gas from which the planets were formed.

95 *lie so far from:* are situated so far from

96 *It may be wondered:* The reader may wonder; You may wonder. Note that authors often prefer a passive construction when they are writing about science.
put forward: suggested

99 *at all seriously:* in any serious way at all
it turns out: it is clear, after what has been said; we find
objections: reasons for not accepting an idea or suggestion

100 *grave:* serious; great

Exercises

I Answer these Questions:

1 What suggestion is contained in paragraph 1 concerning the origin of the sun and planets?
2 What is the position of the sun's axis in relation to the orbits of the planets? (para. 2)

3 How are stars formed? (para. 3)
4 What was the probable diameter of the sun when it was in the gaseous state? (para. 3)
5 According to the laws of dynamics, what must happen to a spinning mass of gas as it contracts? (para. 4)
6 What is the relationship between the size and speed of spin of a contracting mass of gas? (para. 4)
7 What evidence is there for Fred Hoyle's statement that 'some external process' must have slowed down the rate of spin of the sun? Write out, quite briefly, the stages in his argument. (para. 5)
8 What evidence is there that the 'external process' comes into operation mainly during the 'late stages of condensation'? (para. 6)
9 What was the 'external process' to which Fred Hoyle refers? Use a diagram to illustrate your answer. (paras. 8–9)
10 Read the first sentence of paragraph 2; and then write down the 'clue' upon which Hoyle's 'detective story' is based. The author suggests in paragraph 10 that the solution is obvious. Do you agree?
11 What is a *supernova*?
12 How do the rates of spin of stars depend upon their surface temperature? (para. 6)
13 What formations resulted from the forces of rotation acting on the material of the sun and planets? (para. 8)

II Find in the passage *nouns* which are related to these *verbs*:

1	mix	5	suggest	9	solve
2	produce	6	disintegrate	10	rotate
3	shrink	7	depend	11	infer
4	observe	8	signify	12	condense

III Rewrite these sentences, replacing the words printed in italics by others which are used in the passage. Change the order of the words in the sentence if necessary.

1 The material of the earth was *drawn* from an exploding star.
2 The disintegrating supernova *sent out* gases that joined the cloud of gas.
3 The cloud was mainly *made up* of hydrogen.
4 The clue *depends* on the simple fact that the sun takes *about* 26 days to *spin round* once on its axis.
5 New stars are produced in the dense gas clouds *that lie between the stars*.
6 *Apparently* a blob of gas *that has at first a* diameter of about 10 billion miles must be *reduced in size* to *no more than* a million miles in order to produce a star like the sun.

IV Write out the following passage, using *a*, *an*, *the* or *some* in place of each dash (—), except when none of them is needed. Do not refer to the text until you have completed the exercise.

It is — consequence of — laws of — dynamics that, unless — external process acts on it, — blob of — gas must spin more and more rapidly as it shrinks. — size of — condensation and — speed of its spin keep — inverse proportion with each other. — decrease of size to one ten-millionth of — original dimensions leads to — increase in — speed of — spin by 10 million. But — rotation speed of — sun is only about 2 kilometres per second. At — speed of 100 kilometres per second — sun would spin round once in about — half — day, instead of in — observed time of 26 days.

Only one loophole remains. We must appeal to — external process to slow down — spin of — solar condensation. Our problem is to discover how such — external process operates. First we must decide at what stage of — condensation — external process acts. Does it act while — condensing blob still has — very large dimensions? Or does it operate only in — later stages, as — condensation reaches — compact stellar state, or does it operate more or less equally throughout — whole shrinkage?

5 Evolution and Natural Selection

1. The idea of evolution was known to some of the Greek philosophers. By the time of Aristotle, speculation had suggested that more perfect types had not only followed less perfect ones but actually had developed from them. But all this was guessing; no real evidence was forthcoming. When, in modern times, the idea of evolution was revived, it appeared in the writings of the philosophers—Bacon, Descartes, Leibniz and Kant. Herbert Spencer was preaching a full evolutionary doctrine in the years just before Darwin's book was published, while most naturalists would have none of it. Nevertheless a few biologists ran counter to the prevailing view, and pointed to such facts as the essential unity of structure in all warm-blooded animals.

2. The first complete theory was that of Lamarck (1744–1829), who thought that modifications due to environment, if constant and lasting, would be inherited and produce a new type. Though no evidence for such inheritance was available, the theory gave a working hypothesis for naturalists to use, and many of the social and philanthropic efforts of the nineteenth century were framed on the tacit assumption that acquired improvements would be inherited.

3. But the man whose book gave both Darwin and Wallace the clue was the Reverend Robert Malthus (1766–1834), sometime curate of Albury in Surrey. The English people were increasing rapidly, and Malthus argued that the human race tends to outrun its means of subsistence unless the redundant individuals are eliminated. This may not always be true, but Darwin writes:

> 4. In October 1838, I happened to read for amusement Malthus on Population, and being well prepared to appreciate the struggle for existence which everywhere goes on, from long continued observation of the habits of animals and plants, it at once struck me that, under these circumstances, favourable variations would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of new species. Here then I had a theory by which to work.

5. Darwin spent twenty years collecting countless facts and making experiments on breeding and variation in plants and animals. By 1844 he had convinced himself that species are not immutable, but worked on to get further evidence. On 18 June 1858 he received from Alfred Russell Wallace a paper written in Ternate, in the space of three days after reading Malthus's book. Darwin saw at once that Wallace had hit upon the essence of his own theory. Lyell and Hooker arranged with the Linnaean Society to read on July 1st 1858 Wallace's paper together with a letter from Darwin and an abstract of his theory written in 1844. Then Darwin wrote out an account of his labours, and on 24th November 1859 published his great book *The Origin of Species*.

6. In any race of plants or animals, the individuals differ from each other in innate qualities. Darwin offered no explanation of these variations, but merely accepted their existence. When the pressure of numbers or the competition for mates is great, any variation in structure which is of use in the struggle has 'survival value', and gives its possessor an improved chance of prolonging life and leaving offspring. That variation therefore tends to spread through the race by the elimination of those who do not possess it, and a new variety or even species may be established. As Huxley said, this idea was wholly unknown till 1858. Huxley said the book was like a flash of lightning in the darkness. He wrote:

> It did the immense service of freeing us from the dilemma—Refuse to accept the Creation hypothesis, and what have you to propose that can be accepted by any cautious reasoner? In 1857 I had no answer ready, and I do not think anyone else had. A year later we reproached ourselves with dullness for being perplexed with such an enquiry. My reflection when I first made myself master of the central idea of the *Origin* was 'How extremely stupid not to have thought of that!'

7. The hypothesis of natural selection may not be a complete explanation, but it led to a greater thing than itself—an acceptance of the theory of organic evolution, which the years have but confirmed. Yet at first some naturalists joined the opposition. To

the many, who were unable to judge the biological evidence, the effect of the theory of evolution seemed incredible as well as devastating, to run counter to common sense and to overwhelm all philosophic and religious landmarks. Even educated man, choosing between the Book of Genesis and the *Origin of Species*, proclaimed with Disraeli that he was 'on the side of the Angels'.

8. Darwin himself took a modest view. While thinking that natural selection was the chief cause of evolution, he did not exclude Lamarck's idea that characters acquired by long use or disuse might be inherited, though no evidence seemed to be forthcoming. But about 1890 Weismann drew a sharp distinction between the body (or soma) and the germ cells which it contains. Somatic cells can only reproduce cells like themselves, but germ cells give rise not only to the germ cells of a new individual but to all the many types of cell in his body. Germ cells descend from germ cells in a pure line of germ plasm, but somatic cells trace their origin to germ cells. From this point of view, the body of each individual is an unimportant by-product of his parents' germ cells. The body dies, leaving no offspring, but the germ plasms show an unbroken continuity. The products of the germ cells are not likely to be affected by changes in the body. So Weismann's doctrine offered an explanation of the apparent non-inheritance of acquired characters.

9. The supporters of pure Darwinism came to regard the minute variations as enough to explain natural selection and natural selection enough to explain evolution. But animal breeders and horticulturalists knew that sudden large mutations occur, especially after crossing, and that new varieties might be established at once. Then in 1900 forgotten work by Mendel was rediscovered and a new chapter opened.

10. In 1869 Darwin's cousin, Francis Galton, applied these principles to mental qualities. By searching books of reference, Galton examined the inheritance of ability. For instance, he found that the chance of the son of a judge showing great ability was about 500 times as high as that of a man taken at random, and for the judge's father it was nearly as much. While no prediction can be made about individuals, on the average of large numbers, the inheritance of ability is certain.

(Extract taken from Chapter VIII of *A Shorter History of Science* by SIR W. C. DAMPIER.)

Notes

LINE

2 *philosophers:* students of natural phenomena
By the time of Aristotle: During the time preceding the birth of Aristotle
Note: Expressions like *By the time of; By that time; By then; By 1980* etc. are often accompanied by either the past perfect tense e.g. *had appeared*, or the future perfect e.g. *will have appeared* (*by 1980*)
Aristotle: A Greek Philosopher (384–322 B.C.) and the teacher of Alexander the Great. He wrote many books on biology, natural science. politics etc. He was one of the first men to make a classification of animals. Aristotle's scientific principles were the basis of western thought up to the seventeenth century
speculation: See note 2/53. Here *speculation had suggested that* means: 'consideration of the various possibilities had led to the idea that'

3 *types:* kinds (of a particular animal or plant)
ones: types

4 *actually:* even; in fact
all this: all this speculation
The sentence in lines 4–5 shows clearly what is meant by the word *speculation*

5 *no real evidence was forthcoming:* cf. note 2/43, p. 18, no real evidence was produced; nobody brought forward any real evidence

6 *revived:* put forward again for consideration
it: This refers to *the idea of evolution* and NOT to *real evidence*

7 *Bacon:* Sir Francis Bacon (1561–1626), an English philosopher, statesman and man of letters. One of the earliest philosophers who taught the importance of experimental methods.
Descartes: René Descartes (1596–1650), a French philosopher and mathematician. He was regarded as the greatest philosopher of his time. See extract No. 8, paragraph 1, p. 79.
Leibniz: Gottfried Wilhelm, Baron von Leibniz (1646–1716), a German philosopher and mathematician. He was an original thinker who invented the calculus at the same time as Newton.
Kant: Immanuel Kant (1724–1804), a German philosopher. He put forward the idea that the sun and planets were formed from a rotating mass of hot gas, and that nebular systems were produced in a similar way

8 *Spencer:* Herbert Spencer (1820–1903), an English philosopher, often called the philosopher of evolution. Spencer applied his evolutionary formula to various branches of knowledge. Spencer's ideas were not based upon observation as Darwin's were
preaching a full evolutionary doctrine: trying to make people accept fully the idea of evolution

9 *Darwin:* Charles Darwin (1809–1882), an English naturalist and the author of the 'Origin of Species' which is the *book* referred to. His book brought about a complete change in the biological sciences.
while: at a time when
naturalists: scientists who make a study of nature and life

10 *would have none of it:* would not accept the idea of evolution at all; would have nothing to do with the idea
Nevertheless: In spite of this. cf. note 3/94, p. 34
biologists: scientists who make a study of plants and animals
ran counter to: to run counter to: to go against; to be opposed to

11 *the prevailing view:* the view held by most scientists at that time
pointed to: gave as evidence in favour of the idea of evolution
essential: basic; fundamental
unity of structure: similarity of construction of the body

12 *warm-blooded animals:* animals with warm blood

13 *Lamarck:* Jean Baptiste Lamarck (1744–1829), a French naturalist and professor of Zoology

14 *modifications:* changes; alterations (in animals and plants)
due to: resulting from; arising from
environment: natural surroundings; conditions in which a living plant or animal lives (the temperature, the presence or absence of protection, etc.)
if constant and lasting: if they (i.e. the modifications) occur regularly in the same way and for a long time

15 *inherited:* passed on from one generation to another; received by an offspring from its parents. See note, line 53
Though: Although

16 *evidence for such inheritance:* evidence that modifications are inherited in this way
inherit (verb), pronounced ɪnˈherɪt → *inheritance* (noun), pronounced ɪnˈherɪtəns.
no evidence was available: no evidence could be given as a proof

17 *a working hypothesis:* a suggested explanation (of observed facts) that can be used until new evidence shows that it is wrong, or that it must be changed
for naturalists to use: that naturalists could use

social . . . efforts: attempts to improve the conditions in which people live(d)

18 *philanthropic efforts:* efforts made by *philanthropists* (people who wish to improve the conditions in which others live)
the nineteenth century: the years between 1799 and 1900
framed: made; planned

19 *tacit assumption: tacit:* without being spoken;
assume (verb), pronounced əˈsjuːm → *assumption* (noun), pronounced əˈsʌmpʃən. See 4/37, p. 46
acquired improvements: improvements that an animal or plant *obtains or acquires* by changing (modifying) itself

21 *Wallace:* Alfred Russel Wallace (1823–1913), an English biologist. See paragraph 5
the clue: the key to the problem

22 *Malthus:* Malthus was the author of a book called 'An Essay on the Principle of Population' which had great influence on social and political thought in the nineteenth century
sometime curate: who was at one time the curate
a curate: a clergyman who helps the priest (or vicar) of a church

23 *increasing:* increasing *in number*

24 *argued that:* put forward the theory that
tends to outrun: in general (as a rule) increases more rapidly than

25 *its means of subsistence:* what it needs to live; its sources of food
the redundant individuals: those members (of the human race) who are not necessary (for its continuation)

26 *eliminated:* removed; killed; disposed of
writes: When authors are quoting from books, newspapers etc., they often use *the present tense*

27 *I happened to read:* I read, as it happened; by chance, I read . . .

28 *Population:* the number of people living in a place. Instead of using the full title of the book (note line 22) the writer shortens it to 'Malthus on Population'
being well prepared: as I was well prepared
to appreciate: to understand

29 *the struggle for existence:* the fight for life
goes on: takes place
from: as a result of
long continued observation: observation that had continued for a long time

30 *it at once struck me that . . . :* I immediately had the idea that . . .
Darwin thought out his new theory in this way: 'Some creatures

develop useful qualities which help them to survive in the struggle for existence. Others who do not develop these qualities perish and die off'

31 *under these circumstances:* in these circumstances; in these conditions
favourable variations: new types resulting from the right kind of modification

32 *would tend to be preserved:* would probably be kept
and unfavourable ones to be destroyed: and unfavourable variations *would tend* to be destroyed

34 *species:* a group of animals or plants which are alike, and which can breed or reproduce amongst themselves
species has the same form in the singular and in the plural. Here it is *plural*, as we know by the absence of the indefinite article before *new.*
then: therefore
by which to work: on the basis of which I could work

35 *Darwin spent twenty years collecting:* Darwin collected, over a period of twenty years,
countless facts: a very great number of facts

36 *breeding* (noun): the reproduction of animals and plants, with special attention to certain characteristics

37 *By 1844:* See line 2
he had convinced himself: he had become certain (as a result of the evidence he had collected)

38 *immutable:* unchangeable
worked on: continued to work. (*on* is often used, after a verb, with the idea of *continuation*)
further evidence: additional evidence
18 June 1858: In speech we say: 'On *the* eighteen*th of* June, eighteen fifty eight'

39 *a paper:* A short piece of writing on a scientific, philosophical (etc.) subject is called *a paper*

40 *Ternate:* a small island (40 square miles) off the coast of Halmahera, Indonesia.
in the space of three days after: three days after
after reading: after he had read

41 *hit upon:* found or discovered, perhaps by chance
the essence of his theory: the central or essential part of his theory

42 *Lyell:* Sir Charles Lyell (1797–1875), the first professor of Geology at Kings College, London. His famous textbook 'The Principles of Geology' is regarded as the foundation of modern geology
Hooker: Sir Joseph Dalton Hooker (1817–1911), an English botanist

and Director of Kew Gardens, London; and later President of the Royal Society. He was a close friend of Darwin.
the Linnaean Society: named after the Swedish botanist, Carl von Linnè (1707–1778) (Latin—Linnaeus) who first made a *systematic* classification of plants and animals. When Linnaeus died his great collection of specimens was brought to London. The Linnaean Society was established by British naturalists in his honour.

43 *on July 1st:* In speech we say 'on July the first'. cf. line 38

44 *an abstract:* a short statement

45 *an account of his labours:* a description of his work
on 24th November: In speech we say: 'on the twenty-fourth of November'

46 *great:* very important; famous; *NOT* *big

47 *differ from:* are different from
differ (verb) → *different* (adj.) → *difference* (noun)

48 *in innate qualities:* in the qualities with which they are born
offered no explanation: did not try to explain

49 *variations:* differences
merely: simply
the pressure of numbers . . . is great: the number of individuals becomes very great

50 *competition:* rivalry
mates: members of the opposite sex

51 *which is of use:* which is useful
'survival value': The rest of the sentence explains this.
to survive: to remain alive

52 *possessor:* owner
an improved chance: a better chance
prolonging life: making its life longer

53 *offspring:* (of animals) their young
That variation: The variation which has 'survival value'
tends to spread: as a rule, spreads. cf. note line 24

54 *through the race:* to all members of the race
the elimination: the cutting out; the exclusion
See note, line 26

55 *a new variety or even species may be established:* (the variation may lead to) the establishment *not only* of a new variety but *even* of a new species

56 *Huxley:* Thomas Henry Huxley (1825–1895), an English biologist and the greatest teacher of biology in the nineteenth century. He

did more to make Darwin's teaching known than any other scientist
wholly: entirely

59 *the dilemma:* the problem of choosing from two alternatives (to both of which there are strong objections)

60 *Refuse to accept . . . and what have you . . . ? : If you* refuse to accept . . . , what have you . . . ?
Compare: Marry in haste, and repent at leisure
= *If you* marry in haste, *you will* repent at leisure.
the Creation hypothesis: (for *hypothesis* see note, line 17) the hypothesis that the world and life were 'created' in a short period by God
what have you to propose . . . ?: what alternative explanation can you put forward . . . ?

61 *by any cautious reasoner:* by any person who reasons (or works things out) carefully

63 *we reproached ourselves with dullness:* we accused ourselves of being dull, stupid
for being perplexed with such an enquiry: for allowing ourselves to be puzzled by such a question

64 *My reflection:* My thought

65 *made myself master:* completely understood

66 *not to have thought of that:* not to have had that idea myself

67 *The hypothesis of natural selection may not be . . . but it led to . . . : Although* the hypothesis of natural selection *is* not . . . , it led to . . .
The hypothesis (of natural selection) is outlined in the previous paragraph

68 *a greater thing:* something of greater importance

69 *the theory of organic evolution:* the theory that there is a systematic development of living creatures from a simple to a more complex condition
have but confirmed: have simply shown to be true

70 *Yet:* In spite of this
the opposition: those people who opposed the idea

71 *the many:* the majority

72 *incredible:* unbelievable

73 *devasting: a devastating effect:* an effect that causes the destruction of something (in this case, of all previous ideas about the origin of species)
run counter to: See line 10

common sense: what seems to be reasonable
overwhelm: overturn; overcome completely

74 *landmark:* an object helpful to a traveller in finding his way; an object which is easily seen and recognised by a traveller
philosophic and religious landmarks: principles of philosophy and religion which guide men through their lives
educated man: all educated *men*
choosing between: thinking that they had to accept *either* the Book of Genesis *or* the Origin of Species

75 *Book of Genesis:* The first book of the Jewish and Christian scriptures. It describes the beginning or creation of the world
proclaimed with Disraeli: announced, in agreement with Disraeli

76 *Disraeli:* Benjamin Disraeli (1804–1881), later Lord Beaconsfield and Prime Minister of England. When he was asked whether he supported Darwin's theory he said that he was 'on the side of the angels'. By this he meant that he supported the story of creation given in the Book of Genesis. Many people thought that Darwin's theory was anti-religious

77 *took a modest view:* held a moderate opinion (that is, not an extreme opinion)
While thinking: Although he thought

78 *natural selection:* see paragraph 6
chief: principal; main
exclude Lamarck's idea: say that Lamarck's idea was impossible
to exclude: to rule out

79 *characters:* characteristics
use or disuse: habit or absence of habit

80 *though no evidence seemed to be forthcoming:* though it seemed that no evidence was forthcoming. cf. note 2/43, p. 18

81 *Weismann:* August Weismann (1834–1914), a German biologist who believed that acquired characters or qualities could not be passed on to offspring. Lamarck believed that they could (see paragraph 2). Weismann gave scientific reasons for his belief
drew a sharp distinction between: said that there was an important difference between

82 *cell:* The cell is the unit of life in all living things. The simplest living things are the *protozoa*, which consist of a single cell, such as the amoeba and the malaria parasite
soma: The Greek word for body. *Somatic* is the adjective
somatic cells: body cells

83 *can only reproduce:* can reproduce no cells except

84 *give rise to:* control the production of

85 *all the many types:* all the numerous types
descend from: are produced by

86 *in a pure line:* without the intervention of cells of any other type
germ plasm: that part of a germ cell which grows into a new creature. This is an old term which was used in the early days of Weismann's teaching
trace their origin to: have their origin in

87 *From this point of view:* Considered in this way

88 *a by-product:* some additional thing that is produced during a process which is intended to produce something else of greater importance

90 *show:* reveal
continuity: a noun from the verb *continue*. The difference between *continuity* and *continuation* is seen from the words that are used with them. For example: *unbroken continuity; the continuation, after a time, of his work . . .*

92 *doctrine:* teaching; beliefs. cf. line 8
offer an explanation: cf. note, line 48
non-inheritance: non- placed before a noun or an adjective produces a word which 'negates' it (is the negative of it)

94 *Darwinism: -ism* is often added to the name of people to refer to the kind of ideas or actions associated with them
came to regard: cf. note 1/74
to regard: to consider
minute: This is an adjective (pronounced mal'nju:t) meaning *very small*

95 *and natural selection enough to:* and *they came to regard* natural selection *as* enough to

96 *But . . . :* The first sentence in this paragraph tells us that Darwin's supporters accepted Lamarck's idea (line 79). They thought that slight changes, occurring from time to time over long periods, were responsible for natural selection (the survival of those creatures who developed these favourable changes). This, in its turn, led to the evolution or development which has taken place in plants and animals. In other words, they paid no attention to Weismann's teaching. Now the author introduces a fact which proves they were wrong in this belief. The word *But* introduces in contrast the thing which was known by animal breeders, i.e. that the changes took place suddenly
animal breeders: people who control the reproduction of animals and sometimes try to improve the types by a careful selection of males and females for mating

97 *horticulturalists:* people who grow flowers, fruit and vegetables and who try to improve the types
mutations: the sudden changes in offspring which were noticed by animal breeders. A mutation is a new character in a plant or animal which is not inherited from its parents, but which is passed on to new offspring. We now know that mutations can be caused by radioactivity (see extract 7).

98 *crossing:* the mating of a male and female with different characteristics

99 *forgotten work by Mendel:* work by Mendel which had been forgotten
Mendel: Gregor Mendel (1822–1884), an Austrian biologist. See extract No. 6. Mendel's work is second only to Darwin's in its importance.

100 and *a new chapter opened:* i.e. a new chapter *in the development of the theory of evolution* was opened

101 *Galton:* Sir Francis Galton (1822–1911), an English anthropologist and the founder of mental testing. Anthropology is the study of man as an animal. The physical study of man is called physiology; and the mental study of man is called psychology. The *anthropologist* studies both aspects of man as they are shown in his customs, habits and ways of living.
these principles: the principles (or ideas) that have been described

102 *mental qualities:* qualities of the mind, e.g. intelligence
searching: reading through
books of reference: books that contain essential information about certain subjects

103 *ability:* intelligence

104 *the chance of a son of a judge showing:* the chance *that a son of a judge would show*

105 *500 times as high as:* 500 times greater than
taken at random: taken *without any special method of selection*

106 *While:* Although cf. note, line 77
prediction: statement about the probability of something occurring

107 *on the average of large numbers:* when we consider what actually happens in a large number of cases

Exercises

I Answer these Questions:

1 What ideas of evolution had already appeared by the time of Aristotle?
2 Was there any evidence for such views? (para. 1)
3 Which philosophers revived the idea of evolution? (para. 1)
4 What was the attitude of naturalists and biologists to the views of the philosophers on evolution? (para. 1)
5 Upon what grounds did certain biologists accept the theory of evolution? (para. 1)
6 What views did Lamarck put forward? (para. 2)
7 How did the philanthropists make use of Lamarck's ideas? (para. 2)
8 What views did Malthus put forward in his essay 'On Population'? (para. 3).
9 What effect did Malthus have upon Darwin's views? (para. 4)
10 How long did Darwin spend in study and experiment before he published his famous book? (para. 5)
11 What did Darwin do as soon as he read Wallace's paper? Why did he take this step? (para. 5)
12 What period of time passed between the production of Darwin's 'abstract of his theory' and the publication of Wallace's paper? (para. 5)
13 What was the main theme of the *Origin of Species*? (para. 6)
14 What idea was 'wholly unknown' till 1858? Who wrote this comment? (para. 6)
15 State briefly Huxley's opinion of the *Origin of Species*. (para. 6)
16 In what way did the theory of evolution seem to be opposed to religious opinions and thoughts? (para. 7)
17 Why did Disraeli say that he was 'on the side of the Angels'? (para. 7)
18 What is the difference between a germ cell and a somatic cell? (para. 8)
19 Can ability be inherited?
20 What predictions can be made about the inheritance of ability by an individual? (para. 10)

II Rewrite these sentences replacing the words printed in italics by others which are used in the passage. Rearrange the words of the sentence where necessary.

1 Most naturalists *would not accept it* (*i.e. the idea of evolution*) *at all* before Darwin's book was published.

2 A few of them, however, *were opposed to* the view *which was held by most scientists at that time.*
3 *Changes / resulting from /* environment can be *received by an offspring from its parent.*
4 Malthus *put forward the theory* that the human race tends to *increase more rapidly than* its means of subsistence.
5 The individuals *who are not needed* are *removed.*
6 I was well prepared to appreciate the *fight* for *life* which *takes place* among plants and animals.
7 Darwin *continued working in order to* get *additional* evidence.
8 He *realized* that Wallace had *discovered* the *essential part* of his own theory.
9 In any race of plants or animals, the *separate members of it / are different* from each other in *the* qualities *with which they are born.* [Note: The adjective which replaces the last group of words stands before 'qualities'; and the definite article, 'the', is not required.]
10 At first the theory of evolution seemed *unbelievable.*

III Find in passages 4 and 5 *nouns* which are related to these *verbs*:

Passage number 4

1 form	3 solidify	5 coincide
2 determine	4 exist	6 recede

Passage number 5

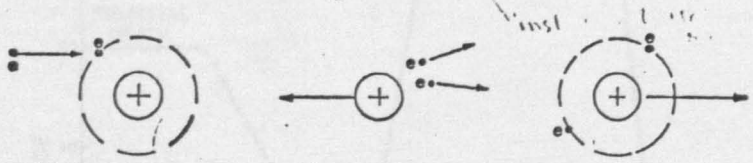
7 speculate	10 assume	13 inherit
8 vary	11 explain	14 modify
9 refer	12 predict	15 select

IV Complete these sentences with one of the relative pronouns *who, which, whose.*

1 What was the name of the man — preached a full evolutionary doctrine before the publication of Darwin's book?
2 Malthus was the man — book gave Darwin the clue — he was looking for.
3 Any variation — is of use in the struggle for existence has survival value.
4 Those members of a race — do not possess the variation are eliminated.
5 Was he the person — drew the distinction between the body and the germ cells — it contains?
6 We must find out the probable age of various basic parts and features — characterize the present state of our universe.
7 All stable atoms were formed under some unusual circumstances — must have existed in the universe a few billion years ago.
8 How old are the rocks — form the crust of our globe?

7 Atomic Radiation and Life

1. The radiation dose given off by an X-ray machine or by isotopes is usually measured by determining the number of ions produced in a volume of gas. Since these carry an electric charge there are a number of extremely delicate methods by which they can be detected. The widely used Geiger counter consists essentially of a wire stretched inside a cylindrical tube, so arranged that an electric current can pass between the wire and the tube



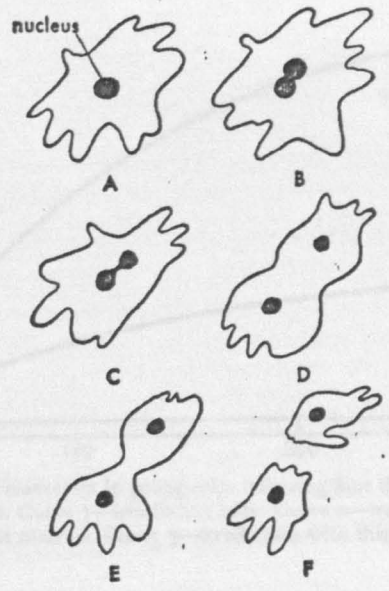
7.1. Ionization (*a*) and (*b*) by collision; (*c*) by attachment

only when there are ions in the gas. Consequently, when an ionizing particle passes through the tube, an electric signal is given out. In this way the number of ionizing particles given off by a radio-active source can be accurately counted. This is called the activity of the material. It is measured in a unit called the *curie* after the discoverer of radium. The activity of one gram of radium together with its decay products is equal to one *curie*. Every time an atom disintegrates a beta- or alpha-ray is given off, together with a certain amount of gamma radiation.

2. The activity in curies can tell us nothing about the dose of radiation given off by the radio-active material, since the curie measures only the number of ionizing particles emitted, independent of their range or energy. If, for example, we put next to the skin one curie of radio-active cobalt, which gives off energetic gamma-rays, the dose received on the surface will be one five-thousandth part of the dose received from one curie of polonium

which gives off alpha-particles. On the other hand the gamma-rays from the curie of cobalt will penetrate deeply, while the alpha-rays will not affect anything which lies more than two one-thousandths of an inch below the surface of the skin.

3. The best way of defining the dose of radiation which an irradiated material has received is in terms of energy. We have seen that on exposure to ionizing radiation electrons, or other sub-atomic particles moving at great speed, lose energy to the surrounding molecules. The amount of energy gained by the irradiated substance is clearly the important factor, and will determine the biological changes produced. The most widely used unit for measuring X-ray and gamma-ray dosage is the *roentgen*—named after the discoverer of X-rays. The remarkable property of ionizing radiation is that the small amount of energy represented by a few hundred roentgens can kill a man.

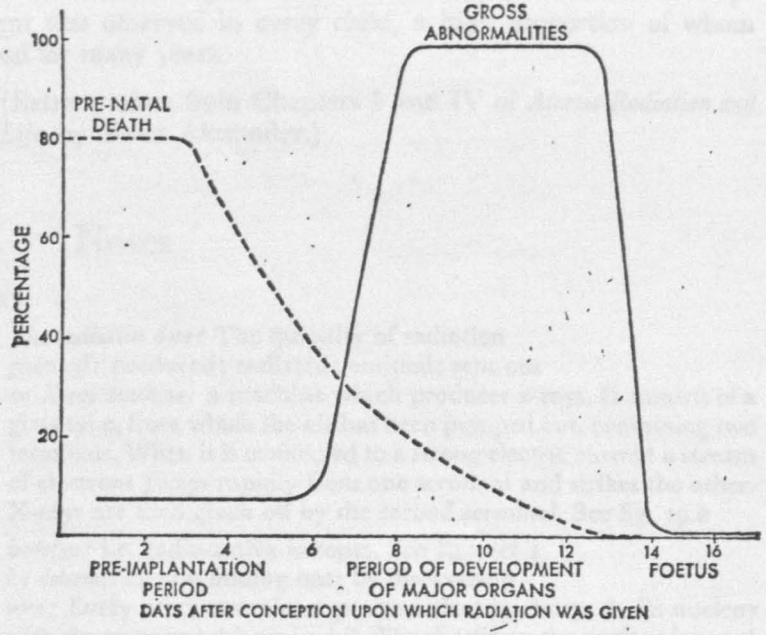


7.2. Cell division

4. The primitive embryonic cell known as the *zygote*, which is formed after the entry of the sperm into the ovum, is very sensitive to radiation. For example, 80 per cent of mice, exposed to 200 rads of X-rays within the first five days after conception, fail to give birth. Smaller doses give rise to a lower incidence of pre-

natal death, but an appreciable reduction in the average litter size has been observed with 50 rads.

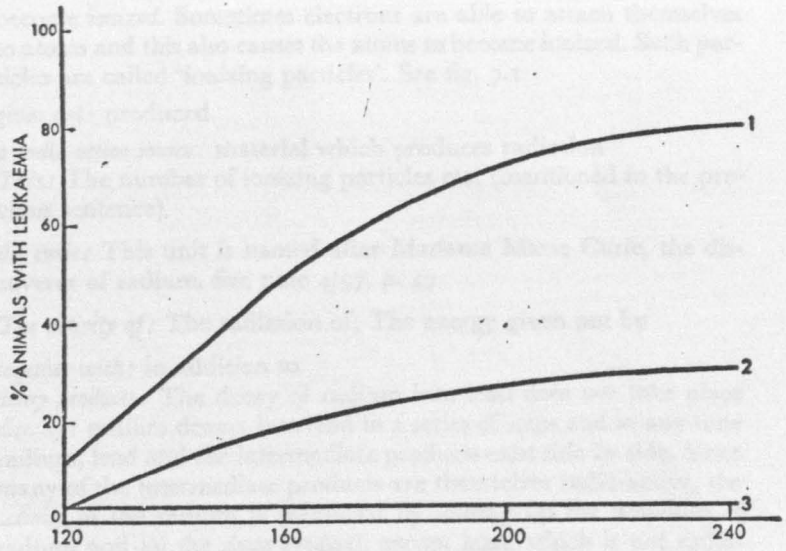
5. At first the embryo grows by cell division without differentiation and becomes firmly implanted in the wall of the uterus. This requires about eight days in human beings and five days in mice. Then differentiation begins, and the individual organs and limbs are formed; the embryo takes shape. During this period it is in the greatest danger. Now radiation no longer kills—the damaged embryo is not re-absorbed or aborted, but proceeds to a live birth which is abnormal. These malformations can be very great, so as to give horrible and distressing monsters, which are, however, quite capable of living for a time. The incidence is particularly high in the early stages of the active development of the embryo. (See figure 7.3.)



7.3. Effect of 200 rads on mouse embryo

6. The period of major organ production is over after about three months in human beings, and the foetus then develops its finer aspects and generally grows and develops. Exposure to doses insufficient to produce severe radiation sickness in the mother no longer produces gross deformities which can be recognized in small

experimental animals. But the absence of striking changes in the newborn does not mean that the irradiation has been without harm. The general effect is less obvious, but none the less serious, and irradiation at the later stages of pregnancy results in very marked growth reduction, giving small babies which develop into smaller adults. Their life span is reduced and their reproductive organs are often affected so that they grow up sterile. Damage to the brain and eyes was found a few weeks after birth in all cases which had been irradiated in the foetal stage with 200 rads, and there is a significant incidence after 100 rads. Since only gross disorders of the brain can be detected in experimental animals, it seems likely that much smaller doses will give effects which are serious in man.



7.4. Production of leukaemia in young mice following four doses of 160 r at intervals of one week. Curve 1—irradiation only. Curve 2—irradiation followed by injection of bone marrow. Curve 3—irradiation with thighs protected by a lead shield.

7. The detailed picture of the influence of radiation on prenatal development has been obtained from studies with animals (figure 7.3). Unhappily, sufficient human cases are known to make it certain that the same pattern also occurs in man; and we can confidently superimpose a human time-scale on the mouse data shown in figure 7.3. Some of our information is derived from the

survivors of the atom bombs in Japan. The children of the women who were pregnant and exposed to irradiation at Nagasaki and Hiroshima are, on average, shorter and lighter and have smaller heads, indicating an under-developed brain. Some show severe mental deficiencies, while others were unable to speak normally at five years old.

8. Most of our knowledge comes from expectant mothers who were irradiated for therapeutic or diagnostic reasons. Many cases are described in the medical literature of abnormalities following exposure of the embryo. Most of these arose twenty or thirty years ago at a time when radiologists did not know of the great radio-sensitivity of the foetus. A detailed survey showed that, where a mother received several hundred roentgen within the first two months after the implantation of the embryo, severe mal-development was observed in every child, a high proportion of whom lived for many years.

(Extract taken from Chapters I and IV of *Atomic Radiation and Life* by Peter Alexander.)

Notes

LINE

1 *The radiation dose:* The quantity of radiation
given off: produced; radiated; emitted; sent out
an X-ray machine: a machine which produces x-rays. It consists of a glass tube, from which the air has been pumped out, containing two terminals. When it is connected to a strong electric current a stream of electrons passes rapidly from one terminal and strikes the other. X-rays are then given off by the second terminal. See fig. 19.2

2 *isotopes:* i.e. radio-active isotopes. See Extract 4
by determining: by finding out; by discovering
ions: Every atom contains a positive electric charge in its nucleus with electrons in orbit around it. The charge on the nucleus is equal to the charge carried by the electrons, and so the atom is neutral. Sometimes an atom acquires an additional electron and is then negatively charged; sometimes it loses an electron and is then positively charged. Such atoms are called *ions*, and are said to be *ionized.* See fig. 7.1

3 *a volume of gas:* a *certain* volume of gas; a *stated* volume of gas
these: these *ions*

4 *a number of . . . methods:* several methods
delicate: accurate

5 *detected:* found; discovered; traced; cf. 3/73
The widely used Geiger counter: The Geiger counter, which is named after its inventor, is the instrument most commonly used to detect radiation. Some writers use a hyphen between words like *widely* and *used* if they are placed before the noun: *widely-used.* cf. line 34
consists essentially of: has, as its most important parts,

6 *a cylindrical tube:* a pipe in the form of a cylinder. *cylinder* (noun) → *cylindrical* (adj.)
so arranged that: arranged in such a way that

9 *an ionizing particle:* Certain particles (see line 15) are able to strike other atoms and knock out electrons, thus causing the atoms to become *ionized.* Sometimes electrons are able to attach themselves to atoms and this also causes the atoms to become ionized. Such particles are called 'ionizing particles'. See fig. 7.1

10 *given out:* produced

11 *a radio-active source:* material which produces radiation
This: The number of ionizing particles etc. (mentioned in the previous sentence)

12 *the curie:* This unit is named after Madame Marie Curie, the discoverer of radium. See note 4/57, p. 47

13 *The activity of:* The radiation of; The energy given out by

14 *together with:* in addition to
decay products: The decay of radium into lead does not take place *directly:* radium decays into lead in a series of steps and at any time radium, lead and the intermediate products exist side by side. Since many of the intermediate products are themselves radio-active, the *activity* of the radium is measured by adding up the activities of radium and all the *decay products,* except lead, which is not radio-active. 1 gramme of radium and its decay products give off 136 billion (thousand million) ionizing particles per second. This amount of activity is therefore equal to one curie.

15 *Alpha-, beta- and gamma-rays:* The alpha-rays are the least penetrating and they can be stopped by aluminium foil 0·01 cm. thick. An alpha-particle carries 2 positive electric charges and is identical with the nucleus of helium, the lightest element next to hydrogen. Beta-rays can penetrate aluminium 0·5 cm. thick, and they seem to be exactly the same as electrons since they carry one negative electric charge. Gamma-rays can pass through iron one foot thick and are therefore very penetrating. They are dangerous to the blood-

forming cells in the bones of animals. Gamma rays are uncharged and are released when beta-rays (electrons) are emitted by radiation.

17 *the activity in curies:* the activity *measured* in curies
can tell us nothing about: can give us no information about

19 *independent of:* without any reference to

20 *their range:* the distance which they travel
next to the skin: touching the skin

21 *radio-active cobalt:* commonly called cobalt 60. This cobalt isotope is produced easily in atomic piles and is now used in medical treatment in place of radium, which is difficult to obtain and therefore expensive. The 'cobalt bomb' units used in hospitals contain 200 curies of cobalt—equivalent to the activity of 4 lbs. of radium
energetic: strong

22 *on the surface:* on the surface of the skin

23 *polonium:* This radio-active element was discovered by Marie Curie, who also discovered radium. Madame Curie was a Pole by birth, and the name *polonium* was given to the new element for this reason

24 *On the other hand:* However. cf. 4/25, p. 39

25 *will penetrate deeply:* will go deep into the body
while: whereas; and in contrast with this

26 *anything which lies:* any part of the body which is

28 *defining:* stating

29 *irradiated: to be irradiated* means *to receive radiation*
in terms of energy: by stating the amount of *energy* which is received.
We have seen that: The author is here referring to previous statements

30 *on exposure to ionizing radiation electrons etc.:* when electrons etc. are exposed to ionizing radiation, they lose energy.
ionizing radiation: See note, line 9.

31 *sub-atomic particles:* particles which are smaller than atoms, such as alpha particles etc. The sub-atomic particles strike the molecules or atoms through which they pass and their speed is reduced i.e. they lose energy. This energy is given to the atoms or molecules which they strike—the surrounding molecules.

32 *surrounding molecules:* the molecules which are around them

33 *clearly:* obviously. This is not at all clear or obvious to the non-scientific reader. It is obvious to the trained scientists to whom the author is speaking

34 *determine the biological changes produced:* decide what biological changes are produced; be responsible for any biological changes

which are produced. See note 5/97, p. 65 *mutations*. Later paragraphs will explain such changes

35 *X-ray and gamma-ray:* X-ray dosage and gamma-ray dosage
dosage: This word is derived from *dose* (line 1), and is sometimes used instead of it
roentgen: Wilhelm Konrad Roentgen (1845–1923), a German physicist, was the first winner of the Nobel prize for Physics in 1901. He discovered roentgen, or X-rays. A roentgen of radiation is that dose of radiation which produces 2·1 billion (thousand million) *ion pairs* (pairs of ionized particles) in 1 cubic cm. of air. Ions are usually produced in pairs. If one electron is knocked out of an atom the electron carries a negative charge and the atom is left with a positive charge. Two charged particles are therefore produced by one collision. See fig. 7.1

36 *remarkable:* surprising

37 *the small amount of energy represented by a few hundred roentgens:* the small amount of energy which, when it is measured, is only a few hundred roentgens

39 *primitive embryonic cell: embryo* (noun): young plant (or animal) before it comes out of the seed (mother) → *embryonic* (adj.)
embryonic cell: cell which is beginning to take shape
zygote: cell formed by the union of the male and female cell, i.e. a fertilized egg-cell. See note 6/38, p. 76

40 *the sperm:* male reproductive cell
ovum: female sex cell, plural *ova*
The sperm penetrates the ovum and produces a zygote which is able to produce new life
is very sensitive to radiation: is very easily affected by radiation

41 *exposed to 200 rads:* when they *are exposed to* 200 rads; when *200 rads are administered, or given,* to them; when they *are irradiated with* 200 rads; when they are *given a dose* of 200 rads

42 *rad:* the rad is the radiation unit of energy. One rad will supply 100 ergs of energy to every gram of the material which receives the radiation
within: during. cf. 2/91, p. 21
conception: Conception takes place when the sperm enters the ovum and produces a zygote.
fail to give birth: do not give birth; do not succeed in giving birth; do not produce young ones

43 *give rise to:* cause
a lower incidence of pre-natal death: a smaller proportion of deaths in the embryonic stage

pre-natal death: death of a creature before it has been born
incidence: See note, line 55

44 *an appreciable reduction:* a considerable reduction; a noticeable reduction
the average litter size: the average *number of young ones* born at one time.
litter: the newly-born young of an animal

45 *with 50 rads:* after a dose of 50 rads

46 *cell division:* Single cells divide into two parts. Each half cell then grows into a full cell and divides into two parts. Cell division of this kind is the simplest form of growth
differentiation: Body cells grow into *tissue*—groups of cells of similar structure which can perform special functions. The different organs of the body are made up of such special tissues. This process is known as *differentiation* (i.e. becoming different or specialized)
different (adj.) → *differentiate* (verb) → *differentiation* (noun), pronounced difərenʃi'eiʃən

47 *implanted in:* fixed in; embedded in
the wall: the side
the uterus: the female organ in which the child is formed—the womb
This: This process

49 *The individual organs:* The separate parts
organs: parts such as the heart, the liver, the lungs, etc.
the limbs: the legs and, in some animals, the arms

51 *Now radiation no longer kills:* From this time radiation does not kill the embryo

52 *re-absorbed:* absorbed again by the mother; taken back into the mother's system. Notice that when *re* is used with a word beginning with a vowel, it may be separated by a hyphen
aborted: made to leave the uterus before the proper time
proceeds to: goes on to
a live birth: the birth of a live creature

53 *abnormal:* not normal
These malformations: The malformations of *these creatures which are abnormal when they are born*
malformations: The young may be born with very large heads, without fingers or toes, or with deformities of various kinds. Children or young animals born with such *malformations* are called *monsters*

54 *distressing monsters:* monsters which cause distress or pain to the person who sees them

55 *capable of living:* able to live

for a time: for a certain length of time
The incidence: The extent to which this occurs; The extent to which malformations of this kind are produced
particularly high: especially great

58 *major organ production:* growth of the most important organs such as limbs, heart, lungs etc. cf. *minor* 4/4, p. 43
is over: is finished

59 *foetus:* young animal, not yet born, inside its mother (pronounced 'fi:təs)

60 *finer aspects:* After 3 months the embryo has grown into the foetus and the most important body organs have developed. At this stage the foetus begins to develop its finer or more delicate characteristics. If radiation is received during this period of growth the ill-effects described in lines 65–75 are produced.
generally: in every part; in general. NOT **as a rule*
Exposure: to expose (verb) → *exposure* (noun), pronounced eks'pouʒə
doses insufficient to: doses which are not great (or large) enough to

61 *radiation sickness:* Radiations from X-rays or atomic explosions often produce a sickness after 2 or 3 weeks although the patients do not die. Common symptoms include loss of hair, sore throat and diarrhoea.
no longer produces: ceases to produce, at this stage

62 *gross deformities:* very great malformations
which can be recognised: which can easily be seen

63 *experimental animals:* animals which are used in experiments
striking changes: very noticeable changes; changes that are so great that they attract our attention
the newborn: the creatures which have just been born

64 *does not mean that:* is not a sign that; is not proof that
that the irradiation has been without harm: that there are no harmful results of the irradiation

65 *the general effect:* the effect which has been produced in the body as a whole
none the less serious: not less serious because it is less obvious

66 *pregnancy:* the state of a female animal when its young are growing in the uterus
results in: causes
very marked growth reduction: a very great reduction in growth

67 *giving:* producing

68 *smaller adults:* adults which are smaller than normal adults NOT **adults which are smaller than the babies!*
Their life-span: The length of their life

their reproductive organs: the parts of their body which they use in the production of offspring

69 *affected:* changed
sterile: not able to produce seeds or offspring

71 *in all cases:* in all the animals studied
Compare: 'a medical *case*', which means a person who requires treatment and attention
in the foetal stage: while the animal was still a foetus. See note, line 59
foetus (noun) → *foetal* (adj.)

72 *a significant incidence: significant:* This word usually means *noteworthy, full of meaning,* or *important.* It is here used in the statistical sense outlined in extract No. 10 paragraphs 6–8. 200 rads cause damage to the brain and the eyes in all cases. With a dose of 100 rads there is a *definite probability* that a fixed percentage will sustain damage. This is the *significant incidence* referred to.
after 100 rads: when a dose of 100 rads or more is given
gross disorders: malformations in the organs which are obvious and too great to avoid detection

73 *it seems likely that:* it seems probable that

75 *in man:* in human beings

76 *The detailed picture:* The detailed pattern of the results

78 *Unhappily:* Unfortunately
human cases: See note, line 71

79 *to make it certain that:* to show clearly that; to show without doubt that.
the same pattern: cf. note, line 76

80 *confidently:* without fear of being wrong
superimpose a human time-scale on the mouse data: apply periods of time that are right for human beings to the facts that have been discovered from the study of mice
data: known facts. Latin plural of *datum*

81 *derived from:* drawn from; obtained from
the survivors of: those who did not die as a result of; *survive* (verb) → *survivor* (noun)

83 *pregnant:* See note, line 66
pregnant (adj.) → *pregnancy* (noun)
Nagasaki and Hiroshima: Japanese towns which were destroyed by atom bombs (uranium fission) in the war of 1939–45

84 *on average:* when we consider the average of *all* the cases
lighter: not so heavy as other people

85 *indicating:* showing the presence of

an under-developed brain: a brain which has not grown or developed to the usual extent
Some: Some of these children
severe mental deficiencies: a serious absence of development of the brain, resulting in the inability to behave and think like other human beings

86 *while:* and

87 *at five years old:* at five years of age; when they were five years old

88 *expectant mothers:* pregnant women

89 *for therapeutic . . . reasons:* for reasons connected with the curing of their disease
for diagnostic reasons: for reasons connected with the identification of their disease
X-rays were used to destroy cancer cells in the human body (i.e. for therapeutic reasons). They were also used to photograph inside the body to assist doctors in *diagnosing* the illness of their patients (i.e. for diagnostic reasons). In either case the patient received a dose of radiation

90 *the medical literature:* the writings of doctors
abnormalties: unusual occurrences, i.e. malformations. See line 53

91 *exposure:* exposure to *radiation*
arose: occurred

92 *radiologists:* Radiology is the scientific study of X-rays. A radiologist is one who makes such studies

92 *the radio-sensitivity:* the sensitivity to radiation

93 *survey:* examination of available information
where: in those cases in which

94 *within:* during. cf. line 42

95 *the implanation: implant* (verb) → *implantation* (noun). See line 47
severe mal-development: serious defects in development

96 *a high proportion:* a large proportion

Exercises

I Answer these Questions:

1 How is radiation usually measured? (para. 1)
2 What is a Geiger counter and for what purposes is it used?
3 What is the unit of 'activity' of a radio-active substance? (para. 1)
4 Why is it that the 'curie' cannot give information concerning the dose of radiation which is given off? (para. 2)

5 What radio-active materials give off (*a*) gamma rays and (*b*) alpha particles? What are the penetrating powers of each? (para. 2)
6 What is the difference between the radiation doses of 1 curie of radio-active cobalt and 1 curie of polonium? (para. 2)
7 What factor, in any radiation, determines later biological changes? (para. 3)
8 What units are usually employed to measure the dosage of X-rays and gamma rays? Why is this?
9 What is a zygote? (para. 4)
10 How does the embryo grow in its early stages, i.e. before it is implanted in the uterus? How long does this period last (*a*) in mice, (*b*) in man? (para. 5)
11 What is the meaning of 'differentiation'?
12 For how long does the period of differentiation last in the human embryo?
13 What are the effects of radiation during the differentiation period, i.e. when the limbs and organs are being developed? (para. 5)
14 Are the effects of radiation on the foetus easily noticed at birth? What effects are likely to be produced during the foetal stage? (para. 6)
15 From what three different sources has the evidence concerning the effects of radiation been collected? (paras. 7–8)
16 In what ways does the evidence taken from Japanese survivors of the atom bomb support that which has been obtained from the experiments which have been conducted on mice? (para. 7)
17 In what ways do the effects of X-rays, received by expectant mothers 20–30 years ago, support the conclusions reached in the experiments with mice? (para. 8)

II Write a summary of the effects of radiation on (*a*) the pre-implantation embryo, (*b*) the embryo during differentiation, and (*c*) the foetus.

III Draw a graph showing the connection between irradiation of mice during pregnancy and the effects on the embryo.

IV Rewrite these sentences, replacing the words printed in italics by others used in the passage.

1 How do we measure the radiation dose *emitted* by an X-ray machine.
2 We can do this by *finding out* the number of ions produced in a volume of gas.
3 The period of major organ production is *finished* after about three months in human beings.
4 Exposure to doses *which are not large enough* to produce severe radiation sickness in the mother no longer produces *very great* deformities which can be recognized in animals *used in experiments*.
5 The effect of irradiation is less *easy to see*.

V Rewrite each of the following sentences, inserting the word(s) given in brackets in the correct place near to the verb, if possible. If there is more than one place where the word(s) can be placed, give the alternatives.

Example: The radiation dose is measured by determining the number of ions produced in a volume of gas. (usually)
The radiation dose is usually measured by determining the number of ions produced in a volume of gas.
OR Usually, the radiation dose is measured by determining the number of ions produced in a volume of gas.

1 The widely used Geiger counter consists of a wire stretched inside a cylindrical tube. (essentially)
2 The gamma-rays from the curie of cobalt will penetrate. (deeply)
3 The amount of energy gained by the irradiated substance is the important factor. (clearly)
4 The embryo is implanted in the wall of the uterus. (firmly)
5 We can superimpose a human time-scale on the mouse data. (confidently)
6 Every receding galaxy will increase its distance from us until it passes beyond the limit of the observable universe. (eventually)
7 I have mentioned the critical limit of about two thousand million light years. (already)
8 Can this process go on? (indefinitely)
9 The universe will remain the same. (Add (i) always; (ii) essentially)
10 Can we assume that all the isotopes of a given element were produced in equal amounts? (originally)

VI In Exercise V above the words given in brackets are adverbs which function as *adjuncts* in the clauses of which they are part. They may be considered as being equal in importance to the *Subject*, the *Predicator* and the *Complement* in the structure of a clause.

e.g. He eats his lunch quickly.
Subject: He; *Predicator:* eats; *Complement:* his lunch; *Adjunct:* quickly.

If we add *generally* to this sentence, we are adding a second *adjunct*: He generally eats his lunch quickly.

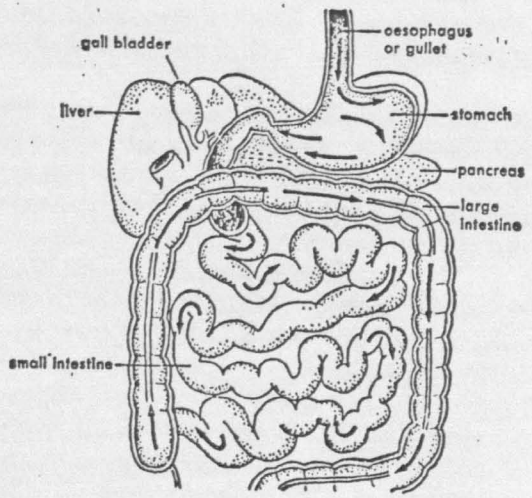
Many of the words which are used as adjuncts in the clause end in *—ly* (e.g. essentially, firmly, generally). But many of these words can be

13 Banting and the Discovery of Insulin

Preliminary Note

[1] *Insulin* is a substance which enables muscles to take up (absorb) sugar from the blood, and to break it up, so that energy is obtained. In the disease called *diabetes*, enough insulin is not produced; the sugar increases in the blood and the body is poisoned. Insulin is produced by the *pancreas* of a healthy person. This is an organ (see diagram) in the lower part of the stomach leading to the small intestine.

1. While at the Medical School, Banting went into the library and looked at the November issue of *Surgery, Gynaecology and Obstetrics*. The first article was entitled 'The relation of the Islets



13.1. Diagram of stomach, liver, and pancreas

of Langerhans to Diabetes' by Dr. Moses Barron of Minneapolis. Banting had to talk to his students next day on the functions of the pancreas, so he took the journal home with him.

2. One paragraph in Barron's review of previous literature on the

subject referred to the experiments on tying the pancreatic ducts of rabbits made by Arnozen and Vaillard thirty-six years earlier. Banting had not heard of these experiments before, but he knew that attempts to treat diabetes with extracts of the pancreas had failed; and he wondered why.

3. A possible answer that occurred to him was that the hormone from the islets of Langerhans was destroyed during the extraction of the pancreas. The question then was what might destroy it; and his thoughts turned to the digestive ferment that the pancreas produced. He knew this was very powerful, so powerful that it could break up and dissolve all sorts of protein foods including the toughest meats. Perhaps, during the process of extraction, this ferment destroyed the vital hormone.

4. If that were so, Banting reasoned, the extraction ought to be delayed until the pancreas was no longer producing this ferment. According to the experiments of Arnozen and Vaillard, this condition could be reached by tying the pancreatic ducts. It was two o'clock in the morning of October 31, 1920, when he wrote in his small black notebook: 'Tie off pancreas ducts of dogs. Wait six or eight weeks. Remove and extract.'

5. Although he did not know it, this was much the same idea that had come to Lydia de Witt fourteen years earlier. But it was not for the idea alone that Banting deserves to be remembered; his greatness lay in the way he put it into practice. He had to wait until the spring of 1921 before he could start work, and he filled in the time by reading all the literature on the subject he could find. He still missed Lydia de Witt's work. At last he was given his laboratory—small, hot and rather primitive—and his ten dogs. His assistant, Charles Best, was a recent graduate in physiology and biochemistry who had been working under Macleod on sugars. They began work on May 16.

6. Banting began by tying off the pancreatic ducts of a number of dogs, which was quite easy. Then he had to remove the pancreas from other dogs to give them diabetes. The operation was not easy, and Banting's training and ability as a surgeon proved invaluable. Even so, several dogs died before he evolved a suitable technique.

7. On July 6 Banting and Best chloroformed two of the dogs whose pancreatic ducts they had tied seven weeks earlier, and were disappointed to find that the pancreas had not degenerated as they had hoped. They had not tied the ducts with the correct

degree of tension needed—the margin of error was very small. And they had only one week left to complete their work. Macleod was away in Europe, but an extension was granted by the authorities, and the experiment was continued. On July 27 another duct-tied dog was chloroformed, and when Banting operated he found that the pancreas had shrivelled to about one-third of its original size. It was removed, chopped into pieces and mixed with saline; and a small amount of a filtered extract was injected into one of the diabetic dogs. Within two hours its blood sugar had fallen considerably, and before long the dog became conscious, rose, and wagged its tail.

8. The effect of the injection was so dramatic that Banting and Best could hardly believe it; but further experiments made them sure that they had indeed found what they were looking for. They had succeeded in extracting the anti-diabetic hormone secreted by the islets of Langerhans. They called it 'isletin'. It was some time later that Macleod renamed it insulin, a word that had been suggested in 1910. Insulin did not cure diabetes. After a while the dog relapsed, and further injections were needed to revive it again. But with regular injections of insulin a dog with diabetes could live.

9. Banting and Best next succeeded in obtaining insulin by injecting secretin to stimulate the production of the digestive ferment from the pancreas and exhaust the cells from which it came. This was a much quicker method than tying the ducts and waiting several weeks; and although the practical results were disappointing, its importance to the theory was considerable.

10. So far insulin had been extracted only in sufficient quantity for laboratory work, and already Banting and Best were seeking means of getting larger supplies. They now obtained insulin from the pancreas of a foetal calf—that is, a calf that had not yet been born. Nature, ever practical, does not supply digestive ferments until a calf starts eating, so there was nothing to destroy the insulin during extraction. This new success enabled Banting and Best to keep up an adequate supply of insulin for more extensive experiments. At the same time they realized that if their work was to have practical results in medical treatment it would be necessary to get much larger supplies. And they could only come from adult cattle in the slaughterhouse. The problem was to find a means of extracting the insulin from the pancreas of an ordinary adult animal.

11. The problem was solved well enough to provide insulin for the first injections on human beings. Two patients in Toronto General Hospital were chosen—a fourteen-year-old boy and a doctor, both very seriously ill with diabetes: 'hopeless' cases. When treated with insulin—although still in a relatively impure form—they improved at once. The boy is alive and well to-day.

12. 'Research in medicine is specialized,' Banting said later, 'and as in all organized walks of life, a division of labour is necessary. In consequence, a division of labour in the field of insulin took place.' Professor J. B. Collip, a biochemist, was called in to produce a purer extract. He succeeded very quickly; and other workers made it possible to obtain insulin on a really large scale. Before very long insulin injections became the standard treatment for diabetes all over the world. They still are today.

13. Banting, only thirty-one years old, was suddenly famous. Although for some extraordinary reason he was not knighted until 1934, he was awarded the Nobel Prize for Medicine in 1923—jointly with Macleod.

(Extract taken from Chapter VIII of *Great Discoveries in Modern Science* by PATRICK PRINGLE.)

Notes

LINE

1 *While at:* While he was at
the Medical School: Frederick Banting (1891–1941), a Canadian physician, studied medicine at Toronto, Canada

2 *the November issue:* the issue ('number' or publication) which appeared in November
Surgery, Gynaecology and Obstetrics: This is the name of the medical journal

3 *was entitled:* had the title
the Islets of Langerhans: Islet, 'pronounced ˈailət (small island). Small areas in the pancreas in which insulin is produced. They are named after Langerhans who first studied them.

4 *Diabetes:* pronounced daiəˈbi:ti:z (See Preliminary Note)

5 *next day:* on the next, or following, day
on: about; concerning
the functions: the work of; the part played by

7 *review:* consideration; examination; short statement
previous literature: things which had previously been written

8 *the subject:* that is 'the functions of the pancreas'
referred to: mentioned
the experiments on: the experiments based on
tying the pancreatic ducts: passing a fine thread round the pancreatic ducts so that the flow of digestive juices was restricted or limited.
the pancreatic ducts: the tubes leading from the pancreas to the stomach.
pancreas (noun) → *pancreatic* (adj.), pronounced pæŋkriˈætik

9 *made by:* (the experiments) which had been made by
Arnozen and Vaillard: These two doctors had tied up the pancreatic ducts of rabbits and had attempted to find an *extract* (ˈekstrækt) of the pancreas which would help in the treatment of diabetes. They were unsuccessful.

10 *had not heard of:* had known nothing about

13 *a possible answer:* that is, a possible answer *to the question which was in his head*
that occurred to him: that entered his head
hormone: substance produced inside the body, usually in a gland, which goes into the bloodstream and produces a special effect. In this case, the hormone referred to is insulin.

14 *the extraction of:* the removal of; the cutting out of

15 *then:* in that case
it: the hormone

16 *his thoughts turned to:* he began to think about
the digestive ferment: The pancreas produces four liquid ferments, i.e. liquids which help to break down chemical substances, so that the body can absorb (digest) its food
ferment (noun), pronounced ˈfə:ment (verb), pronounced fə:ˈment

17 *so powerful that it could break up and dissolve:* powerful enough to break up and to dissolve

18 *protein:* Protein is the main chemical substance of living (organic) matter. Protein contains 50 per cent carbon, 25 per cent oxygen and about 15 per cent nitrogen with small amounts of hydrogen, phosphorus and sulphur. Here *protein* modifies the headword *foods*. See note 2/35, p. 18.
protein foods: foods containing protein

19 *the toughest meats:* Lean meat is a protein food.
toughest here means *hardest to digest*

20 *vital:* essential

21 *If that were so:* If that were true
Banting reasoned: This is a reporting clause, similar to *Banting said, Banting decided* . . . etc.
reasoned: concluded; thought
the extraction ought to be delayed: it would be better to delay the extraction. *extract* (verb), pronounced ɪksˈtrækt → *extraction* (noun)
to extract: to take out

22 *was no longer producing:* had stopped producing

26 *Tie off pancreas ducts:* Separate the pancreas ducts by tying them

27 *Remove and extract:* Remove and *make an extract* of the pancreas (see lines 55–7)
To extract (verb) often means *to remove.* In this case the pancreas is first removed and *an extract* is then made of the 'vital hormone' (line 20) as described in lines 55–7

28 *it:* This refers to the whole of the following clause: 'this was much . . . earlier'
much the same idea: very like the idea
the same idea that had come to Lydia de Witt: the same idea as Lydia de Witt had had

29 *Lydia de Witt:* an American doctor who had experimented in the same way as Banting with the pancreatic ducts of dogs. Her results were negative, i.e. she was unsuccessful

31 *lay in the way:* was in the manner in which
he put it into practice: he applied it

33 *filled in the time:* used the time before the spring of 1921
he could find: This clause qualifies *the literature* and NOT *the subject.*

34 *missed:* did not find; did not discover; did not come across

35 *his laboratory . . . and his ten dogs:* the laboratory and the ten dogs for which he had asked
primitive: not comfortable; containing only the essential things for his work

36 *a recent graduate:* a young man who had recently taken a University degree

37 *physiology:* the study of the way in which a living organism (such as man) carries out its functions
biochemistry: the study of the chemical changes which take place in living things. Charles Best was a physiologist and biochemist
under Macleod: under the direction of Macleod
Macleod: Dr. J. Macleod was in charge of the research work on 'sugars' at the Medical School. Banting's work on diabetes was therefore of great importance to him

39 *a number of dogs:* several dogs

40 *which:* This refers to the action mentioned in the previous clause: 'tying off etc.'
he had to remove: it was necessary for him to remove

41 *to give them diabetes:* in order to give them diabetes
When the pancreas was removed from a dog, it was no longer able to absorb sugar into its system (see preliminary note). The removal of the pancreas produced (or gave it) diabetes
The operation: Any treatment of an animal or human being, in which surgery is used, is called an *operation*

42 *training:* education
ability: skill
a surgeon: a doctor who treats people by operating on them, e.g. by opening their bodies and removing certain parts
proved invaluable: was extremely useful

43 *Even so:* In spite of this
evolved: found, by experience; worked out
a suitable technique: a suitable way of performing the operation

45 *chloroformed: to chloroform:* to give chloroform to a person (or animal) in order to make him unconscious

47 *disappointed:* unpleasantly surprised
degenerated: lost its strength; changed in such a way as to become ineffective

48 *as they had hoped:* in the way that they had hoped it would degenerate.
the correct degree of tension: the right (amount of) tightness

49 *the margin of error:* The tension had to be just right. If it had been too tight the pancreas would have shrivelled up (see note line 54) completely and both the digestive ferment and the insulin would have dried up. If it had been too loose the pancreas would not have shrivelled up enough and the ferment would have destroyed the insulin. In such cases we say that the 'margin of error' is small, i.e. a small difference in tension (a small error in the tension) will spoil the experiment

50 *to complete their work:* in which they could complete their work

51 *away:* absent
an extension: an increase in the time allowed
granted: given; agreed to
the authorities: the people responsible for providing the necessary money

52 *another duct-tied dog:* another dog whose pancreatic duct had previously been tied

54 *shrivelled:* to shrivel: to shrink; to be reduced in size

55 *chopped:* cut

56 *saline:* a solution of salt
a filtered extract: The pancreas was cut into very small pieces and placed in a salt solution. This was then filtered through blotting paper. The pieces of pancreas remained behind and the remainder of the solution, which had passed through the filter paper (i.e. the extract), was used for an *injection*
injected into: introduced into the blood stream of

57 *diabetic: diabetes* (noun, the name of the disease) → *diabetic* (adj.; also *noun* meaning: a person suffering from diabetes)
Within: See 2/91, p. 21
its blood sugar: the amount of sugar contained in its blood

58 *had fallen considerably:* had been considerably reduced
before long: in a short time

59 *rose:* stood up

60 *dramatic:* striking (like some exciting incident in a play)

61 *could hardly believe it:* had difficulty in believing it
further: additional; more
made them sure: convinced them

63 *the anti-diabetic hormone:* the hormone which prevents the occurrence of diabetes
secreted: to secrete, pronounced si'kri:t, to produce
The islets of Langerhans secrete (produce) insulin. Insulin is a *secretion* of the islets of Langerhans

65 *insulin:* The name insulin is derived from the Latin word for 'island'. See note, line 3

66 *a while:* a certain time

67 *relapsed:* collapsed again; became unconscious again
further: additional; more
to revive it: to cause it to recover

68 *regular injections:* injections given always at fixed times
could live: could stay alive

71 *secretin: Secretin* is produced (secreted) in the upper part of the bowels

when food enters, and then travels to the pancreas. It causes the *digestive ferment* or juices (see line 16) to flow into the bowel
to stimulate: to encourage; to cause; to make more active

72 *exhaust the cells:* empty the cells; make the cells secrete all the digestive ferment that they contained

74 *the practical results:* the results of the actual experiments which were conducted

75 *its importance:* the importance of this new method

76 *So far:* Up to this point
in sufficient quantity for: in a quantity which was large enough for

77 *laboratory work:* work in the laboratory
seeking: looking for; trying to find

78 *means:* ways
now: as their next step

79 *foetal: foetus* (noun) → *foetal* (adj.)
calf: the young of a cow

80 *ever practical:* always arranging things in the best and most suitable way
supply: produce; provide
Note: *supply* is a *verb* here; in line 78 *supplies* is a *noun*

81 *starts eating:* After the verb *to start* we can use either an *-ing* form or a *to-infinitive* (*starts to* eat)
there was nothing to destroy the insulin: there was nothing which could destroy the insulin

82 *during extraction:* while it (the insulin) was being extracted, or taken out
new: additional
to keep up: to maintain; to continue producing

83 *adequate:* sufficient (but not abundant)
more extensive experiments: experiments with more animals and for a longer period

84 *At the same time:* However; Even so; Nevertheless
they realized: they understood quite clearly
if their work was to have practical results: if they wanted their work to have results that could be applied usefully

85 *in medical treatment:* in the treatment of diabetics (see line 57) by medical means

86 *to get:* to obtain
they: the 'much larger supplies' mentioned in the previous sentence
adult cattle: fully-grown cattle
cattle: cows, bulls, etc.

87 *the slaughterhouse:* the place where animals are slaughtered (killed) for their meat
a means: a method; a way
Notice that the word *means* here is a singular noun, as we see by the use of the indefinite article *a* before it: cf. line 78, where *means* (= ways) is a plural noun

88 *an ordinary adult animal:* that is, an adult animal that has not been specially treated (e.g. by having its pancreatic ducts tied)

90 *The problem was solved well enough:* A way of dealing with this problem was found which was good enough

91 *the first injections on:* that is, the first injections *that were ever given to*

92 *a fourteen-year-old boy:* a boy who was fourteen years old
Notice that in *fourteen-year-old* the word *year* does not have an *s*

93 *seriously ill:* Notice the use of *seriously* with *ill*
'hopeless' cases: A sick person is called a *case* when he is being treated; *'hopeless' cases* are people for whom there is no hope, who are not expected to recover

94 *When treated with:* When they were treated with; When they were given
although still in: although the insulin was still in
a relatively impure form: less pure than the form in which it was later produced
Notice: pure → *im*pure

95 *they improved:* their condition became better
at once: immediately

96 *Research:* The search for new knowledge
specialized: divided into small 'areas' or 'fields' of investigation
later: some time after the events which have just been described

97 *all organized walks of life:* all professions or 'occupations' which are organized or arranged systematically
a division of labour: a distribution, among a certain number of people, of the work that must be done

98 *In consequence:* Consequently; So; Thus
in the field of insulin: in the research concerned with insulin
field: see note on line 96 (specialized)

99 *was called in:* was appealed to; was invited

101 *workers:* people engaged in research; research workers
on a really large scale: in really large quantities

102 *Before very long:* Quite quickly; Quite soon
the standard treatment for diabetes: the normal way of treating diabetes

103 *all over the world:* in every part of the world

They still are: They: insulin injections
are: are the standard treatment

105 *for some extraordinary reason:* for some reason which no-one knows. The phrase suggests that there was *no* good reason for the delay
knighted: made a knight by the sovereign (at that time, George V). A knight has certain privileges, one of which is to use the title *Sir* before his Christian name, e.g. Sir Frederick Banting

106 *Nobel:* Alfred Nobel (1833–1896), a Swedish chemist and engineer. He invented dynamite and made a large fortune. When he died he left £2 million to provide annual prizes for outstanding work in literature, physics, chemistry, medicine and the cause of peace

107 *jointly with:* together with
That is, he shared the prize for medicine with Macleod

Exercises

I Answer these Questions:

1 What caused Banting first to begin the study of diabetes? (para. 1)
2 What previous experiments had been made on the pancreas?
3 What produces the digestive ferment?
4 What idea occurred to Banting regarding the effect of the digestive ferment on the hormone? (para. 3)
5 What did Banting write in his notebook on 31st October 1920? Why did he make this note? (para. 4)
6 How did Banting spend his spare time while he was waiting for a laboratory in which to work? (para. 5)
7 Banting's idea had already occurred to Lydia de Witt about 14 years earlier, although Banting did not know this. For what does Banting deserve special praise? (para. 5)
8 Who was Banting's assistant in these experiments, and what was his special field of study? (para. 5)
9 What was the first step to be taken in carrying out the experiments on dogs? (para. 6)
10 What was the second step taken? What difficulties were experienced in this matter? (para. 6)
11 What kind of operation did he perform on the two dogs on July 6th? What was the result of these operations? (para. 7)
12 How many dogs were used in the operation of July 27th? What was the result? (para. 7)
13 What did Banting do to the pancreatic duct which he had extracted from the dog? (para. 7)
14 What was the reaction of the dog which had been injected with the extract? (para. 7)

15 Why was the result of this experiment surprising? What results had it achieved? (para. 8)
16 What was the first name given by Banting to the insulin which he had prepared? Who gave insulin its present name? (para. 8)
17 Is the injection of insulin a permanent cure for diabetes? (para. 8)
18 How did Banting and Best obtain fresh supplies of insulin by a much shorter method? What results were obtained? (para. 9)
19 How did Banting and Best obtain sufficient supplies of insulin for further experimental work? (para. 10)
20 How were adequate supplies of insulin obtained to meet the needs of diabetic patients? (para. 10)
21 Who were the first two human patients to receive insulin treatment? Was the treatment successful? (para. 11)
22 What kind of assistance was sought to produce a purer insulin extract? Was this achieved? (para. 12)
23 How was Banting honoured for his great discovery? (para. 13)

II The first part of the verbal groups in the following sentences indicate *possibility, desirability, necessity* (or *certainty*), *probability, obligation, inference, reasonable expectation.*

Write down (i) the number of each sentence
(ii) the complete verbal group printed in italics
(iii) the meaning indicated by the first part of the verbal group, i.e. *desirability*, etc.

Examples: (*a*) I *must go.* *Answer:* (*a*) *must go*—necessity
(*b*) You *must be tired.* *Answer:* (*b*) *must be*—inference

1 Banting *had to talk* to his students next day on the function of the pancreas.
2 The question was: 'What *might destroy* the hormone?'
3 The extraction *ought to be delayed* until the pancreas was no longer producing the ferment.
4 He *had to wait* until the spring of 1921.
5 With regular injections of insulin a dog with diabetes *could live.*
6 He filled in the time by reading all the literature on the subject *he could find.*
7 The shower of stars *must have been surrounded* by a cloud of gas.
8 The vital clue in a detective novel *should be* far from obvious.
9 It is a consequence of the laws of dynamics that a blob of gas *must spin* more and more rapidly as it shrinks.
10 The sun's hydrogen *ought to provide* radiation for at least several thousands of millions of years.
11 Any change in the condition of the earth *may be* either gradual or catastrophic.

12 It (i) *might be thought* that this (ii) *could not go on* indefinitely.
13 Without continuous creation the universe *must evolve* towards a dead state.
14 Before we (i) *can discuss* the basic problem of the origin of our universe, we (ii) *must ask* ourselves whether such a discussion is necessary.
15 We *must reject* the idea of a permanent unchangeable universe.
16 The atoms were formed under some unusual circumstances which *must have existed* a few billion years ago.
17 The needle *should fall* on a line a little less than two times out of three.
18 The experiment *should have detected* the delay by a much smaller current.
19 The spark from the first apparatus *must have been transferred* through the intervening space in the form of some kind of wave.
20 He *ought to have seen* the error in his calculations.

III Write down, if possible, the words to which *it* refers in the lines indicated. If the word *it* does not refer to any words, state its function. For example, in 'It was two o'clock', *it* may be described as the subject of the verb *was* in an impersonal construction; *it* does not 'refer' to any other words in the text.

1 line 15
2 line 28
3 line 29
4 line 31
5 line 55
6 line 61
7 line 64 (first occurrence)
8 line 64 (second occurrence)
9 line 85
10 line 101

IV Without referring to the text, write out the following paragraph, supplying *a, an* or *the* where necessary. Note that in several places no word is required.

While at — Medical School, Banting went into — library and looked at — November issue of — *Surgery,* — *Gynaecology and* — *Obstetrics.* — first article was entitled ' — relation of — Islets of Langerhans to — Diabetes' by — Dr. Moses Barron of Minneapolis. Banting had to talk to his students next day on — functions of — pancreas, so he took — journal home with him.

Banting was especially interested in one paragraph in — Barron's review of — previous literature on — subject. This paragraph referred to — experiments on — tying — pancreatic ducts of — rabbits made by Arnozen and Vaillard thirty-six years earlier. Banting had not heard of these experiments before, and he drew — line against — paragraph; and sat brooding over — paper.

— possible answer that occurred to him was that — hormone from — islets of Langerhans was destroyed during — extraction of — pancreas.

— question then was what might destroy it; and his thoughts turned to — digestive ferment that — pancreas produced. He knew this was very powerful — so powerful that it could break up and dissolve all — sorts of — protein foods including — toughest meats. Perhaps, during — process of — extraction, this ferment destroyed — vital hormone.

V Write out the following sentences, replacing the blank spaces by *who, whom; whose, which* or *what.*

1 Banting's assistant was a young man — had recently graduated and — had been working on sugars.
2 Banting had been trained as a surgeon, — was very fortunate as the operations on the dogs were not easy.
3 They chloroformed the dogs — pancreatic ducts had been tied seven weeks earlier.
4 They had at last found — they were looking for.
5 Nature, — does not supply digestive ferments until a calf starts eating, is always practical.
6 For this reason there was nothing — could destroy the insulin during extraction.
7 Two patients — were both considered to be 'hopeless cases' were chosen for treatment.
8 Severe maldevelopment was observed in every child, a high proportion of — lived for many years.
9 Descartes, — book Newton read in Cambridge, was a Frenchman.
10 At last he heard the sound for — he had been listening.
11 He began by tying off the pancreatic ducts of a number of dogs, — was quite easy.
12 Lydia de Witt, — work Banting had missed, had had much the same idea fourteen years earlier.

14 Metallurgy: Making Alloys

1. The majority of alloys are prepared by mixing metals in the molten state; then the mixture is poured into metal or sand moulds and allowed to solidify. Generally the major ingredient is melted first; then the others are added to it and should completely dissolve. For instance, if a plumber makes solder he may melt his lead, add tin, stir, and cast the alloy into stick form. Some pairs of metals do not dissolve in this way. When this is so it is unlikely that a useful alloy will be formed. Thus if the plumber were to add aluminium, instead of tin, to the lead, the two metals would not dissolve—they would behave like oil and water. When cast, the metals would separate into two layers, the heavy lead below and aluminium above.

2. One difficulty in making alloys is that metals have different melting points. Thus copper melts at 1,083° C., while zinc melts at 419° C. and boils at 907° C. So, in making brass, if we just put pieces of copper and zinc in a crucible and heated them above 1,083° C., both the metals would certainly melt. But at that high temperature the liquid zinc would also boil away and the vapour would oxidize in the air. The method adopted in this case is to heat first the metal having the higher melting point, namely the copper. When this is molten, the solid zinc is added and is quickly dissolved in the liquid copper before very much zinc has boiled away. Even so, in the making of brass, allowance has to be made for unavoidable zinc loss which amounts to about one part in twenty of the zinc. Consequently, in weighing out the metals previous to alloying, an extra quantity of zinc has to be added.

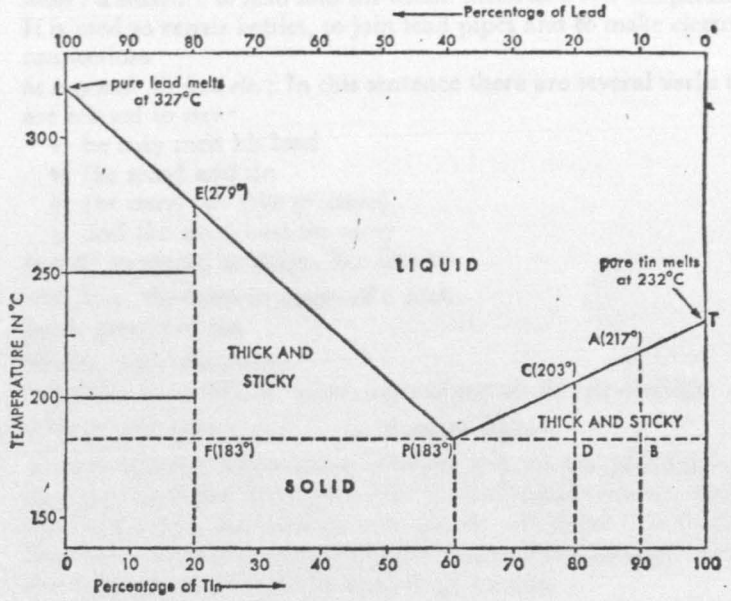
3. Sometimes the making of alloys is complicated because the higher melting point metal is in the smaller proportion. For example, one light alloy contains 92 per cent aluminium (melting point 660° C.) with 8 per cent copper (melting point 1,083° C.). To manufacture this alloy it would be undesirable to melt the few pounds of copper and add nearly twelve times the weight of

aluminium. The metal would have to be heated so much to persuade the large bulk of aluminium to dissolve that gases would be absorbed, leading to unsoundness. In this, as in many other cases, the alloying is done in two stages. First an intermediate 'hardener alloy' is made, containing 50 per cent copper and 50 per cent aluminium, which alloy has a melting point considerably lower than that of copper and, in fact, below that of aluminium. Then the aluminium is melted and the correct amount of the hardener alloy added; thus, to make 100 lb. of the aluminium-copper alloy we should require 84 lb. of aluminium to be melted first and 16 lb. of hardener alloy to be added to it.

4. In a few cases, the melting point of the alloy can be worked out approximately by arithmetic. For instance, if copper (melting point 1,083° C.) is alloyed with nickel (melting point 1,454° C.) a fifty-fifty alloy will melt at about halfway between the two temperatures. Even in this case the behaviour of the alloy on melting is not simple. A copper-nickel alloy does not melt or freeze at one fixed and definite temperature, but progressively solidifies over a range of temperature. Thus, if a fifty-fifty copper-nickel alloy is liquefied and then gradually cooled, it starts freezing at 1,312° C., and as the temperature falls, more and more of the alloy becomes solid until finally at 1,248° C. it has completely solidified. Except in certain special cases this 'freezing range' occurs in all alloys, but it is not found in pure metals, metallic, or chemical compounds, and in some special alloy compositions, referred to below, all of which melt and freeze at one definite temperature.

5. The alloying of tin and lead furnishes an example of one of these special cases. Lead melts at 327° C. and tin at 232° C. If lead is added to molten tin and the alloy is then cooled, the freezing point of the alloy is found to be lower than the freezing points of both lead and tin (see figure 14.1). For instance, if a molten alloy containing 90 per cent tin and 10 per cent lead is cooled, the mixture reaches a temperature of 217° C. before it begins to solidify. Then, as the alloy cools further, it gradually changes from a completely fluid condition, through a stage when it is like gruel, until it becomes as thick as porridge, and finally, at a temperature as low as 183° C., the whole alloy has become completely solid. By referring to figure 14.1 it can be seen that with 80 per cent tin, the alloy starts solidifying at 203° C., and finishes only when the temperature has fallen to 183° C. (note the recurrence of the 183° C.).

6. What happens at the other end of the series, when tin is added to lead? Once again the freezing point is lowered. An alloy with only 20 per cent tin and the remainder lead starts to freeze at 279° C. and completes solidification at the now familiar temperature of 183° C. One particular alloy, containing 62 per cent tin and 38 per cent lead, melts and solidifies entirely at 183° C. Obviously this temperature of 183° C. and the 62/38 per cent composition are important in the tin-lead alloy system. Similar effects occur in many other alloy systems and the special composition which has the lowest freezing point of the series and which entirely freezes at that temperature has been given a special name. The particular alloy is known as the '*eutectic*' alloy and the freezing temperature (183° C. in the case of the tin-lead alloys) is called the *eutectic* temperature.



14.1 Graph of eutectic alloy

7. By a careful choice of constituents, it is possible to make alloys with unusually low melting points. Such a fusible alloy is a complex eutectic of four or five metals, mixed so that the melting point is depressed until the lowest melting point possible from

any mixture of the selected metals is obtained. A familiar fusible alloy, known as Wood's metal, has a composition:

Bismuth	4 parts
Lead	2 parts
Tin	1 part
Cadmium	1 part

and its melting point is about 70° C.; that is, less than the boiling point of water. Practical jokers have frequently amused themselves by casting this fusible alloy into the shape of a teaspoon, which will melt when used to stir a cup of hot tea.

8. These low melting point alloys are regularly in use for more serious purposes, as for example, in automatic anti-fire sprinklers installed in the ceilings of buildings. Each jet of the water sprinkler system contains a piece of fusible alloy, so that if a fire occurs and the temperature rises sufficiently high, the alloy melts and the water is released through the jets of the sprinkler.

(Extract taken from Chapter V of *Metals in the Service of Man* by W. ALEXANDER and A. STREET.)

Notes

LINE

1 *The majority of alloys:* Most alloys
alloys: An alloy is a mixture of two or more metals. The alloy possesses properties (strength, hardness etc.) which are not possessed by the original metals
are prepared: are made; are produced
in the molten state: when they have been turned into liquids by heating. *Molten* is a form of the past participle of the verb *to melt*. It is generally used as a modifier e.g. *molten metal, molten lead;* but it can also be used with the verb *to be*. See line 21. cf. line 4. *melted*

2 *then:* when the molten metals have been mixed
metal or sand moulds: metal moulds or sand moulds; that is, moulds which are made of metal or sand
moulds: hollow containers into which liquid metal is poured. When the metal cools down it takes the same shape as the mould. Sand is often used for this purpose. A wooden pattern of the object to be made in metal is pressed into a box containing sand. The molten metal is then poured into the hole which is left when the pattern is taken out.

3 *allowed to solidify:* left in the mould until it becomes solid. *solid* (adj.), pronounced ˈsɔlid → *solidify* (verb), pronounced səˈlidifai
the major ingredient: the metal of which there is most in the alloy
an ingredient: one of the items of which something else is made. Used especially in *cookery*

4 *should:* ought to.
If it does not do so, what happens? See lines 8–10

5 (*a*) *plumber:* a man who specializes in putting pipes in houses, e.g. for water or gas. He uses *lead* in his work
solder: a mixture of lead and tin which melts at a low temperature. It is used to repair kettles, to join lead pipes and to make electrical connections
he may melt his lead etc.: In this sentence there are several verbs that are related to *may:*
1. he may melt his lead
2. (he may) add tin
3. (he may) stir (the mixture)
4. and (he may) cast the alloy
to cast: to mould or shape. See line 10

6 *stick form:* the form or shape of a stick
pairs: groups of *two*

7 *dissolve:* mix completely
When this is so: that is, 'when pairs of metals do not dissolve'

8 *if the plumber were to add:* if the plumber added

9 *would not dissolve:* The melting points of lead, tin and aluminium are 327°, 232° and 660° C. respectively. If small pieces of tin are dropped into lead which has been melted, the tin will dissolve in the lead. But small pieces of aluminium will not melt in molten lead because the temperature of the lead is not high enough

10 *they would behave like oil and water:* (It is well known that oil and water do not mix, that one will not dissolve in the other)
When cast: When the mixture (of aluminium and lead) was poured into the mould. The process is called *casting*. *Casting* is also used to refer to the object which is produced by this process, as in note, line 34

11 *the heavy lead:* the lead, which is heavy in comparison with the aluminium of the attempted mixture

13 *One difficulty:* One of the difficulties
in making: when we make

14 *melting points:* temperatures at which they melt
1,083° C.: We say: 'One thousand and eighty three degrees Centigrade'

while: whereas; but in contrast

15 *So:* Therefore
just: simply

16 *a crucible:* a melting pot; a pot in which metals can be melted, usually made of earthenware or porcelain
above: to a temperature higher than

18 *boil away:* disappear as a result of boiling
the vapour would oxidise: Zinc becomes a liquid at 419° C. and a gas (vapour) at 907° C. Molten copper has a temperature of 1,083° C. which is hot enough to turn molten zinc into a gas or vapour. The zinc 'vapour' would then combine with the oxygen in the air to form zinc oxide, i.e. the zinc vapour would oxidize

19 *adopted:* used
in this case: in the example we are considering

20 *the metal having the higher melting point:* the metal which has the higher melting point
namely: that is

22 *very much zinc:* a great deal of zinc

23 *Even so:* In spite of this; Nevertheless
allowance has to be made for unavoidable zinc loss: the unavoidable loss of zinc has to be considered, taken into account

24 *amounts to:* is; is equal to
one part in twenty: one-twentieth (1/20th)

25 *in weighing out the metals:* when the metals are weighed out
to weigh out: to weigh and set aside for use

26 *previous to alloying:* before the process of making the alloy is begun

28 *the higher melting point metal:* the metal which has the higher melting point
in the smaller proportion: used in a smaller quantity than that of the metal with the lower melting point

29 *one light alloy:* This alloy was used for the gear-boxes and crank-cases of motor cars and motor-cycles. The alloy was very light but not very strong

31 *To manufacture: In order to* manufacture, make or produce
it would be undesirable to melt the few pounds of copper and add etc.: the melting of the few pounds of copper and the addition of etc. would not be a good method to use

32 *twelve times the weight of aluminium:* aluminium equal to the *weight* of the copper *multiplied by twelve*

33 *The metal would have to be heated:* It would be necessary to heat the metal
so much: to such a high temperature
to persuade the large bulk of aluminium: to persuade: to cause
bulk: amount, referring especially to its *size*

34 *gases would be absorbed:* The copper (8%) is small in bulk (size) and would take a long time to absorb (take in) such a large quantity of aluminium. Meantime, because of the much higher temperature of the copper, the aluminium would first become a liquid and would then become a gas, i.e. it would *vaporize* (note the spelling). Some of the vapour would produce chemical action in the molten metal. This chemical action would produce impurities in the metal, and these impurities would cause cracks to appear in the casting, i.e. the casting would not be sound and strong

35 *leading to:* resulting in
unsoundness: sound (adj.) → *soundness* (noun) → *unsoundness* (noun)

36 *done:* carried out
intermediate 'hardener alloy': We cannot make an alloy by mixing 92% aluminium with copper for the reason already given. We therefore make an intermediate (or middle) alloy using 50% of each metal. This alloy is not an engineering material—it is only an 'intermediate' product. This 'middle' alloy becomes hard (hardens) at a temperature below 660° C, which is the melting point of aluminium. The 'middle' alloy can therefore be dissolved in molten aluminium. Alloys of this 'intermediate' kind which have a melting point lower than those of their parent metals are called 'hardener alloys'
hardener: hard (adj.) → *harden* (verb) → *hardener* (noun)

38 *which alloy:* an alloy which

39 *that of copper:* the melting point of copper

40 *and the correct amount of the hardener alloy added:* and the correct amount of the hardener alloy *is added*

41 *to make:* in order to make
to make 100 lb . . . : We use 84lb. of pure aluminium and 16 lb. of the hardener alloy containing 8 lb. of aluminium and 8 lb. of copper. This gives an alloy containing 92 lb. of aluminium and 8 lb. of copper.

42 *we should require 84 lb. of aluminium to be melted first:* it would be necessary to melt eighty four pounds of aluminium first *OR* it would be necessary for us to melt . . .

44 *In a few cases:* In the making of a few alloys
can be worked out: can be calculated, estimated

45 *approximately:* roughly; not exactly

47 *a fifty-fifty alloy:* an alloy containing equal weights of the two metals

48 *the behaviour of the alloy:* the way the alloy behaves; what the alloy does *on melting:* when it melts

49 *freeze:* become hard
one . . . temperature: one *single* . . . temperature

50 *progressively solidifies:* becomes more and more solid

52 *liquefied: liquid* (noun) → *liquefy* (verb)
and then gradually cooled: and then *is gradually cooled*

53 *as the temperature falls:* while the temperature becomes lower and lower
more and more of the alloy: an increasing amount of the alloy

55 *this 'freezing range' occurs in all alloys:* we find this 'freezing range' in all alloys

56 *metallic, or chemical compounds:* compounds of metals or chemicals

57 *and in some:* and *it is not found* in some
special alloy compositions: alloy compositions of special importance
An example is given in the next paragraph

59 *furnishes:* gives us

60 *and tin at 232° C.:* and tin *melts* at 232° C.

65 *217° C.:* See the point marked A in figure 14.1

66 *as the alloy cools further:* See the dotted line AB in the figure. A represents 217° C. and B represents 183° C. At temperatures above A the alloy is liquid. At temperatures below B the alloy is solid. Between A (217° C.) and B (183° C.) the alloy is a thick, sticky mixture, neither liquid nor solid. This thick mixture looks first like *gruel* and then like *porridge. Porridge* is a dish made by boiling oat-meal with milk or water until it is a thick, sticky 'mixture'. *Gruel* is made from the same ingredients, but is more liquid
cools further: becomes cooler

68 *at a temperature as low as . . . :* at the (surprisingly) low temperature of . . .

70 *By referring to . . . it can be seen that:* If you refer to . . . you can see that

71 *starts solidifying:* See 13/81, p. 171
203° C.: This is the point C in the figure. Above the temperature represented by C the alloy is liquid

72 *the recurrence:* the repetition; the reappearance
of the 183° C.: of the temperature (or figure) 183° C. (*the* refers back to the earlier mention of this figure)

73 *183° C.:* This is the point D in the figure. Below the temperature represented by D (or shortly, below D) the alloy is solid. Between C and D it is a thick, sticky paste (like porridge)

74 *the series:* We are considering a series of alloys in the order of their percentage composition. The scale at the bottom of the figure deals with the series of alloys in terms of the percentage of tin. At the top of the figure we can see the same series of alloys in terms of their percentage of lead. The line LP in the figure represents the temperatures (of melting) with tin added to lead. The line TP represents the temperatures (of melting) with lead added to tin

75 *An alloy with:* An alloy which contains

76 *the remainder:* the rest
starts to freeze: cf. line 71

77 *279° C.:* This is the point E shown in the figure. Above this temperature the alloy is a liquid
solidification: process of becoming solid
solid (adj.) → *solidify* (verb) → *solidification* (noun) pronounced səlidifi'keiʃən
the now familiar temperature of 183° C.: the temperature with which we are now familiar, namely 183° C. *OR* the temperature which we are now accustomed to expect, namely 183° C.

78 *183° C.:* This is the point F in the figure. Below F the alloy is solid. Between F and E the alloy is neither solid nor liquid, but thick and sticky
particular: special

79 *solidifies entirely at 183° C.* The line LP represents the temperatures (melting points) of the series of lead/tin alloys. The line TP represents the melting points of the series of the tin/lead alloys. The point P indicates 183° C. as the melting point, and a ratio of 62% tin and 38% lead. At this point the alloy changes suddenly and immediately from solid to liquid or from liquid to solid

80 *the 62/38:* We say: 'the sixty-two, thirty-eight'

81 *the tin-lead alloy system:* the system of alloys which can be made from tin and lead

85 *is known as:* has been given the special name of

86 *in the case of the tin-lead alloys: for* the tin-lead alloys

81–87 The figure will explain these two sentences. The point P (183° C., 62% tin, 38% lead) is the 'critical' point. 183° C. is the eutectic temperature, and the eutectic alloy contains 62% tin and 38% lead

88 *By:* By means of
choice: selection

constituents: parts that constitute, or make, a whole

89 *a fusible alloy:* an alloy which melts completely at a fixed temperature—a eutectic alloy

90 *mixed so that:* which is mixed in such a way that

91 *depressed:* pushed down; made lower
the lowest melting point possible: Notice that when *possible* is used with a superlative adjective it can stand before or after the noun
(1) the lowest melting point possible
(2) the lowest possible melting point
from any mixture: which can be obtained from any mixture

92 *familiar:* well-known

99 *Practical jokers:* People who play tricks on others

100 *casting . . . into the shape:* making (or moulding) in the shape

101 *when used:* when it is used

102 *are regularly in use:* are regularly used

103 *automatic:* See 11/63, p. 144
anti-fire sprinklers: sprinklers installed in buildings to prevent fire. These sprinklers throw water out in all directions

104 *installed:* placed; fixed

107 *released:* allowed to escape
jet: outlet

Exercises

I Answer these Questions:

1 What is an alloy?
2 What is meant by the phrase 'major ingredients'? (para. 1)
3 How is an alloy of two metals, say lead and tin, made?
4 Which of the ingredients is melted first? (para. 1)
5 If the second ingredient cannot be melted in the major ingredient, what conclusion can you draw? Give an example. (para. 1)
6 What would happen if a mixture of two such metals was cast?
7 Give the temperatures of: (*a*) the melting point of zinc; (*b*) the boiling point of zinc; (*c*) the melting point of copper.
8 What would happen if pieces of copper and zinc were placed in a crucible and heated to a temperature of 1,100° C. and then allowed to cool? (para. 2)
9 What is done to avoid the boiling away of zinc in making brass? (para. 2)
10 Why do we have to add an extra quantity of zinc when we are making brass? What additional fraction of zinc is needed? (para. 2)

11 Suppose that an alloy is to be made of 92% aluminium and 8% copper. Why is it not desirable to melt the copper first and to add the aluminium afterwards? (para. 3)
12 What must we do if we wish to make 100 lb. of the alloy mentioned in paragraph 3?
13 What is the 50–50 alloy of zinc and copper called? (para. 3)
14 What is the melting point of nickel? (para. 4)
15 At what temperature does a 50–50 alloy of copper and nickel (*a*) begin to 'freeze'; (*b*) complete the process of 'freezing', and solidify? (para. 4)
16 What is the range of temperature between the beginning and the completion of solidification called? (para. 4)
17 Does this range occur in (*a*) pure metals; (*b*) chemical compounds; (*c*) all other alloys? (para. 4)
18 Answer the following questions about the tin-lead alloys mentioned in paragraph 5:
(*a*) What is the melting point of lead?
(*b*) What is the melting point of tin?
(*c*) At what temperature does a 90/10 alloy of tin and lead begin to solidify?
(*d*) At what temperature does the alloy become completely solid?
(*e*) At what temperature does an 80/20 alloy of tin and lead begin to solidify?
(*f*) At what temperature does the alloy mentioned in (*e*) become completely solid?
(*g*) What changes take place after the process of solidification begins in both cases?
19 Answer the following questions on the tin-lead alloys in which lead is the major ingredient. Find the information on the graph (figure 14.1).
(*a*) At what temperature does a 20/80 alloy of tin-lead begin to solidify?
(*b*) At what temperature does the alloy complete solidification?
(*c*) What is the upper temperature at which the alloy begins to solidify when there is 30% of tin and 70% of lead?
(*d*) At what temperature does the alloy mentioned in (*c*) complete solidification?
20 Look at the graph (figure 14.1) which shows the temperature of solidification in alloys of tin and lead:
(*a*) In what condition is the tin/lead alloy below the 183° C. temperature line?
(*b*) Of what consistency is the tin/lead alloy above the thick graph line?
(*c*) In what condition is the alloy between these two lines, i.e. the 183° C. line and the line showing commencement of solidification?

21 The observations that you made in order to answer Question 20 show clearly that the temperature 183° C. is of importance. What is the technical name given to this temperature for tin/lead alloys? What do we call the alloy which solidifies completely at this temperature?

22 Of what materials is Wood's metal composed? If you require 12 lb. of Wood's metal, how many lb. of each constituent would be required?

23 What is a 'practical joker'? Why is Wood's metal a favourite with practical jokers?

24 What is a fusible alloy. How are such alloys used in automatic fire extinguishers?

II Passage No. 14 is taken from a book which was written to be read silently by students of metallurgy. It was not written as a lecture or as something to be read aloud. The style is quite different from that of passage No. 3 (The Theory of Continuous Creation), which is in fact taken from a lecture. In material which is written to be spoken, the passive forms of the verb occur less frequently and are replaced by active constructions, beginning *We*, *You*, and sometimes *I*.

Imagine that you are explaining some of the processes described in passage No. 14 to a group of people, and rewrite the following passages in an appropriate style. Do not make any changes in the first three sentences, which are already in the form that a speaker might use. Where necessary, use two or three shorter sentences to replace a long one.

'Let us suppose that we are making brass. If we just put pieces of copper and zinc in a crucible and heated them above 1,083° C., both the metals would certainly melt. But at that temperature the liquid zinc would also boil away and the vapour would oxidize in the air. The method adopted in this case is to heat first the metal having the higher melting point, namely the copper. When this is molten, the solid zinc is added and is quickly dissolved in the liquid copper before very much zinc has boiled away. Even so, in the making of brass, allowance has to be made for unavoidable zinc loss which amounts to about one part in twenty of the zinc. Consequently, in weighing out the metals previous to alloying, an extra quantity of zinc has to be added.

'To manufacture a light alloy containing 92 per cent aluminium (melting point 660° C.) with 8 per cent copper (melting point, 1,083° C.) it would be undesirable to melt the few pounds of copper and add nearly twelve times the weight of aluminium. The metal would have to be heated so much to persuade the large bulk of aluminium to dissolve that gases would be absorbed, leading to unsoundness. In this, as in many other cases, the alloying is done in two stages. First an intermediate "hardener alloy" is made, containing 50 per cent copper

and 50 per cent aluminium, which alloy has a melting point considerably lower than that of copper and, in fact, below that of aluminium. Then the aluminium is melted and the correct amount of the hardener alloy added: thus, to make 100 lb. of the aluminium-copper alloy we should require 84 lb. of aluminium to be melted first and 16 lb. of hardener alloy to be added to it.'

III Complete the following sentences by using one of these words in each space:

about at for from in into of on through to within

1 Lead melts — 327° C. and tin — 232° C.
2 — the making — brass, allowance must be made — unavoidable zinc loss, which amounts — about one part — twenty — the zinc.
3 This temperature is obviously important — the tin-lead alloy system.
4 The melting point — Wood's metal is — 70° C.
5 Low melting point alloys are regularly — use, — example, — automatic sprinklers installed — the ceilings — buildings.
6 The alloy melts and the water is released — the jets — the sprinklers.
7 The metals will separate — two layers.
8 One difficulty — making alloys is that metals have different melting points.
9 — cooling further, the alloy will change — a completely fluid condition — a stage when it is like gruel.
10 We can prepare most alloys — mixing metals — the molten state.

IV *Spelling*. Write out the following sentences, giving the missing letters:

1 The mixture is poured into metal or sand m—lds.
2 If a plum—er were to add a—uminium to the lead it would not di—olve.
3 The melting point of Wood's metal is a—roximately 70° C.
4 As the alloy cools its condition gradua—y changes.
5 Note the recu—ence of the temperature 183° C.
6 Anti-fire sprinklers are often insta—ed in the c—lings of b—ldings.
7 The present diamet— of the sun is about a million miles.
8 We must appeal to some external pro—ess to slow down the spin of the sol—r condensa—n.
9 The rates of spin have a cur—ous depend—nce on surface temperature.
10 What is the equat—l rota—n speed po—essed by the sun?
11 The atoms are broken up, part—ly or who—y, into their constitu—nt parts.
12 The conditions on earth were fav—able to life.

Appendix 9

Dimensions of the field of medicine as presented in the contents pages of two basic textbooks on the subjects

C from Last,R. J. (1978) Anatomy : Regional and Applied. Sixth Edition. Churchill Livingstone.London.and New York.

CONTENTS

PAGINATION ERROR

SECTION 5. THE ABDOMEN

(From: Ganong,W. F. (1981) Review of Medical Physiology. 10 Edition, Marazen, Asian Edition, Singapore.

Table of Contents

SECTION III. FUNCTIONS OF THE NERVOUS SYSTEM

SECTION VIII. FORMATION & EXCRETION OF URINE

Appendix 10

Questionnaire (Professor's Version)

Dear professor, your answers would be of vital importance for the development of the English course in this faculty.Please tick ☑ the appropriate box after reading the questions in this questionnaire carefully.Thank you.

Name of professor : Faculty :

Subjects taught : Department:

I.How would you describe the usefulness of English for graduating as a well-qualified professional in medicine ?

☐ Necessary ☐ Convenient ☐ Unnecessary

2.By means of the numbers I (most),2,3,and 4 (least)indicate the language skills your students need to be developed in coping adequately with their studies in this faculty?

☐ Listening ☐ Speaking ☐ Reading ☐ Writing

3.Which of the following study skills you think your students would deal with during their studies in this faculty?

☐ Laboratory experiment ☐ Writing medical essays ☐ Seminars

☐ Note-making ☐ Writing clinical reports ☐ Using library reference

If there are other skills,please specify.....

4. Would you like to work in collaboration with the EST teachers(Teachers of English for Science and Technology) in order to improve the process of teaching English in this faculty? ☐ Yes ☐ No

5. What kind of cooperation you think would be involved between the EST teacher and the specialit teacher ?Please specify .....

.....

6. By means of the numbers I (most),2,3,4 and 5 (least) indicate the degrees of difficulty your students would face in dealing with the following English medical materials.

☐ Medical terminology ☐ Understanding spoken English

☐ Understanding reading texts ☐ Writing essays

☐ Answering written examinations

7.Is there any other information you feel is relevant to this questionnaire?

☐ Yes ☐ No

If yes,please specify.....,...

....

Date; / / I98

Appendix 11

Questionnaire (Student's version)

By giving accurate answers you would help much in arriving at good results which would help for the development of the English course in your faculty. From every question choose the answer which suits your case by putting ☑ in the appropriate box.

Student's name: Faculty: Age:

Sex: ☐ Male ☐ Female

I. Are you a preparatory-school leaver of the scientific section ?

☐ yes ☐ No

If No, please specify.....

2. What was your score in English language in the ministerial examination?.....

3. In your opinion, is it necessary to know English well in order to graduate in this faculty ? ☐ yes ☐ No

4. How do you read in English ?

☐ fluently ☐ little difficulty ☐ some difficulty ☐ great difficulty

5. Which of the following difficulties would you face when you read medical English texts ?

☐ understanding medical terminology

☐ understanding medical terminology, but failing to get the meaning of the sentence.

☐ understanding the meaning of the sentences, but failing to understand the paragraph or the text.

6. By means of the numbers I (most), 2, 3, and 4 (least), indicate the language skills you would need in coping with your studies in this faculty ?

☐ listening ☐ Speaking ☐ Reading ☐ Writing

7. Would you like to study for a postgraduate degree(s) in medicine after getting your MBchB, if such an opportunity arrises ? ☐ Yes ☐ No

If Yes, would you like to do it in an English seaking country ?

☐ Yes ☐ No

Date: / /198

Appendix 12

Name: Faculty:

Class:

Pre-EST Test for Medical Students in Faculty of Medicine in Iraq

Q.1. Listening Comprehension

In this section of the test, you will have an opportunity to demonstrate your ability to understand spoken English. Listen to the following text(1) carefully, and then tick ☑ the most appropriate answer.

1. According to the directions, which of the following people should take the medication described?
   - ☐ Someone with high blood pressure or heart disease.
   - ☐ Someone with diabetes.
   - ☐ Someone under six years old.
   - ☐ Someone who has a cough

2. One of the side effects of taking this medicine is that of
   - ☐ feeling sleepy
   - ☐ high blood pressure
   - ☐ coughing
   - ☐ addiction

3. A ten-year-old child should
   - ☐ not take this preparation.
   - ☐ take two teaspoonfuls of this preparation.
   - ☐ take one teaspoonful of this preparation.
   - ☐ take one-half teaspoonful of this preparation.

4. If this medication does not help within three days, one should
   - ☐ take fifteen teaspoonfuls on the fourth day.
   - ☐ stop driving and operating machinery.
   - ☐ stop taking it and see a doctor.
   - ☐ take half of the usual dosage.

5. According to the instructions on the label of this medicine, for purposes of dosage, an adult is a person
   - ☐ six years old
   - ☐ twelve years old
   - ☐ seven years old
   - ☐ none of the above

(10 marks)

Q.2. Reading Comprehension

Read carefully the following text(2) which is followed by questions about the meaning of the material. You are to choose and tick the one best answer, (a), (b), (c), or (d), to each question. Answer all the

questions following the text on the basis of what is stated or implied in the text.

Medical Research

A cure for the common cold; a method for opening up a blocked artery; a new antibiotic; a study of diet: these are all examples of medical research. Its scope is vast, but its final aim is always the prevention or cure of disease.

Any medical discovery, like any other scientific advance, requires a combination of luck and years of hard, detailed research. It also requires the spark of original (genuine) thought that sets the whole project going in the first place.

Early in 1981. a new drug for treating seriously raised blood pressure was introduced: it is called Captopril. The first stages in the development occurred in the late 1960s. Scientists noticed that people bitten by some kinds of snake, particularly the Brazilian pit viper, suffered from a very low blood pressure. The next step was to see why this happened. It was found that there was a substance in the snake venom that blocked the formation of a compound in the blood called angiotensin, which is one of those responsible for keeping the blood pressure up to its normal level.

The final stage along this path of discovery was for the chemists to try to make a compound that had the same effect on the blood pressure as the snake venom, without any of the other poisonous side-effects. This is a process that may take years, as hundreds of chemically similar compounds are made and then they are tested to see if they have the required effect.

When researchers are on the track of a drug in this way, they frequently get a long way with one particular compound, only to discover that it has some toxic effect, and they then have to start all over again with a new compound.

Once a new drug such as Captopril has been made and thoroughly tested in animals, it is then tested in human beings. Patients are informed that the new drug they are receiving is under trial, and very careful precautions are taken to make sure that there are no unwanted or dangerous side-effects. (It is very unlikely that there will be any effects in human beings which were not present in animals.)

Questions:

1. According to the text, a drug under trial.
   - ☐ (a) is first tested in human beings.
   - ☐ (b) is not risky for patients to use freely.
   - ☐ (c) is done with very careful precautions.
   - ☐ (d) has dangerous side-effects.

2. To cure people with high blood pressure, Chemists have made a compound

   ☐ (a) from the Brazilian snake venom.
   ☐ (b) which has some toxic effects.
   ☐ (c) known angiotensin.
   ☐ (d) with the same effect as the Brazilian snake venom.

3. It may be concluded from this text that medical research requires

   ☐ (a) a hard detailed research.
   ☐ (b) a spark of original thought.
   ☐ (c) a combination of genuine thought and hard work.
   ☐ (d) a new antibiotic.

4. The Brazilian snake bites would cause people to get

   ☐ (a) normal blood pressure.
   ☐ (b) very low blood pressure.
   ☐ (c) raised blood pressure.
   ☐ (d) no blood pressure at all.

5. The text implies that

   ☐ (a) a drug should be tested on people when it has some toxic effect.
   ☐ (b) new drugs will have no effects in human beings.
   ☐ (c) research should be renewed when it proves to have toxic effects.
   ☐ (d) research should have the same side effects in animals and human beings.

(10 marks)

Q.3. Summarizing a text.

Read carefully the following text.(3) Then try to write a 50-word summary of it. Use your own language as far as possible. Try to point out the most important ideas of the text in the summary you write.

Adenoids

Adenoids are lymph glands situated at the back of the nose just where the air passages join those of the back of the mouth or pharynx. The lymph system is the body's defence against infection and the lymph glands, such as the adenoids, are full of infection-fighting cells, the white blood cells. The adenoids are so placed that any infection breathed in through the nose is filtered by them and hopefully - killed. Sometimes, however, things can go wrong.

Adenoids are present from birth, but on the whole they disappear

before puberty. They are most obvious from the age of one to four. This is because between these ages the child is continually exposed to new types of infection.

Not a great deal is known about how the adenoids become infected, but any respiratory germ can affect them. Once they become damaged, chronic infection may set in. If the adenoids are recurrently inflamed, they tend to swell and this can give rise to ill-effects.

If the glands become swollen due to infection, they interfere with the flow of air through the nose so that the child has to breathe through the mouth. This may cause heavy snoring at night. The closed mouth also causes a nasal tone of speech. The child finds that his 'm' comes out as 'b' and 'n' sounds like 'd'. This is because when he closes his mouth to pronounce 'm' and 'n' through the nose, he cannot do so since his nose is blocked. Breathing through the mouth also makes it very dry and the child may continually ask for something to drink.

As the adenoids fight infection, white blood cells - both dead and alive - are released in the form of pus (abscess). This pus will be seen as a discharge from the nose - quite different from the clear, watery discharge of a runny cold. The child sniffs to try to clear it but it then runs down the back of his throat and makes him cough. The cough is particularly obvious at night and is a typical sign of infected adenoids. In the morning, the swallowed pus may cause vomiting.

(20 marks)

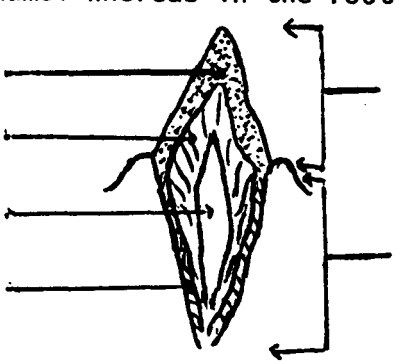
Summary

Q.4. Transcoding

Read the following text(4) and try to point out the parts of the tooth in the illustration beneath it.

The tooth

A tooth is composed of two main parts: a crown and a root. The centre of the tooth is made of a substance known as pulp. This is surrounded by another substance known as dentine. In the crown, the dentine is covered with a substance known as enamel whereas in the root a substance called cement covers the dentine.



(10 marks)

Notes Related to the test.

1. This section of the test was extracted from TOFEL tests, Model Test Two, p.125,. The text is as follows:

Dosage: Adults twelve years old and over take two teaspoonfuls as needed, not to exceed fifteen teaspoonfuls per day. Children six years old to twelve years old take half of the adult dosage, not to exceed seven teaspoonfuls per day.

Warning: Do not exceed the recommended dosage unless directed by a physician. Do not administer to children under six years old or to individuals with high blood pressure, heart disease, or diabetes. This preparation may cause drowsiness. Do not drive or operate machinery while taking this medication.

Chronic cough is dangerous. If relief does not occur within three days, discontinue use and consult your physician.

2. This text was extracted from "Doctor's Answers', No.42, Marshall Cavendish Ltd. London, 1981, p.1158.

3. This text was extracted from "Doctor's Answers', No.1, Marshall Cavendish Ltd. London, 1981, p.23.

4. This text was extracted with modification from: Maclean, Joan (1975) English in Basic Medical Science. English in Focus. O.U.P. London, p.10.

LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL
LLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLLL

Appendix 13

SPSS programme used to compare students' T value

```
LABEL: PRTI02 -FORM

SPOOLED:  83-06-22.12:20
STARTED:  83-06-22.12:21, ON:    AMLC   BY: TERM

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

SPSS BATCH SYSTEM                                                            18:33:02  06/16/83  PAGE    1

SPSS FOR PRIME 400/500, VERSION M, RELEASE 8.0         DECEMBER 17, 1979

DEFAULT SPACE ALLOCATION..      ALLOWS FOR..    163 TRANSFORMATIONS
WORKSPACE     114688 BYTES                      655 RECODE VALUES + LAG VARIABLES
TRANSPACE      16384 BYTES                     2624 IF/COMPUTE OPERATIONS

                  1 RUN NAME         TABLE 3 -  PRE-TEST READING
                  2 VARIABLE LIST    MARKS
                  3 SUBFILE LIST     EXPERIMT(41),CONTROL1(41),CONTROL2(41)
                  4 INPUT MEDIUM     [T3.NEW]
                  5 INPUT FORMAT     FREEFIELD
                  6 MISSING VALUES   MARKS(200)
                  7 RUN SUBFILES     EACH
                  8 FREQUENCIES      GENERAL=MARKS
                  9 OPTIONS          8

GIVEN WORKSPACE ALLOWS FOR   4096 VALUES AND   4096 LABELS PER VARIABLE FOR 'FREQUENCIES'

                 10 READ INPUT DATA
```

Subj. NO 2

Appendix 14
Samples of students' performance on the pre-Est course Test. The Summarizing part.

14/20

English

Adenoids are lymph glands situated at the back of the nose. The adenoids is are full of ~~infection fight~~ white blood cells. The adnoids filters the breath; but some times they are not succeaded.

The adnoids, infected by respiratory germs which cause damage to them, and when they effected the chiled has to breath throught his mouth which make him thirsty soar at night and mixed in the pronouncestion of the letters.

As the person effected he ~~natural that his~~ suffers from discharg from the nose, and cough

A clarity of thought

B grammatical mastery

C. self-dependence

D [redacted]

[redacted]

Subject No 29

4/20

Adenoids

Adenoids, lymph defence against infection, it works as filtering as killed germs.

the Adenoids, A obvious from one to four because the child exposed to new infection.

Adenoids closed interfere flow air through the nose, if it attack from germs.

cough practically clear at night (2)

A B C D

SPSS programme used to compute students speeds

```
SPSS BATCH SYSTEM                                          16:20:12  07/04/83  PAGE

SPSS                    FOR PR1ME 400/500, VERSION M, RELEASE 9.1, AUGUST 1, 1982

                                CURRENT DOCUMENTATION FOR THE SPSS BATCH SYSTEM
ORDER FROM MCGRAW-HILL:  SPSS, 2ND ED. (PRINCIPAL TEXT)       ORDER FROM SPSS INC.:  SPSS STATISTICAL ALGOR
                         SPSS UPDATE 7-9 (USE W/SPSS,2ND FOR REL. 7, 8, 9)           KEYWORDS: THE SPSS INC
                         SPSS POCKET GUIDE, RELEASE 9
                         SPSS INTRODUCTORY GUIDE:  BASIC STATISTICS AND OPERATIONS
                         SPSS PRIMER (BRIEF INTRO TO SPSS)

DEFAULT SPACE ALLOCATION..      ALLOWS FOR..    163 TRANSFORMATIONS
WORKSPACE    114688 BYTES                       655 RECODE VALUES + LAG VARIABLES
TRANSPACE     16384 BYTES                      2624 IF/COMPUTE OPERATIONS


                1 RUN NAME        TABLE 7 -  PRE-TEST SPEED
                2 VARIABLE LIST   TIMES
                3 SUBFILE LIST    EXPERIMT(41),CONTROL1(41),CONTROL2(41)
                4 INPUT MEDIUM    [T7.NEW]
                5 INPUT FORMAT    FREEFIELD
                6 MISSING VALUES  TIMES(200)
                7 RUN SUBFILES    EACH
                8 COMPUTE         SPEED = 50 /TIMES·
                9 ASSIGN MISSING  SPEED(200)/TIMES(200)
               10 *RECODE         SPEED(0.58 THRU 0.69=1)(0.69 THRU 0.80 =2)
               11                 (0.80 THRU 0.91 =3)(0.91 THRU 1.02 =4)
               12                 (1.02 THRU 1.14 =5)(1.14 THRU  2 = 6 )
               13 FREQUENCIES     GENERAL=SPEED
               14 OPTIONS         8

GIVEN WORKSPACE ALLOWS FOR   4096 VALUES AND   4096 LABELS PER VARIABLE FOR 'FREQUENCIES'

               15 READ INPUT DATA
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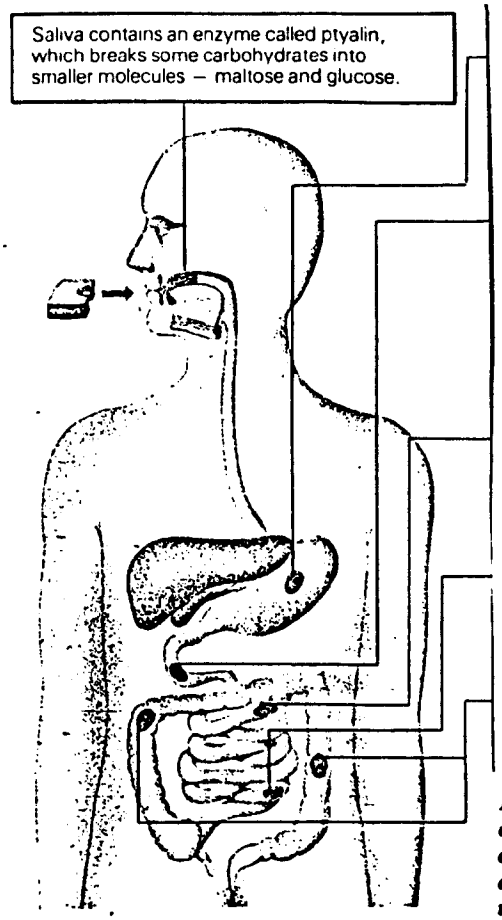
How a cheese sandwich is digested



A cheese sandwich contains fat, protein and carbohydrate, but these must be broken down into very small molecules so that they can be absorbed into the bloodstream and used by the body.

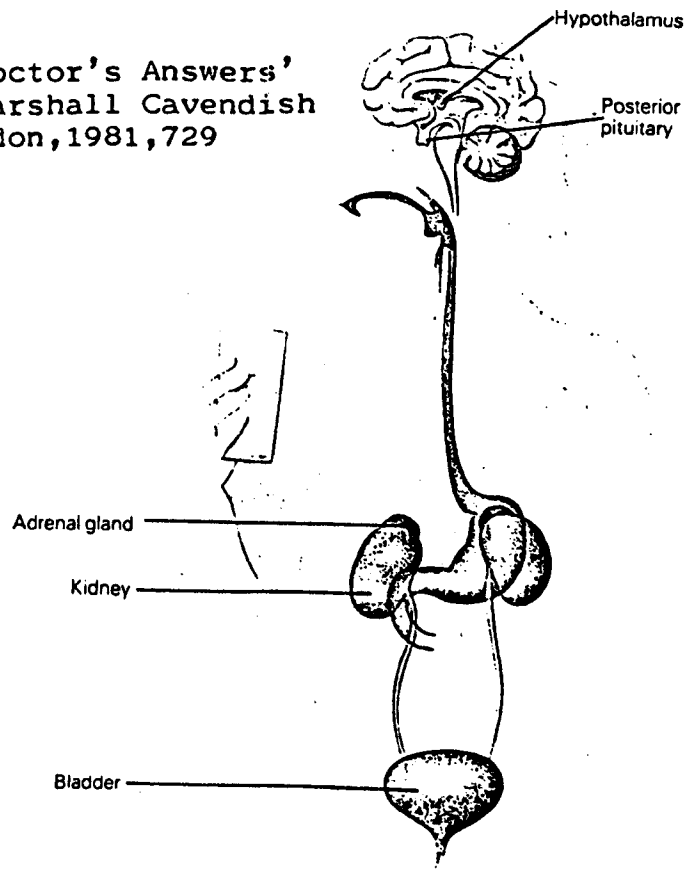
Appendix 16

Exercises for filling gap activities.

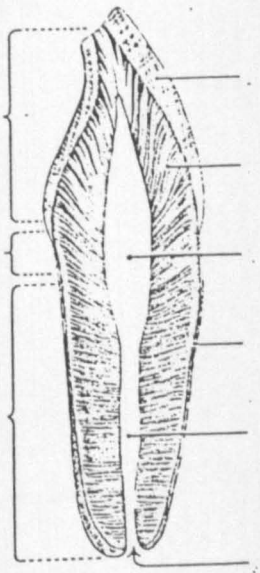
(From;Doctor's Answers', No.15,Marshall Gavendish Ltd. London,1981, p.397

How the body maintains a constant water level

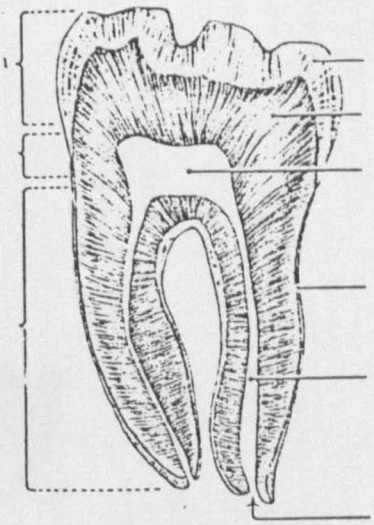
From:Doctor's Answers' No.27,Marshall Cavendish Ltd.London,1981,729



From; Boilexu Grant,1962

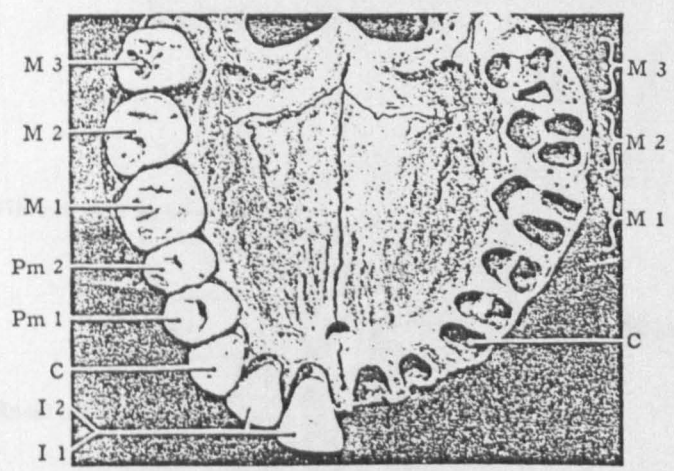


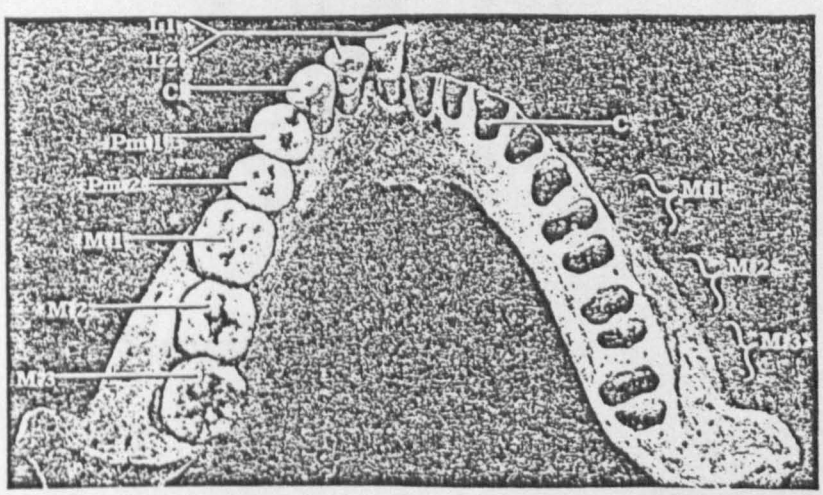
An Incisor Tooth,
longitudinal section



A Molar Tooth,
longitudinal section

Permanent Teeth and Their Sockets





From: Boilexu Grant, 1962

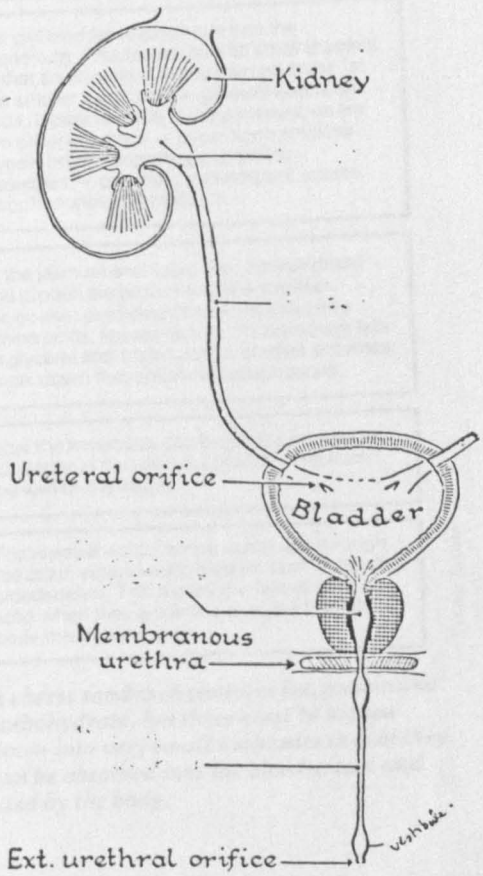
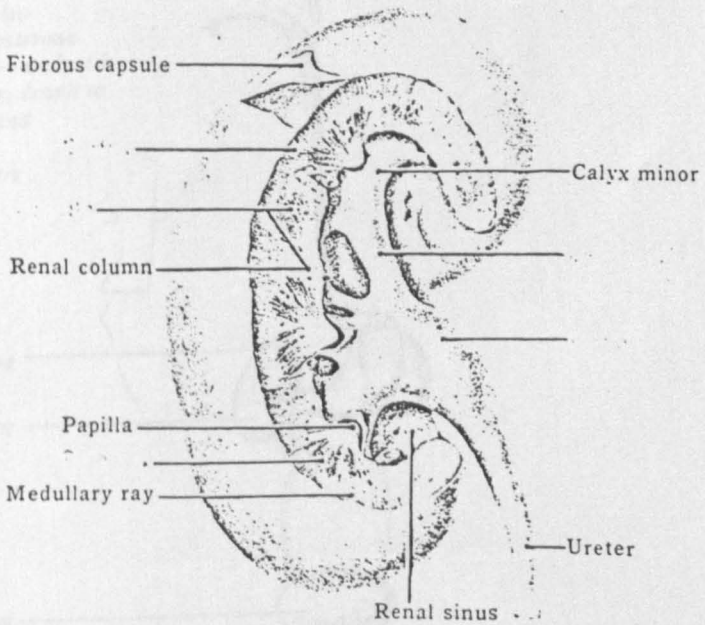


Diagram of the Male Urinary System



Structure of the Kidney

Appendix 16a.

How a cheese sandwich is digested

Saliva contains an enzyme called ptyalin, which breaks some carbohydrates into smaller molecules – maltose and glucose.

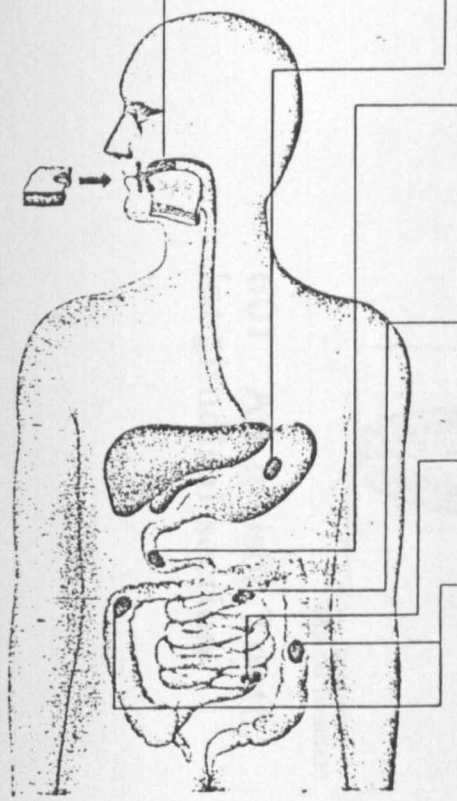
In the stomach an enzyme called pepsin begins to break protein into smaller molecules – peptones.

The gall bladder releases bile into the duodenum. This breaks fat into small droplets so that an enzyme called lipase can break fat into smaller molecules – glycerol and fatty acids. Lipase is made in the pancreas, as are two other enzymes – trypsin and amylase. Trypsin breaks peptones into smaller molecules – peptides, and amylase breaks carbohydrates into maltose.

In the jejunum and ileum fat, carbohydrate and protein are broken into the smallest molecules; peptidases break peptides into amino acids, lipases reduce the remaining fats to glycerol and fatty acids, and other enzymes break down the remaining carbohydrate.

Now the molecules can begin to pass into the capillaries in the villi (small protrusions from the wall of the ileum).

The residual waste matter continues through the colon where water is taken from it into the bloodstream. This makes the faeces semi-solid when they are finally expelled from the body through the anus.

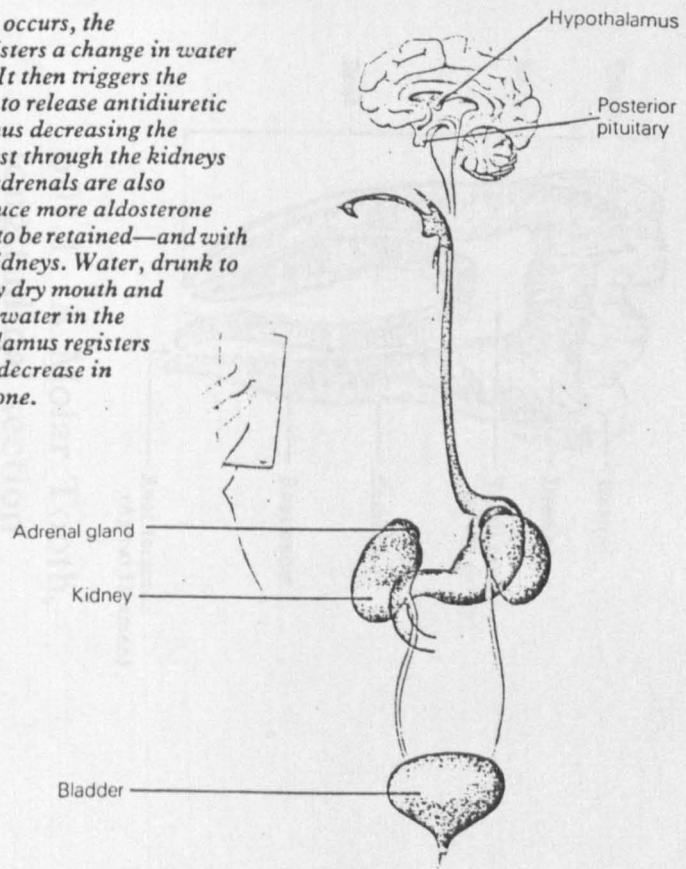


Vennor Artists

A cheese sandwich contains fat, protein and carbohydrate, but these must be broken down into very small molecules so that they can be absorbed into the bloodstream and used by the body.

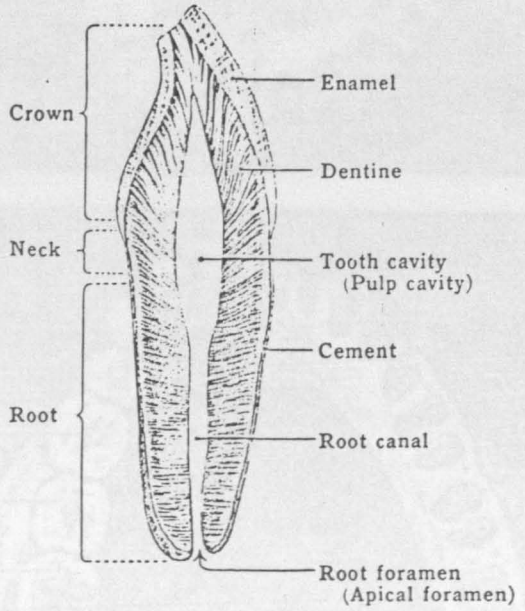
How the body maintains a constant water level

When dehydration occurs, the hypothalamus registers a change in water level in the blood. It then triggers the posterior pituitary to release antidiuretic hormone (ADH) thus decreasing the amount of water lost through the kidneys and bladder. The adrenals are also stimulated to produce more aldosterone enabling more salt to be retained—and with it, water—in the kidneys. Water, drunk to quench thirst felt by dry mouth and throat, replenishes water in the body. The hypothalamus registers change and causes decrease in ADH and aldosterone.

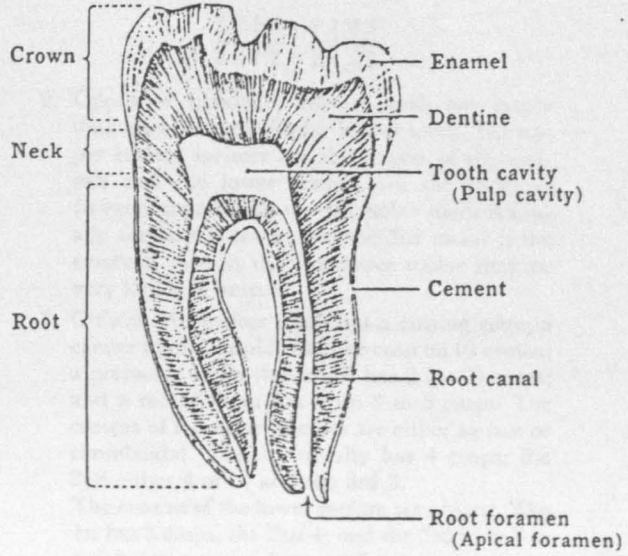


Advertising Arts

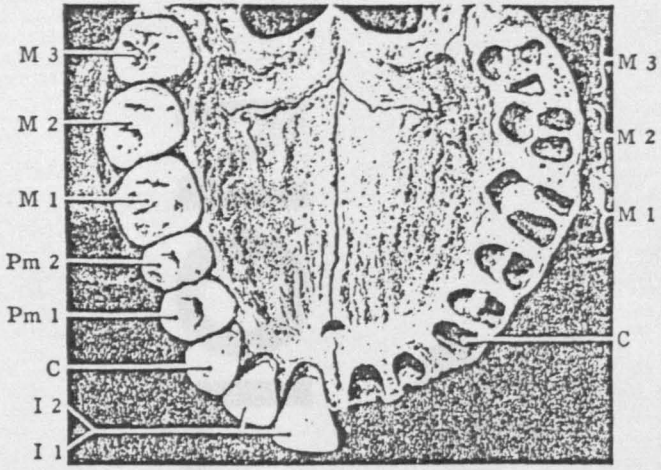
PAGE NUMBERING AS ORIGINAL

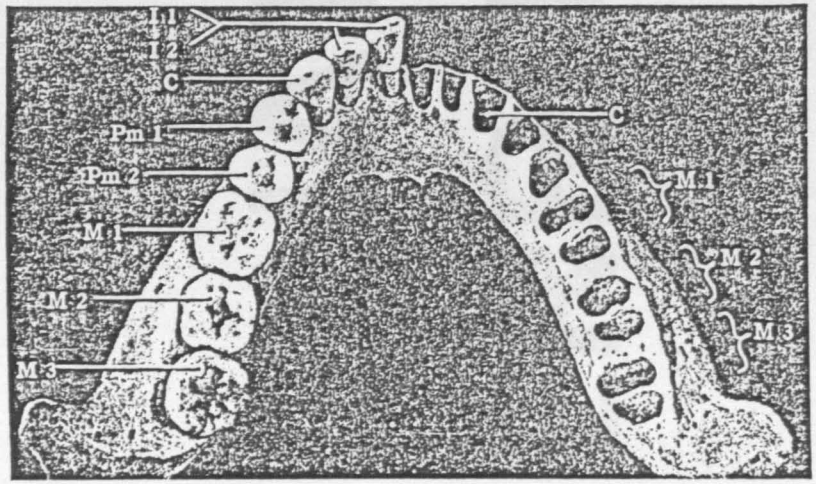


601 An Incisor Tooth, longitudinal section



601.1 A Molar Tooth, longitudinal section





601.2 Permanent Teeth and Their Sockets

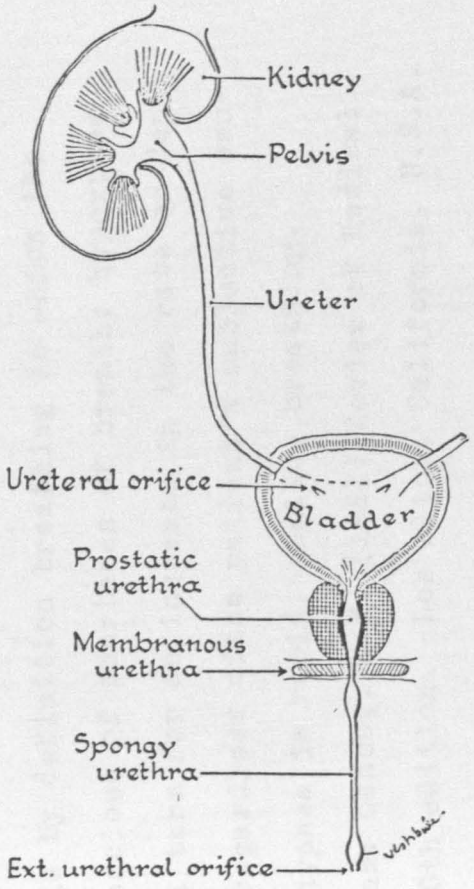
Observe:

1. There are 32 permanent teeth, of which 8 are on each side of each dental arch—2 incisors, 1 canine, 2 premolars, and 3 molars. Hence the formula reads:

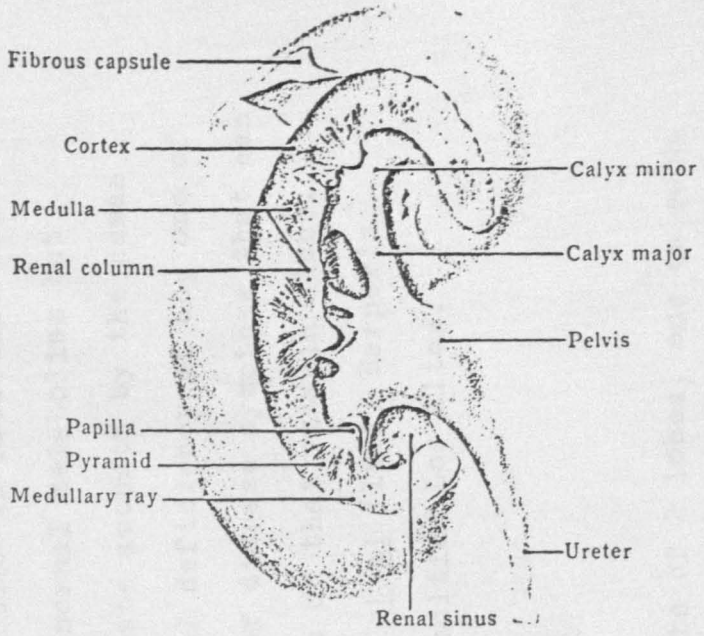
$$\frac{3.2.1.2.}{3.2.1.2.} \quad \frac{2.1.2.3.}{2.1.2.3.}$$

2. Upper or maxillary incisor teeth are larger than lower or mandibular incisor teeth. The upper central incisors are the largest of the incisors and the lower central are the smallest. In each dental arch the 1st molar tooth is usually the largest molar and the 3rd molar is the smallest, though the 3rd lower molar may be very large, as here.
3. Crowns: An incisor tooth has a cutting edge; a canine tooth (cuspid) has one cusp on its crown; a premolar tooth (bicuspid) has 2 (or 3) cusps; and a molar tooth has from 3 to 5 cusps. The crowns of the upper molars are either square or rhomboidal. The 1st usually has 4 cusps; the 2nd either 4 or 3; and the 3rd 3.
   The crowns of the lower molars are oblong. The 1st has 5 cusps; the 2nd 4; and the 3rd from 3 to 5. The crowns are, here, well worn.

PAGINATION ERROR



182 Diagram of the Male Urinary System



183 Structure of the Kidney

The anterior lip of the sinus is cut away. The outer $\frac{1}{3}$ of the renal substance is cortex; the inner $\frac{2}{3}$ is medulla. Cortical tissue (glomeruli, convoluted tubules) is granular on section and extends, as renal columns (of Bertin), through the medulla to the sinus. The medulla contains 7 to 14 pyramids which are striated because they consist of converging tubules (collecting, loops of Henle). Each pyramid sends finger-like rays into the cortex and each ends as a papilla on which a dozen or more ducts open. One or two (or more) papillae project into each calyx minor; several calyces minores unite to form a calyx major. Of calyces majores there are usually two, an upper and a lower, but not uncommonly there are also one or two middle.

Appendix 17

Samples of Reading Texts for
Developing Students' Reading Speeds

Respiratory Stimulation

Dyspnea is by definition breathing in which the subject is conscious of shortness of breath; hyperpnea is the general term for an increase in the rate or depth of breathing regardless ofthe patient's subjective sensations. Tachypnea is rapid, shallow breathing. (Extracted from: Ganong, W.F. (1981) Review of Medical Physiology. 10th edition. Los Altos, California, U.S.A. p.537).

Vitamins

Vitamins are organic molecules in food that are required in small amounts for normal metabolism but cannot be synthesised in adequate amounts by the human body.A dietary or physiological deficiency of any one of them leads to a specific set of disease symptoms that can be corrected by administration of that vitamin alone. (Extracted from: Martin, D.W. et al (1981) Harper's Review of Biochemistry 18th edition Los Altos, California, U.S.A. p.577).

The Thyroid

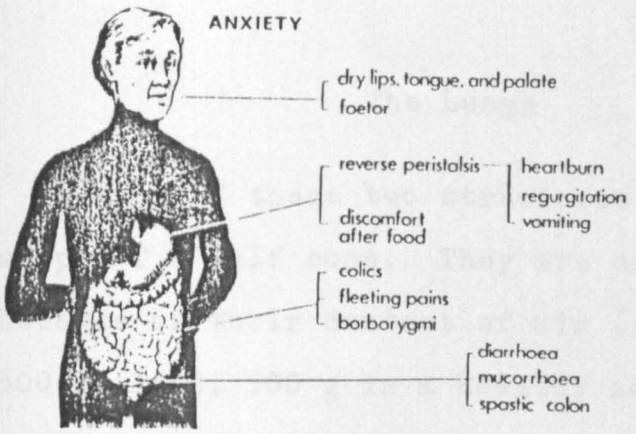
The thyroid gland consists of 2 lobes, one on each side of the trachea, with a connecting portion making the entire gland more or less H-shaped in appearance. In the adult, the gland weighs about 25-30 g. Although there is some evidence of extrathyroidal production of thyroid-like

hormones, the thyroid gland is the primary source of their production. (Extracted from: Martin D.W. et al (1981) Harper's Review of Biochemistry 18th edition, Los Altos, California, U.S.A. p.468).

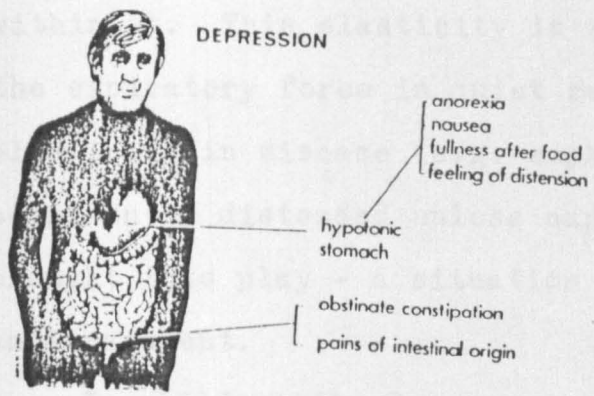
Aetiology

To a large extent everyone is subject to nervous disorders of the gut. Few students can have escaped pre-examination nausea, few athletes pre-race diarrhoea. If the stimulus causing the disorder, whether it be fear, rage or sexual excitement, is easily recognised by the sufferer, he will accept it. But if the emotional cause of his discomforts is not obvious to him, and if it continues, then he will feel it (Read, et al , 1981:2).

Gastrointestinal symptoms due to anxiety



Gastrointestinal symptoms due to depression



(Extracted from Read, A.E., et al (1981) Basic gastro-enterology including diseases of the liver, Third Edition, John Wright and Sons Ltd., Bristol, Great Britain. p.2.

Appendix 18

First Reading Skills Test

The Lungs

Each of these two structures (the lungs) has the shape of a half cone. They are comparatively light because of their content of air (right, approximately 600 g; left, 500 g in a healthy adult) and they float freely in water unless filled with fluid (e.g., before birth) or consolidated by disease.

The lungs contain a high proportion of elastic tissue. The fresh lung will contract and expel most of the air within it. This elasticity is responsible for most of the expiratory force in quiet respiration. The loss of elasticity in disease (e.g. emphysema) leaves the lungs permanently distended unless expiratory muscles are brought into play - a situation causing expiratory embarrassment.

In children the lungs are yellowish pink. In the adult, deposition of carbon particles which are picked up by phagocytes leads to the surface becoming mottled with dark patches and lines. The lines indicate the position of lymph channels in the interlobular fibrous septa.

Each lung lies free in its own pleural cavity, attached only to the mediastinum by its root. In most dissecting room cadavers, the pulmonary pleura is adherent to the parietal pleura at places as a result of old

inflammation of the pleura (pleurisy). When the lungs are fixed in situ, their elasticity is destroyed and so they retain the shape of the structures to which they were moulded in the thorax.

Now, tick the most appropriate answer A,B,C or D according to the information in the above text.

1. The lungs are comparatively light .....
   A. because they are filled with fluid.
   B. because they are consolidated by disease.
   C. because they are very small in comparison to the thorax
   D. because of their content of air.

2. The lungs in the adults are .....
   A. mottled with dark patches and lines.
   B. yellowish pink.
   C. covered with black colour because of smoking.
   D. red and blue because of veins and arteries.

3. From reading the text one understands that .....
   A. both lungs are the same weight.
   B. the left lung is heavier than the right one.
   C. the right lung is heavier than the left one.
   D. the text does not mention the weight of the lungs.

4. The lungs retain the shape of the structures in the thorax .....
   A. because of the root of the mediastinum.
   B. when their muscles are brought into play
   C. when their elasticity is damaged.
   D. when they expel most of the air within it.

5. Most of the expiratory force in quiet respiration is due to .....

A. an old inflammation of the lungs.

B. the elasticity of the lungs.

C. the small shape of the pleural cavity.

D. the lymph channels in the interlobular fibrous septa.

Name:

Class:

Faculty:

Date: /198

(1) The text was extracted from: Romanes, G.J. (1977) Cunningham's Manual of Practical Anatomy. Volume Two. Thorax and Abdomen. Fourth Edition. O.U.P. Oxford, New York p.27.

Appendix 19
Second Reading skills Test

Name: Class: Date: /1/1983

Read the following text and answer the questions below[1]:

For quick relief of upset stomach or acid indigestion caused from too much to eat or drink, drop two tablets in an eight-ounce glass of water. Make sure that the tablets have dissolved completely before drinking the preparation.

Repeat in six hours for maximum relief. Do not take more than four tablets in a twenty-four hour period.

Each tablet contains aspirin, sodium bicarbonate, and acid.

If you are on a sodium-restricted diet, do not take this medication except under the advice and supervision of your doctor.

Not recommended for children under twelve years old or adults over sixty-five.

Now, tick the most suitable answer.

1. This medication is recommended for .....

a) someone who needs more sodium in his diet.

b) someone who does not eat enough citrus fruit.

c) someone who has eaten too much.

d) someone who has a headache.

2. According to the directions, which of the following persons should NOT take this medication?

a) a thirteen year old boy
b) a fifty year old woman
c) a sixteen year old girl
d) a sixty-eight year old man

3. If you took this preparation one hour ago, how many hours must you wait in order to take it again?

a) Two hours
b) Three hours
c) Five hours
d) Twenty-four hours

4. What should you do with this preparation?

a) Drink it
b) Eat it
c) Rub it on
d) Gargle with it

(1) Extracted from TOFEL Model Test Four, p.163

Appendix 20

EST Term Test for the Experimental Group

Name: Class:

1. State if the following statements are True or False.

   a. The basic function of the heart and lungs is to produce phlegm or sputum from the chest. ( )

   b. The windpipe through which air passes to the lungs is also called the trachea. ( )

   c. Sebaceous glands produce sebum and they are controlled by sex hormones. ( )

   d. The shape of our hair follicles is inherited. ( )

   e. It takes three to four years for a cell in the lowest layer to reach the skin surface. ( )

   f. The normal daily hair loss is between 20 and 100 hairs. ( )

   g. Fine, downy hair is found over the palms of the hands and soles of the feet. ( )

   h. The hollow centres of bones are filled with marrow where the manufacture of blood cells takes place. ( )

   i. Besides the heart and lungs, the chest contains the oesophagus and the thymus. ( )

j. Bones have the capacity to repair themselves when broken - even completely in two. ( )

2. Complete the following: (5 only).

a. Pleurisy is .....

b. The dermis is formed of .....

c. Bones are made up of .....

d. Intercostal muscles are .....

e. Apocrine glands are .....

f. Tonsillitis .....

3. Write 50 words only on one of the following:

a. Chest problems

b. Hair and nails.

c. The growth of bones.

Appendix 20a

EST Term Test for the Control Groups

Name: Class:

1 State if the following statements are True or False.

a. The cloud of the planets was mainly made up of oxygen. ( )

b. The rates of spin of stars have a very curious dependence on surface temperature. ( )

c. The probable diameter of the sun was 10 miles when it was in the gaseous state. ( )

d. The sun takes more than 26 days to spin once round on its axis. ( )

e. Germ cells can only reproduce cells like themselves. ( )

f. Somatic cells can reproduce germ cells. ( )

g. Wallace had hit on the essence of Darwin's own theory.

h. The zygote is not sensitive to radiation.( )

i. In order to be firmly implanted in the wall of the uterus the embryo requires about five days in human beings and eight days in mice. ( )

j. The 'curie' is a unit which measures the number of ionising particles given off by radio-active source. ( )

2. A. Give the meanings in English of the underlined words (two only).

1. However, the idea of evolution <u>was revived</u> in modern times.

1.

2. Exposure to radiation may produce <u>gross malformations</u>.

2.

3. There are certain <u>innate qualities</u> which are inherited in the individuals.

e.

B. Complete the following (three only):

1. The zygote is .....
2. Tracheotomy is .....
3. The main theme of 'The origin of species' is ..
4. Radiation is measured by .....

3. Write 50 words only on one of the following:

a. The formation of the sun and planets.
b. The development of Darwin's theory.
c. The effect of atomic radiation on children of expectant mothers.

Appendix 21

Transliteration of Students' Classroom Interaction

Control Group A (1) (Subject No. 2)

Teacher (Henceforth, T.) (Talking to class). Who is going to talk about Banting and the discovery of insulin? (A student (subject No. 2) raises her hand to talk. The teacher approaches her). Yes, please.

Student (Henceforth, S.) Energy is obtained which is a.. the ...ah..ah by breaking up insulin and insulin is a substance ...a substance... a substance which is ..ah ..ah.

T. a substance which is formed ...

S. which is secret out the sugar and it is secreted of ..ah.. and insulin, insuline is a secreted of pancreas ..ah certain diseases such as diabetes, the the pancreas .. the pancreas has not had it secret enough amount of insulin.

T. Yes, what was your name?

S. Sawsan.

T. Thank you.

(3) (Subject No. 28)

T. (Talking to class) Who is going to talk about Banting? Who was Banting? What was his work? (A Student (No. 28) raises his hand to talk. The teacher approaches him). Yes, what was his work?

S. Banting was a teacher in medical college ... medical school, he want to give the lecture about the pancreas. Then he go to the library.

T. Yes.

S. Then he read / ri:d /(1) some journals in the library about the pancreas.

T. (encouraging) Yes.

S. and the article he read / ri:d / the relation between the ..ah Islets (aisl◆s / of Langerhans and diabetes. Therefore, he take his journal and begin to read about this subject.

T. What subject?

S. ah.. diabetes.

T. Yes.

S. And he begin to read more than .. more books ..ah more textbooks ..ah ..ah of .. this .. of this .. of this ..

T. This subject.

S. He begin to thought to give the solution ah ... the solute (2) to the disease ... the diabetes .. he began .. to su.., sup.. to ..

T. He began to think how to cure .. how to cure diabetes. And was he working alone?

S. No, there was another one to assist him.

T. His assistant ... Best.

S. Yes. He found the insulin which cured this disease.. diabetes.

T. What's your name?

S. Adnan.

T. Thank you.

(3) (Subject No. 29)

T. (Talking to class). Any other person who wants to talk? What experiments did he make? Or what kind of animal he used? (A student (subject No. 29) raises his hand to talk. The teacher approaches the student). Yes.

S. He made the experiment on dogs.

T. He.. (The teacher notices the student continue his speech). Yes.

S. By tying the animal ducts of pancreas. Then he waited some weeks to give insulin for secret on ..of pancreas ..ah ..ah..

T. Yes.. yes. So he waited for ... for how many weeks? Do you remember?

S. Two to four weeks.

T. ah.. six to eight weeks.

S. Six to eight weeks.

T. Then what did he do to the pancreas?

S. He turned ...

T. (correcting) He tied.

S. He tied the ducts of pancreas, and then he waited some weeks, ah.. after this he removed the pancreas.

T. Yes, he extracted it .. he removed it. And then did he find insulin there? (No answer). Did he fail?

S. He failed in the experiment at the first time, and at the last ..

T. But why did he fail? Do you know why he failed?

S. Because a wrong in the tying of the ducts.

T. Yes. Good. What kind of wrong? What wrong was that?

S. The tying was loose /los/ and the same insulin ..ah the ... coming of the duct.. and wrong the duct

T. Yes. Then what did he do later on?

S. He repeat... this experiment.

T. Yes.

S. And .. and tying the duct.

T. Yes.

S. And then the experiment succeed.

(4) (Subject No. 12)

T. (Talking to class) And who can talk about ah.. the chopping of the pancreas into pieces? The cutting of .. the cutting of the pancreas into pieces? Any one to talk) (A student raises his hand)(Subject No. 12). (But the teacher wants more participation of the class so he goes back to the previous student What was your name?

S. Faris.

T. Faris. Yes. Faris talked about the ..ah how the experiment failed. Then how it succeeded. Anyone to talk about the experiment? How Banting applied it to another dog and he succeeded?

S. I will talk about it.

T. Yes.

S. He extracted ..ah ..ah.

T. He extracted the pancreas from the dog. Then he mixed it with saline: salty water, and filtered it ... yes. Banting and his friend needed more insulin for laboratory work, what did they do? (No answer). (Teacher goes on). How did they get more insulin? (No answer). (The teacher answers). They got it from the calf.

(5) (Subject No. 6)

T. (Talking to class). Who can talk about the first experiment done on people in hospital by using.. using insulin? Who were those people?

S. (Raising his hand) I talk. (Subject No. 6). The first one was a boy at fourteen years old, and the other is a doctor, ah.. both cases was hopeless ah.., the... the ...

T. Did they get well?

S. Yes, after the.. the injection .. they have injection, they are improved, of course, .. the boy is still alive.

T. Was the insulin pure or impure?

S. The professor /pro:fiso:r/Collip (Ko:li/ ah.. was a biochemist ah..

T. Yes. Why did they call on him?

S. To produce very large quantity, and equipment large ah.. ah..

T. and purer

S. purer insulin.

T. Did he succeed?

S. And he succeed quickly because he was specialised.

T. What was his speciality?

S. His speciality was biochemist .. and he was biochemist. He produced in a large amount ... in a large scale .. and very number of patients ah ... in ..ah.

T. Can make use of...

S. Can make use of insulin.

T. Thank you.

T. (Talking to class) Now who can talk about Banting? What prize was he given? When was that? (No answer) (The teacher continues). He was given a prize. He was given a noble prize. When was that? (No answer.

Teacher notices that no-one knows the answer and no-one was ready to talk so he answers the question himself). In 1923 .. Yes, 1923.

Control Group B

(1) (Subject No. 36)

T. (Teacher talking to class) What do you know about insulin? What is insulin? (Some students raise their hands to answer. One of them was Subject No. 36) Yes. Labeed.

S. It enables the muscles to absorb the ..ah the sugar from the blood and break it up. So the energy can obtained and the diseases diabetes .. that in disease diabetes that the sugar increase in the blood and the insulin was ah.. not enough so the sugar is increase.

T. Yes. Thank you. That's enough.

(2) (Subject No. 18)

T. (Talking to class) I want somebody to talk about Banting. Who was Banting? (No answer). Where was he teaching? What experiment did he make? (A student raises her hand. The teacher approaches her). Yes, Saleema (Subject No. 18).

S. He was a teacher in medicine school.

T. Yes.

S. One day, he was a teacher in medical school. One day he was in the library /laibiry) to read articles

about the relation of Islets /ˈailənd/ to the diabetes ... to the disease of diabetes.

T. Yes.

S. So he took ..ah ..ah the ..ah journals to .. to home in order to explain the subject to his students .. his students

T. Yes, yes.

S. And in the article .. ah the writer wrote about ..ah ..ah the experiment .. the duct .. the pancreas duct. So .. so from this time and he began to think about the experiment in the pancreas duct.

T. So he made use of the people's ..ah the experiments produced by people before him.

S. So he made use of the experiments before him.

T. Yes. Thank you.

(3) (Subject No. 40)

T. (Talking to class) What about the ducts? What did Banting do to the ducts? (The teacher approaches a student (Subject No. 40) who is not raising his hand). Abdul-Karim, what did Banting do to the ducts?

S. Istaath (Sir, in Arabic), he was ..ah ..ah ..ah ..ah because ..ah ..secretion ..ah.

T. So, he tied the ducts.. the pancreatic ducts of what animal?

S. of ..ah of ... Sir ..ah.

T. A dog .. a dog, of a dog. So he did experiments on dogs. So why did he tie the pancreatic ducts of those dogs?

S. To some ..secrete ..ah it and ..ah ..ah and ..ah.

T. Yes, to secrete a sufficient amount of insulin. The insulin will be secreted from the pancreatic ducts. ..ah what was the name of his assistant? (No answer) Who was his assistant (No answer. Another student raises his hand to answer. The teacher nods to him to answer)

Other student: Best

T. Yes. Best, Best. So Best was the assistant.

(4) (Subject No. 27)

T. (The teacher approaches a student (Subject No. 27) raising her hand to speak). ..ah so Banting made an experiment.

S. He made it on the dog. Then he tied the duct of the pancreas. But Banting and Best not took enough amount of insulin because they did not tie justly the duct and there are no time to perform the experiment, but the government gave to them another time and they are continue in the experiment and then the ... Banting tied justly the duct and he found that the pancreas is shrinking.

T. Yes.

S. And he keep it and go up to the school and injected the dog again. He found that ..

T. So ..so ..no .. so he extracted the pancreatic ducts of the dog. And what did he do? He chopped it. And did he use it alone or did he use another substance with it?

S. Substance ..another substance.

T. What was that substance? He mixed it with what?

S. He mixed it with another liquid.

T. Yes. What was that substance?

S. (No answer).

T. Saline.

S. Saline.

T. Yes, and then..

S He inject it to the dog.

T. Yes. So he took the substance and injected the dog.

S. So he injected the dog.

T. So the dog rose .. rose and.. (The teacher wants the student to continue, but she doesn't, so he continues) and wagged its tail. It means that it became well again.

S, And later he found that the dog .. is returned to the ..ah.

T. Yes, returned to the previous state. It means the dog collapsed .. collapsed.

S. He must inject it too.

T. Yes. So the ..the dog now needed more injections in order to live. Thank you.

(5) (Subject No. 32)

T. (Talking to class) What did Banting do in order to get more insulin for the laboratory? (A student (Subject No. 32) raised his hand to talk).

S. In 1908, the insulin did not cure .. did not cure the .. diabetes, while ..

T. (Noticing that the student gives a wrong answer the teacher repeats his question with modification). I mean Banting and Best needed more amounts of insulin; what did they do in order to get more amount?

S. Chopping in .. chopping and with the saline /slain/ .

T. They took it from the foetal calf. They took it from the foetal calf. But that amount was not enough, so what did they do? From where did they get more .. more amount? They got it from the .. from the .. (The teacher wants the student to speak)

S. Cattle.

T. from the .. from the adult ..

S. adult cattle.

T. Now, ..ah those people Banting and best had enough amount of insulin to use on people, right?

S. Yes.

T. Do you remember how did they apply it in hospital?

S. In the laboratory ....

T. Not in the laboratory ... in the hospital .. because there were other cases. (No answer) (The teacher gives another clue). The patients. (No answer) (The teacher then directs his question to another student (No. 6 below) who raises his hand to talk).

(6)(3)

T. Yes, Abdul-Rahman. They used it ...

S. Yes, in two cases: first a boy and other a doctor (Other students raise their hands to speak but the teacher continues his discussion with the same student).

T. And what was the result, Abdul-Rahman. You know the result. What was the result?

S. That the boy fourteen years old continued to live/laiv/.

T. He continued ..ah to live.

S. To live.

T. So how were the cases? Were they hopeless?

S. No, success.. success.

T. At first.

S. At first.

T. At first, what kind of people were they, the doctor and the boy? They were hopeless cases, but later on they got well. How was the doctor?

S. (No answer).

T. He was well, too. Now, how was the insulin used? In what form?

S. By secrete ..ah substance ..ah injection to the ..ah body.

T. And was it pure or impure?

S. Pure.

T. It was pure when applied to the doctor and to the boy?

S. Impure.

T. Yes, it was impure. And so what did they do in order to get purer amount? (No answer) What did they do? (No answer) (Another student (Subject No. 3) raises his hand to speak, and the teacher directs the question to him).

(7) (Subject No. 3)

T. Labid, what did they do in order to get a purer amount of insulin?

S. Ah.. that get some secrete ..ah substance ..ah

T No, they asked another person.

S. ..ah ..ah.

T. They asked Professor ... Professor Collip ... who was Professor Collip?

S. (No answer) (The teacher directs the question to another student (Subject No. 39) who is not raising her hand to speak.)

(8) (Subject No. 39)

T. Sinnan, do you know who was Professor Collip, please?

S. He was another school lecturer.

T. Yes.

S. ..m ..m he was ah..

T. He was a biochemist. Did he help them? Did he help Banting and Best?

S. Yes, the experiment in the lab.

T. And what was the result?

S. (No answer).

T. They got purer amount of insulin. Right?

S. (Nodding) Yes.

T. Later on, Banting was ..ah he was given what?

S. ..ah ..ah

T. He was given a noble prize. He was given a noble prize. When was that?

S. In nineteen ....

T. (To another student who is raising his hand to answer) Yes.

Other student: It was in nineteen ah..

T. It was in nineteen .. nineteen twenty ...

S. Twenty four.

T. Twenty three.. twenty three.

Experimental Group

(1) (Subject No. 35)

T. (Talking to class) Who would like to talk about the structure of the nose? (A student (Subject No. 35) raised her hand to speak)

S. (The recording is not clear)

(2) (Subject No. 11)

T. (Talking to class) Who wants to talk about the structure of the nose, please? (A student (Subject No. 11) raises his hand to speak.

S. From the external or inside?

T. From the external and internal.

S. From the external it consists of two bones in the above and in below bone the cartilage called the nasal cartilage and the nasal consists of cartilage also. In the inside of the nose, the nasal concha. This consists of nasal bone called concha. And between them there is .. there is ..ah

T. Enough (Pointing to another student (Subject No. 27) Yes, you.

(3) (Subject No. 27)

T. Talk about about a broken bone?

S. Always there is a feature of sport ..sport injuries. So always out of shape, and if it is not reseted without a side .. without side, it lead to another problems such as catarrh.

T. asthma.

S. Or asthma. Resetting the break, always require one night at least in the hospital.

(4) (Subject No. 16)

T. (To class) What causes cold inflammation, bacteria or virus? (A student (Subject No. 16) raises his hand to answer).

S. The cold ..ah the cold inflammation?

T. Yes.

S. By virus, of course.

T. Yes.

S. This is inflammation of the mucous membrane. Half the half ..the ..of half of way of breathing

T. Both ways

S. ah.. both ways. Yes.

T. What about polyps? Talk about polyps. What are polyps? Are they cancerous?

S. I have injury in my nose. I can't talk (The student and teacher laugh). No, they aren't cancerous. Some people think they are, but they aren't. They are some inflammation or swelling, but they can respond to the surgery ..ah.

T. Well.

S. Well. They can be taken by a surgeon.

T. What about cold? If a person has a cold, what should he do?

S. He should stay at home, but someone like me can't stay at home because he has exam (laughing) ..ah and if one got ..ah a cold, we must stay away from him.. because we will get cold.

T. What about the structure of the nose?

S. The nose.. the nose structure ..ah from bones and cart ilage.

T. Yes. What divides the nose into two cavities?

S. ..ah ..ah divide the nose ..ah

T. The nasal septum.

S. The nasal septum.

T. Thank you.

(5) (Subject No. 39)

T. (To class) Who will talk about the importance of the nose to our body? (A student (Subject No. 39) raises his hand to talk).

S. The air to enter our body ..the nose filtering the air to entering our body. The ..ah ...

T. So this organ is very important to our health.

S. So this organ is important to our health and an inflammation /infalmaʃin/ bear discomford to us. We remedy this inflammation .. mucous inflammation .. broken nose ..ah by resting at home, and taking antibodies(4) or ..ah aspirin.

T. When we get sour throat ..ah, I mean when we have a broken bone, we can't reset it at home.

S. Some inflammation we can ..ah get surgery, a minor surgery and this is the correct behaviour treat this problem.

T. Yes.

(6) (Subject No. 38)

T. (Approaching a student (Subject No. 38) who is not raising a hand to speak) What about cold, Ahmad? If you have a cold what should you do?

S. If I have a cold ..ah I must stay in the house.

T. (Encouraging) Yes.

S. And that's better than the treatment, I think.

T. So .. so what is the best thing to avoid cold?

S. We must have some aspirin and must stay in the home. ..ah ..ah ...

T. And can you talk about polyps? What do you know about polyps?

S. No.

T. What are adenoids?

S. I do not know.

T. You don't know what adenoids are?

A. No.

The following are recordings from the group-work activity:

(7) (Subject No. 6)

T. (To Subject No. 6) Talk about painkillers.

S. The medical term of painkilling drug is called analgesic /ənsigəsik/. The doctors usually divided the painkilling drug into two groups: narcotic and non-narcotic. Narcotics such as morphine, heroin which derived from opium is ..ah is .. yanni(5) the drug.

T. Yes.

S. And this usually obtainted ..ah ..ah yanni(6) ..ah..

T. From natural sources.

S. Na'm(7) ..ah yes, obtained .. it depends .. the branch.

T. Yes (Nodding to him to go on)

S. Non-narcotic such as aspirin ..ah it act on the site of the pain ..ah non .. mn-narcotic/nnnnakrotik/

T. (Correcting pronunciation) non-narcotic

S. ..ah narcotic usually used in the high control such as in hospital to relieve the pain in internal organs.

T. Good.

S. And non-narcotic is usually used in relieve the pain in skin, the bones ..ah or joints.

T. Enough. Thank you.

(8) (Subject No. 18)

T. (Approaching a student (Subject No. 18) from the same group who is not raising a hand). Yes, Jwan, please.

S. The .. the.. the relative of this pain ..ah killer are from natural source like morphine ..ah source from opium/ofu:m/

T. (Correcting pronunciation) opium.

S. Opium ..ah opium ..ah ..ah from, from opium or ..ah solution produced ..ah ..ah the painkillers like ..ah ..ah paracitol[8] or aspirin ..ah ..ah which act on our body. ..ah ..ah.

T. Thank you.

(9) (Subject No. 28)

T. (The teacher approaches a student (Subject No. 28), from another group, who is raising her hand to talk). I want group E to talk. So you are talking about what?

S. Aspirin.

T. About aspirin.

S. Aspirin is best known and widely known.

T. Yes.

S. Aspirin is ..ah ..ah best known and widely known ..ah because of .. it is serve the pain, reduce temperature of the patient and because it has no addictive, the doctors give it to people.

T. Yes.

S. The aspirin affect people because it is .. because stomach pain, and if we swallowed a whole aspirin .. but not only because stomach pain but only pain in the stomach ..why they may not give aspirin empty stomach.

T. (Encouraging) Yes

S. And we take it in soluble /solibl/ form, because in normal liquid and take the aspirin in soluble/solibl/ form help to solve .. solve(9) it ..

T. (Correcting) Dissolve.

S. In the stomach line(10).

T. Thank you.

(10) (Subject No. 27)(11)

T. (To Subject No. 27) Yes, what's your name?

S. Khalid.

T. Khalid Hanna. So Khalid, what are you going to talk about?

S. Aspirin.

T. Yes.

S. It's one of the most well-known drug ..ah. It is used as well as in case of influenza /infəlwənz/.

T. (Correcting pronunciation) influenza.

S. Influenza. It doesn't just relieve the pain, it also .. also reduce the painer. But for this reason always doctors prescribe ..to describe(12) this drug in case of influenza and the like. As well as in the case of this drug, it has some side effects such as it cause pain in stomach and also as an ret..... reltat... retait...

T. Irritate

S. Because it irritate the lining the stomach. As well as if it take in ..ah much.

T. ..ah.

S. In much amount.

T. Yes.

S. It may be causes bleeding. For the ideal /i:diəl/ form or this ideal /i:diəl/ case to take this drug as a soluble form ..ah in ..ah water as well as in plenty of liquid.

T. Yes (correcting), ideal. Do you think that Aspirin could be given to any person? Or are there some people ah.. who should not be given Aspirin?

S. Yes. Some people should not take the Aspirin in case if they have ..ah ..ah ..ah.

T. Stomach pain or allergy to Aspirin.

S. Allergic or stomach pain because this causes as I said sided effect.

T. Thank you.

(11) (Subject No. 39)[13]

T. (To class) Who is going to talk about other kinds of painkillers? (a student (Subject No. 39) raises his hand to speak) Yes, Amin.

S. Sometimes and many people some patients can not take Aspirin because of allergy or stomach .. stomach pain.

T. Yes.

S. So another medicine ..another medicine called paracetemol which can take the place of Aspirin.

T. Yes.

S. Paracetemol is a reducer of temperature ..reduce of ..ah the temperature, and loses[14] pain; and it used for abdonimal pain because it is not irritate the stomach ..pain of the stomach.

T. Thank you.

(12) (Subject No. 14)

T. (To class) Is there anyone to talk about paracetemol? (A student (Subject No. 14) raises her hand to respond).

S. If some patients cannot take aspirin, they can take paracetemol. Paracetemol is used to remove the pain, and it used for temperature, and it also used to remove the abdonimal pain. Paracetemol it cannot affect the memerane lining the stomach. It is used for a long time, its effect to the liver or kidney.

T. Yes.

(13) (Subject No. 13)

T. (Approaching a student (Subject No. 13) from the same group). AAzad. Is it good to take Aspirin in low do... doses?

S. Yes, there is much increasing evidence to suggest that Aspirin help in blood ...ah say in heart attacks. But since it causes ..ah stomach trouble and ..ah some other causes, it is not needing to take the Aspirin at the moment. nd doctors in the England and and other country trying to ah answer this question and the whole subject .. subject is under trial now.

T. Thank you.

(14) (Subject No. 17)

T. (To another group) What about question two? (A student (Subject No. 17) raises her hand to respond). Yes, Basima, some doctors in China are now applying acupuncture. What is acupuncture?

S. Acupuncture is anaesthetic.

T. Yes. It is used instead of anaesthetic ...instead of chloroform and others.

S. The patient does ..ah why .. doctors does as test this anaesthetised works if the patient ..ah ..ah ..ah is free.

T. It could work if he believes in it.

(15) (Subject No. 16)

T. (To another group) I want someone to talk about Aspirin and its effect on women who are pregnant. (A student (Subject No. 16) raises his hand to talk).

S. She is asking if she can take aspirin for .. for the pain. The doctor say that nowadays people smoke cigarette, take alcohol, and so many things, and for that reason he said that .. that we can't determin if the harm ..harm ..ah drug or not.

T. On ..ah children.

S. But he advised /əd'vaisd/ on the three months.

T. Yes.

S. Don't to take any drug, even aspirin.

T. Yes. Thank you.

(16) (Subject No. 12)

T. (Approaching a student (Subject No. 12) from another group). So this person ... What does he think?

S. This person thinks that the drug more better than ..ah the ..no. He thinks that alcohol is much better ..ah ..ah.

T. A painkiller.

S. Then ..ah drugs for headaches, and doctors answer in that alcohol may be used as ..ah a drink .. as a painkiller ..ah because it is relax and sedates /sediks) many parts of the brain.

T. But in fact ... can we use it instead of drugs or aspirin?

S. ..ah in some cases it may be dangerous for using ..ah ..ah.

T. Alcohol.

S. Alcohol as a painkiller but if because of it relax and sedates /sediks/ many parts of the brain, it may be used as a painkiller, but it can remove the .. the pain .. the signals of the pain in the patient.

T. ..ah.

S. That depend on the drinker ... himself.

T. Do you think ... did the doctor agree with the taking of .. did he agree with the patient in taking of alcohol instead of drugs or he didn't agree?

S. He agreed in some cases and he refused in other ..ah in other. In same injury it is dangerous, but he agree with the patient that if the drinker himself .. it depends on him, if he ..

T. Can the drinker in this case use alcohol instead of drug? Can or he cannot?

S. He cannot.

T. He cannot. It is dangerous.

S. Yes, it is dangerous.

T (Talking to students of another group) What about....

S. (The same student interrupting) But alcohol can be used to remove signals of pain.

T. It is not scientifically ..ah agreed. Yes, alcohol has ..ah influence on the ..the brain, but it cannot at all be used instead of drug. Because it is not a drug.

S. It could be dangerous.

T. Yes.

(17) (Subject No. 2)

T. (Talking to student of another group again) What about overdose? People who take overdose? (A student (Subject No. 2) raises her hand to respond). Yes, Aamaal.

S. It is addictive.

T. What do you mean?

S. I talk about another antibody .. another kind of ..ah ...

T. Painkiller.

S. If this.. the person, he has an allergic or he is not able to take aspirin.

T. (Encouraging) Yes.

S. For example, paracetemol and morphine. Paracetemol is used if ..ah ..ah affected the pain and make ...

T. So you mean we can use paracetemol instead of aspirin, right? But could paracetemol affect other parts of the body?

S. Yes, it may affect about ..ah the liver /laivər/ and the kidney.

T. (Correcting pronunciation) The liver and the kidney.

S. The liver and the kidney.

T. Yes.

S. Another is also morphine. If the person had the morphine regularly /reglwər/ .. many times, for long period could use them ..ah morphine will be addative /ədəbtid/.

T. So would you advise a person to take paracetemol or aspirin regularly?

S. No. ..ah he must take them if the doc.. doctor ask him to, because any or ill person .. person cannot know if this harm him or not.

T. Good.

Notes Related to Appendix 21

1. Words which are mispronounced will be shown in phonetic symbols, in slanted lines.
2. He means 'solution'.
3. This subject has been excluded from the experiment because he is from previous year.
4. He means 'antibiotics'.
5. 'Yanni' means 'I mean' in Arabic.
6. See footnote 5 above.
7. 'Na'm' means 'yes' in Arabic.
8. She means 'paracetemol'.
9. She means 'dissolve'.
10. She means 'lining'.
11. This student also talked about 'The Structure of the Nose' (Subject No. 27, p.602).
12. He means 'prescribe'.
13. This student also talked about 'The Structure of the Nose (Subject No. 39, p.604).
14. He means 'relieves pain'.

APPENDIX 22

Comparison of Students' mean scores in the faculty subjects

1. Anatomy

Group	$\bar{X}$	S.D.	S.E.	T. Value	Level of significance
Exp.G.(N=38)	9.89	3.10	0.50	0.24	Not significant at the .01 level
Con.G.1(N=34)	10.03	3.30	0.30		

Group	$\bar{X}$	S.D.	S.E.	T.Value	Level of significance
Exp.G.(N=38)	9.89	3.10	0.50	-2.17	Not significant at the .01 level
Con.G.2(N=41)	11.33	3.00	0.46		

Group	$\bar{X}$	S.D.	S.E.	T.Value	Level of significance
Con.G.1(N=34)	10.03	3.50	0.60	1.73	Not significant at the .01 level.
Con.G.2(N=41)	11.33	3.00	0.46		

2. Histology

Group	$\bar{X}$	S.D.	S.E.	T. Value	Level of significance
Exp.G.(N=38)	9.77	3.76	0.61	0.37	Not significant at the .01 level
Con.G.1(B=34)	9.45	3.50	0.60		

Group	$\bar{X}$	S.D.	S.E.	T.Value	Level of significance
Exp.G.(n=38)	9.77	3.76	0.61	-0.29	Not significant at the .01 level
Con.G.1(N=41)	10.01	3.63	0.56		

Group	$\bar{X}$	S.D.	S.E.	T.Value	Level of significance
Con.G.1(N=34)	9.45	3.50	0.60	-0.68	Not significant at the .01 level
Con.G.2(N=41)	10.01	3.63	0.56		

3. Biochemistry

Group	$\bar{X}$	S.D.	S.E.	T.Value	Level of significance
Exp.G.(N=38)	8.58	2.95	0.47	0.91	Not significant at the .01 level
Con.G.1(N=32)	7.90	3.28	0.58		

Group	$\bar{X}$	S.D.	S.E.	T.Value	Level of significance
Exp.G.(N=38)	8.58	2.95	0.47	1.07	Not significant at the .01 level
Con.G.2(N=40)	7.96	2.09	0.33		

Group	$\bar{X}$	S.D.	S.E.	T.Value	Level of significance
Con.G.1(N=32)	7.90	3.28	0.58	-0.09	Not significant at the .01 level
Con.G.2(N=40)	7.96	2.09	0.33		

4. Physics

Group	$\bar{X}$	S.D.	S.E.	T.Value	Level of significance
Exp.G.(N=39)	14.38	2.12	0.34	1.21	Not significant at the .01 level
Con.G.1(N=34)	13.64	3.04	0.52		

Group	$\bar{X}$	S.D.	S.E.	T.Value	Level of significance
Exp.G.(N=39)	14.38	2.12	0.34	-0.83	Not significant at the .01 level
Con.G.2(N=41)	14.78	2.17	0.34		

Group	$\bar{X}$	S.D.	S.E.	T.Value	Level of significance
Con.G.1(N=34)	13.64	3.04	0.52	-1.88	Not significant at the .01 level.
Con.G.2(N=41)	14.78	2.17	0.34		

APPENDIX 23

Questionnaire for Subject Teachers in

Some Iraqi Science Faculties

Dear Colleague,

I am doing a research related to science faculties in Iraq. I would be grateful if you could provide me with accurate answers. Thank you in advance.

Abdulla S. Tawfiq
28.6.1983

Name of Professor: University:

Department: Faculty:

Where applicable please tick thus ✓ in box provided, where a broken line is provided please write answer.

1. The language of instruction used in your faculty.
   - ☐ English
   - ☐ Combination of English and Arabic
   - ☐ Arabic
   - ☐ Arabic with English (Latin) terminology
2. The language of the textbooks.
   - ☐ English
   - ☐ Combination of English and Arabic
   - ☐ Arabic
   - ☐ Arabic with English (Latin) terminology
3. The language of the supplementary materials.
   - ☐ English
   - ☐ Combination of English and Arabic
   - ☐ Arabic
   - ☐ Arabic with English (Latin) terminology
4. The language used in oral and written examinations.
   - ☐ English
   - ☐ Combination of English and Arabic
   - ☐ Arabic
   - ☐ Arabic with English (Latin) terminology

5. The language of references and periodicals.

☐ English ☐ Combination of English and Arabic

☐ Arabic ☐ Arabic with English (Latin) terminology

6. If there is other information you feel is relevant to the aims of this questionnaire, please specify .....

.....

.....

.....

.....

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