CHAPTER FIVE

The Prospects of ESP 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).

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

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.
<table>
<thead>
<tr>
<th>Type of School</th>
<th>Number of hours per week (30 weeks)</th>
<th>Average number of hours per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commerce</td>
<td>1st year 4</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>2nd year 4</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>3rd year 4</td>
<td>120</td>
</tr>
<tr>
<td>Agricultural</td>
<td>1st year 2</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>2nd year 2</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>3rd year -</td>
<td>-</td>
</tr>
<tr>
<td>Industrial</td>
<td>1st year 2</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>2nd year 3</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>3rd year 3</td>
<td>90</td>
</tr>
<tr>
<td>Primary School</td>
<td>1st year 5</td>
<td>150</td>
</tr>
<tr>
<td>Teacher Training</td>
<td>2nd year 5</td>
<td>150</td>
</tr>
<tr>
<td>College</td>
<td>3rd year 4</td>
<td>80 (20 weeks)</td>
</tr>
</tbody>
</table>

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 The Teacher of English

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

<table>
<thead>
<tr>
<th>Language of instruction</th>
<th>Lectures %</th>
<th>Textbooks %</th>
<th>Supplementary materials %</th>
<th>Examinations %</th>
<th>References %</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>95</td>
<td>100</td>
<td>100</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>Mixed</td>
<td>5</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td>Arabic with English terminology</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Arabic</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Table No. 74
Percentage of language of instruction used in science faculties in Iraq

<table>
<thead>
<tr>
<th>Language of instruction</th>
<th>Lectures %</th>
<th>Textbooks %</th>
<th>Supplementary materials %</th>
<th>Examinations %</th>
<th>References %</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>9</td>
<td>56.8</td>
<td>35.2</td>
<td>34</td>
<td>77.2</td>
</tr>
<tr>
<td>Mixed</td>
<td>68.1</td>
<td>31.8</td>
<td>25.71</td>
<td>38.6</td>
<td>18.1</td>
</tr>
<tr>
<td>Arabic with English</td>
<td>34</td>
<td>11.3</td>
<td>44.7</td>
<td>15.7</td>
<td>5.2</td>
</tr>
<tr>
<td>terminology</td>
<td>-</td>
<td>-</td>
<td>5.8</td>
<td>15.7</td>
<td>-</td>
</tr>
</tbody>
</table>

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 one 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 [3 from medical faculties (medicine and dentistry) and 44 from other science faculties]
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 facilities 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 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)

<table>
<thead>
<tr>
<th>BASIC SCHEME FOR METHODS COURSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.B. These stages show an order but they are not time units.</td>
</tr>
</tbody>
</table>

**Phase 1**

**PRACTICAL TECHNIQUES**

A. Listening & Speaking; B. Reading; C. Writing

<table>
<thead>
<tr>
<th>Stage</th>
<th>Practical Experience</th>
<th>Basic Theoretical Concepts</th>
<th>Student Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>'Lesson' in a foreign language with presentation, choral, individual and pairs practice shown</td>
<td>Three levels of language: sound grammar meaning</td>
<td>They are ‘taught’ the lesson and will discuss it in groups, guided by controlled questions.</td>
</tr>
</tbody>
</table>
| 2     | Organizing choral and individual class practice | L₁ & L₂ 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

<table>
<thead>
<tr>
<th></th>
<th>Activity</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Applying oral techniques to reading stimuli</td>
<td>Correspondence of English sound and writing systems contrasted with Spanish</td>
<td>Student practice.</td>
</tr>
<tr>
<td>13</td>
<td>Remedial techniques for reading aloud</td>
<td>Correspondence of English sound and writing systems contrasted with Spanish</td>
<td>Student practice.</td>
</tr>
<tr>
<td>14</td>
<td>Basic reading procedures. Sentences and longer sequences</td>
<td>Skills or lack of skills. Transfer to English</td>
<td>Practise effective reading aloud of longer passages; voice projection.</td>
</tr>
<tr>
<td>15</td>
<td>Using oral questions on reading texts</td>
<td>Nature of comprehension</td>
<td>Draft part of lesson plan with questions on a given text.</td>
</tr>
<tr>
<td>16</td>
<td>Using written questions on reading texts</td>
<td>Possible causes for comprehension errors</td>
<td>Prepare and test and revise questions on a given text.</td>
</tr>
</tbody>
</table>

### C. WRITING

<table>
<thead>
<tr>
<th></th>
<th>Activity</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Techniques for introducing writing at sentence level</td>
<td>Writing as a learning device</td>
<td>Play memorisation games with and without help by being allowed to write.</td>
</tr>
<tr>
<td>18</td>
<td>Techniques based on textbook materials</td>
<td>The role of the textbook in class activity</td>
<td>Teach mini-lessons in small groups with textbook.</td>
</tr>
<tr>
<td>19</td>
<td>Oral preparation techniques (for writing)</td>
<td>Integration of skills</td>
<td>Plan preparation in groups. Some to demonstrate to whole class.</td>
</tr>
<tr>
<td>20</td>
<td>Controlling techniques</td>
<td>Justification for controlled work</td>
<td>Write several types of controlled writing exercises.</td>
</tr>
<tr>
<td>21</td>
<td>Guiding techniques (planning for class)</td>
<td>Methodological sequencing</td>
<td>Draft complete lesson plan for guided composition lesson.</td>
</tr>
<tr>
<td>22</td>
<td>Techniques for pupils' correction</td>
<td>Cognitive versus behaviorist language learning theories</td>
<td>Answer one writing exercise (Stage 20), anticipating typical errors, and propose pupil-centered correction technique.</td>
</tr>
<tr>
<td>23</td>
<td>Remedial techniques for written errors</td>
<td>Error analysis</td>
<td>Correct and classify errors in a given passage. Discuss in groups.</td>
</tr>
</tbody>
</table>
## Phase 2
### APPROACHES BY TEACHING LEVEL

<table>
<thead>
<tr>
<th>Stage</th>
<th>Practical Experience</th>
<th>Basic Concept</th>
<th>Student Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>Presentation of lesson plan (Part A) Pre-class activities</td>
<td>Selection sequencing</td>
<td>Discuss and prepare Stage A of a lesson plan by group.</td>
</tr>
<tr>
<td>25</td>
<td>Presentation of lesson plan (Part B) In-class activities</td>
<td>Objectives</td>
<td>Discuss and prepare Stage B of a lesson plan.</td>
</tr>
<tr>
<td>26</td>
<td>Division of a lesson plan into class plans</td>
<td>Motivation through variety of activities</td>
<td>Divide lesson plans into class plans.</td>
</tr>
<tr>
<td>27</td>
<td>Application of practical techniques (Phase I) to first grade syllabus</td>
<td>The Role of a Syllabus</td>
<td>Prepare lesson plans for the structures in the first grade syllabus with reference to existing textbooks.</td>
</tr>
<tr>
<td>28</td>
<td>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.)</td>
<td>Objectives</td>
<td>Prepare lesson plans for the structures in the second grade syllabus with reference to existing textbooks.</td>
</tr>
<tr>
<td>29</td>
<td>Application of practical techniques to third grade syllabus content. (Additional, more complex communicative activities. Extensive reading, written composition: messages, letters, etc.)</td>
<td>Self-evaluation in relation to lesson planning</td>
<td>Prepare lesson plans for the structures in the third grade syllabus with reference to existing textbooks.</td>
</tr>
<tr>
<td>30</td>
<td>Teaching adults</td>
<td>Age factor</td>
<td>Discuss use of appropriate materials.</td>
</tr>
<tr>
<td>31</td>
<td>Advanced work: more complex techniques</td>
<td>E.S.P. and English for Vocational Purposes</td>
<td>Discuss appropriate materials.</td>
</tr>
<tr>
<td>32</td>
<td>Evaluation and testing pupils' performance</td>
<td>Purpose and function of evaluation</td>
<td>Practise evaluation techniques in relation to syllabus and available materials.</td>
</tr>
</tbody>
</table>
## Phase 3
### ANALYSIS OF METHODOLOGICAL PROCEDURES

<table>
<thead>
<tr>
<th>Stage</th>
<th>Basic Theoretical Concepts</th>
<th>Reference to previous Practical Stages</th>
<th>Student Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>Different Methods</td>
<td>I-A-1</td>
<td>Assignment in reading on different methods. Group discussion of techniques pertaining to each method. Summary by teachers.</td>
</tr>
<tr>
<td></td>
<td>Eclectic Method</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Aims and goals of Language.</td>
<td>II-28, 31</td>
<td>Group discussion of Basic Concept. Summary by teacher. Reading assignment.</td>
</tr>
<tr>
<td></td>
<td>Reasons for teaching</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>English related to aims and</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>goals of language work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Problems of language</td>
<td>I-A-2, 4, 6, 7, 10</td>
<td>Reading assignment (Resoluciones de Chetumal)</td>
</tr>
<tr>
<td></td>
<td>teaching in Mexico.</td>
<td>I-B-12, 13, 14, 15, 16</td>
<td>Group discussion and conclusions.</td>
</tr>
<tr>
<td></td>
<td>Mixed-ability groups</td>
<td>I-C-23</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>II-26, 30, 31</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Pupil's characteristics</td>
<td>I-A-10</td>
<td>Reading assignment. Group discussion and summary.</td>
</tr>
<tr>
<td></td>
<td>(variables)</td>
<td>II-26, 30</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Differences in learning</td>
<td>I-A-2, 6, 7, 10</td>
<td>Reading assignment. Group discussion and summary.</td>
</tr>
<tr>
<td></td>
<td>$L_1$ and $L_2$. (Individual</td>
<td>I-C-17, 21, 22</td>
<td></td>
</tr>
<tr>
<td></td>
<td>differences in learning)</td>
<td>II-24, 25, 26, 28, 30</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Need for standard model</td>
<td>I-A-9, 11</td>
<td>Listening to different forms of standard English (native speakers). Group discussion and conclusions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>II-24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and Deep Structure</td>
<td>1-B-15, 16</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Syntactic Analysis of $L_2$</td>
<td>I-A-1</td>
<td>Analysis of basic structures and systems of language description.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I-B-16</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I-C-23</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>II-24, 27</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Error Analysis of Syntax</td>
<td>I-A-1, 2</td>
<td>Reading assignment. Error analysis of their own compositions and speech and that of pupils.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I-B-16</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I-C-20-23</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>II-24</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Error Analysis of phonological problems both of pupils and students</td>
<td>I-A-1, 2, 6, 11</td>
<td>Reading assignment. Error analysis of their own speech and that of pupils.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I-B-12, 13</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>I-C-20</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>II-24</td>
<td></td>
</tr>
<tr>
<td>Phase 3 continued</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>43</strong> Phonetics. Its use in the classroom</td>
<td>I-A-1, 2, 6, 7, 11</td>
<td>Discussion and conclusions.</td>
<td></td>
</tr>
<tr>
<td><strong>44</strong> Direct method. (Use of $L_2$ in the classroom)</td>
<td>I-A-3, 4, 5, 11</td>
<td>Reading assignment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-C-18, 21, 22</td>
<td>Group discussion on the Direct Method and its contribution to foreign language learning.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II-24, 25, 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>45</strong> Rationale for the use of Audio-lingual techniques</td>
<td>I-A-3, 4, 5, 8, 11</td>
<td>Reading assignment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-C-18, 21, 22</td>
<td>Group discussion on the Audio-lingual Method and its contribution to foreign language learning.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II-24, 25, 28</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>46</strong> Influence of teacher's personality and attitude. (Basic characteristics)</td>
<td>I-A-4, 10</td>
<td>Group discussion and conclusions after observation of real classes.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II-26, 29</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>47</strong> Textbooks Analysis</td>
<td>I-A-3, 4, 5, 10</td>
<td>Comparative analysis based on criteria of textbooks in use in secondary schools.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-C-17, 18, 19, 21, 22</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>II-24, 26, 27, 31</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>48</strong> Language as Communication</td>
<td>I-A-1, 3, 5, 9, 11</td>
<td>Group discussion and conclusion.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-B-15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I-C-19</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>II-25, 28, 31</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Phase 4**

**ORGANIZATION AND BACKGROUND INFORMATION**

| 49 | The role of English and English teaching in Mexico.†—Statistics. |

† 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 other forms: con- as in connect; com- as in communicate; cor- as in correlate; col- as in collaborate.

- **contra-** contra-rotation contra = opposite
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-** 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-** polyanert 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
go- 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
 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

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 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 damaged. The driver of the yellow car was calm. He came 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 damage estimated at about five hundred dollars. Though I was lat getting home that day, I had an interesting story to tell my parents.

Rewrite of Protocol

I was going home from school. When I was standing at the 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 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.
Skin and skin diseases

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 instability 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 treatment 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.

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.
Skin and Skin Diseases

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.

When 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 sebaceous 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 pain, 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 bed and its shape is partly determined by genetic factors. The tip of the nail is the cuticle which overlies 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 continue to produce 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 (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 lower layers 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 into 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 than 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 forms a raw. Blood vessels and fibrinous 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

Bithmarks (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 bithmarks 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.

Rashes 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 adheer 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 132-22) 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 and 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—or it is tempting to warm cold feet in front of the fire this can 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 particularly

---

Structure of the skin

- Pigment granules
- Folicular melanocytes
- Keratinocytes
- Ruffini corpuscles (mechanoreceptors)
- Pacinian corpuscles (pressure receptors)
- Fat cells
- Hair follicles
- Nerve fibres
- Epidermis
- Dermis
- Collagen and elastic fibres
- Blood vessels
- Lymphatics
- Nerve endings

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.
Bones

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 armor 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 part, 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 do we have bones

The primitive function of bones as armor 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 guides 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 inside 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.

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 hard material, which gives a result something like concrete, with bits of gravel—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 to grow, 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 designs of bones. The hollow centre, 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 definite 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 through 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 in the middle, and this provides extra solidity at the joint where it is most needed. This shaping, technically known as modelling, is especially encouraged 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.
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 things known as ligaments.

Self-maintenance

Like many other parts of the body, bones have the extraordinary capacity to maintain themselves if infected or injured. 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), the main reason being 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 this happens it is simply complete, the hardening process must be finished. The finished joint 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 complete, much like the limb once again in use, so that eventually the place of the break—doctors call it a fingering—persists unchanged, though 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 known as osteomyelitis, the 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 broken bones, which are abnormally weak. Although the condition itself cannot be cured, it can be treated effectively, mostly by preventing situations where the bone area might be great strain.

Dwarfism can also be caused by bone disease, such as dwarfism of a child due to growth to the normal height of an adult, but develops normally. In other ways, this is used to either from failure of bone growth or a failure of control over the bone-growing process.

The final, least serious type of inherited bone problem is the misaligned bone—perhaps an irregularity of a limb, 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

There then are what are known as the mechanically caused bone diseases, this means a failure of the bone's chemistry to supply bone formation properly. Of the best known is now virtually a disease of the post—rickets. It is caused by a lack of a certain essential vitamin due to the body not being able to digest the food. Weakening of the bones occurs, giving the legs especially a characteristic, bowed look. Although rare, it is sometimes seen in strict vegetarians and is treated by vitamin D supplements.

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

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

Bone tumours

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

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

Bone cancer is a serious matter, but these days it is controllable to a considerable extent. The types of treatment available are usually effective and usually totally eliminating the pain of the swelling caused by the bone.

The spread of cancer to the bone 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 former is a weakening 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—parathyroid hormone—which 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.

Osteoporosis and hyperparathyroidism. Fagan's disease, seems to be on the increase. It affects the elderly, its cause is unknown, and it causes bone growth of the bones. Treatment with a hormone that stops the bone loss from the osteoporosis, hardening substances seems to be successful.

The future

Consensus is extensive and how complex it is all but comprehensible. The human skeleton is, it is prone to comparatively few problems, and most of these are curable, or controllable. So bone diseases need no longer a death or disease, and they do not work in the way they would normally do.
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 occurs in 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 change in pressure will bring on the pain. However, to put your mind at rest, do consult 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 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 hollowness 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 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 strings—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 trachea. 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 gut, 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.

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 yellowrather 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.

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 distress)

Heart attack

Pleurisy (inflammation of the membrane lining the heart)

Central, pressing pain spreading to the neck, shoulders or arms

Brought on by exercise or emotional excitement

Angina

Percarditis

Anywhere, worse on inspiration (breathing in) or on coughing

May well be associated with a cough or an attack of bronchitis

Pleurisy

Percarditis

Central, burning, worse after food, or when lying on the side, may be worse at night

Foods may bring it on, and it may be relieved by milk or indigestion tablets

When a cough needs medical attention

Type of cough

Cause

Green or yellow sputum

Branchitis (inflammation of the lining of the bronchial tubes coughed up)

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

"CHEST"

1959
**NOSE**

Lotions for soothing a cold

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 g (1/2 tsp) sodium bicarbonate</td>
<td>2 g (1/2 tsp) borax</td>
<td>Add 2 g (1 tsp) sugar</td>
</tr>
</tbody>
</table>

Application: Apply the chosen lotion to the inside of the 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 disease." 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.

**Cold 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. Astringent and proprietary cold powders are nothing 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 broken nose usually requires at least one night in hospital.

**Nosebleeds**

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 allergic reaction. If the bleeding seems severe, put a small packet 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 persists 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.

**Treat nasal congestion**

If nasal bleeding leaves the nose very dry, then use a spray that contains water and soothing ingredients. Use only 5 minutes of each nostril at a time. This treatment stops bleeding and makes the nose more comfortable. If the bleeding seems excessive, stop immediately. A small amount of over-the-counter aspirin is beneficial. A nasal douche will also help.
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 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.

Q My son has begun to pick his nose. When should I start being severe with him?
A Nose-picking is unhealthy 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.

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 I've had •••
A There could be hundreds of causes.

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

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 warms and moistens 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 mucuses. 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

Side view of the nose

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).
Have you had a crooked nose ever since 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 rectify 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 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 top 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.

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

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

Highly unlikely—although there are a few physical illnesses which can cause such anxiety. More often, anxiety and nervousness such as you suffer from are caused by your 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 tension are not relieved 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.

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

Yes. If a nerve containing sensory fibres is slightly compressed, its individual fibres may fire off a flood of sensory 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—for example to sit on a cross-legged chair—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.

Does heavy drinking damage the nerves?

Yes. Heavy consumption over a period of years may cause a permanent disturbance in the conduct of signals by nerve cells. Alcoholic drinks contain B vitamins, defciency in which can cause the brain to deteriorate in mental functioning. Chronic alcoholics often suffer from vitamin deficiency, too, because of not eating properly, and this may also disturb nerve functioning.

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.

The nervous system is essential to sight and hearing, to 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 neurons, 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 neurons or bring about some action, such as the contraction of muscle fibres.

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

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 fibres outside the central nervous system. 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 receptor cells are transmitted 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 supplying 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 larynx. 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 as a 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.
What is it about the 'funny bone' that causes 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. The nerve runs behind the elbow, on its way to the forearm, and is sensitive to pressure at this point. A slight knock will cause a volley of signals in the nerve's sensory fibers and evoke a perception of pain.

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 give off branches 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.

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 fibers that used to send messages from your foot 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 fibers send messages via the spinal cord to the brain, which from past experience interprets the message as having come from the foot.

Q: 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 neurons that extend in long bundles called the spinal nerves. These bundles run varying distances down the spinal cord, and at their ends farthest from the brain they come into contact with the fibers or cell bodies of sensory and motor neurons belonging to the peripheral nervous system. Messages can be transmitted across the gaps, called synapses, between the peripheral neurons and the spinal neurons. The second function of the spinal cord is to control simple reflex actions. This is achieved by neurons whose fibers extend short distances up and down the spinal cord, and by interneurons, which relay messages directly between the sensory and motor neurons.

If, for example, you accidentally put your hand on a hot stove, pain receptors in the skin send messages along sensory fibers to the spinal cord. Some of these messages are relayed immediately by motor neurons that control the movements of the arms and hands. Other messages travel up the spinal cord and are relayed by interneurons to the motor neurons 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.

Q: The brain

This has three main parts. The stalk, or brainstem, is a continuation of the spinal cord and supports the brain's 'large' cephalic region, the cerebrum. Below the cerebrum is the cerebellum. Although many sensory neurons terminate, and many motor neurons originate in the brain, the majority of the brain's neurons are interneurons 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 felt when one touches a hot stove is memorized, and the memory will later affect a decision whether or not to touch the same object again.

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 hearing, speaking, sight and smell. Others, such as the speech and language areas, are involved in the perception of visual and auditory information.

Between these motor, sensory and language areas of the cortex is a group of areas consisting of millions of interconnected neurons. These are connected with reasoning, emotions and the will to act.

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 cortex of the cerebrum to coordinate body movements.

The brain itself contains a number of different structures with a variety of roles, and the most important of which is the 'centres' which control the lungs, heart and blood vessels. The central and autonomic functions of the brain are essential to life and are controlled by the cerebellum. Other centres 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 brain is the cerebellum, which contains the motor and sensory interneurons. The cerebellum has a number of roles, such as maintaining posture and balance, and it is the site of the 'funny bone' described by your friend.

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 protect, nourish and provide support for the neurons.

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

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.

To speed the transmission 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

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

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

3. CHEST (Thorax)

Exercise 1

Read the reading text carefully and try to tick (/) the most appropriate 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 inflammation of the membrane lining the outside of the lungs and the inside of the chest.
   B. breathlessness and sweating
   C. an inflammation 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 diaphragm 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 inflammation 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

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
fossae
olfactory
ridges
nasal conchae
meatus
membrane
cilia
tear ducts

earache
proprietary
douche
displaced
malformation
catarrh
sinusitis
meningitis
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, neuritis, synapses, peripheral, cerebrum, skeletal, cerebellum, spinal cord, cerebral, somatic nervous system, hypothalamus, automatic nervous system, dendrites, pancreas, axon, sensory nerve fibres, myelin.
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 turned her 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 penicillin?

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 other allergic rashes or eczema often do grow out of these 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.
pollen that spork off symptoms of an allergy in someone who is allergic to it. Among the commonest allergens are foods (notably eggs, milk, and fish), pollens, insects, animal dander (e.g., cat and dog fur), and metal. Plants and other types of pollen 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.

Allergy Allergen

| Hay fever | Pollen | Puffiness and teary eyes as well as itchy, red, runny nose and sneezing.

| Migraine | Usually caused by cheese, red wine, yeast extract, but not only caused by an allergen.

| Nettlerash | Foods | Hiding certain plants

<table>
<thead>
<tr>
<th>Allergy</th>
<th>Allergen</th>
<th>Symptoms</th>
<th>Treatment</th>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>Dust mites</td>
<td>Difficulty breathing; wheezing</td>
<td>Pick test for diagnosis</td>
<td>Keep house dust-free</td>
</tr>
<tr>
<td></td>
<td>Animal hair</td>
<td></td>
<td>Bronchodilator if breathing problem severe</td>
<td>Avoid pollen; keep clear of animal hair</td>
</tr>
<tr>
<td></td>
<td>Pollen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Some foods and food additives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contact dermatitis</td>
<td>Contact with allergen, e.g., jewellery, chemicals in washing powder</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Topical steroids</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Itchy, blistering inflammation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A soothing cream can often relieve the symptoms of a skin allergy such as eczema. This should always be prescribed by a doctor.

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 conjunctivitis), tablets for stomach allergies or via another device called the insufflator, which looks rather like a very small hand pump.

Corticosteroid drugs like cortisone, which are very powerful and anti-inflammatory, are sometimes prescribed for skin allergies or, via an inhalant, to combat asthma. Asthma can also be controlled by a group of drugs known as bronchodilators, so called because they dilate 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 one of them. It is important to let your doctor know if you are experiencing any 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 of 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 a 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 it is at its 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 pollen 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 country.

Dust mites are difficult to eliminate altogether from the home, but regular vacuuming of carpets and curtains, and washing of bedcovers will reduce their number. Artificial fibres in pillows and duvets, are much 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 of the 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 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 the patient is able 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 10 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 reversed by giving up smoking, but it is never...
**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 My son has an impacted wisdom tooth that never comes to my mouth correctly. Should he have it removed before he goes?

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 I am a professional boxer and am worried about going to Africa on holiday. In case of injury, my nose may be broken. Would it be a good idea to have my wisdom teeth removed?

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

**Impact of canine teeth**

Q I am a professional boxer and am worried about going to Africa on holiday. In case of injury, my nose may be broken. Would it be a good idea to have my wisdom teeth removed?

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 am worried about going to Africa on holiday. In case of injury, my nose may be broken. Would it be a good idea to have my wisdom teeth removed?

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

**Impact of canine teeth**

Q I am a professional boxer and am worried about going to Africa on holiday. In case of injury, my nose may be broken. Would it be a good idea to have my wisdom teeth removed?

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 am worried about going to Africa on holiday. In case of injury, my nose may be broken. Would it be a good idea to have my wisdom teeth removed?

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

**Impact of canine teeth**

Q I am a professional boxer and am worried about going to Africa on holiday. In case of injury, my nose may be broken. Would it be a good idea to have my wisdom teeth removed?

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 am worried about going to Africa on holiday. In case of injury, my nose may be broken. Would it be a good idea to have my wisdom teeth removed?

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

**Impact of canine teeth**

Q I am a professional boxer and am worried about going to Africa on holiday. In case of injury, my nose may be broken. Would it be a good idea to have my wisdom teeth removed?

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 am worried about going to Africa on holiday. In case of injury, my nose may be broken. Would it be a good idea to have my wisdom teeth removed?
IMPACTED TEETH

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 advisable for an impacted tooth to be left in position indefinitely, 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.

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

When impacted teeth are taken out using a local anesthetic, 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 wear 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.

Usually if the patient is very nervous, a general anesthetic would be used, but in other cases, a local anesthetic is preferable, as general anesthetics carry more risks than local anesthetics.

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

When impacted teeth are taken out using a local anesthetic, 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 wear 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.

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

Sometimes a problem that the patient may have is the removal of wisdom teeth. This is often necessary if the teeth are impacted, or if there is overcrowding. The removal of wisdom teeth may be carried out under a general anesthetic, or a local anesthetic may be used. In some cases, the removal of impacted wisdom teeth may be necessary as a result of overcrowding.

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 anaesthetised 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 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 and the course of things—cafeine 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 relatives like pethidine and methadone, act principally on the brain and often induce 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, paracetamol, codeine and morphia. Non-narcotic drugs such as the first two are available over the counter and are commonly used to relieve headaches or pains like pretrenal stomach cramps. The painkillers we buy from chemists are all combinations of aspirin, paracetamol 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-inflammation property.

However, aspirin can be extremely dangerous for some people in certain circumstances. It is an irritant and can cause stomach pain, 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 or 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 'fix' when dissolved in water. This is not just a commercial gimmick: sodium bicarbonate is an alkali and so helps to prevent irritation. Aspirin is non-addictive—the subject of great controversy. 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 as the chemical compound such as acetyl salisylic, 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 analogues**

If, for any reason, a patient should not take aspirin, paracetamol is often a good alternative. Paracetamol 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 mild abdominal pain. However, paracetamol can affect the function of the kidneys and the liver and 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 suppresses the cough centre in the brain. Codeine is rarely used on its own but is often combined with other drugs, commonly

### Common painkillers

<table>
<thead>
<tr>
<th>Uses</th>
<th>Dangers</th>
<th>Long term use</th>
<th>Contra indications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aspirin</strong></td>
<td>Mild painkiller brings down temperature and reduces inflammation. Good for headaches and discomfort from colds and influenza or simple pains like backache.</td>
<td>Imitates stomach lining; can cause ulcers and bleeding.</td>
<td>Not addictive but do not take regularly without doctor's advice.</td>
</tr>
<tr>
<td><strong>Paracetamol</strong></td>
<td>Mild painkiller. Used similarly to aspirin, can also be used for stomach aches.</td>
<td>Can cause kidney damage if taken in high doses for a long time.</td>
<td>Use of large doses can cause kidney damage.</td>
</tr>
<tr>
<td><strong>Distalgesic</strong></td>
<td>Paracetamol available on prescription; contains paracetamol and morphine-derived dextropropoxyphene. Stronger than the above.</td>
<td>Can cause kidney damage.</td>
<td>Can be addictive and cause kidney damage.</td>
</tr>
<tr>
<td><strong>Vegamin</strong></td>
<td>Mild painkiller containing aspirin, paracetamol and codeine. Can be used for influenza, rheumatism and period pains.</td>
<td>As with aspirin and paracetamol.</td>
<td>Contains codeine, so heavy and long-term use could be addictive—but the codeine contained is in very small amounts.</td>
</tr>
</tbody>
</table>

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

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 or 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 size 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 relieves 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.

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

It is 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 not 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 burglar rampaging through your house as 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 pain-killer 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.

Points to watch with painkillers

- 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

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.

**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 the virus 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 cold sores during menstruation.

**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 re-infected 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 antihistamine in an attempt to immobilize sufferers against severe attacks, but the value of these is doubtful.

**Outlook**

Most cold sores will heal naturally within a fortnight or so—three weeks at most.
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.

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

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 opposition 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 opposition 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

6. thereby: in that way; by that means

7. then: therefore; consequently
   formed out of: formed from

8. a characteristic: a thing or quality that is part of the nature of something
   vital: essential

9. a 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

10. far from obvious: not at all easy to find or see
    Such a clue: A clue of this kind

11. 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 . . .

12. 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

13. which lie in . . .: which are in nearly the same plane; whose plane is nearly the same

14. has no business to be: ought not to be
    to rotate: to turn; here it means 'to make a single complete turn'

15. a fraction of a day: a small part of a day

16. doing: rotating. Do is used to avoid the repetition of the verb rotate, actually: in reality; in fact

17. 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

18. 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)

19. 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'

20. 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.)

21. Nebula: a group of very distant stars or a mass of gas which looks like a patch of light in the sky at night

22. Orion: a group of stars. The 'sword' is formed by the stars which are in the middle of Orion's belt

23. 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)
28 density: According to Hoyle the density of a star like the sun is about
ten million million million (or \(10^{20}\)) times that of the inter-stellar gas
29 as the sun does: as the sun contains. cf. doing, line 20
31 10,000,000,000,000 miles: In speech we say ten million, million, miles
or billion miles
32 Evidently: Apparently; It seems that. It does NOT mean—obviously
33 a blob: a mass of no special shape
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
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
38 some external process: some outside event (which has not been con-
sidered in studying shrinkage)
39 inverse proportion: When two quantities are in inverse proportion their
product is constant. The simplest example is Boyle's Law—Pressure
\(\times\) Volume is constant, or pressure is inversely proportional to
volume. In the case of a star the speed of spin or rotation should in-
crease as it gets smaller in such a way that size \(\times\) 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 (\(10^8\)) miles. The circumference
is \(\pi\) times the diameter and should be multiplied by 1.6 to change
miles to kilometres. This gives a circumference of about 5 million
(5 \(\times\) \(10^7\)) km. The sun spins round once on its axis in 26 days or
about 24 million (\(2.25 \times 10^8\)) seconds. The speed of spin or rotation
is therefore about 5 million km. in 24 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 line
58-40). 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
55 hint: suggestion; indication; piece of evidence clue
56 comes: Note that the subject of comes is hint
57 It is found that: We find that . . .
58 curious: strange
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 pro-
cess takes place in a star or blob of gas
The origin of the sun and planets

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)
FRED HOYLE

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. (para. 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 out-run 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 dulness 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.
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

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 revised: 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
SIR W. C. DAMPIER

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.

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.

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.

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.

15 inherited: passed on from one generation to another; received by an offspring from its parents. See note, line 53.

16 evidence for such inheritance: evidence that modifications are inherited in this way. inherit (verb), pronounced in'herit → inheritance (noun), pronounced in'heritance.

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.

18 philanthropic efforts: efforts made by philanthropists (people who wish to improve the conditions in which others live). the nineteenth century: the years between 1819 and 1900. framed: made; planned.

19 tacit assumption: tacit: without being spoken; assume (verb), pronounced ə'ʃərəm → assumption (noun), pronounced ə'səmpʃən. See 4/37, p. 46 acquired improvements: improvements that an animal or plant obtains or acquires by changing (modifying) itself.

20 Wallace: Alfred Russel Wallace (1823–1913), an English biologist. See paragraph 5
cue: the key to the problem.

21 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 of a church.

22 Increasing: increasing in number.

23 argued that: put forward the theory that tends to outrun: in general (as a rule) increases more rapidly than 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).

24 eliminated: removed; killed; disposed of. Writings: When authors are quoting from books, newspapers etc., they often use the present tense.

25 I happened to read: I read, as it happened; by chance, I read...

26 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.

27 the struggle for existence: the fight for life. goes on: takes place from: as a result of.

28 it at once struck me that...: I immediately had the idea that...

29 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

32 would tend to be preserved: would probably be kept

33 and unfavourable ones to be destroyed: and unfavourable variations

34 would tend to be destroyed

35 species: a group of animals or plants which are alike, and which can breed or reproduce amongst themselves

36 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

38 Darwin spent twenty years collecting: Darwin collected, over a period of twenty years,

countless facts: a very great number of facts

39 breeding (noun): the reproduction of animals and plants, with special attention to certain characteristics

40 By 1844: See line 2

he had convinced himself: he had become certain (as a result of the evidence he had collected)

41 said: he had become certain (as a result of the evidence he had collected)

42 so far as it was possible: so far as it was necessary

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

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 possession: owner

53 offspring: (of animals) their young

54 through the race: to all members of the race

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

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...?

61 Compare: Marry in haste, and repent at leisure

63 by any cautious reasoner: by anyone who reasons (or works things out) carefully

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...

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

70 Yet: In spite of this

71 the many: the majority

72 incredible: unbelievable

73 devastating: a devastating effect: an effect that causes the destruction of something (in this case, of all previous ideas about the origin of species)

74 common sense: what seems to be reasonable

75 Book of Genesis: The first book of the Jewish and Christian scriptures. It describes the beginning or creation of the world

76 proclaimed with Disraeli: announced, in agreement with Disraeli

77 took a modest view: held a moderate opinion (that is, not an extreme opinion)

78 natural selection: see paragraph 6

79 characters: characteristics

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 6). Weismann gave scientific reasons for his belief that there was 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

83 can only reproduce: can reproduce no cells except

84 give rise to: control the production of
all the many types: all the numerous types descend from: are produced by

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

From this point of view: Considered in this way

a by-product: some additional thing that is produced during a process which is intended to produce something else of greater importance

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...

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)

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'ni:jut) meaning very small

and natural selection enough to: and they came to regard natural selection as enough to

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

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).

crossing: the mating of a male and female with different characteristics

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.

and a new chapter opened: i.e. a new chapter in the development of the theory of evolution was opened

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

mental qualities: qualities of the mind, e.g. intelligence searching: reading through books of reference: books that contain essential information about certain subjects

ability: intelligence

the chance of a son of a judge showing: the chance that a son of a judge would show

500 times as high as: 500 times greater than taken at random: taken without any special method of selection

While: Although cf. note, line 77 prediction: statement about the probability of something occurring 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.
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 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.

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.

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.)

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. 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

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

6 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,

7 a cylindrical tube: a pipe in the form of a cylinder. cylinder (noun) → cylindrical (adj.) so arranged that: arranged in such a way that

8 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

9 given out: produced

10 a radio-active source: material which produces radiation This: The number of ionizing particles etc. (mentioned in the previous sentence)

11 the curie: This unit is named after Madame Marie Curie, the discoverer of radium. See note 4/57, p. 47

12 The activity of: The radiation of; The energy given out by

13 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 156 billion (thousand million) ionizing particles per second. This amount of activity is therefore equal to one curie.

14 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 par-
graphs 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 21 billion (thousand million)
ton 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. 2/97, 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

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 (nouns), pronounced dif'er'en'ten

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

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

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 'fetus')

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'pozúr does 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
does not mean that: is not a sign that; is not proof that
the irradiation has been without harm: that there are no harmful results of the irradiation

do not mean that: is not a sign that; is not proof that

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

affected: changed
sterile: not able to produce seeds or offspring

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.)

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

it seems likely that: it seems probable that

in man: in human beings

The detailed picture: The detailed pattern of the results

Unhappily: Unfortunately
human cases: See note, line 71
to make it certain that: to show clearly that; to show without doubt that.
the same pattern: cf. note, line 76
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 which have been discovered from the study of mice
data: known facts. Latin plural of datum
derived from: drawn from; obtained from
the survivors of: those who did not die as a result of; survive (verb) → survivor (noun)
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

on average: when we consider the average of all the cases
lighter: not so heavy as other people
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

while: and
at five years old: at five years of age; when they were five years old
expectant mothers: pregnant women

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

the medical literature: the writings of doctors
abnormalities: unusual occurrences, i.e. malformations. See line 53

exposure: exposure to radiation
arose: occurred

radiologists: Radiology is the scientific study of X-rays. A radiologist is one who makes such studies
the radio-sensitivity: the sensitivity to radiation
survey: examination of available information
where: in those cases in which
within: during. cf. line 42

the implantation: implant (verb) → implantation (noun). See line 47

severe mal-development: serious defects in development

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)
In what ways do the effects of X-rays, received by expectant mothers, influence pregnancy and the effects on the embryo? (para. 16)

From what three different sources has the evidence concerning the effects of radiation been collected? (paras. 7-8)

What effects are likely to be produced during the foetal stage? (para. 6)

What is the difference between the radiation doses of 1 curie of radio-active cobalt and 1 curie of polonium? (para. 2)

The effect of irradiation is less easy to see.

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.

The widely used Geiger counter consists of a wire stretched inside a cylindrical tube. (essentially)

The gamma-rays from the curie of cobalt will penetrate deeply.

The amount of energy gained by the irradiated substance is the important factor. (clearly)

The embryo is implanted in the wall of the uterus. (firmly)

We can superimpose a human time-scale on the mouse data. (confidently)

Every receding galaxy will increase its distance from us until it passes beyond the limit of the observable universe. (eventually)

I have mentioned the critical limit of about two thousand million light years. (already)

Can this process go on? (indefinitely)

The universe will remain the same. (Add (i) always; (ii) essentially) ' ' ' ' ' '

Can we assume that all the isotopes of a given element were produced in equal amounts? (originally)

Can this process go on? (indefinitely)

Many of the words which are used 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 -(y) (e.g. essentially, firmly, generally). But many of these words can be
Preliminary Note

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 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 Amozen 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 Amozen 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 pancreatic 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 see the 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.
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. When treated with insulin—although still in a relatively impure form—they improved at once. The boy is alive and well to-day.

Before 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

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 'ailat (small island).
   Small areas in the pancreas in which insulin is produced. They are named after Langerhans who first studied them.

4 Diabetes: pronounced di'æbətɪs (See Preliminary Note)

5 next day: on the next, or following, day
   on: about; concerning
   the functions: the work of; the part played by

Banting and the Discovery of Insulin

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 pærəkrɪətɪk

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 ('ekstrækt) of the pancreas which would help in the treatment of diabetes. They were unsuccessful.

10 had not heard of: had known nothing about

11 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.

12 the extraction of: the removal of; the cutting out of

13 in that case
   it: the hormone

14 so powerful that it could break up and dissolve: powerful enough to break up and to dissolve

15 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

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 'fərment (verb), pronounced fər'ment

17 so powerful that it could break up and dissolve: powerful enough to break up and to dissolve

18 the toughest meats: Lean meat is a protein food. toughest here means hardest to digest

19 vital: essential
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 ɪkstrækt → extraction (noun)
to extract: to take out

was no longer producing: had stopped producing
Tie off pancreas ducts: Separate the pancreas ducts by tying them
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

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

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

lay in the way: was in the manner in which he put it into practice: he applied it

filled in the time: used the time before the spring of 1921
he could find: This clause qualifies the literature and NOT the subject.

missed: did not find; did not discover; did not come across
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

a recent graduate: a young man who had recently taken a University degree

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

a number of dogs: several dogs
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
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

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

Even so: In spite of this
evolved: found, by experience; worked out
a suitable technique: a suitable way of performing the operation

chloroformed: to chloroform: to give chloroform to a person (or animal) in order to make him unconscious

disappointed: unpleasantly surprised
degenerated: lost its strength; changed in such a way as to become ineffective

as they had hoped: in the way that they had hoped it would degenerate.
correct degree of tension: the right (amount of) tightness

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

to complete their work: in which they could complete their work

away: absent
an extension: an increase in the time allowed
granted: given; agreed to
the authorities: the people responsible for providing the necessary money
another duct-tied dog: another dog whose pancreatic duct had previously been tied

shrivelled: to shrivel: to shrink; to be reduced in size

cut

saline: a solution of salt

chopped: cut

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 remaining 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

within: See 2/91, p. 21

its blood sugar: the amount of sugar contained in its blood

had fallen considerably: had been considerably reduced before long: in a short time

rose: stood up

dramatic: striking (like some exciting incident in a play)

could hardly believe it: had difficulty in believing it further: additional; more made them sure: convinced them

the anti-diabetic hormone: the hormone which prevents the occurrence of diabetes

secreted: to secrete, pronounced /skrɪkt, to produce

The islets of Langerhans secrete (produce) insulin. Insulin is a secretion of the islets of Langerhans

the name insulin is derived from the Latin word for 'island'.

a while: a certain time

relapsed: collapsed again; became unconscious again further: additional; more to revive it: to cause it to recover

regular injections: injections given always at fixed times could live: could stay alive

secretin: Secretin is produced (secreted) in the upper part of the bowels

exhaust the cells: empty the cells; make the cells secrete all the digestive ferment that they contained

the practical results: the results of the actual experiments which were conducted

its importance: the importance of this new method

So far: Up to this point in sufficient quantity for: in a quantity which was large enough for

laboratory work: work in the laboratory seeking: looking for; trying to find

means: ways now: as their next step

foetal: foetus (noun) — foetal (adj.)

calf: the young of a cow

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

starts eating: After the verb to start we can use either an -ing form or a to-infinitive (starts to eat)

starts to eat

there was nothing to destroy the insulin: there was nothing which could destroy the insulin

during extraction: while it (the insulin) was being extracted, or taken out new: additional to keep up: to maintain; to continue producing

adequate: sufficient (but not abundant)

more extensive experiments: experiments with more animals and for a longer period

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

in medical treatment: in the treatment of diabetics (see line 57) by medical means

to get: to obtain they: the 'much larger supplies' mentioned in the previous sentence adult cattle: fully-grown cattle cattle: cows, bulls, etc.
the slaughterhouse: the place where animals are slaughtered (killed) for their meat.

an ordinary adult animal: that is, an adult animal that has not been specially treated (e.g. by having its pancreatic ducts tied)

The problem was solved well enough: A way of dealing with this problem was found which was good enough

t he first injections on: that is, the first injections that were ever given to

a fourteen-year-old boy: a boy who was fourteen years old

When treated with: When they were treated with; When they were given

research: The search for new knowledge

organized walks of life: all professions or 'occupations' which are organized or arranged systematically

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

In consequence: Consequently; So; Thus

in the field of insulin: in the research concerned with insulin

was called in: was appealed to; was invited

workers: people engaged in research; research workers

Before very long: Quite quickly; Quite soon

the standard treatment for diabetes: the normal way of treating diabetes

all over the world: in every part of the world

They still are: They: insulin injections

are: are the standard treatment

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).

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

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)
Why was the result of this experiment surprising? What results had it achieved? (para. 8)

What was the first name given by Banting to the insulin which he had prepared? Who gave insulin its present name? (para. 8)

Is the injection of insulin a permanent cure for diabetes? (para. 8)

How did Banting and Best obtain fresh supplies of insulin by a much shorter method? What results were obtained? (para. 9)

How did Banting and Best obtain sufficient supplies of insulin for further experimental work? (para. 10)

How were adequate supplies of insulin obtained to meet the needs of diabetic patients? (para. 10)

Who were the first two human patients to receive insulin treatment? Was the treatment successful? (para. 11)

What kind of assistance was sought to produce a purer insulin extract? Was this achieved? (para. 12)

How was Banting honoured for his great discovery? (para. 13)

The first part of the verbal groups in the following sentences indicate possibility, desirability, necessity (or certainty), probability, obligation, inference, reasonable expectation.

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.

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
8. line 64
9. line 85
10. line 101

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 Armstrong 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 alloy 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.

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.

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.

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:

<table>
<thead>
<tr>
<th>Metal</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bismuth</td>
<td>4 parts</td>
</tr>
<tr>
<td>Lead</td>
<td>2 parts</td>
</tr>
<tr>
<td>Tin</td>
<td>1 part</td>
</tr>
<tr>
<td>Cadmium</td>
<td>1 part</td>
</tr>
</tbody>
</table>

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

1. The majority of alloys: Most alloys are prepared as a mixture of two or more metals. The alloy possesses properties (strength, hardness etc.) which are not possessed by the original metals.

2. When the molten metals have been mixed in the mould 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.

3. The majority of alloys: Most alloys are prepared as a mixture of two or more metals. The alloy possesses properties (strength, hardness etc.) which are not possessed by the original metals.

4. Should: ought to.

5. 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.

6. Stick form: the form or shape of a stick.


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.)

11. The heavy lead: the lead, which is heavy in comparison with the aluminium of the attempted mixture.

12. One difficulty: One of the difficulties in making: when we make.

13. Melting points: temperatures at which they melt.

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)
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
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)
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
to make: in order to make
to make 100 lb . . . : We use 84 lb. of pure aluminium and 16 lb. of the
hardener alloy containing 8 lb. of aluminium and 8 lb. of copper. This
provides an alloy containing 92 lb. of aluminium and 8 lb. of copper.
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
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
58 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)

METALLURGY: MAKING ALLOYS

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
77 270° 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 solidif/keifjan
      the new 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
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
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)

II 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)

III What must we do if we wish to make 100 lb. of the alloy mentioned in paragraph 3?

IV What is the 50–50 alloy of zinc and copper called? (para. 3)

V What is the melting point of nickel? (para. 4)

VI 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)

VII What is the range of temperature between the beginning and the completion of solidification called? (para. 4)

VIII Does this range occur in (a) pure metals; (b) chemical compounds; (c) all other alloys? (para. 4)

IX 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?

X 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 (e) complete solidification?

XI 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?
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?

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?

What is a 'practical joker'? Why is Wood's metal a favourite with practical jokers?

What is a fusible alloy. How are such alloys used in automatic fire extinguishers?

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."

Complete the following sentences by using one of these words in each space:

about at for 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.

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—umium 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 gradu—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 diame—t of the sun is about a million miles.
8 We must appeal to some external pro—ss to slow down the spin of the sol—r condensa—n.
9 The rates of spin have a cur—ous depend—nce on surface temp—erature.
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


CONTENTS

Preface to the Sixth Edition v
Preface to the Third Edition v
Preface to the First Edition vi
Acknowledgments vi
Section of Coloured Plates following p. xii

SECTION 1

Tissues and Structures 1

The Nervous System 20

Early Embryology 38

Anatomy of the Child 46

SECTION 2. THE UPPER LIMB

The Pectoral Girdle 52

The Axilla 61

The Breast 65

The Scapular Region 67
Muscles. Shoulder joint.

The Arm 73

The Forearm (Flexor compartment) 78
PAGINATION ERROR
The Forearm (Extensor compartment) 88

The Hand 95

The Nerves of the Upper Limb 106
Summary of the Nerves.

Osteology of the Upper Limb 111

SECTION 3. THE LOWER LIMB

General Plan of the Lower Limb 126
Lower and upper limbs compared.

The Front of the Thigh 130

The Adductor Compartment 142

The Gluteal Region 145

The Hamstring Compartment 152

The Popliteal Fossa 154

The Front of the Leg 165

The Dorsum of the Foot 168

The Peroneal Compartment 170

The Calf 171

The Sole 175
Four layers. Vessels and nerves.

The Ankle Joint 181

The Tarsal Joints 183
Inversion and eversion. Arches of the foot.

Osteology of the Lower Limb 190

SECTION 4. THE THORAX

The Body Wall 210

The Thoracic Wall 212

Thoracic Cage Movements 218
The Cavity of the Thorax

The Superior Mediastinum

The Anterior Mediastinum
Thymus.

The Middle Mediastinum

The Posterior Mediastinum

The Pleura

The Lungs

Osteology of the Thoracic Cage

SECTION 5. THE ABDOMEN

The Anterior Abdominal Wall

The Testis and Epididymis
Descent. Embryological remnants.

The Abdominal Cavity
General topography.

The Peritoneum

Topographical Anatomy of the Alimentary Canal

The Liver
Biliary system. Portal vein.

The Pancreas

The Spleen

The Posterior Abdominal Wall

The Autonomic Nerves

The Kidney and Ureter
Suprarenal gland

The Pelvis
Pelvic walls. Pelvic floor. Pelvic fascia.

The Rectum

The Bladder
Ureter in the pelvis. Development.
The Prostate 331
The Uterus 333
Uterine tube.
The Ovary 337
The Pelvic Peritoneum 339
The Pelvic Vessels 339
The Nerves of the Pelvis 341
The Perineum 344
The Anal Triangle 344
Anal canal. Ischio-rectal fossa.
The Urogenital Triangle in the Male 349
Penile muscles. Scrotum. Urethra.
The Urogenital Triangle in the Female 353
Cutaneous nerves.
The Joints of the Pelvis 355
Summary of Nerves 356

SECTION 6. THE HEAD AND NECK

General Topography of the Neck 360
Fasciae.
The Posterior Triangle 363
Cervical plexus. Cutaneous nerves.
The Anterior Triangle 366
The Suprahyoid Region 370
Submandibular fossa. Side of the neck. Vessels.
The Prevertebral Region 374
Muscles. Sympathetic trunk.
The Root of the Neck 376
Scalene muscles.
The Face 379
The Scalp 385
Temporal fossa. Zygomatic arch.
The Pre-auricular Region 387
Masseter. Parotid gland.
The Infratemporal Fossa 389
The Pterygo-Palatine Fossa 397
Osteology. Pterygo-palatine ganglion.
The Nose  

The Paranasal Sinuses  
Development. Maxillary, ethmoidal, sphenoidal and frontal sinuses.  

The Mouth  

The Pharynx  

The Soft Palate  

The Larynx  
Skeleton. Intrinsic muscles. Extrinsic muscles. Vessels and nerves.  

The Orbit  

The Eye  

Lymphatic Drainage of the Head and Neck  
General. Face. Tongue.  

The Mandibular Joint  
Movements of mandible. Movements of floor of mouth.  

The Ear  

The Vertebral Column  

Osteology of the Vertebrae  

The Cranial Cavity  

The Spinal Canal  
Venous plexus. Meninges. Subarachnoid space.  

SECTION 7. THE CENTRAL NERVOUS SYSTEM  

The Brain  

The Brain Stem  

The Cerebellum  

The Spinal Cord  

Summary of the Projection Fibres 538
Development of the Nervous System 540
Summary of the Cranial Nerves 543

SECTION 8. OSTEOLOGY OF THE SKULL
External features. Internal features. Separate skull bones. The mandible. The hyoid bone. 553

Biographical Notes 575
Index 583
Table of Contents

Preface .......................................................... xi

SECTION I. INTRODUCTION ...................................... 1

1. Physiologic Principles ...................................... 1
   Functional Morphology of the Cell 1
   Body Fluid Compartments 12
   Units for Measuring Concentration of Solutes 14
   Composition of Body Fluids 15
   Forces Producing Movement of Substances Between Compartments 15
   Cell Membrane & Resting Membrane Potentials 18

   The Capillary Wall 22
   Sodium & Potassium Distribution & Total Body Osmolality 22
   pH & Buffers 24
   Intercellular Communication 24
   Homeostasis 28
   Aging 28

Section I References: 28

SECTION II. PHYSIOLOGY OF NERVE & MUSCLE CELLS .......... 29

2. Excitable Tissue: Nerve ..................................... 29
   Nerve Cells 29
   Electrical Phenomena in Nerve Cells 32
   Ionic Basis of Excitation & Conduction 37
   Properties of Mixed Nerves 39

   Nerve Fiber Types & Function 40
   Nerve Growth Factor 42
   Glia 42

3. Excitable Tissue: Muscle .................................... 43
   Skeletal Muscle 44
      Morphology 44
      Electrical Phenomena & Ionic Fluxes 45
      Contractile Responses 46
      Energy Sources & Metabolism 50
      Properties of Muscles in the Intact Organism 51
   Cardiac Muscle 53
      Morphology 53
      Electrical Properties 53

   Cardiac Muscle (cont’d)
      Mechanical Properties 53
      Metabolism 55
      Pacemaker Tissue 56
      Smooth Muscle 56
      Morphology 56
      Visceral Smooth Muscle 56
      Multi-Unit Smooth Muscle 59

4. Synaptic & Junctional Transmission .......................... 60
   Synaptic Transmission 60
      Functional Anatomy 60
      Electrical Events at Synapses 62
      Chemical Transmission of Synaptic Activity 65
      Inhibition & Facilitation at Synapses 74

   Neuromuscular Transmission 77
      The Myoneural Junction 77
      Nerve Endings in Smooth & Cardiac Muscle 78
      Denervation Hypersensitivity 79

5. Initiation of Impulses in Sense Organs ....................... 81
   Sense Organs & Receptors 81
   The Senses 81

   Electrical & Ionic Events in Receptors 83
   “Coding” of Sensory Information 85

Section II References: 87
SECTION III. FUNCTIONS OF THE NERVOUS SYSTEM

6. Reflexes

- The Reflex Arc 88
- Monosynaptic Reflexes: The Stretch Reflex 88
  - Polysynaptic Reflexes: The Withdrawal Reflex 93
  - General Properties of Reflexes 95

7. Cutaneous, Deep, & Visceral Sensation

- Pathways 97
- Touch 99
- Proprioception 100
- Temperature 100
- Pain 100
  - Differences Between Somatic & Visceral Sensory Mechanisms 102
  - Visceral Pain 103
  - Referral & Inhibition of Pain 104
  - Other Sensations 106

8. Vision

- Anatomic Considerations 107
- The Image-Forming Mechanism 112
- The Photoreceptor Mechanism: Genesis of Action Potentials 114
  - Responses in the Visual Cortex 118
  - Other Aspects of Visual Function 120
  - Color Vision 123
  - Eye Movements 124

9. Functions of the Ear

- Anatomic Considerations 126
- External & Middle Ear 126
- Inner Ear 127
- Hearing 130
- Auditory Responses 130
- Sound Transmission 131
- Electrical Phenomena 133
- Brain Mechanisms 134

10. Smell & Taste

- Smell 138
  - Receptors & Pathways 138
  - Physiology of Olfaction 139
- Taste 140
  - Receptor Organs & Pathways 140
  - Physiology of Taste 141

11. The Reticular Activating System, Sleep, & the Electrical Activity of the Brain

- The Reticular Formation & the Reticular Activating System 144
- The Thalamus & the Cerebral Cortex 144
- Evoked Cortical Potentials 145
  - The Electroencephalogram 146
  - Physiologic Basis of the EEG & Consciousness 147
  - Sleep 151
  - Modulation of Sensory Input 153

12. Control of Posture & Movement

- Pyramidal System 154
  - Anatomy 154
  - Function 156
- Extrapyramidal Mechanisms 157
  - Spinal Integration 158
  - Medullary Components 160
  - Midbrain Components 162
  - Extrapyramidal Mechanisms (cont'd)
    - Cortical Components 162
    - Basal Ganglia 163
    - Cerebellum 165
    - Anatomic & Functional Organization 165
    - Physiology 168

13. Efferent Pathways to Visceral Effectors

- Anatomic Organization of Autonomic Outflow 172
- Chemical Transmission at Autonomic Junctions 173
  - Responses of Effector Organs to Autonomic Nerve Impulses 175
# 14. Neural Centers Regulating Visceral Function

- Medulla Oblongata 178
- Hypothalamus 179
  - Anatomic Considerations 179
  - Hypothalamic Function 181
  - Relation of Hypothalamus to Autonomic Function 181
  - Relation to Sleep 183

- Hypothalamus (cont'd)
  - Relation to Cyclic Phenomena 183
  - Hunger 183
  - Thirst 185
  - Control of Posterior Pituitary Secretion 186
  - Control of Anterior Pituitary Secretion 190
  - Temperature Regulation 193

# 15. Neurophysiologic Basis of Instinctual Behavior & Emotions

- Anatomic Considerations 198
- Limbic Functions 199
- Sexual Behavior 200
- Fear & Rage 202

- Motivation 203
- Brain Chemistry, Behavior, & Synaptic Transmission in the Central Nervous System 204

# 16. "Higher Functions of the Nervous System": Conditioned Reflexes, Learning, & Related Phenomena

- Learning 209
- Memory 211
- Functions of the Neocortex 212

## Section III References: 216

### SECTION IV. ENDOCRINOLOGY & METABOLISM

# 17. Energy Balance, Metabolism, & Nutrition

- Energy Metabolism 218
  - Metabolic Rate 218
  - Energy Balance 222
  - Intermediary Metabolism 222
    - General Considerations 222
    - Carbohydrate Metabolism 224

- Intermediary Metabolism (cont'd)
  - Protein Metabolism 231
  - Fat Metabolism 237
  - Nutrition 245
  - Essential Dietary Components 245

# 18. The Thyroid Gland

- Anatomic Considerations 250
- Formation & Secretion of Thyroid Hormones 251
- Transport & Metabolism of Thyroid Hormones 253
- Effects of Thyroid Hormones 253

- Mechanism of Action of Thyroid Hormones 258
- Regulation of Thyroid Secretion 258
- Clinical Correlates 259

# 19. Endocrine Functions of the Pancreas & the Regulation of Carbohydrate Metabolism

- Islet Cell Structure 264
- Structure, Biosynthesis, & Secretion of Insulin 265
- Fate of Secreted Insulin 267
- Consequences of Insulin Deficiency & Actions of Insulin 267
- Insulin Excess 274
- Mechanism of Action of Insulin 274

- Regulation of Insulin Secretion 275
- Glucagon 278
- Other Islet Cell Hormones 280
- Endocrine Regulation of Carbohydrate Metabolism 281
- Hypoglycemia & Diabetes Mellitus in Humans 282

# 20. The Adrenal Medulla & Adrenal Cortex

- Adrenal Morphology 284
- Adrenal Medulla 285
  - Structure & Function of Medullary Hormones 285
  - Regulation of Adrenal Medullary Secretion 287
- Adrenal Cortex 288
  - Structure & Biosynthesis of Adrenocortical Hormones 288
  - Transport, Metabolism, & Excretion of Adrenocortical Hormones 292
  - Effects of Adrenal Androgens & Estrogens 294

- Adrenal Cortex (cont'd)
  - Physiologic Effects of Glucocorticoids 294
  - Pharmacologic & Pathologic Effects of Gluco­corticoids 297
  - Regulation of Glucocorticoid Secretion 298
  - Effects of Mineralocorticoids 302
  - Regulation of Aldosterone Secretion 304
  - Role of Mineralocorticoids in the Regulation of Salt Balance 306
  - Summary of the Effects of Adrenocortical Hyper- & Hypofunction in Humans 306
### 21. Hormonal Control of Calcium Metabolism & the Physiology of Bone

- Calcium & Phosphorus Metabolism 308
- Bone Physiology 309
- Vitamin D and the Hydroxycholecalciferols 311
- The Parathyroid Glands 312
- Calcitonin 315
- Effects of Other Hormones on Calcium Metabolism 317

### 22. The Pituitary Gland

- Morphology 318
- Intermediate Lobe Hormones 320
- Growth Hormone 321
- Physiology of Growth 325
- Pituitary Insufficiency 328
- Pituitary Hyperfunction in Humans 329

### 23. The Gonads: Development & Function of the Reproductive System

- Sex Differentiation & Development 331
- Chromosomal Sex 331
- Embryology of the Human Reproductive System 334
- Aberrant Sexual Differentiation 337
- Puberty 338
- Precocious & Delayed Puberty 339
- Menopause 340
- Pituitary Gonadotropins & Prolactin 340
- The Male Reproductive System 342
- Structure 342
- Gametogenesis & Ejaculation 343
- The Female Reproductive System 349
- The Menstrual Cycle 349
- Ovarian Hormones 354
- Control of Ovarian Function 357
- Abnormalities of Ovarian Function 359
- Pregnancy 359
- Lactation 361

### 24. Other Organs With Established or Suggested Endocrine Functions

- The Endocrine Functions of the Kidneys: Renin & Erythropoietin 364
- Pineal 368

### Section IV References: 369

### SECTION V. GASTROINTESTINAL FUNCTION

### 25. Digestion & Absorption

- Carbohydrates 372
- Proteins & Nucleic Acids 374
- Lipids 375
- Absorption of Water & Electrolytes 377
- Absorption of Vitamins & Minerals 378

### 26. Gastrointestinal Secretion & Motility

- Gastrointestinal Hormones 381
- Mouth & Esophagus 384
- Stomach 386
- Regulation of Gastric Secretion & Motility 388
- Other Functions of the Stomach 390
- Exocrine Portion of the Pancreas 391
- Liver & Biliary System 393
- Small Intestine 397
- Colon 400

### Section V References: 404

### SECTION VI. CIRCULATION

### 27. Circulating Body Fluids

- The Circulatory System 405
- Blood 405
- Bone Marrow 405
- White Blood Cells 407
- Immune Mechanisms 408
- Platelets 411
- Blood (cont'd)
  - Red Blood Cells 412
  - Blood Types 416
  - Plasma 419
  - Hemostasis 420
  - Lymph 423

- Origin & Spread of Cardiac Excitation 424
- The Electrocardiogram 426
- Cardiac Arrhythmias 431

**Electrocardiographic Findings in Other Cardiac & Systemic Diseases 437**

## 29. The Heart as a Pump

- Mechanical Events of the Cardiac Cycle 441
- Cardiac Output 445

## 30. Dynamics of Blood & Lymph Flow

- Anatomic Considerations 452
- Biophysical Considerations 454
- Arterial & Arteriolar Circulation 458
- Capillary Circulation 462

- Lymphatic Circulation & Interstitial Fluid Volume 463
- Venous Circulation 464

## 31. Cardiovascular Regulatory Mechanisms

- Local Regulatory Mechanisms 466
- Systemic Regulatory Mechanisms 467

## 32. Circulation Through Special Regions

- Cerebral Circulation 476
  - Anatomic Considerations 476
  - Cerebrospinal Fluid 477
  - The Blood-Brain Barrier 479
  - Cerebral Blood Flow 480
  - Regulation of Cerebral Circulation 483

- Cerebral Circulation (cont'd)
  - Brain Metabolism & Oxygen Requirements 484
  - Coronary Circulation 485
  - Splanchnic Circulation 488
  - Circulation of the Skin 489
  - Placental & Fetal Circulation 490

## 33. Cardiovascular Homeostasis in Health & Disease

- Compensations for Gravitational Effects 494
- Exercise 496
- Hemorrhage & Hemorrhagic Shock 498
- Other Forms of Shock 500

- Fainting 502
- Heart Failure 502
- Hypertension 504

**Section VI References: 506**

### SECTION VII. RESPIRATION

## 34. Pulmonary Function

- Properties of Gases 507
- Mechanics of Respiration 508
- Gas Exchange in the Lung 516

- Pulmonary Circulation 516
- Other Functions of the Respiratory System 518

## 35. Gas Transport Between the Lungs & the Tissues

- Oxygen Transport 520
- Buffers in Blood 523

- Carbon Dioxide Transport 525

## 36. Regulation of Respiration

- Neural Control of Breathing 527
- Regulation of Respiratory Center Activity 529

- Chemical Control of Breathing 529
- Nonchemical Influences on Respiration 533

## 37. Respiratory Adjustments in Health & Disease

- Effects of Exercise 535
- Hypoxia 537
- Hypoxic Hypoxia 538
- Other Forms of Hypoxia 542

- Oxygen Treatment 543
- Hypercapnia & Hypocapnia 544
- Effects of Increased Barometric Pressure 545
- Artificial Respiration 546

**Section VII References: 548**
SECTION VIII. FORMATION & EXCRETION OF URINE

38. Renal Function
- Functional Anatomy 549
- Renal Circulation 552
- Glomerular Filtration 554
- Tubular Function 556
- Water Excretion 560
- Acidification of the Urine & Bicarbonate Excretion 566
- Regulation of Na⁺ & Cl⁻ Excretion 568
- Regulation of K⁺ Excretion 571
- Diuretics 571
- Effects of Disordered Renal Function 572

39. Micturition
- Filling of the Bladder 574
- Emptying of the Bladder 574
- Abnormalities of Micturition 575

40. Regulation of Extracellular Fluid Composition & Volume
- Defense of Tonicity 577
- Defense of Volume 577
- Defense of Specific Ionic Composition 578
- Defense of H⁺ Concentration 578

Section VIII References: 584

Appendix
- General References 585
- Normal Values & the Statistical Evaluation of Data 585
- Appendix References 587
- Abbreviations & Symbols Commonly Used in Physiology 588
- Standard Respiratory Symbols 591
- Equivalents of Metric, United States, & English Measures 591
- Greek Alphabet 592

Index

Tables
- Atomic Weights
- Ranges of Normal Values in Human Whole Blood, Plasma, or Serum

Appendix

Index

Tables
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:
Subjects taught:

Faculty:
Department:

1. 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 1 (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-taking
- 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 speciality teacher? Please specify

6. By means of the numbers 1 (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: / / 198
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?

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 sentences.
: : : understanding the meaning of the sentences, but failing to understand the paragraph or the text.

6. By means of the numbers 1 (most), 2, 3, and 4 (least), indicate the language skills you would need in coping with your studies in this faculty?

7. Would you like to study for a postgraduate degree(s) in medicine after getting your MBchB, if such an opportunity arises? : : : Yes : : : No
If Yes, would you like to do it in an English speaking country?
: : : Yes : : : No

Date:  /  / I98
Appendix 12

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 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  
   - coughing  
   - high blood pressure  
   - 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

Q.2. Reading Comprehension

Read carefully the following text 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

Name:  
Class:  
Faculty:  

(10 marks)
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.

Q.3. Summarizing a text.
Read carefully the following text. 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 and try to point out the parts of the tooth in the illustration beneath it.

The 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.
SPSS programme used to compare students' T value

SPooled: 83-06-22.12:20
STARTED: 83-06-22.12:21, ON: AMUC BY: TERM

SPSS BATCH SYSTEM

SPSS FOR PRIME 400/500, VERSION M, RELEASE 8.0       DECEMBER 17, 1979

DEFAULT SPACE ALLOCATION: ALLOWS FOR:
WORKSPACE 114688 BYTES
TRANSPOSE 163840 BYTES

163 TRANSFORMATIONS
655 RECODE VALUES + LAG VARIABLES
2624 IF/COMPUTE OPERATIONS

1 RUN NAME TABLE 3 - PRE-TEST READING
2 VARIABLE LIST MARKS
3 SUBFILE LIST EXPERIMENT(41),CONTROL1(41),CONTROL2(41)
4 INPUT MEDIUM [IB3,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
Appendix 14
Samples of students' performance on the pre-Est course test. The Summarizing part.

English

Adenoids are lymph glands situated at the back of the nose. The adenoids are full of respiratory germs which cause damage to the throat and mouth, which make the person thirsty and cough. As the person suffered from pain, they were infected with adenoids. The adenoids cause the person to breathe through the nose and mixed in the pronunciation of the words.

A) Clarity of thought
B) Communicative mastery
C) Self-confidence
D) Accuracy
A child exposed to new infection
the body reacts by producing an antibody response.

After several weeks the reaction is no longer evident.

American Immunology

A. 20

Y. 45
Appendix 15

SPSS BATCH SYSTEM

SPSS programme used to compute students speeds

FOR PRIME 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 ALGORG
KEYWORDS: THE SPSS INC

SPSS UPDATE 7-9 (USE W/SPSS, 2ND FOR REL. 7, 8, 9)
SPSS POCKET GUIDE, RELEASE 9
SPSS INTRODUCTORY GUIDE: BASIC STATISTICS AND OPERATIONS
SPSS PRIMER (BRIEF INTRO TO SPSS)

DEFAULT SPACE ALLOCATION... ALLOWS FOR...
WORKSPACE  114688 BYTES  163 TRANSFORMATIONS
TRANSpace  16384 BYTES  655 RECODE VALUES + LAG VARIABLES
       2624 IF/COMPUTE OPERATIONS

1  RUN NAME
2  VARIABLE LIST TIMES
3  SUBFILE LIST EXPERIMT(41),CONTROL1(41),CONTROL2(41)
4  INPUT MEDIUM [I7.NEW]
5  INPUT FORMAT FREEFIELD
6  MISSING VALUES TIMES(200)
7  RUN SUBFILES EACH
8  COMPUTE SPEED = 50 /TIMES'1
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
How a cheese sandwich is digested

Saliva contains an enzyme called ptyalin, which breaks some carbohydrates into smaller molecules — maltose and glucose.

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

An Incisor Tooth, longitudinal section

A Molar Tooth, longitudinal section

Permanent Teeth and Their Sockets
Diagram of the Male Urinary System

Structure of the Kidney
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.

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.
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:

   3.2.1.2. 2.1.2.3.
   3.2.1.2. 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 (bicusp) 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 $\frac{3}{4}$ of the renal substance is cortex; the inner $\frac{1}{4}$ 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 calyceae 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 of the patient's subjective sensations. Tachypnea is rapid, shallow breathing.

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.

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

Aetiology

To a large extent everyone is subject to nervous disorders of the gut. Few students can have escaped pre­examination 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

- dry lips, tongue, and palate
- foetor
- reverse peristalsis
- discomfort after food
- colics
- fleeting pains
- borborygmi
- diarrhoea
- mucorrhoea
- spastic colon

Gastrointestinal symptoms due to depression

- anorexia
- nausea
- fulness after food
- feeling of distension
- hypotonic stomach
- obstinate constipation
- pains of intestinal origin

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

Appendix 19
Second Reading skills Test

Read the following text and answer the questions below:

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 **was revived** in modern times.

2. Exposure to radiation may produce **gross malformations**.

3. There are certain **innate qualities** which are inherited in the individuals.

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/ 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 (aislēs) 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...

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 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?
A dog .. a dog, of a dog. So he did experiments on dogs. So why did he tie the pancreatic ducts of those dogs?

To some .. secrete .. ah it and .. ah .. ah and .. ah.

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

Yes. Best, Best. So Best was the assistant.

(Subject No. 27)

(The teacher approaches a student (Subject No. 27) raising her hand to speak). .. ah so Banting made an experiment.

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.)
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...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 cartilage.

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 /infəˈmeɪʃn/ bear discomfort to us. We remedy this inflammation /ˌmjuːkəs ɪnˈfləməʃn/ 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 /ænsɪgˈsɪk/. 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 obtained ..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 .. non-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 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 relative of this pain ah killer are from natural source like morphine ah source from opium opium.

T. (Correcting pronunciation) opium.

S. Opium ah opium ah from, from opium or ah solution produced ah ah the painkillers like ah ah paracitol or aspirin ah which act on our body 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 /inflʊənˈza/. 

T. (Correcting pronunciation) influenza.

S. Influenza. It doesn't just relieve the pain, it also . also reduce the pain. But for this reason always doctors prescribe . to describe 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..... retiat... retai...

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:dɪəl/ form or this ideal /i:dɪəl/ 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)

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 cannot take Aspirin because of allergy or 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 pain; and it used for abdominal 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 abdominal pain. Paracetemol it cannot affect the membrane 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'veisd/ 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 /laivәr/ 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 /reglәr/ .. many times, for long period could use them ..ah morphine will be addative /әdәbtid/.

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

<table>
<thead>
<tr>
<th>Group</th>
<th>$\bar{X}$</th>
<th>S.D.</th>
<th>S.E.</th>
<th>T. Value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp.G. (N=38)</td>
<td>9.89</td>
<td>3.10</td>
<td>0.50</td>
<td>0.24</td>
<td>Not significant at the .01 level</td>
</tr>
<tr>
<td>Con.G.1 (N=34)</td>
<td>10.03</td>
<td>3.30</td>
<td>0.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exp.G. (N=38)</td>
<td>9.89</td>
<td>3.10</td>
<td>0.50</td>
<td>-2.17</td>
<td>Not significant at the .01 level</td>
</tr>
<tr>
<td>Con.G.2 (N=41)</td>
<td>11.33</td>
<td>3.00</td>
<td>0.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>$\bar{X}$</th>
<th>S.D.</th>
<th>S.E.</th>
<th>T. Value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Con.G.1 (N=34)</td>
<td>10.03</td>
<td>3.50</td>
<td>0.60</td>
<td>1.73</td>
<td>Not significant at the .01 level</td>
</tr>
<tr>
<td>Con.G.2 (N=41)</td>
<td>11.33</td>
<td>3.00</td>
<td>0.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. Histology

<table>
<thead>
<tr>
<th>Group</th>
<th>$\bar{x}$</th>
<th>S.D.</th>
<th>S.E.</th>
<th>T. Value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp.G. (N=38)</td>
<td>9.77</td>
<td>3.76</td>
<td>0.61</td>
<td>0.37</td>
<td>Not significant at the .01 level</td>
</tr>
<tr>
<td>Con.G.1 (B=34)</td>
<td>9.45</td>
<td>3.50</td>
<td>0.60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>$\bar{x}$</th>
<th>S.D.</th>
<th>S.E.</th>
<th>T. Value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp.G. (n=38)</td>
<td>9.77</td>
<td>3.76</td>
<td>0.61</td>
<td></td>
<td>Not significant at the .01 level</td>
</tr>
<tr>
<td>Con.G.1 (N=41)</td>
<td>10.01</td>
<td>3.63</td>
<td>0.56</td>
<td>-0.29</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>$\bar{x}$</th>
<th>S.D.</th>
<th>S.E.</th>
<th>T. Value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Con.G.1 (N=34)</td>
<td>9.45</td>
<td>3.50</td>
<td>0.60</td>
<td>-0.68</td>
<td>Not significant at the .01 level</td>
</tr>
<tr>
<td>Con.G.2 (N=41)</td>
<td>10.01</td>
<td>3.63</td>
<td>0.56</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 3. Biochemistry

<table>
<thead>
<tr>
<th>Group</th>
<th>S.D.</th>
<th>S.E.</th>
<th>T.Value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp.G.(N=38)</td>
<td>8.58</td>
<td>2.95</td>
<td>0.47</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not significant at the .01 level</td>
</tr>
<tr>
<td>Con.G.1(N=32)</td>
<td>7.90</td>
<td>3.28</td>
<td>0.58</td>
<td>1.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not significant at the .01 level</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>S.D.</th>
<th>S.E.</th>
<th>T.Value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Con.G.2(N=40)</td>
<td>7.96</td>
<td>2.09</td>
<td>0.33</td>
<td>-0.09</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not significant at the .01 level</td>
</tr>
</tbody>
</table>
4. Physics

<table>
<thead>
<tr>
<th>Group</th>
<th>X</th>
<th>S.D.</th>
<th>S.E.</th>
<th>T.Value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp.G. (N=39)</td>
<td>14.38</td>
<td>2.12</td>
<td>0.34</td>
<td>1.21</td>
<td>Not significant at the .01 level</td>
</tr>
<tr>
<td>Con.G.1 (N=34)</td>
<td>13.64</td>
<td>3.04</td>
<td>0.52</td>
<td>-0.83</td>
<td>Not significant at the .01 level</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>X</th>
<th>S.D.</th>
<th>S.E.</th>
<th>T.Value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Con.G.2 (N=41)</td>
<td>14.78</td>
<td>2.17</td>
<td>0.34</td>
<td>-1.88</td>
<td>Not significant at the .01 level</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group</th>
<th>X</th>
<th>S.D.</th>
<th>S.E.</th>
<th>T.Value</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Con.G.1 (N=34)</td>
<td>13.64</td>
<td>3.04</td>
<td>0.52</td>
<td>-1.88</td>
<td>Not significant at the .01 level</td>
</tr>
<tr>
<td>Con.G.2 (N=41)</td>
<td>14.78</td>
<td>2.17</td>
<td>0.34</td>
<td>-1.88</td>
<td>Not significant at the .01 level</td>
</tr>
</tbody>
</table>
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 ......

..............................................................
..............................................................
..............................................................
..............................................................
References
REFERENCES


Al-Hamash, Khalil (1979)

Teaching English as a Foreign Language Al-Sadoon Printing Press, Baghdad, Iraq.


Allison, Desmond (1981)

Allwright, J. & Allwright, R. (1977)

Al-Muttalibi, Aziz (1974)  


Anastasi, Anne (1976)  
Psychological Testing  
Fourth Edition  

Anthony, Edward M. (1976)  


Bachman, Lyle (1982)  
"The Trait Structure of Cloze Test Scores" in  


British Council (1979a) English for Specific Purposes An International Seminar. 17-22 April, Colombia.


Ferguson, Nicolas (1972)  Teaching English as a Foreign Language.


<table>
<thead>
<tr>
<th>Source/Media</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moore, J.D. (1977)</td>
<td>&quot;Materials Development: A Case Study&quot; in English For Specific Purposes. An Internation Seminar, 17-22 April 1977, Paipa Bogota, Colombia, Published by the British Council, Colombia, pp.41-51.</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Author</th>
<th>Title</th>
</tr>
</thead>
</table>
Stauffer, Russell G. (1975) Directing the Reading 
Thinking Process. Harper 
and Row, Inc. New York.

Strevens, Peter (1973) "Technical Technological 
and Scientific English" in ELT, 27/1, June 1973, 
pp.215-34.

Strevens, Peter (1977) New Orientations in the 
Teaching of English. 
Oxford University Press 
London and Edinburgh.

Strevens, Peter (1977a) Special Purpose Language 
Learning" in Language 
Teaching and Linguistics: 
Abstracts, Vol.10, No.3, 
July 1977.

Strevens, Peter (1980) Teaching English as an 
International Language, 
From Practice to 
Principle. Pergamon 
Institute of English 
Great Britain.

Strevens, Peter (1981) "Training the Teacher of 
Foreign Languages: New 
Responsibilities for the 
Teacher Require New Patterns 
of Training." in 
Canadian Modern Language 
Review.

Sturtridge, Gill et al (1977) "The British Council and 
the English Language 
Problems of Overseas 
Students: English for 
academic purposes materials 
development" in Cowie, A. 
and Heaton, J. (eds) (1977) 
English for Academic 
Purposes. BAAL, University 
of Reading, pp.108-120.

Verb. The Hague, Mouton.

speech: elicited translation 
and imitation as indicators 
of second language 
competence" in Working 
Papers in Bilingualism, 
Special Issue on Language 
Acquisition Studies, Vol.3, 
1974, pp.68-79.
<table>
<thead>
<tr>
<th>Author and Co-authors (Year)</th>
<th>Title and Details</th>
</tr>
</thead>
</table>
Turabian, Kate L. (1967) A Manual for Writers of Term Papers, Theses and Dissertations, 3rd edition, Chicago, U.S.A.


<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Title</th>
<th>Publisher</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilkins, David</td>
<td>1972</td>
<td>&quot;Grammatical, Structural and Notional Syllabuses&quot;</td>
<td>Brumfit and Johnson (eds) 1979, pp.82-90.</td>
<td></td>
</tr>
</tbody>
</table>


