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A Study Evaluating the Awareness of International Medical Students About the Evolution and History of Medical Terminologies

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Abstract
The consolidation of key medical terminologies is an arduous, yet vital, task for numerous medical students. Many of the terminologies used in common medical practice are derived from Greek and Latin, which poses an added challenge in the task of memorising such terminologies; amongst others, one of the reasons being that these classical languages are no longer routinely taught in the primary, secondary, or higher education settings within the United Kingdom. The relationship between the knowledge of Greek or Latin which medical students possess and their understanding of medical terminologies is an essential area of enquiry within the field of medical education and clinical practice. This study endeavours to examine if acquisition of the Greek or Latin languages during primary and/or secondary school education can benefit medical students. In order to investigate this, a survey was carried out on 218 medical students from 28 countries worldwide who were attending the Doctors Academy 7th International Medical Summer School at the University of Manchester, United Kingdom. The survey was conducted on the final day of the week-long event. The results indicate that medical students have a limited understanding of the Greek or Latin origin of medical terminologies and that, as a result, their ability to comprehend the meaning of certain medical terminologies might be hindered. This might have a detrimental effect on their clinical practice in the future which may be directly related to less than optimal patient care.

Key Words
Latin, Greek; Terminology; Medicine; Medical Education; Clinical Practice

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Introduction

The origin of medical terminology is a rich area of research which encourages the field of Medical Science to interact with that of Translation Studies, a collaborative opportunity which has not been fully explored or its potential reconnoitred within the world of academia. The language of medicine offers intriguing challenges and opportunities both to medical historians and to linguists. The majority of medical terms used today throughout Europe, and even beyond, are of Greek or Latin origin. Clinical terminology tends to derive from Greek (*dermatitis*, *laryngotomy*, *gastroscopy*) while anatomical vocabulary is often rooted in the Latin language (*dorsum*, *medialis*, *ventriculus*).

A Brief History of Medical Language

The Greeks founded rational medicine and dominated the field until the beginning of the 18th Century. It is thus estimated that three quarters of medical terminology derives from the Greek language. Hippocratic writings of the 4th and 5th centuries BC form the foundation of modern medicine. This collection of Greek medical works, which indicate numerous concepts and terminologies pertaining to the field of medicine, marked the beginning of the Greek influence in the language of Western medicine. The influence of this period is still evident in the medical terminology used in today's practice. In particular, the names of numerous diseases and symptoms derive from Greek. Examples include *arthritis* (from the Greek *arthron* [meaning *joint*] and *-itis* [meaning inflammatory disease]), *dermatitis* (from the Greek *derma* [meaning skin] and *-itis* [meaning inflammatory disease]), and *pneumoconiosis* (from the Greek *pneumōn* [meaning lung], *konis* [meaning dust], and *-osis* [meaning disease]), to name a few.

In the 1st Century AD, the Roman encyclopaedist Aulus Cornelius Celsus (c.25 BC – c.50 AD) wrote *De Medicina*, an overview of medicine based on numerous Greek sources. Realising that there was no Latin equivalent for the majority of Greek

medical terminologies, Celsus implemented strategies which would allow the core medical aspects to reach those versed in Latin. He borrowed words directly from Greek, such as *pyloros* (now *pylorus*). In addition, he adapted Greek terms in order to make them suit the Latin alphabet and pronunciation. For example, the Greek word *krānían* (meaning *skull*) became *crānium*.

During the Middle Ages, medical works were translated into Arabic and Arabic terms such as *carania* (meaning *cornea*), *al-batan* (meaning *abdomen*), *bu'bo* (meaning *pupil*) and *ein* (meaning *eye*), were encouraged to enter the medical language of the Western world. Yet, the Renaissance period saw a decline in the widespread use of Greek and, subsequently, existing medical works were translated into Latin while new texts were written in this language. This signalled the beginning of the Latin influence in medical terminology.

The Romans continued to study the field of medical science and encouraged Latin terminologies to enter its vocabulary. In addition, Latin was considered the language of science, and therefore medicine, until the start of the 19th Century. This led to numerous texts, including Andreas Vesalius's anatomical work *De humani corporis fabrica* (1543), appearing in Latin. From the beginning of the 19th century, national languages, including English, French, German and Italian, gained prominence which resulted in the decline of Latin. Each language developed its own medical terminology but, since the majority of terms derived from Latin, there were commonalities which are still apparent today. Due to the constant advances in medicine, it is essential to create and implement newer medical terminologies. Words are needed to denote new diseases, conditions, instruments and technologies. Following the decline of Latin, the medical community now tends to implement terms of Greek origin since this language allows the composition of new words to an easier extent than Latin (*e.g., pneumonectomy* and *otoscopy)*. Furthermore, Greek prefixes and suffixes including *-itis* and *hyper-* were employed, leading to the formation of terms such as *appendicitis* and *hypertension*.

Today, English is seen as 'the language of medicine'. Most influential medical journals use the medium of English and international conferences tend to be held in English. As innovative medical concepts are developed and medical technology advances, English words enter the medical terminology. For example, the terms *screening* and *scanning*. Medical inventions will continue to emerge and it is possible that scholars will employ words which are common in the English language rather than rely on terms of Greek or Latin origin. Nevertheless, the Greek and Latin roots of a significant number of medical terminologies which are common in today's practice are visible and cannot be easily ignored.

The Doctors Academy International Medical Summer School is a global educational event which attracts medical students of all years from universities throughout the world. The School covers all specialities and comprises of over 80 lectures and 10 workshops during the week. Since it is the only event of its kind in the world, it provided a unique platform for this study and offered the opportunity to assess the awareness not only of medical students studying in the United Kingdom but also of those studying in various countries worldwide. A total of 218 students attended the 2015 Summer School, enabling the study to be conducted amongst a large audience and facilitating a wide, international study.

This study aimed to evaluate the extent to which medical students are aware of the origin of the medical terminologies which are used in everyday practice today. The results will enable researchers to determine if there is a correlation between a medical student's knowledge of Greek or Latin and his or her understanding of medical terminologies.

Methodology

A survey was conducted on 218 medical students from 28 countries worldwide during the 2015 Doctors Academy International Medical Summer School which was held at the University of Manchester, United Kingdom, between 27th - 31st July 2015.

The 218 participants were seated in a lecture theatre with sufficient space between each individual to ensure that there was no conferring. Each participant was given an exercise sheet (*see Appendix A*) and asked to complete it alone and in silence within the stipulated time of twenty minutes. Invigilators were present for the duration of the study to ensure that the participants did not engage in discussion. After the twenty minutes had passed, the papers were collected by the invigilators and the data was later analysed.

The paper consisted of 60 questions which were divided into four sections. The first section, comprising of 10 questions (*see Appendix B*), was out of a total of 10 while the second section, comprising of 14 questions (*see Appendix C*), was out of a total of 21. The third section, comprising of five questions (*see Appendix D*), was out of a total of eight and the fourth section, comprising of 11 questions (*see Appendix E*), was out of a total of 21.

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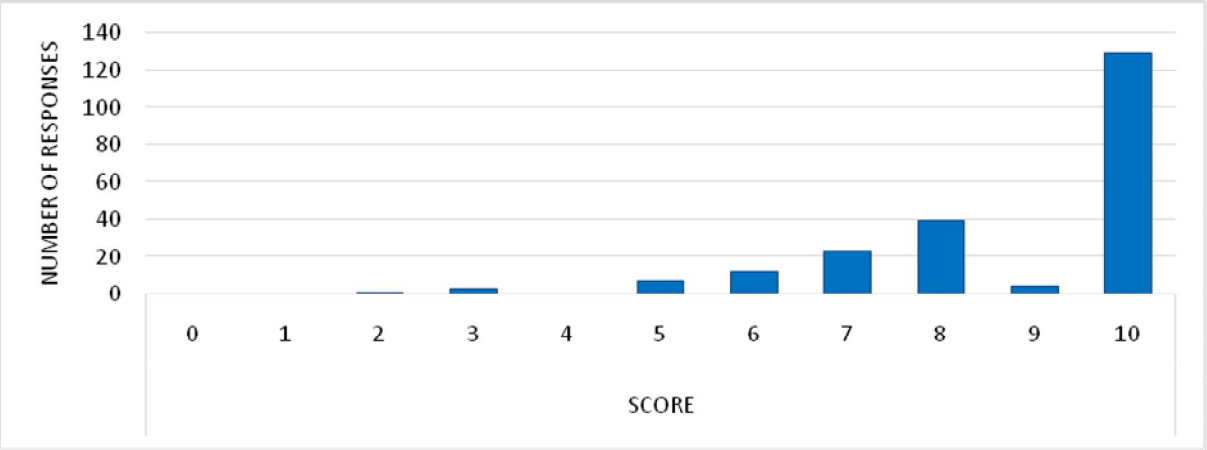
A total of 218 papers were collected, marked, scored, and analysed.

Results

Section 1

The first section provided a list of ten prefixes and suffixes in Greek or Latin which form part of numerous common medical terminologies. The meaning of each prefix and suffix was also given in English. Participants were asked to match the Greek or Latin prefixes and suffixes with their English meaning.

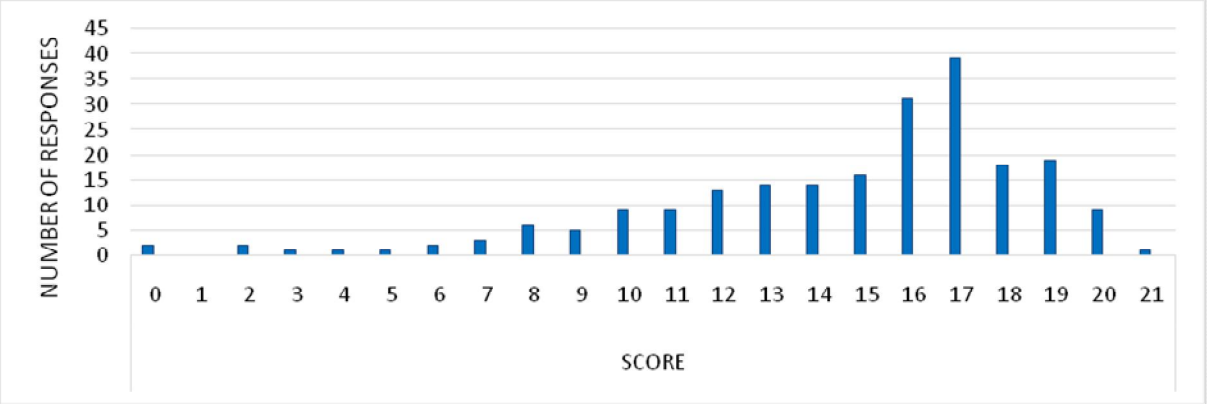
The graph indicates that the majority of participants (129 in total) attained the maximum score of 10. The other participants also scored highly, with two being the lowest score achieved by only one individual.



Figures 1: *The graph shows how the participants scored in Section 1 which asked 'Match the following Greek and Latin prefixes and suffixes with their meaning in English. Draw lines to link the answers.'*

Section 2

In order to complete the second question, participants were given 14 prefixes and suffixes which are either Greek or Latin and form a large number of common medical terminologies. They were required to explain the meaning of the Greek or Latin term, as well as provide an example of each prefix or suffix used as part of a word relating to the field of medicine. For the sake of clarification, an example was provided. In addition, the meaning of certain prefixes and suffixes was offered in order to aid those whose first language was not English.

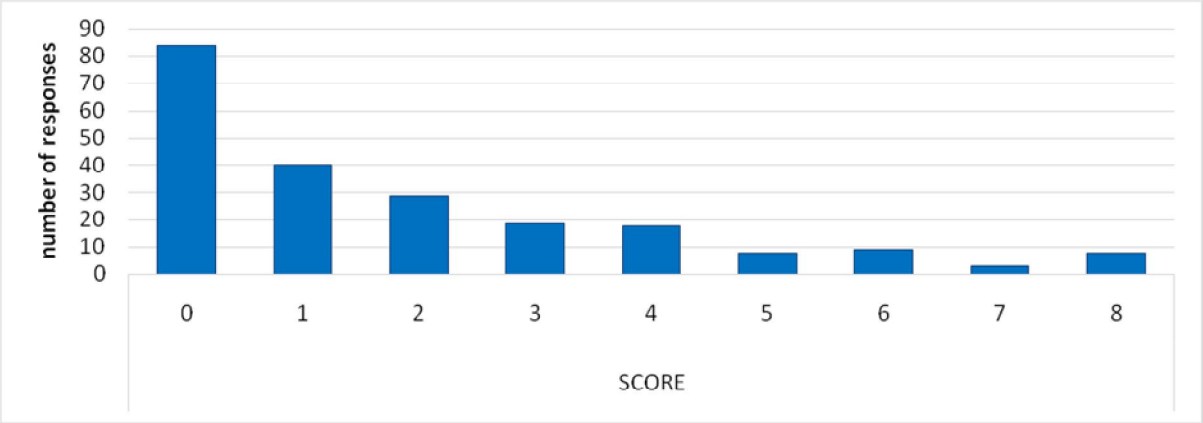


Figures 2*: The graph indicates the way in which the participants scored in Section 2 which asked 'Below you have a list of prefixes and suffixes commonly used in medicine. Please explain their meaning and give an example for each one.'*

Section 3

Participants were presented with five medical terms in English and asked to state the Greek or Latin word from which they derive. They were also required to give an example of a common medical term which uses the Greek or Latin derivative. Two answers were completed in order to provide the participants with examples.

The graph indicates that the greatest number of participants (84 in total) scored 0. The number of participants attaining a high score remained low: eight out of a total of 218 participants obtained the maximum score of eight and three participants gained seven.

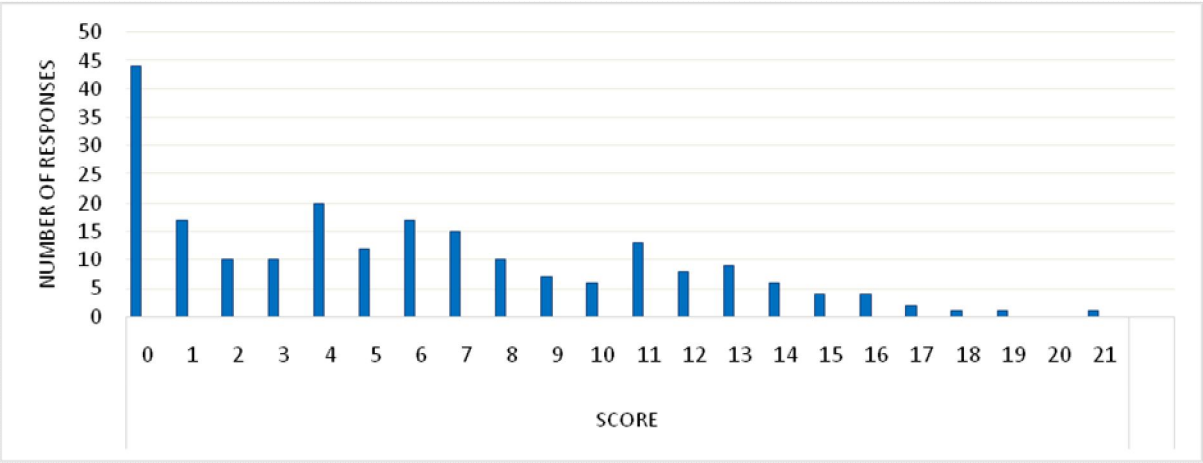


***Figures 3**: The graph reveals how each participant scored in Section 3 which asked 'Below you have a list of English medical terms. Please state the Latin or Greek word from which they derive.'*

Section 4

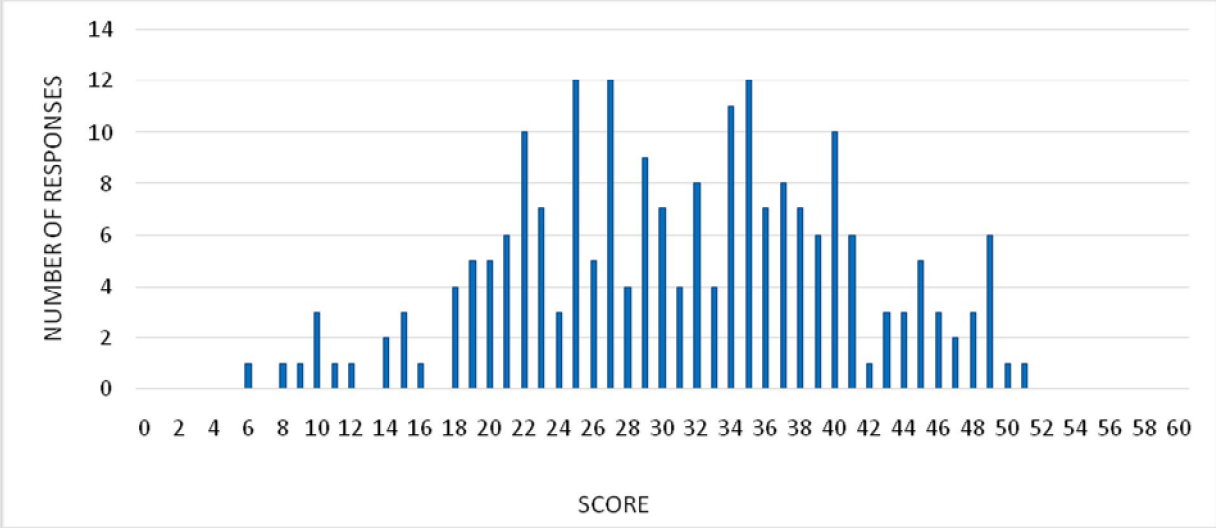
The final question provided explanations of 11 medical terminologies and asked participants to state the Latin or Greek word from which these terms derive. Participants were also required to give an example of each term employed in an anatomical context.

The graph demonstrates that one of the 218 participants scored the maximum score of 21 while the greatest number of participants (44 in total) scored 0. A large number of participants obtained a low score, with 20 scoring four and 17 scoring six.



***Figures 4**: The graph illustrates the way in which each participant scored in Section 4 which asked 'Below you have explanations of words. Please state the Latin or Greek word from which they derive and give an example.'*

Overall Score



Figures 5: *The graph indicates the overall score of individual participants with the particular score correlated to the number of responses.*

The graph reveals the overall score achieved by each participant with the particular score correlated to the number of responses. The maximum score of 60 was not attained by any participant; the highest score was 51 which was obtained by one participant. The lowest score achieved was six. The majority of participants obtained a total score between 18 and 41 which indicates that the results were mixed.

Discussion

The results suggest that medical students do not have adequate understanding of the Greek or Latin origin of common medical terminologies. That the overall scores were relatively low and the maximum score of 60 was not obtained by any participant support this assertion.

While the majority of participants achieved a maximum score of 10 in the first section, it is vital to remember that both the Greek or Latin forms *and* the English equivalents were offered. It could therefore be argued that the medical students were able to deduce the Greek or Latin terminologies when all of the required information was presented. This corresponds to the 'remembering' level of Bloom's Taxonomy of Learning Domains (1956; 2001) where the learner is encouraged to recognise and retrieve terms, concepts or facts without necessarily understanding the meaning. The first section in this survey tested the participants' basic recall of facts and, therefore, the tendency to score highly does not indicate that the participants were truly aware of the origin of the medical terminologies.

In order to complete the second section, participants were given Greek or Latin terminologies, as well as the English meaning of half of the words. The Greek and Latin derivatives which formed the question are recognisable to those working in the field of medical science. For example, the Greek derivative '-iatrics' was provided and resulting terms, such as 'paediatrics' and 'geriatrics', are frequently used today. This question resembles the second level of Bloom's Taxonomy: 'understanding'. A learner at this level is able to comprehend the meaning of a term, concept or fact and offer his or her own example. The question assessed the extent to which the participants recognised the Greek and Latin influence in medical vocabulary. That many participants scored relatively highly indicates that there is some recognition of this.

The third and fourth sections contained fewer completed answers which meant that participants were encouraged to generate more responses independently. It could be suggested that this was a primary reason for a large number of participants achieving a low mark in both of these sections. Furthermore, sections three and four required participants to give the Greek or Latin terms, as opposed to sections one and two which demanded the English words. These two sections reflect the 'applying' phase of Bloom's Taxonomy since participants were invited to utilise existing knowledge, namely Greek or Latin terminologies that are frequently employed in current practice, in a new situation. That many students struggled to offer the correct answers could reflect two

indications: medical students show little awareness of the Greek and Latin origin of common medical terminologies *or* the knowledge that medical students possess of the Greek and Latin origin of common medical terminologies is not harnessed sufficiently to allow them to apply it within new situations.

It is vital to consider that the 218 medical students who participated in this survey are of different nationalities and have various native languages. Since delegates of the International Medical Summer School are not required to possess an indicated standard of English language proficiency in order to attend the event, it is supposed that each participant's competence in English differed. While the students would have possessed at least a minimum standard of English language proficiency, the exact level is unknown. It is probable that some participants would have possessed limited skills in the English language whilst others would have achieved a high standard of proficiency. This disparity will have impacted the results of the survey since the participants would have been influenced by their knowledge of the English language. In order to illustrate this in a clear manner, we will take section three as an example. Student A, whose native language is Russian and who did not possess a high standard of English language proficiency, did not understand the medical terminologies written in English and presented in this question. His limited knowledge of the English language prevented him from completing the question and he scored 0. This does not, however, imply that he does not know the Greek or Latin derivative of the English word. He is unable to interact in English but he would have been able to respond correctly if the terminologies had been offered in his native language of Russian.

Furthermore, it is anticipated that some participants with a limited proficiency in the English language would have struggled to understand the questions. This may have prompted incorrect or ill-informed answers. In addition, that participants were required to complete the paper within a stipulated time would have prevented some from offering the correct answers. Indeed, it is expected that those with a minimum standard of English language proficiency will be unable to engage with the question as rapidly as those whose native language is English.

The native language of certain participants was Greek. These students would have approached the paper from a different perspective and the challenges faced would have differed from those tackled by native speakers of English, for example. While these participants may have understood the Greek derivatives of the medical terminologies with relative ease, it is possible that they would have struggled to express the answer in English for the reasons highlighted in the previous paragraph.

As a final point of consideration, it is important to note that the participants' level of knowledge of Greek and/or Latin was varied. Certain countries include Greek and Latin in the national curriculum and, as such, children learn these languages from a young age. For example, in Italy, Latin is compulsory for students who attend the *Liceo scientifico* and the *Liceo classico* while Ancient Greek is also compulsory for those attending the *Liceo classico*. To this end, some participants would have been in an informed position. Moreover, Romance languages such as French and Italian directly descend from Vulgar Latin, a form of non-classical Latin. Participants whose native language was a Romance language, as well as those who possessed a high level of proficiency in a Romance language, would arguably have responded to the questions in a different manner to those whose mother tongue was a Germanic language.

Conclusion

The language of medicine is a rich and intriguing area of study for both linguists and medical doctors. Exploring the flow of terminologies from one vernacular to another proves fascinating for linguists while an appreciation of the history and origin of words used in medical practice will offer a new dimension to the professional knowledge, language, and practice of doctors. Awareness of the origin of medical terminologies boasts a valuable academic significance. In addition to this, a perspicacity of the history of medical language will encourage medical students and doctors to conceptualise anatomical terms, pathologies, and treatments in a less arduous manner. This will prove vital to the development of a clinician's career, as well as help him or her to contribute to medical patois, all of which will eventually benefit and enhance patient care. It can therefore be suggested that prospective medical students should consider learning the fundamental concepts of the Greek and Latin origin of medical terminologies before commencing their medical studies.

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Appendices

Appendix A: Exercise Sheet

INTERNATIONAL STUDY OF MEDICAL STUDENTS/JUNIOR DOCTORS
EVOLUTION AND HISTORY OF MEDICAL TERMINOLOGIES

1. Match the following Greek and Latin prefixes and suffixes with their meaning in English. Draw lines to link the answers.

a) -algia	1) reconstruction
b) -ectomy	2) rotten
c) -plasty	3) wound
d) trauma	4) excision
e) onco-	5) pain/inflammation
f) septi-	6) swelling
g) -tomy	7) bad, faulty
h) ectop-	8) displaced
i) dys-	9) incision
j) gangli-	10) tumour

2. Below you have a list of prefixes and suffixes commonly used in medicine. Please explain their meaning and give an example for each one. The first one has been completed for you as an example

LATIN/GREEK WORD	MEANING	EXAMPLE
- IATR(O)	**Doctor**	**Iatrogenic**
-IATRICS		
-OSIS	Condition or disease	
SEPTI-		
TUBER-	Swelling	
THROMB (O)-,		
-ITIS		
ASTHEN-	Weakness	
PLEGIA-	Paralyse	
-ECTOMY		
-TOMY	Incision (operation by cutting)	
-STOMY		
-OPSY	Examination	
-SCOPY		
VOLV-	Rotate	

3. Below you have a list of English medical terms. Please state the Latin or Greek word from which they derive?

ENGLISH TERM	LATIN OR GREEK DERIVATIVE	EXAMPLE
Drug		
Poison		
Pus		
Grease	SEB(O)-	
Shield		Thyroid gland

4. Below you have explanations of words. Please state the Latin or Greek word from which they derive and give an example. The first one has been completed for you as an example.

MEANING	LATIN OR GREEK DERIVATIVE	ANATOMICAL EXAMPLE
Rock	**Petrous**	**Petrous bone in skull**
Shell-like (located within head)		
Resembling spider's web (located within skull)		
Short		
Deep		
Drowsiness (artery in the neck)		
Wandering, straying (cranial nerve)		
Body		
Hard protector (located within brain)		
Receiving chamber		
Groove or trench		
Yellow	Flavus	

Appendix B: Section 1 of Exercise Sheet

1. Match the following Greek and Latin prefixes and suffixes with their meaning in English. Draw lines to link the answers.

k) -algia	1) reconstruction
l) -ectomy	2) rotten
m) -plasty	3) wound
n) trauma	4) excision
o) onco-	5) pain/inflammation
p) septi-	6) swelling
q) -tomy	7) bad, faulty
r) ectop-	8) displaced
s) dys-	9) incision
t) gangli-	10) tumour

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Appendix C: Section 2 of Exercise Sheet

2. Below you have a list of prefixes and suffixes commonly used in medicine. Please explain their meaning and give an example for each one. The first one has been completed for you as an example.

LATIN/GREEK WORD	MEANING	EXAMPLE
- IATR(O)	**Doctor**	**Iatrogenic**
-IATRICS		
-OSIS	Condition or disease	
SEPTI-		
TUBER-	Swelling	
THROMB (O)-,		
-ITIS		
ASTHEN-	Weakness	
PLEGIA-	Paralyse	
-ECTOMY		
-TOMY	Incision (operation by cutting)	
-STOMY		
-OPSY	Examination	
-SCOPY		
VOLV-	Rotate	

Appendix D: Section 3 of Exercise Sheet

3. Below you have a list of English medical terms. Please state the Latin or Greek word from which they derive?

ENGLISH TERM	LATIN OR GREEK DERIVATIVE	EXAMPLE
Drug		
Poison		
Pus		
Grease	SEB(O)-	
Shield		Thyroid gland

Appendix E: Section 4 of Exercise Sheet

4. Below you have explanations of words. Please state the Latin or Greek word from which they derive and give an example. The first one has been completed for you as an example.

MEANING	LATIN OR GREEK DERIVATIVE	ANATOMICAL EXAMPLE
Rock	**Petrous**	**Petrous bone in skull**
Shell-like (located within head)		
Resembling spider's web (located within skull)		
Short		
Deep		
Drowsiness (artery in the neck)		
Wandering, straying (cranial nerve)		
Body		
Hard protector (located within brain)		
Receiving chamber		
Groove or trench		
Yellow	Flavus	

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