Do Japanese Medical Students Benefit from English Etymological Instruction?

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Etymological instruction (EI) possesses high face validity for both students and teachers. Research on the benefits of EI has produced mixed results, and very little of it has been done in validating this form of instruction in Japan. This study of 147 students at Fukui University's Faculty of Medical Sciences investigated two of the perceived benefits of EI. The experimental group received approximately 330 minutes of EI. The test performance of the control and experimental groups was analyzed using regression analysis and Pearson's product moment correlation across a range of medical terminology questions. There was no statistically significant difference between the control and experimental group. There was no indication that Japanese students were manifesting two of the benefits traditionally associated with EI. Further research is required in order to identify the reasons why EI is not producing the expected benefits.

語源を使った教授法には一定の妥当性があり、これまで学生と教師の両者にとって妥当であるように思われてきた。しかし、先行研究ではその妥当性についての評価は分かれており、日本においてこの解説の妥当性を検証した研究は非常に少ない。本研究では福井大学医学部の147名の学生を対象に、語源を解説する2つの利点を分析した。実験において処理群は約330分の医療用語の語源に関する解説を聞く。そのあと医療用語に関する試験を行い、語源の解説を聞いた処理群とそうでない対照群とのパフォーマンスの違いを回帰分析とピアソンの積率相関係数を使って分析した。分析の結果、処理群と対照群では試験の点数について統計的な有意差は生じなかった。日本人学生を対象とした本研究では、これまで伝統的に言われてきた語源解説の2つの利点を支持する結果は得られなかった。語源解説の利点について、期待される結果が得られなかった原因を特定するためにはさらなる研究が必要である。

The efficacy of explicit etymological instruction (EI) for instructing students in medical and scientific terminology has remained unchallenged for centuries; however, recent studies have raised questions about whether this teaching approach delivers the promised benefits (Carlo, et al., 2004). Little research can be found concerning the effectiveness of EI in Japan. Yamazaki and Yamazaki's (2006) research found it ineffective, but concluded that this was primarily the result of insufficient Greek and Latin cognates and a lack of relevance to that field of study. This study was conducted in a medical school English class in Japan where the relevance of EI was clearer as there were more Greek and Latin cognates.

Literature Review

MacDonald (2015, p. 27) defines EI as follows: "EI is distinguished from other instructional methods in that it promotes an awareness of the underlying structure and form of English words, and through this awareness produces most of the benefits associated with this teaching approach." The literature proposes that benefits arising from this enhanced awareness are:

a) Enhanced recall and memorization for both words and word parts (Namdar & Bagheri, 2011; Pierson, 1989; Zolfagharkhani & Moghadam, 2011);
b) An improved ability to guess the meanings of unfamiliar words (Hutcheon, Campbell, & Stewart, 2012);
c) Better pronunciation (Koda, 2005);
d) A deeper understanding of words' meanings (Hutcheon, Campbell, & Stewart, 2012);
e) An improved understanding of irregular spellings of English words (Koda, 2005).

Research Method

This study focused on two areas where EI was expected to be most clearly beneficial in learning medical terminology, namely enhanced recall and guessing the meaning of words. Other benefits were not explored as they involved subjective judgements, such as inter-rater differences in judging pronunciation. For those interested in replicating this study additional information on the procedures, course content, and assessments are included in the appendices.

Participants

This study took place with 147 students from the Medical English courses in Fukui University's Faculty of Medical Sciences, during 2013 and 2014. The Medical English course was taught by three different instructors: two English L1 instructors and

one Japanese L1 instructor. The study only involved the students taught by the English L1 instructors, as there were concerns that students taught by a Japanese L1 instructor might perform differently (Ford, 2009; Yamashita & Jiang, 2010). Students were randomly divided into two groups, an experimental group of 75 students, and a control group of 72 students.

Procedure

Each course consisted of fifteen 90-minute classes. The experimental group received 20 to 35 minutes of EI each lecture, for a total of approximately 330 minutes of EI across the course. The normal experimental group lesson pattern can be seen in Table 1.

Table 1. Normal Experimental Group Lesson Pattern

Activity	Total Time	EI Time
Vocabulary Quiz and Review	15 minutes	5 to 10 minutes
Listening Homework Cloze	30 minutes	Negligible
Student Presentations	30 to 35 minutes	10 to 15 minutes
Vocabulary Introduction	10 to 15 minutes	5 to 10 minutes
Grand Total	90 minutes	20 to 35 minutes

The control group followed a similar pattern, but received no EI. The normal experimental group lesson pattern is detailed in Table 2.

Table 2. Normal Control Group Lesson Pattern

Activity	Total Time	EI Time
Vocabulary Quiz and Review	15 minutes	0 minutes
Listening Homework and Cloze	30 minutes	0 minutes
Student Presentations	40 minutes	0 minutes
Vocabulary Introduction	5 minutes	Negligible
Grand Total	90 minutes	0 minutes

The vocabulary lists contained word parts as separate items, and both the control and experimental groups received identical materials in order to prevent any possible bias. Therefore, in introducing the vocabulary materials to the class it was occasionally necessary for the control group teacher to introduce word parts. In the control group no great emphasis was placed on these and no attempt was made to explain how compound words could be formed from these word parts. Therefore, the EI time for Vocabulary Introduction were listed as "Negligible."

Assessments

Both the experimental and control groups received identical assessments.

Variable Control

Raw scores were not adjusted for differences in initial ability, satisfaction, or motivation, but rather the variables are discussed in the results section to account for expected variances between the two groups. Variables controlled for included:

Initial Differences in the English Levels of the Groups

The first vocabulary quiz at the start of the second lecture was used to control for initial English ability prior to EI. All students had one week to study the vocabulary list and prepare. The control group averaged 77% on the vocabulary quiz, while the experimental group averaged 83% on the vocabulary quiz. The control group's initial English ability was, on average, 5.59% lower than the experimental group.

Student Satisfaction and Motivation

The anonymous end-of-course survey conducted by the administration department revealed minor differences in satisfaction and motivation levels between the two classes. The difference was less than 0.1 on a 5 point scale across all measures, with the control group scoring slightly higher than the experimental group. It was felt that, given the subjective nature of the ratings and the small effect size (<2%), this did not influence the research results.

Limitations

EI Exposure Quantity

The EI quantity was approximately 330 minutes over 12 weeks, however there is no research to provide a benchmark for EI quantity in Japanese medical school classes. It was also unknown if the

benefits of EI would manifest incrementally, or as a *gestalt* phenomenon showing no benefits until some EI threshold was reached.

Instructor Quality

The experimental and control groups were taught by the same instructors during both years. This is a possible source of experimental bias if one instructor was a significantly more effective teacher. The student satisfaction survey was used to control for this factor. Students evaluated the instructors very similarly, with a 2% difference in student satisfaction between the experimental and control groups. However, students are not expert evaluators and this could be a potential source of experimental bias.

Research Hypothesis

Research Purpose Statement

The purpose of this research is to establish whether, after approximately 330 minutes of EI, the experimental group showed no statistically significant improvement in either their ability to recall vocabulary or their ability to guess the meaning of unknown words with taught word parts, as compared with the control group. This would show that EI did not produce the expected benefits when teaching English to Japanese medical school students.

The following hypotheses were advanced:

- **Hypothesis 1**: If the experimental group and control group show a strong statistically significant positive correlation (r=≥0.06, p=≤0.05) in their results on vocabulary questions (i.e., there is no difference between the group that received EI and the group that did not), then there is strong statistical support for the research purpose statement.
- **Hypothesis 2**: If the experimental and control group are negatively correlated (r=<0, p=≤0.05) on their performance on vocabulary questions (i.e., the experimental group did better on items that the control group did worse on) then there is statistical support for EI producing a statistically significant difference between the two groups and the research purpose statement is disproved.
- **Null Hypothesis**: If the experimental and control group showed no statistically significant correlation (p=≥0.06) between their performance on vocabulary questions, then there is insufficient statistical evidence to be certain of the reason for the variation between the groups. This may be the result of an insufficiently large sample size, confounding variables that were not accounted for in the research design, or other errors in experimental method.

Results

The mid-term and final examination results on taught and untaught vocabulary will be presented in this section. Taught vocabulary questions were words selected from the list of 193 vocabulary items taught in the course. These questions were presented in two formats:

- **List format**: Twenty taught words (different on the mid-term and final examinations) and students had to match the correct word to the meaning.
- **Paragraph format**: A previously unseen passage was presented with blanks. Students had to choose the correct taught word to fill in the blanks.

The taught vocabulary items were used to test students' recall. If 330 minutes of EI produced a memory-enhancing effect, then it was expected that the experimental group would achieve higher results on these questions than the control group. Untaught vocabulary questions were compound words containing one or more of the word parts taught in the course. The students were presented with a paraphrased meaning and had to choose the most correct answer. The untaught vocabulary questions were used to test the students' ability to guess the meaning of unfamiliar words based on word parts. If 330 minutes of EI produced an enhanced ability to guess the meaning of words, then it was expected that the experimental group would achieve higher results than the control group.

Table 3. Mid-Term Taught Vocabulary Descriptive Statistics

	N	M	SEM	SD	Variance	SE Skewness	Min.	Max.
Control: Untaught	72	.81	.01	.12	.02	.28	.50	1.00
Experimental: Untaught	75	.86	.01	.11	.01	.28	.48	1.00

Mid-Term Examination

Taught Vocabulary

The control and experimental groups performed almost identically on the taught vocabulary section of the mid-term examination.

Table 3 shows that the control group averaged 81%, 5% less than the experimental group's average of 86%. Adjusting for the expected 5.59% difference in the initial abilities of the groups the scores are functionally identical.

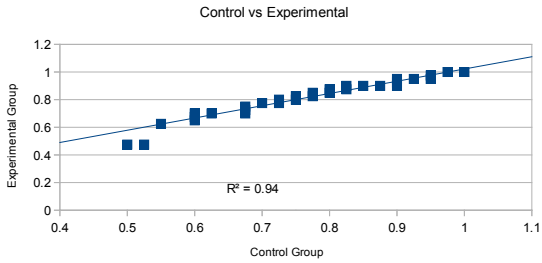

Figure 1. Mid-term taught vocabulary.

The control and experimental groups showed an extremely strong positive statistical significant correlation on the Pearson's product-moment correlation (r=0.97, p<0.01), indicating that the two groups co-varied extremely strongly, and the p value of <0.01 indicates that there is little or no chance that this is random. The positive correlation is illustrated in Figure 1, where the two groups are plotted against one another. This constitutes very strong statistical evidence that 330 minutes of EI had no statistically significant effect on students' recollection of taught vocabulary.

Untaught Vocabulary

The control and experimental groups performed very similarly on the untaught vocabulary section of the mid-term examination.

Table 4 shows that the control group averaged 91% and the experimental group averaged 95%. After adjusting for the 5.59% difference between the control and experimental groups the control group out-performed the experimental group by 1% on average.

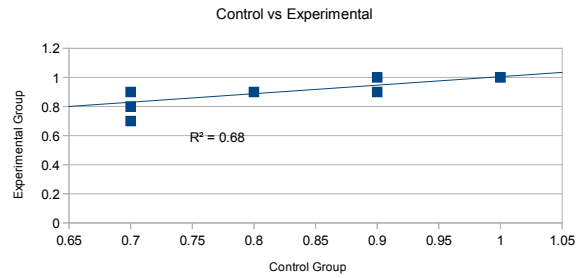

Figure 2. Mid-term untaught vocabulary.

As can be seen in Figure 2, the experimental group and control group showed a strong positive statistically significant correlation on the Pearson's product-moment correlation (r=0.83, p<0.01), indicating that the two groups co-varied very strongly. There is more variation in the untaught questions, but this is expected as students may have guessed where they were unsure. The positive correlation constitutes strong evidence that 330 minutes of EI had no statistically significant effect on students' ability to guess the meanings of unfamiliar words.

Final Examination

Taught Vocabulary

The control and experimental groups performed similarly on the taught words section in the final examination.

Table 5 shows that the control group averaged 90% and the experimental group averaged 92%. After adjusting for the 5.59% difference between the control and experimental groups the control group out-performed the experimental group by 3%, and

Table 4. Mid-Term Untaught Vocabulary Descriptive Statistics

	N	M	SEM	SD	Variance	SE Skewness	Min.	Max.
Control: Untaught	72	.91	.01	.09	.01	.28	.70	1.00
Experimental: Untaught	75	.95	.01	.06	.00	.28	.70	1.00

Table 5. Final Taught Vocabulary Descriptive Statistics

	N	M	SEM	SD	Variance	SE Skewness	Min.	Max.
Control: Untaught	72	.90	.02	.12	.01	.39	.52	1.00
Experimental: Untaught	75	.92	.02	.10	.01	.38	.64	1.00

may be a result of the additional time spent by the control group's lecturer on teaching vocabulary, while the experimental group focused on EI.

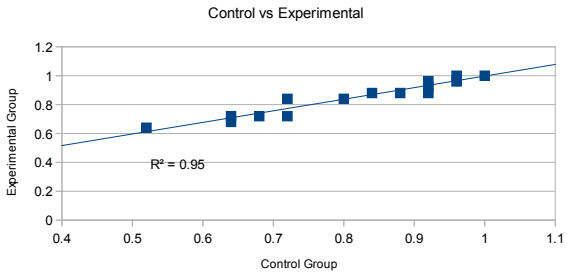

Figure 3. Final taught vocabulary.

The control and experimental groups showed an extremely strong positive statistical significant correlation on the Pearson's product-moment correlation (r=0.97, p<0.01), indicating that the two groups co-varied extremely strongly, and the p value of <0.01 indicates that there is little or no chance that this is random, as displayed in Figure 3. The positive correlation constitutes very strong statistical evidence that etymological instruction had no statistically significant effect on students' ability to recall taught vocabulary.

Untaught Vocabulary

The control and experimental groups performed almost identically on the taught vocabulary section of the mid-term examination.

Table 6's mean values show that the control group averaged 83% and the experimental group averaged 88%. This 5% difference was predicted by the initial difference in ability between the two groups.

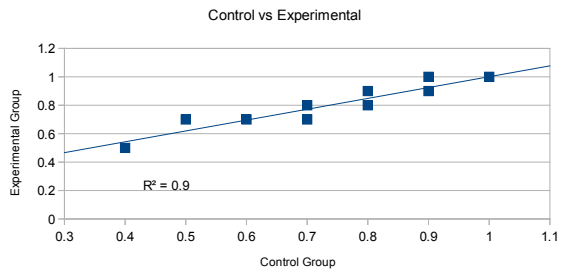

Figure 4. Final untaught vocabulary

The control and experimental groups showed an extremely strong positive statistical significant correlation on the Pearson's product-moment correlation (r=0.95, p<0.01), indicating that the two groups co-varied extremely strongly, and the p value of 0.00 indicates that there is little or no chance that this is random. This can be seen in Figure 4, where the two groups are plotted against one another. The positive correlation constitutes very strong statistical evidence that 330 minutes of EI had no statistically significant effect on students' ability to guess the meanings of untaught vocabulary.

Discussion and Conclusions

This study examined the effectiveness of EI in an environment where it had a high relevance and using items that the literature proposed that EI would show the strongest benefits. Had EI resulted in mnemonic benefits above and beyond standard vocabulary instruction methods, there should have been some difference between the taught vocabulary scores of the control and experimental group. If EI enhanced students' ability to guess the meaning of untaught vocabulary, there should have been a difference between the experimental and control groups' ability to guess the meaning of unfamiliar words. The statistics show that there was no statistically significant difference, and there is strong statistical evidence that the experimental and control group performed almost identically on the vocabulary items tested.

However, quantitative analysis is not the whole story. The course satisfaction survey at the end of 2013 produced very little in the way of qualitative data. An additional bilingual English-Japanese survey was administered in the last class in 2014. The students were informed that this study was examining the effects of EI, with the Japanese (英語の語源 *eigo no gogen)* provided to assist students in the control group in understanding what was meant by English etymology. The experimental group was already familiar with the term. Students were asked, "What did you think of this course?" The question was deliberately left as open as possible to avoid prompting specific answers. A total of 22 comments were received, 6 from the control group and 16 from the experimental group.

Table 6. Final Untaught Vocabulary Descriptive Statistics

	N	M	SEM	SD	Variance	SE Skewness	Min.	Max.
Control: Untaught	72	.83	.03	.16	.02	.39	.40	1.00
Experimental: Untaught	75	.88	.02	.13	.02	.38	.50	1.00

The control group showed some confusion about the meaning of EI, however even in the control group one student commented on the perceived value and utility of EI. Across both the control and experimental groups 8 of 22 comments mentioned English etymology, and 7 of the 8 comments were positive, mentioning benefits such as improving their English and vocabulary retention.

This research should not be seen as a rejection of EI. The experimental group, which received EI, did no worse than the control group, which suggests that EI is no worse than other vocabulary instruction techniques for EFL students studying scientific or medical terminology. Instructors are not disadvantaging students by using this method. What is worrying is that EI is not manifesting the benefits traditionally associated with EI. If the barriers to accessing the full benefits of EI can be identified and addressed then it would be of considerable benefit to students and instructors. The students' belief in the face validity of etymological instruction, and lack of any disadvantage in using EI, is arguably sufficient reason to continue teaching using EI, and it may have other long-term benefits that fell outside of the scope of this research.

Further research is required into this area, such as which factors are preventing EFL students from unlocking the same benefits that English L1 students receive from EI.

Endnotes

1. The New York Times. Patient Voices [internet]. Available from: http://www.nytimes.com/interactive/2009/09/10/health/Patient_Voices.html?_r=0

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William Tait MacDonald works at the University of Nagasaki (Siebold), and has diverse research interests, but is particularly interested in drawing on his background as a professional psychologist to bring a multi-disciplinary perspective to issues in English teaching.

Appendices

The two appendices for this article, *Appendix A: Course Content* and *Appendix B: Course Assessments*, can be found with the online version of this article at http://jalt-publications.org/tlt.

Appendix A: Course Content

A.1. Experimental Group Procedure

Classes started with a 5 minute vocabulary quiz. The goal of this quiz was to check the students' understanding, ensure that students were not late for class, and check their understanding of the vocabulary. After the quiz the instructor reviewed the test results and identified problematic vocabulary items. These vocabulary items were written on the board and the students were invited to break the words down into their component word parts, explain the word parts' meaning, the meaning of the whole word, pronounce the word and provide other examples of words that shared a similar sound or meaning. The instructor corrected misunderstandings and provided additional examples of other medical terms that shared similar word parts. The EI component was approximately 5 to 10 minutes. In total 10 to 15 minutes were spent on the quiz section.

Next, the listening homework was checked, and idiomatic expressions from the listening exercise were identified and discussed. The students were also asked questions about the patients' emotion state in order to encourage more empathy towards patients. The listening homework was based on the New York Times' "Patient Voices"[i] supplement. Approximately 30 minutes were spent on the listening section.

After the listening section a group of three to four students gave a 10 minute presentations on a pre-assigned topic from 'Patient Voices'. At the end of the presentations 10 minutes were reserved for questions. During the presentations students often attempted complex medical terms. The instructor made a note of these and they were written on the board. A further 10 to 15 minutes was devoted to analyzing these with presenting students leading the discussion and giving hints (in English and Japanese)

about the meanings of the words. The instructor moderated the discussion and clarified misunderstandings, such as false cognates.

The lesson ended by introducing the next week's vocabulary items. The time allocated to this activity varied depending on how much time remained, averaging 10 to 15 minutes. For 5 to 10 minutes students were encouraged to guess the meanings of the new words and identify common word parts in that week's vocabulary list, and in previous vocabulary lists, in order to reinforce an awareness of common word parts. Looking up the dictionary meanings of the words in both English and Japanese was assigned as homework. Standardized definitions of the vocabulary items were not given to the control or experimental group as it was felt that this would encourage memorization without understanding.

A.2. Control Group Procedure

The lesson started with the same 5 minute vocabulary quiz, and the instructor spent an additional 5 to 10 minutes correcting common errors and teaching the week's vocabulary.

The control group and experimental group spent the same amount of time on the listening exercise, approximately 30 minutes checking the homework, identifying idioms and discussing the listening exercise and patient's feelings.

The control group's instructor spent more time on the presentation and presentation skills, spending approximately 40 minutes on this section. Topics covered included correct referencing for presentations, plagiarism, vocabulary choices for presentations, pronunciation, posture, how to handle questions and other presentation skills topics.

The control group ended with a 5 minute introduction of the next week's vocabulary, generally consisting of reading and repeating the words. Looking up the dictionary meaning of the words in both English and Japanese was assigned as homework. Some word parts were included as stand-alone items in the vocabulary list, but the control group instructor did not provide explicit EI beyond explaining that these were common English word parts in medical terminology.

Course materials and assessments were otherwise identical for both groups.

Appendix B: Course Assessments

B.1. Assessment Types

Four forms of assessment were used in the course. Both the experimental and control groups received identical assessments.

- Weekly vocabulary quizzes with vocabulary tested in context and in lists.
- Listening cloze exercise from the 'Patient voices' patient voices for homework
- Examinations (mid-term examination in the 8th week of the course, and final examination in the 15th week of the course), consisting of:
    - Listening questions - consisting of true/false questions, multiple choice questions, and fill in the blanks questions
    - Idiomatic expressions questions
    - Vocabulary questions – similar to those in the weekly vocabulary quiz
    - Untaught words - Words derived, in whole or in part, from word parts taught in the course. Students had to match the word to the closest meaning from a list of paraphrased meanings. There were 10 questions,

with 15 possible answers, 5 of which were incorrect.

The patient voices recordings and paragraph questions were used to present the words in context, with an English L1 speaker's associations, and examples of normal use, as well as providing information on pronunciation, register, and so forth. Likewise the students were encouraged to use what they learned in the course when giving their presentations in order to explore the use of the material in context.

B.2. Assessment Example

The following example contains samples of the types of assessments used in the course. Parts A and B are similar to those items contained in the weekly vocabulary quizzes. Part C, which contained unknown words and word parts, was only present in the examination.

Final Examination Questions

Taught Words Taught Word Parts

Part A: Words

Choose the correct meaning for the following terms (20 点)

1. A virus that infects and destroys bacterial cells.	S
2. Uncommonly or unexpectedly early, for example when a child is born early	U
3. A deadening or absence of the sense of pain without loss of consciousness	B
4. To go back; move backward.	D
5. Uncomfortable, distressed, mild pain	E
6. Impaired intestinal absorption of nutrients.	R
7. A chromosome that is not a sex chromosome.	M
8. To, at, near or on the kidneys	A
9. To clean to destroy or prevent the growth of disease-carrying microorganisms.	T
10. Different, not the same	O
11. Below the normal or legal age, as for drinking or voting	G
12. An impairment in the control of the motor system	L
13. An agent that reduces or prevents fever. Also called antifebrile, antithermic.	Y

14.	An illness that starts slowly and lasts for a long time.	P
15.	Any tumor of the liver, especially hepatocellular carcinoma	H
16.	Illness with a rapid onset and a short, severe course	I
17.	Blood in the urine.	C
18.	Start, begin	F
19.	Excessive discharge of blood from the blood vessels; profuse bleeding.	V
20.	Abnormally low blood pressure.	N

a) Adrenal	b) Analgesia	c) Hematuria	d) Regress	e) Discomfort
f) Genesis	g) Underage	h) Hepatoma	i) Acute	j) Anorexia
k) Orthopedics	l) Dyspraxia	m) Autosomal	n) Hypotension	o) Hetero-
p) Chronic	q) Hepatic	r) Malabsorbtion	s) Bacteriophage	t) Disinfect
u) Premature	v) Hemorrhage	w) Homozygosity	x) Heterozygosity	y) Antipyretic

Part B: Passage

Choose the correct words from the list below (5 点)

Do you remember the first five minutes of your life? Most babies in Japan get B - postnatal care in a hospital or a clinic for a few days. If you did, then an obstetrician probably checked you for physical problems and tested your blood for congenital abnormalities. Some diseases, like HIV, sickle cell anemia & hepatitis can be E - transmitted from mother to child through birth.

Do you remember your first meal? You might have enjoyed some breast milk. Early breast milk is full of A - antibodies to protect you and nutrients to help you grow. Birth can be very traumatic for mothers, especially if there are complications. Some babies turn yellow from jaundice, some babies get colic and cry all night long, and some babies have trouble eating and suffer from C - undernutrition. Each complication increases the risk of postpartum depression. The H - prevalence of postpartum depression is unclear, but it may be up to 25% in both mothers and fathers. Unfortunately, most parents don't seek help or receive any kind of therapy when they experience symptoms of postpartum depression.

A. antibodies	B. postnatal	C. undernutrition	D. virus	E. transmitted
F. transfused	G. hepatocyte	H. prevalence	I. regress	J. transplant

Part C: Challenge!

Choose the correct meaning for these NEW words (10 marks)

1.	The development of the embryonic (baby) heart	B
2.	Having atoms of only one element	O
3.	The study of the liver, gallbladder and pancreas	L
4.	The emission of light by a living organism (such as a firefly)	D
5.	A deficiency in one or more components of the immune system	F

6.	Inflammation or swelling of the colon	A
7.	Self-treatment of a medical condition, self-medication	C
8.	A language disorder that affects a person's ability to write	I
9.	Giving blood	N
10.	Through the liver	G

a) Colitis	b) Cardiogenesis	c) Autotherapy	d) Bioluminescence	e) Heteroatomic
f) Immunodepression	g) Transhepatic	h) English class	i) Dysgraphia	j) Pancreatitis
k) Hepatoartery	l) Hepatology	m) Hatostato	n) Hemodonation	o) Homonuclear

[i] The New York Times. Patient Voices [internet]. Available from: http://www.nytimes.com/interactive/2009/09/10/health/Patient_Voices.html?_r=0