

Medical Education: Eternal Values

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The physician's mission, regardless of technology or era, is to preserve the health of his fellow human beings. In order to achieve this purpose, the physician must have the requisite knowledge and be in a position to apply it to an individual patient. It is important that this process should be ruled by medical ethics. Therefore, the sum of a physician's training must equip him/her with everything that is necessary to help achieve their mission.¹

Medical education systems change and adapt according to local needs and to the development of medical science and technology. Despite the fact, however, that such changes often take place as they should, there are certain basic principles in medical education that must be viewed as very important. The purpose of this article is to present the principles of an integrated medical education with special emphasis on the eternal values that must be observed, regardless of the educational system or the era. In addition, since a physician's education does not end with the attainment of a specialty, but with the end of their career, it also amounts to a lifetime of education. The authors of this paper, who include clinicians, researchers and teachers of medicine for decades in different medical schools, on both sides of the Atlantic, and two different generations, present their experience.

Overview of medical education

Figure 1 represents an outline of a sound medical education, from the selection of the students to the completion of their training in a specialty or subspecialty.

The number of students admitted to a medical school, regardless of country of origin, should be determined first by the number of students to whom a school is able to provide a sufficient education, and second by the number of physicians the country needs. To arrive at the best selection, apart from examinations an interview is also required, so that the medical school can admit those who not only have the knowledge, but in addition have the character and other necessary qualities to help them become good physicians (see below).

Medical schools should cultivate a friendly rivalry between students. The best students should be made aware of their potential and know that they have a head start to achieve the best positions in the future – as happens in other sectors, such as sports. In this way, medical students will realize that their training will be the main criterion necessary to assist them to achieve their future goals.

The quality of education provided by medical schools must be monitored, and can be seen by the quality of the physicians who graduate from them. The evaluation of physicians must be based not

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Figure 1. The stages of a well-designed medical education from the selection of the student to the acquisition of a subspecialty.

only on relative merit, but also on national, or even international standards, so as to allow comparison between different medical schools. During medical school, students should, at least twice, take national examinations (Figure 1). The first examination should be after the completion of basic science courses and should cover all that material (Step I); the second examination should take place in the latter portion of the final year of medical school, covering all the material in the clinical sciences (Step II). In order to proceed to clinical training as a physician, or internship, the student must have passed the first set of examinations and graduated from medical school. Thus, based on the examination results, which will be “impersonal” and documented as fair, there can be an objective evaluation of the students, the teachers, and the medical schools. If the education in a medical school is not good, its students will have a much higher failure rate in the national examinations and will not be able to complete their medical training. In this way, it will be possible to carry out a review of the educational program with a view to improving it. Further, after receiving their medical degree, physicians should be required to take an additional examination after completing their first year of in-hospital training

(internship) in order to acquire a license to practice medicine (Step III).

Education should be intensive, with a daily program that must be observed strictly and without deviations. Otherwise, the student will not be able to assimilate the knowledge of medical science and technology. «*Ο βίος βραχύς η τέχνη μακροή*» (Life is short, art is long), as Hippocrates said. The student will have to work intensively for many hours in the hospital, to put in night shifts and to take on responsibilities. As a rule, the student should graduate from medical school after four or six years, depending on the country of origin, having completed the full syllabus. For those who are not able to graduate within the standard timeframe, this means that they are not capable of keeping up with the intensive training program that medicine requires, or that they do not wish to graduate and in consequence do not have the qualities needed to function as a physician.

Fellowships in a specialty should be filled based on merit. The best students should be given priority so that they can start their specialized training without delay and at the best training hospital. The criteria can easily be established by constructive discussions between medical schools, the state, and all bodies involved in medical education, and may include results from special examinations, personal interview, etc. Thus, physicians will specialize without losing their most productive years of life waiting in turn for a fellowship, while at the same time students will have an incentive to improve their performance.

The total number of fellows should be determined by the current needs in each country for a given specialty, and also by the number of fellows to which each hospital is able to provide adequate training. In order to determine and to apply a uniform educational program throughout the country, all fellows should start their specialty on the same fixed date every year. The material taught to the fellow each year should also be predetermined. Finally, the examinations for the acquisition of a specialty or subspecialty should be held simultaneously at a national level (Figure 1). In this way, it will be possible to compare the performance of interns from various hospitals, and by extension the educational and teaching level of the country’s health care institutions in general.²

University and other hospitals that offer specialization must also be evaluated at regular intervals (e.g. every five years), to determine whether they meet the necessary requirements and conditions for the training they provide. The primary goal is excellent training

of physicians and not just the provision of services in the hospital. Hospitals that do not have the ability to provide sufficient training to a physician in a specific field should not offer specialization in that field until their program has been revised accordingly.

The procedure described above, which has been followed for many years in the USA and other countries³ with great success, can also be applied in Greece or anywhere else without extra financial cost. As a result, only the necessary number of physicians will be trained in each specialty, while most importantly, the quality of their training will be assured.

The relationship between teacher and student should be impeccable and amiable. The student should have complete freedom to express his thoughts and to disagree with the teacher, but always based on reasoning. At the same time, however, there must be respect for the teacher. Teachers, through their behavior and the way they teach or deal with the student, should inspire the student and serve as role models with the student and the patient.

Education should aim at molding the physician's character. In other words, it should cultivate the human values that the aspiring physician must possess in abundance from childhood and long before enrolling in medical school. The future of medicine will depend not only on developments in medical science and technology, but mainly on the physician's human values. The student must be inspired to realize that the application of rules, a disciplined life, order, concentration, and the existence of obligations are the basic elements, not only of medicine, but of democracy and a well-organized society. Mental stability is essential for the physician, who is often obliged to work under difficult conditions while taking crucial decisions that affect the lives of others, in a state of uncertainty and within a very short time.¹

Eternal values in medical education

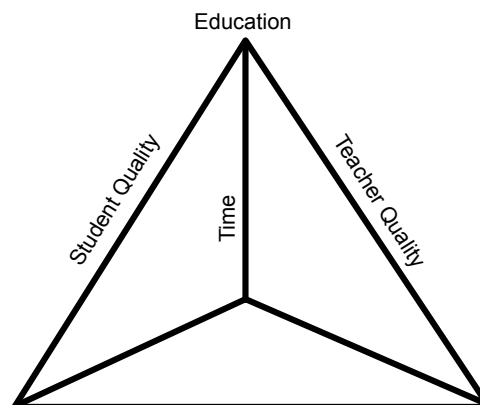
The knowledge a physician is taught is always changing; however, the values of medical education are eternal. For this reason, some of these values are worth summarizing.

The role of teacher and pupil

"A teacher affects eternity; he can never tell, where his influence stops" – Henry Brooks Adams

The success of any educational program, to a

The Quality of the Student and the Teacher in Education



"The fate of an institution lies in the men and women who work in its halls and in the ideals which they cherish and teach"

Sir William Osler

Figure 2. The success of any educational program depends mainly on the quality of teacher and student.

large degree, depends on the quality of the teacher and the Student (Figure 2).^{4,5} In consequence, all medical schools should undergo continuous evaluation of their teachers and students.^{2,4,5} It is easy to change the structure of medical education programs; however, it is very difficult to create effective teachers. Trainers, students and legislators should not be under the illusion that the quality of education depends only on the structure of these programs. In any system with worthy teachers and high-level students, regardless of the syllabus, the final result, namely the education, will be excellent, because nothing can replace a worthy teacher and a talented Student.^{4,5}

Combination of clinical experience, scientific knowledge, and technology

Medicine is not just a science, it is also an art. This must be stressed to the Student from the first years of training. From the early years, the Student of medicine begins to acquire clinical experience that becomes ever greater with the passage of time. Clinical experience is nothing more than knowledge that accumulates after attentive and continuous following and management of countless patients over many years. For this reason, it is essential for students to be responsible for as many patients as possible.

At the same time, the Student acquires knowledge about the medical science and medical technology of his era. The physician's clinical decisions are

based on both experience and scientific knowledge. Over time, the clinical experience and the scientific knowledge become internalized. Every decision the physician makes comes from the combination of experience and scientific knowledge, without the individual being able to determine whether the decision arises from the one or the other. A perfect balance between clinical experience, scientific knowledge, and technology is important for the physician.^{1,5-7}

Understanding basic mechanisms

“...Education with inert ideas is not only useless; it is, above all things, harmful.” – Alfred North Whitehead⁸

During medical education the importance must be stressed of learning and understanding the basic pathophysiological mechanisms and molecular mechanisms, for which mainly comprehension more than memorization is required. Memorization is passive, while comprehension is dynamic. Through comprehension it is possible for someone to mobilize knowledge and, in combination with only a few basic mechanisms, arrive at conclusions that nobody else has ever reached.

If, for example, someone learns that stimulation of the β -adrenergic receptors results in an increase in heart rate and myocardial contractility, then it is not difficult to appreciate that blocking these receptors has the opposite effect (Figure 3). This knowledge is sufficient, and it is not necessary to memorize all the drugs that have these effects. The function of the β -adrenergic receptors will never change, while the drugs will.

Application of knowledge to an individual patient – integrated medical personality (professionalism)

Knowledge is not enough for the practice of medicine. The physician must be in a position to apply the

knowledge to the individual patient. The application of knowledge requires excellent training, integrity of character, and absolute commitment to the treatment of the patient. In every case, the patient must be the focus of the physician’s activities. Each patient has his own personal problems and worries, which no laboratory test can show. Thus, the physician has to treat the patient and not the laboratory tests.^{5,7-9} Many diseases may be hereditary. Consequently, only a thorough and extensive medical history can help in the best understanding of these diseases.

In biology, variety is the rule and not the exception. The view that all patients with the same disease are the same is not only wrong but also contrary to nature. All people are equal before the law, but the same does not apply to biology. As Sir William Osler said, “it is more important to determine what kind of patient has the disease than what kind of disease the patient has.” It must be stressed to students of medicine that, since biology is complex, as a general rule, there is no ideal examination or treatment that will solve all problems. In other words, the physician should not seek a single solution – like Diogenes searching ancient Athens to find an honest man – because one does not exist. Usually, a combination of methods should be applied, following the “mosaic” approach, as the Anglo-Saxons put it.^{1,5,7,9}

Emphasis on indications for medical actions

While the use of technology is vital, in clinical medical practice the clinician cannot be a specialist or be up-to-date in all modern technology. The clinician, however, must have knowledge of the indications and applications of the technology that will be applied to the patient. Simply, the clinician must know what to do, that is, which technology should be applied, without being the one to apply the technology.¹ In medical education today, greater emphasis is placed on

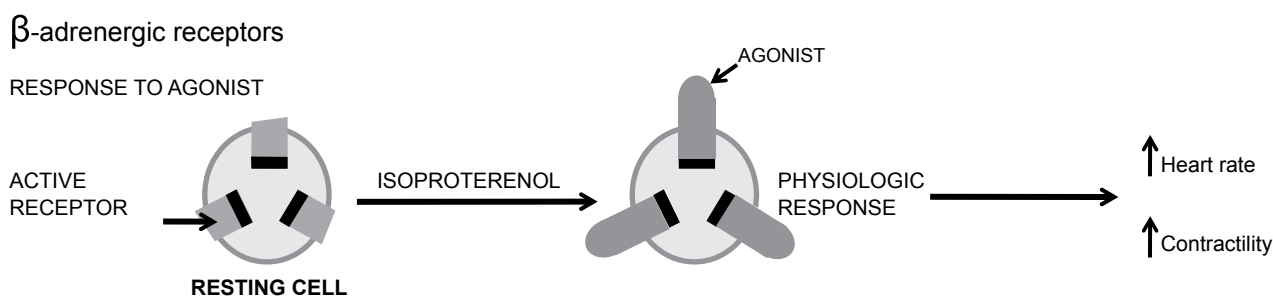


Figure 3. Schematic representation of the mechanism of action of the β -adrenergic receptors. Their stimulation with an agonist increases heart rate and myocardial contractility.

learning the technology, namely how to perform an echocardiographic or a coronary angiographic examination, and so on, and less on when and how this technology should be used. If the physician knows what test must be completed, even if they are not in a position to do it themselves, the physician will be able to refer the patient to the appropriate specialist.

Self-assessment and self-teaching

The Student of medicine and the physician must learn to perform self-assessments. After the history and the clinical examination, the physician forms an impression, an initial diagnosis. If the physician believes that laboratory tests are required, then the lab results, if the initial hypothesis is correct, should agree with it. If there is no agreement, it means that something is wrong: the initial hypothesis was not correct or the laboratory result was in error. The physician checks the initial hypothesis and the lab results again to determine why there is disagreement.⁵ This process continues until the final diagnosis is made, at which point the treatment is determined (Figure 4).

Medical deontology and ethics

“... the secret of the care of the patient is in caring for the patient.” – Francis Peabody

Knowledge and experience alone are not sufficient to make a good physician. The physician must feel the need to do good to the patient. As Peabody said in a series of lectures to students at Harvard Medical School, “... the secret of the care of the patient is in caring for the patient.”¹⁰ During clinical medical practice the physician makes decisions about the life and health of another person, thus a serious approach is imperative regardless of place and time.

Medical error

«Ὀφελῆειν ἢ μὴ βλάπτειν» (First, do no harm) – Hippocrates

The physician tries to preserve health, which is a divine gift, and is thus practicing a divine vocation. However, physicians are human beings and no matter how careful or experienced they are, mistakes will occur.¹¹ The father of medicine, Hippocrates, noted this fact and said «τούτον τον ιατρον ισχυρωσ επιαιεσουσιν τον σμικρον αμαρτανοντα», that is, “the physician best praised is the one of few errors”. The

Diagnostic Process Self Assessment

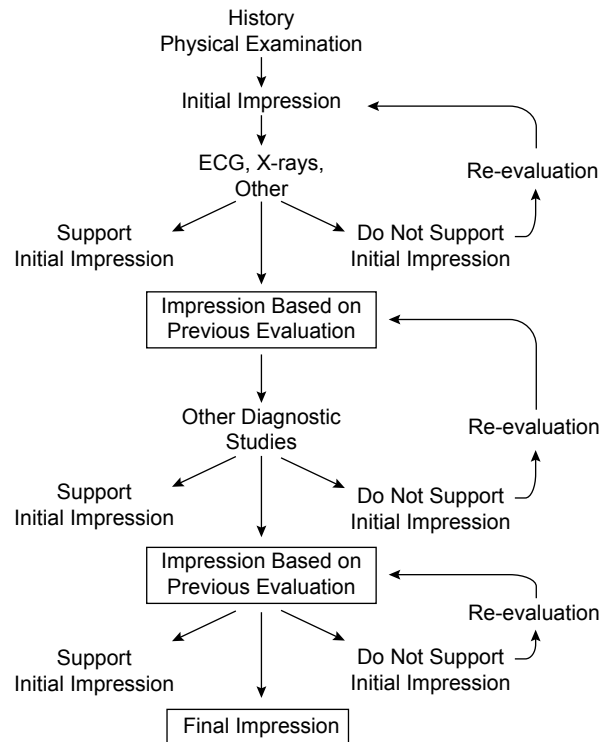


Figure 4. Diagnostic approach to the patient. At each stage there must be self-assessment of the diagnostic process.

physician who receives the most praise is the one who makes the fewest errors, not the one who makes no errors, because there is no such physician; the physician is a human being and to err is human. When the physician makes a mistake, the patient suffers. Look at the difference between the fighter pilot and the physician. If the piloting instructor or student makes an error, then the plane may crash, so both will suffer. In contrast, if the medical instructor or student makes an error, they will remain unharmed, but the patient will suffer. This must be stressed to medical students from their undergraduate years. Physicians must know and accept their errors and must try to note the reasons that contributed to them.^{1,12,13} Only in this way will errors be avoided in the future, because «το δις εξαμαρτείν ουκ ανδρος σοφου» (the wise man does not make the same mistake twice).

Continuous education

«Γηράσκω δ' αεί πολλά διδασκόμενος» (As I grow old I am always learning more) – Solon

Medical science is continually evolving. Apart from

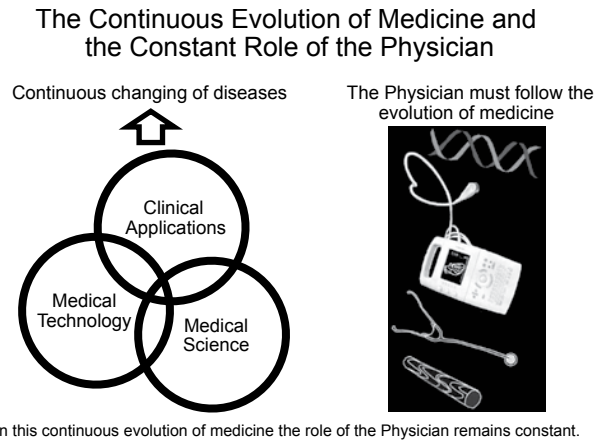
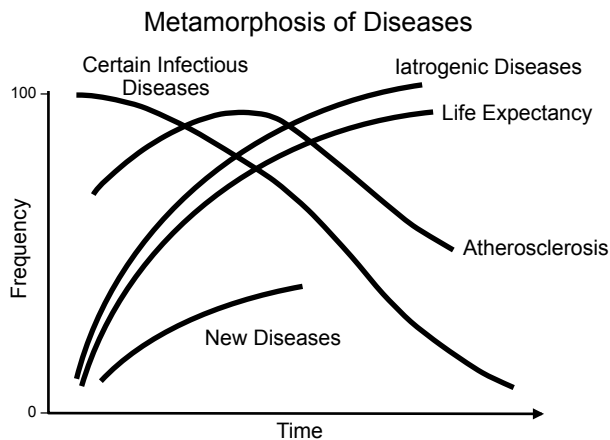


Figure 5. The continuing development of medical science and technology and their application in clinical practice will result in the continuous transformation of diseases and their manifestations, as has happened in the past (left). Physicians should follow the development of medical science and technology and adjust their knowledge accordingly; however the purpose of keeping their fellow human beings healthy remains constant (right).

the knowledge that relates to basic mechanisms, everything the physician learns as a student, intern, resident, or fellow will be out of date after a few years.^{1,2,7} At the beginning of the last century, the physician based diagnosis and treatment mainly on clinical observation. Today, however, basic knowledge of technology and the basic principles of pathophysiology, molecular biology, genetics, biological systems, etc, are required.

The steady development of medical science and technology, and their applications in clinical practice will result in a continual transformation of various diseases and their manifestations, as has been seen in the past (Figure 5). This will go on for as long as human beings exist. In consequence, the physician must follow the development of science and technology, constantly adapting to newly acquired knowledge. In the USA, for example, a physician's license to practice must be renewed every two years. For this reason, the physician is obliged to follow courses, lectures, seminars, congresses, and so on, and to obtain respective certificates. In addition, every ten years physicians have to take examinations to reconfirm their specialty, which are exhaustive and cover the latest developments in that area.

The only fixed point in the development of medical science is the physician's mission. People come and go, social systems appear and disappear, empires are created and lost, but the physician's mission, which is to keep his fellow human beings healthy, remains constant. Since health is a divine gift and the

physician's mission is to preserve health, the physician is practicing a divine vocation. As Steven Page said, "if the physician's life cannot be a divine vocation, then no life is a vocation and nothing is divine."

References

1. Wooley CF, Boudoulas H. Clinician. *Hellenic J Cardiol.* 1993; 34: 241-43.
2. Boudoulas H. Medical education. *Hellenic Medicine.* 2006; 72: 228-230.
3. Hall J. Cardiology training in the United Kingdom. *Rev Cardiovasc Med.* 2011; 12: 229-230.
4. Boudoulas H. There is no substitute for talent. *Hellenic J Cardiol.* 2005; 46: 375.
5. Wooley CF, Sparks EA, Olsen S, Boudoulas H. A cardiovascular teaching laboratory: the master class in ambulatory teaching. *Hellenic J Cardiol.* 2008; 48: 7-16.
6. Langmuir A.D. The training of the physician. *N Engl J Med.* 1964; 271: 772-774.
7. Boudoulas H. The well-rounded clinician. *Hellenic J Cardiol.* 2005; 46: 317.
8. Dialogues of Alfred North Whitehead as recorded by Lucien Price. David R Gordine Publisher, Boston 1954.
9. Geleris P, Boudoulas H. Problems related to the application of guidelines in clinical practice. A critical analysis. *Hellenic J Cardiol.* 2011; 52: 97-102.
10. Peabody FW. The care of the patient. *JAMA.* 1927; 88: 877-882.
11. Boudoulas H. Medical error in clinical practice. *Hellenic J Cardiol.* 2006; 47: 129-130.
12. Wu AW, Folkman S, McPhee SJ, Lo B. Do house staff officers learn from their mistakes? *JAMA.* 1991; 265: 2089-2094.
13. Myers JD. Preventing iatrogenic complications. *N Engl J Med.* 1981; 304: 664-665.