

The Neurosurgeon as Mentor and Student

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The term *mentor* derives from a character by that name in Homer's *Odyssey*. Mentor was the loyal friend, counselor, and teacher of Odysseus' son Telemachus while Odysseus made his long journey back from the Trojan war. Apparently, the goddess Athena (the goddess with the flashing eyes), who was infatuated with Odysseus, assumed the form of Mentor while watching over Telemachus.(5,7) So it is unclear if Mentor represented an actual person or if Mentor was the goddess Athena who had transformed herself into a human being. To quote from the *Odyssey*, "she [Athena] assumed the appearance of Mentor and seemed so like him as to deceive both eye and ear."(10) The names *mentes* and *mentor*, along with the word, *mental*, stem from the Greek word for mind (*menos*), a marvelously flexible word that can mean intention, force, or purpose as well as mind, spirit, remembrance, or courage.

One of the greatest mentors in antiquity was the centaur Chiron. Centaurs were half man and half horse. Most centaurs were more like beasts than men and, as a rule, wild and savage creatures. Chiron, however, was an unusually kind and peaceful centaur, who mentored many of the Greek leaders. Chiron had the energy and constitution of his wild nature, but he gentled and redirected it to teaching. He was the bridge between humans and the higher powers of nature and the universe. Chiron was a foster father and trainer to an army of Greek heroes including Hercules, Achilles, Actaeon, Peleus, and Aesculapius, the greatest surgeon of antiquity.(7) Chiron also taught the use of herbs, gentle incantations, and cooling potions. As a mentor, Chiron led his heroes-in-training through their threshold of manhood by patiently teaching them the skills of archery, poetry, and surgery. Chiron received the highest distinction the Greeks could bestow. Zeus transformed him into a constellation in the rising Zodiac: Sagittarius, a centaur firing a bow.

Medicine can trace its lineage to the legendary mentor, Aesculapius, one of Chiron's pupils. Aesculapius became Greece's god of medicine and was able to help all types of maladies. He delivered all, whether suffering from wounded limbs or bodies wasted away with disease, even those who were sick unto death, from their torment. Apparently, he raised Theseus's son from death, an act that led to Aesculapius' death. Zeus would not allow a mortal to exercise such power over the dead, and he struck Aesculapius with a thunder bolt and killed him.(7)

Throughout antiquity, temples to Aesculapius, the equivalent in Egyptian mythology of Imenhotep, were common throughout the Mediterranean and for hundreds of years attracted patients seeking miraculous cures. In these temples, the sick and maimed prayed and made sacrifices. During sleep, Aesculapius revealed to the patients how they would be cured. Snakes were considered sacred servants of Aesculapius and played a significant part in cures. This association is most likely why the most recognized emblem of medicine, the caduceus, also known as the staff of Aesculapius, is a serpent entwined around a staff. Followers of Aesculapius, known as Aesculapiads, practiced in temples ministering to the sick.(15,21)

One follower of Aesculapius, Hippocrates (460-377 B.C.), changed the practice of medicine from an art involving the sacred to a discipline based on observation, reasoning, and experiments. Two of the most brilliant ancient philosophers, Plato and Aristotle, mentioned Hippocrates' name with obvious admiration and respect. Plato called him "Aesculapiad" and Aristotle referred to him as the "leader of the Aesculapiads."(17) Hippocrates rejected the long-standing concept that illness was caused by divine powers. He attributed disease to natural causes and believed that treatment should be based on observation, reasoning, and experience. This radical departure from convention earned Hippocrates the title, the father of medicine.(16)

According to Hippocrates, the ideal physician was concerned primarily with the patient, not only with the disease.

Hippocrates could be called the father of spine surgery. In his book *On Joints*,⁽²⁵⁾ Hippocrates described anatomy and diseases of the spine and suggested treatment for patients with spinal deformities. He considered knowledge of spinal anatomy essential for physicians: “one first should get the knowledge of the structure of the spine; for this is also a requisite for many diseases.”⁽¹⁶⁾ Hippocrates described the segments of the human spine in the *Nature of Bones*^(9,16) and classified diseases of the spine into five groups: kyphosis, scoliosis, concussion of the spinal cord, dislocation of the vertebrae, and fracture of the spinous processes. These abnormalities were treated by correcting the abnormal curvature and by reducing the dislocation. He used what is now known as Hippocrates’ ladder and Hippocrates’ boards to help achieve these goals. He also described cranial procedures. Hippocrates used trephining to treat skull fractures, epilepsy, blindness, and headaches.⁽¹⁾ His instructions for the use of trephination were precise:⁽¹⁾ The opening should not be made over the cranial sutures because the dura, which adheres to the skull in this area, would likely be damaged. The region of the temple was to be avoided for fear of damaging a vessel—possibly he was referring to the middle meningeal artery—and such damage might lead to convulsions on the opposite side of the body. The trephine was to be removed repeatedly from the skull cooling the burr hole with water intermittently. The opening was to be examined to ensure that the dura was not yet reached. He advocated leaving a thin shell of the inner table to protect the dura, which would later extrude itself as suppuration developed.

Hippocrates also knew that extradural bleeding could result from a blow to the head^(1,11) and that the presence of a skull fracture was a matter of grave concern that required immediate

attention. If left untreated, it could cause fevers “7 days in summer or 14 days in winter,” followed by local changes in the wound, convulsion, and death.(1) Hippocrates rejected the idea that convulsions were of sacred or divine origin and attributed the notion to charlatans, conjurers, and excessively religious persons who used the concept to hide their own ignorance.

Hippocrates was respected, not only as a great physician, but as an inspired teacher, that is, as a *mentor*. One of his followers was Galen (129-200 A.D.).(15,21) At an early age, Galen received intensive instruction from his father who exposed him to the importance of anatomy, empiricism, and the doctrines of Hippocrates. Galen’s contribution to medicine were staggering. He wrote extensively: 9 books on anatomy, 17 on physiology, 6 on pathology, 14 on therapeutics, and 30 on pharmacology. Galen’s views dominated European medicine for 15 centuries until the time of Andreas Vesalius (1514-1564) and William Harvey (1578-1657).

Not until the 17th century, the “age of scientific revolution,” did a major turning point in the history of medicine occur. Instead of asking *why* things occurred, scientists began to ask *how* things occurred. However, the 17th century was not an innovative period in medical education. In universities and medical societies teaching was at best haphazard and depended on the works of antiquity or the writings of arabic authors such as Avicenna.

Throughout the 17th and 18th centuries and most of the 19th century, medicine was taught at medical centers that greatly benefited from the charismatic presence of a single teacher or mentor. Alexander Monro (1697-1767), who was succeeded by his son and grandson by the same name, was a master anatomist who made Edinburgh the principle center of medical instruction for the English-speaking world.(15,21) Morgagni (1682-1771) did the same for the university of Padua when he disposed of the ancient humoral theory of a single morbid cause for all diseases. Many giants, including Harvey, Hunter, Magendie, Virchow, Vesalius, Billroth, and

Horsley, contributed to medical education by teaching admiring student apprentices. Formal education of budding physicians before and after receiving their medical degree was nonexistent. Admission requirements for medical schools were minimal. Usually a high school or equivalent education was all that was needed. Annual sessions were short and often a repetition of previous years.(12)

In the United States, a few medical schools such as Harvard, Michigan, and Pennsylvania were attempting to establish university standards and faculties. In 1893 the establishment of Johns Hopkins University School of Medicine, headed by William Welch and William Osler, was a bold, inspired departure in medical education. Welch, a pathologist, first introduced microscopy and bacteriology to the United States. Osler was a firm advocate of extensive bedside training for medical students. These two giants, joined by William Halsted, changed American medical education and established a pattern that persists today.(12)

Two surgeons who are most responsible for making neurosurgery a subspecialty as well as being master surgeons, educators, and mentors themselves also have strong connections to Johns Hopkins. Harvey Cushing trained under Halsted at Johns Hopkins starting in the fall of 1896 and stayed as a faculty member until 1912, establishing himself as a “brain surgeon” in his early years.(4,24) Cushing also established the Hunterian Laboratory of Experimental Medicine at the medical school. He, of course, continued his brilliant career in Boston. As a surgeon, Cushing’s persistent inquiry gave birth to the modern science of neurosurgery. As a teacher, he was a relentless and sometimes hard task master. Yet he unfailingly won the lasting respect and affection of his pupils. He also was a generous man and established scholarships for the study of medicine at both Harvard and Yale University.

Walter Dandy started his training at Johns Hopkins as a second-year medical student in the fall of 1907. After graduation, Dandy became the sixth in line of Cushing's Hunterian appointees (1910-1911). At that time, Dandy claimed "Cushing was a dramatically good teacher."⁽²³⁾ Dandy remained at Johns Hopkins Medical University the rest of his illustrious career. Initially Cushing's pupil, Dandy, became a giant in neurosurgery rivaling Cushing himself. Dandy advanced the specialty of neurosurgery by continually questioning how, what, and why. His curiosity was combined with the courage to break new ground: "Not content with existing procedures when these seemed to be inadequate, his keen observation and deduction often led to a solution which meant the saving of a life in an apparently hopeless situation."⁽²⁰⁾ "Dandy was an unlikely and largely reluctant hero, but a hero for all that, to the young physicians and the many patients that came within his orbit."⁽²⁾ His loyalty to the Johns Hopkins Medical Institution is legendary.

Johns Hopkins required a college degree as a prerequisite for admission. The university provided a 4-year curriculum, made extensive use of laboratories for teaching, and integrated the hospital and college facilities to provide clinical training to advanced students. In 1904, Halsted's resident training program, modeled after the German *Oberartz* system, consisted of serving as an assistant for 6 years in preparation for 2 years as house surgeon (similar to the contemporary chief resident).^(6,12) The trainees received extensive clinical experience and were expected to engage in research. In 1954 this pattern of training was formalized by the committee on graduate surgical training (now the resident review committee in surgery).

Although the education of medical students and residents at Johns Hopkins was somewhat structured, the training of most medical students was still seeded with corruption, profiteering, fraud, and malpractice. In 1910, the Flexner report (commissioned by the Carnegie

Foundation for the advancement of teaching) on medical education in the United States and Canada helped to introduce the standard medical curriculum, which persists, largely unmodified, today. Before the report, the primary problem with medical education centered on the motivation to profit from educating physicians and a concomitant disregard for libraries, laboratory facilities, admission standards, or even knowledgeable faculty. It led to an epidemic of iatrogenic morbidity and mortality.(8)

Besides emphasizing biomedical teaching and standards, Flexner stressed that budding physicians needed “a varied and enlarging culture experience.”(3) Consequently, medical educators in the latter half of the 20th century turned their attention to training humane physicians to treat illnesses, not only with technology and pharmacology, but also with attentive listening and empathy. In the beginning and even now for a variety of reasons, this move to teach humanities to future physicians was and is quite slow. Students were and are infatuated with high technology (i.e., computers). Financial incentives often overshadow appropriate and correct patient care. An ingredient appears to be missing, an ingredient needed to transform brilliant biomechanical technicians into effective healers. Perhaps incorporating a humanitarian curriculum into medical schools or even earlier in high schools or college could reverse this tendency. The days of subjecting medical students to overwork, abuse, demeaning attitudes, and unrealistic demands must end. Physician-teachers who apply scientific and humanistic views to the marvelous technology of contemporary medicine and through it, to healing, need to serve as actual mentors to foster this mindset.

Over the last half century, the medical world has become bureaucratized and depolarized and, yes, specialized. Yet the popular expectation of medicine remains in part traditional, that is, to receive excellent care from caring, devoted physicians. Nevertheless, almost all Americans

also want that excellent care to include the latest breakthroughs and high-technology procedures or techniques. With these conflicting changes and demands, how can the learning process be structured to avoid becoming depersonalized, boring, procedural, and, ultimately, unsuccessful?

The greatest challenge to improving medical education is to modify the internal culture of the academic health center to reinforce the scientific and humanistic values that medical educators wish to impart. At present, this is no small task because the managed-care revolution has caused medical schools and teaching hospitals to become less friendly to patients and students, contributing to the deterioration of bedside clinical skills, and to the demoralization of faculty. Perhaps it has affected the quality of care adversely.(13) Managed care is a business that survives, in part, by its ability to deny customers the product they want, a product that can be the difference between life and death. A patient's bill of rights presently under consideration by congress should provide the right of a second opinion, prohibit health plans from paying bonuses to administrators for denying care, guarantee access to emergency care and specialties, and establish procedures for timely internal and external review.

The emphasis on the bottom line has eroded the quality of the clinical learning environment, particularly by reducing the time available for teachers to teach and for students to learn.(13,14) One might wonder about the long-term consequences of educating the nation's physicians in today's commercial atmosphere in which a good visit is a short visit, patients are "consumers," and institutional officials more often speak about the financial sheets than service and relief of patients' suffering. This attitude challenges the altruism and idealism that students typically bring to the study of medicine.(13,14)

To make the culture of teaching centers less commercial and more service oriented requires not only attention to formal didactic teaching but active faculty mentoring. This combination can help create competent residents and physicians.

This competency should continue throughout a physician's career. In 1910 Flexner recommended that physicians pursue life-long learning and critical teaching skills.(19) Until recently, Flexner's educational recommendation has not been implemented. Acquiring competency during medical school and residency is mandatory, and maintaining that competency is just as crucial. The ABMS appointed a task force on competence in March 1998. The ABMS is the umbrella organization for 24 member boards, including the American Board of Neurological Surgeons (ABNS).

Board certification signifies that diplomates have met their board standards through education, training, knowledge, skills, and experience. The public, hospitals, health plans, and other organizations recognize these certification credentials as attainment of high standards. Nevertheless, the ABMS and its member boards recognize that board certification does not necessarily guarantee that a diplomate will practice competently after the certification process. The public has come to understand this point as well. Recertification by most boards every 10 years or so is designed to stimulate diplomates to "keep up" with new knowledge by testing, usually by taking a written examination.

Unfortunately, simply passing a written examination does not connote competency in contemporary medical practice. Medicine, especially highly technical specialties such as neurosurgery, changes more often than every 10 years. Changes occur almost daily. Neither the appropriate and skillful use of these changing technologies nor desirable characteristics such as professionalism and communication skills can be assessed adequately by a written examination.

Consequently, the ABMS and ACGME have agreed on six general competencies that both residents and practicing physicians should display: patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and system-based practices.(18) Most of these competencies are self-explanatory. System-based practice needs further explanation.

Competency in a system-based practice means how a physician practices cost-effective care, understands the interaction of practice in a larger system, and acts as an advocate for patients within the healthcare system. These general competencies were introduced to the accreditation of residency programs on July 1, 2002. The six general competencies can differ, depending on the specialty. For example, the communication skills needed by a neurosurgeon differ from those of a pathologist. Medical knowledge and patient care also differ among specialties. Despite these differences, competencies should be measurable, teachable, and learnable.

Besides the six general competencies, the ABMS and its member boards agreed that four primary elements are required to maintain certification:(18)

- (1) evidence of professional standing
- (2) evidence of commitment to life-long learning and involvement in periodic self-assessment
- (3) cognitive expertise
- (4) practice performance

Being competent in these four elements will assure that a physician is a “life-long” learner (i.e., a life-long student).

The ABNS has adopted the ABMS definition of evidence of professional standing. The physician must hold an unrestricted license to practice medicine in at least one jurisdiction in the United States, its territories, or Canada. If licenses are held in more than one jurisdiction, all licenses held by a physician should meet the requirement. Letters of concern or reprimand shall not be considered a restriction.

Life-long learning might consist of an open-book examination every 2 years, continuing medical education (CME) hours, or both. The cognitive examination most likely will be a proctored closed-book examination, taken at a computer center and based on questions from the open-book examinations.

Practice performance might consist of key case submissions (i.e., 10 consecutive anterior cervical discectomy cases for spine specialists or 10 consecutive clippings of a supratentorial aneurysm for vascular specialists). These analyses would be submitted every 2 years. The second component of practice performance could consist of analyzing all consecutive operative cases during one year, that year being 1 to 2 years before the physician takes the cognitive examination. The analysis of these cases is not punitive. Rather, it is educational with the hope of improving patient care by comparing data from one period to another.

Physicians and teachers should be mentors to medical students, residents, younger colleagues, and even to peers. They have a chance to influence budding or new physicians. They need to devote the extra time and effort to impart knowledge and skills and to guide and counsel them. Their excitement and enthusiasm should be visible. They should share their failures as well as their successes—but the students' role in success and the teachers' role in failures should be emphasized.

Patients not only seek relief from pain, suffering, disease, or disorders, they also seek counseling and guidance, that is, mentoring. The physician's primary professional duty and responsibility is the appropriate and compassionate treatment of patients. This duty should be performed with integrity, honor, respect; it should never be driven by self-serving, greedy, or financial goals.

From the heroes in Greek mythology to Hippocrates to Halsted, Flexner, Welch, Osler, Cushing, Dandy, and others, we in Neurosurgery have had the good fortune to have enjoyed great mentors. A mentor is someone who cares; someone who is competent and gives of themselves freely; someone who values respect, knowledge, and fairness. All physicians can be such a mentor. All physicians *should* be such a mentor, whether to your colleagues, students, patients, or their own children.

Medicine is at a crossroads with pressures related to financial management, high technology, litigation, and endless paperwork, all of which erode the humanistic, caring way that we want to treat our patients and the way our patients want to be treated. Being a competent physician means being a mentor and a student, creating an environment that emphasizes excellence and healthy morale. In this way we can hope to navigate safely through the difficult terrain ahead so that at the end of the day, we have the respect of those around us but, more importantly, our own.

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