Presidential Address: How Shall We Teach? How Shall We Learn? Educating Hand Surgeons in the New Millennium

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Before I begin I would like to ask two questions. I do this to characterize you, my audience. First, I ask all the students to raise their right hand. Next, I ask all the teachers to raise their right hand.

My great hope is that each of you in this room raised your hand in response to both questions. My expectation is that you are, as I am, a life-long learner and teacher. Teaching and learning have a special relationship. Let me illustrate this relationship. A man boasted to his friend that he had taught his dog how to whistle. The friend put his ear up close to the dog's mouth and listened intently. "I don't hear anything," the friend said. The man replied, "I said I taught him to whistle. I didn't say he learned it."

As health care professionals you and I are obligated by those who give us license to practice our craft to learn about new knowledge that enhances our ability to care for our patients. As for teaching, we do not all lecture medical students or mentor residents and fellows. If we care for patients, however, we continually teach. Indeed, the word "doctor" is derived from the Latin "docer" meaning "teacher." Since my subject is teaching and learning, let me offer the following definitions: *learning* is the interest in acquiring information; *teaching* is helping the acquisition of information and stimulating that interest. *Education* is learning and teaching.

While some of the tools we use in medical education have changed radically, until the early part of this now dying decade the basic methodology has been the result of a simple linear progression from prehistoric time. Teaching and learning were two sides of a simple equation. On one side was the expert, or primary source, and on the other side was the unfilled vessel. The physician's teaching/learning paradigm has always involved pedagogic methods designed to make each new physician an independent information master. Knowledge was transferred from some primary source to what would become in time the next generation's expert or primary source. This transference took successive forms as first one epistemologic theory prevailed only to be replaced by another. Socrates had his methods and Plato his. Both were good teachers for they satisfied Milton's definition: "A good teacher is one whose spirit enters the soul of the pupil."

At this moment we are involved in the very oldest of these transference processes: the lecture. The scope of verbal transmission was on a one-to-one or a one-to-just a few basis. History has failed to record the name of the first boring lecturer. This is, of course, someone who talks in someone else's sleep.

The transmission of information became enhanced when we attained the ability to represent objects and ideas by written symbols. Information and thus

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knowledge no longer depended solely on the memory of the primary source and could more readily accumulate. Since copying by hand was expensive, however, distribution remained limited, as did the scope of information. For example, one simple historical event, the burning of the Alexandrian library in the seventh century, resulted in the instantaneous loss of most of what medical information had been accumulated, ushering in the dark ages of medical informatics.

By the 15th century, the printing press brought about a marked but still linear change in the distribution of and access to medical information. We could now teach and learn from books whose pages could be illustrated to augment the reader's understanding. More books led to the need for more libraries and more librarians.

There followed a slow accumulation of information, especially within these central repositories. Recall that the printing press predated the Industrial Revolution by almost 300 hundred years. We could produce books but we were still primarily a survivalist agrarian society in which most worked to feed themselves and thus survive. This changed with the Industrial Revolution. We now could work part of the time to feed ourselves and with the remaining time make things to improve ourselves. One of the things that we made was information. By thinking and discovery, the pace of medical information acquisition increased. Because books remained relatively expensive until this century, however, personal access to medical information remained limited. If you were a 19th century hand surgeon, the information was either in your head or it was probably unknown to you.

Sometime around the middle of the 20th century we entered into the information age, an age characterized not by the manufacture of things but by the creation and distribution of information. This had a very profound effect on what has been termed the *information life cycle,* which Faughnan and Elson[1] defined as a cycle beginning with the creation of some new packet of information, followed by its representation, then storage, integration, presentation, indexing, retrieval, maintenance, and finally obsolescense. In past eras, the cycle slowly evolved from creation to obsolescense. Unvalidated information frequently had an abbreviated tour through the cycle. Good information had a way of rising, albeit slowly, like cream, to the top.

Today, electronic representation of information, termed *information technology* or *informatics,* allows rapid and theoretically unlimited production and access, unlimited transformations (termed *multimedia*), and potentially unlimited personal acquisition and storage. The file drawer full of valuable reprints has given way to PubMed software and a 3-gigabyte hard drive. Some have termed this the *era of article onslaught.* Information technology has forever changed the "knowledge landscape," the environment within which we clinicians work. Today there are more than 25,000 scientific journals. Who knew that typing would become a critical skill, as critical to our professional survival as hunting skills were to our human ancestors. To quote Faughnan and Elson[1]: "Today, it is no longer efficient and perhaps it is now impossible for each of us to be independent 'information masters.'"

We stand within the initial envelope of a revolutionary event, one that threatens to derail this linear progression of the rules and methods that have governed teaching and learning since the time of Socrates. We must be aware, however, that learning is not just filling the void with information. For, as T. S. Elliott wrote, "Where is the wisdom we have lost in knowledge? Where is the knowledge we have lost in information?" Or, to quote Goethe: "Knowing is not enough, we must apply. Willing is not enough, we must do."

Today, information technology, medical knowledge, and the economics of medical practice are on a collision course. The consequences, like that following the collision of critical masses of radioactive elements, will change the way we work; the way medical knowledge is processed, packaged, and delivered; and the way patients obtain medical care and information. The consequence portends a profound metamorphosis, a Shakespearean sea change.

Information Technology

Consider first information technology. The rapid changes in information technology are now legendary. This includes hardware such as the microprocessor chip. The co-founder of Intel Corporation, Gordon Moore, gave his name to Moore's Law, which states that the computational power of the chip doubles every 18 to 24 months. The doubling time seems to be shrinking, however; so fast that, as humorist Dave Barry notes, the computer you really need is the one introduced 45 minutes after you bought the latest model. Although computers are everywhere, for many of us our interaction with computers is, as Gabgan[2] describes, "like early awkward sex, you don't know where to put your hands and you don't know how to ask for what you want."

We have witnessed, according to Randall Tobias, a former ATT Vice President, a 3,000-fold improvement in computing power over the last 30 years. A similar rate of progress in the automobile industry would translate today to a Lexus that costs $2.00, travels at the speed of sound, and gets approximately 600 miles to a thimbleful of gasoline.[3]

There have been similar transformations in the way information is represented, integrated, retrieved, and distributed. This transformation has given rise to a new medical discipline, medical informatics, with graduate programs awarding PhDs.

Technology moves very fast. Some years ago Bill Gates, the founder of Microsoft Corporation, was quoted as saying that no one would ever need more than 640 kilobytes. In 1986, the then merely wealthy Bill Gates, in distinction to what some see as the obscenely wealthy Bill Gates, wrote a rather gushing forward to a book entitled *The New Papyrus.* The book touted a then-emerging technology, the CD-ROM, as "forever transforming the information industry." Five years later, CERN, the European Particle Physics Consortium, introduced the information "superconductor," the world wide web. The web and the internet have accomplished the remarkable feat of lowering the cost of information distribution to nearly zero. Like the CD, will the web be on the way toward obsolescense in a few years? All the futurists say definitely no!

The distribution system is itself now driving hardware technology design. Does the word I-Mac ring a bell? This change in information distribution is also altering hardware marketing decisions. An advertisement for a complete computer system with the almost latest bells and whistles and costing less than $300 appeared in the July 27, 1999, New York Times. The message here is very clear. The information industry has discovered, as King Gillette discovered a century ago, that the profit is not in the razor, but the razor blades. The profit center is no longer the hardware or software but the distribution system. My friends, this is the Revolution and it is already here! And it is gathering speed. In computers, speed is everything.

Now I know that many of you have already had this explained to you by your sons and daughters, but for the others, let me bring you up to speed by reviewing some terminology. It's all quite simple actually. Or, as Mark Twain, explaining the music of composer Richard Wagner, wrote: "It's not as bad as it sounds."

Every letter and number and symbol that we might use to communicate our ideas can be represented by some combination of ones and zeros. These ones and zeros are termed *binary digits* or a *bits.* It takes 8 of these binary digits to represent a letter or number. These strings of 8 bits is termed a *byte.* For reasons not worth worrying about, a kilobyte equals not 1,000 bytes but 1,024 bytes. A typical floppy disk might have room for (and the term is *store*) 1 megabyte or 1,000 kilobytes (1 million bytes). A CD can store approximately 650 megabytes. Most computers now come with hard disk drives that have a capacity of 1 to 6 gigabytes. A gigabyte is 1,000 megabytes or 1 billion bytes. These numbers start making your head swim, especially the predictions of future storage capacity of a billion billion bytes. Hearing these numbers always makes me think of the late Carl Sagan talking about the "billions and billions of stars out there in the galaxies."

Information is currently transmitted across the world wide web via a system now termed *internet I,* so termed because we will soon have internet II. Internet I, the current system, carries information at 10 megabytes per second. Internet II will increase the speed of transmission 10- to 100-fold. With the soon to be readily available fiber optic cable connections, this means that with internet II, theoretically, a 3-gigabyte hard drive can be fully stuffed with new information in about 4 seconds.

The impact of new technology, such as virtual reality, on how we teach and learn facts (information) and skills is really just in its adolescence. Tomorrow's hand surgeons, that is, today's medical students, are experiencing, albeit still slowly, the changing knowledge transference paradigm. The old paradigm saw education as a product or a destination. Today's paradigm sees education as more of a process or a journey.

The computer laboratory with its clusters of computers and interactive problem sets will soon be relics of the past. I am speaking about this new technology's simplest application and, in my mind, that is in how we now, and will more so in the future, teach old subjects in new ways, for example, using virtual reality.

Virtual Reality and Education

Virtual reality is as old as 3-dimensional photography. Many may remember seeing advertisements for commercial virtual reality devices that incorporated 3-dimensional scenes, aromas, stereo sound, and motion and only cost ¢25 a ride.

Computer-generated virtual reality has a great educational appeal. If the interface is intuitive, all brain power goes to learning. There is both spatial and psychomotor engagement. This is termed *presence.* We always learn better what we want to learn; therefore, making it a more compelling experience. That educational sage Roy Meals said it best: "Learning is enhanced when the lesson is relevant, and enjoyable when students are challenged to reach beyond the current base of facts and understanding."[4]

A few examples now or soon to be available over the internet include the following:

- A proposed CD and internet-based educational tool on fractures of the distal radius under development by Dr Amy Ladd at Stanford University and funded in part by the American Society for Surgery of the Hand. Dr Ladd has digitized a series of photographs demonstrating the changes in the growing skeleton and created from these images an animation of the growing skeleton, making the subject become more alive and interesting for the reader.
- Stephanides and colleagues have produced an interactive internet-based study on how to repair a cleft lip so that surgical techniques can be learned over the network with interactive multimedia tools.

Consider the example of the teaching of structural human anatomy. Technology is reversing the trends of texts such as *Grey's Anatomy,* which for decades has reduced medical students to tears by bleeding all the color and art from their subjects. Recall that during the Renaissance public dissection provided recreational titillation much like today's amusement park rides.[5] Computers have provided the opportunity to combine the precision of classic anatomic texts with some of the 3-dimensional thrills that kept those renaissance audiences glued to their bench. The Visible Human Project sponsored by the National Library of Medicine has returned head-to-toe anatomy to a spectator sport.

Cadavers are still dissected in most medical schools; in many, however, it is to demonstrate a point first learned on simulations derived from the Visible Human Project. Computer-enhanced anatomy education allows the student an almost unlimited opportunity to conceptualize relationships. A specific region can be constructed and deconstructed again and again. A region can be explored from the inside out. Digital representations can be manipulated at will, and tissue elements added or removed at will. Multimedia allows even more indepth understanding.

One such project, VisualizeR, has been developed by Dr Helene Hoffman at the University of California, San Diego. VisualizeR is a general purpose-learning environment to support educational domain. It uses multimedia for curricular depth and virtual reality for compelling 3-dimensional simulations. The goal is to make the educational experience authentic yet risk free. Students have permission to fail. These scenarios not impossible in the real world.

Functional parameters, once identified, can be easily added. Consider an interactive digit that could be used to study the consequences of altering the biomechanics by altering the anatomy. With computers, tomorrow's students will be able to anatomically model a radial nerve palsy and then witness the biomechanical consequences of tendon transfers. Future applications include dissecting anatomic models together via network, performing surgery together on a simulation available to both parties, and a library of anatomic variations that will allow a specific anatomic variation to be downloaded.

Virtual Reality and Surgical Training

Virtual reality and computer-assisted education is altering how we teach and learn about new products and procedures. Surgeons will be able to use specifically designed computer-based virtual reality modules to learn about new technology and even practice basic psychomotor skills before they attend the hands-on skills workshop.

There are some consequences of this information revolution that are and will be even more unique to the education of surgeons and that will impact on how we surgeons practice our craft. The process of educating a surgeon has evolved little since the time of Halstead. Perhaps this is a consequence of our notorious resistance to change. Surgical learning still remains a hands-on apprenticeship, usually conducted in the clinical environment, with progressively greater responsibility given as technical skills and judgment increase. The myth is exemplified by the old saw, "See one, do one, teach one." The reality is more, "See one, screw up the next two or three before finally getting one right." This quote from Bertrand Bell appeared last year in *New Yorker* magazine: "The culture of surgical training does not encourage the inexperienced to ask for help or assistance lest they be seen as weak ignoramuses."[6]

We all recognize the risks of such a system. We train primarily on live patients because practicing on animals arouses even greater controversy than practicing on live patients. Cadaver-based training is limited by supply and inert materials are rarely used because of profound dissimilarities. We also recognize the limitations of a system that depends on a totally subjective analysis of when competence has been achieved. We cannot even define competence in surgical skills.

Technology offers the possibility of altering this paradigm in a way that potentially addresses both issues: risk and analysis of competence. Training using virtual reality simulations is an old concept made modern by the leaps in microprocessor technology. The first flight simulator was developed 5 decades ago. It had a few virtual instruments and reality was provided by a couple of strong guys shaking the device. Four decades were to pass before training in a simulator became the standard for the industry.

Virtual reality as entertainment is as old as 3-dimensional photography. While our parents might have been entertained by viewing photographs through the hand-held viewer, we know what kinds of realism can be achieved with a hundred brilliant programmers working with a billion dollars of the latest hardware at the Star Wars film producer, George Lucas's Skywalker Ranch.

The application of virtual reality technology to surgical training is in its infancy, both in terms of technology and acceptance, but its evolution in both realms will be much more rapid than the flight simulator. Today its acceptance suffers from what I call the George Lucas effect. We have been spoiled by the consequences of virtual reality simulations costing hundreds of millions of dollars to produce. Our expectations are much higher than current medical virtual reality budgets can produce. There are many hurdles to acceptance, including the cartoonish quality of current images versus our Star Wars expectations and the issue of cost versus benefit. A 747 aircraft simulator costs about $12 million.

Today there are several commercially available surgical simulators designed to assist surgeons in training to acquire skills in such areas as anastomoses and arthroscopy. This virtual reality technology incorporates interactivity in real time and in 3 dimensions. Objects can be manipulated in real time with the operator's hand or with an instrument held in the operator's hand. Soft tissues can be made to deform realistically in response to being touched, probed, incised, and pierced. Using the technology of haptics, the object touched can push back with the appropriate pressure against the operator's finger or hand or instrument. Here again, optimization strategies can be determined and skills can be assessed. This application of virtual reality technology to the development of surgical skills has some interesting side effects in terms of allowing us to judge competence. The technology requires that a skill such as suturing be mathematically decomposed into its essential elements. The thrust is to identify essential elements and from these first develop, then validate, and finally teach optimization strategies. Competence might be assessed by analyzing one's proximity to what has been determined to be optimal strategy for a single task, such as making an incision, or sets of tasks, which is just another way of defining a surgical procedure. It is easy to measure what is too much pressure, for example. The next generation of surgical simulators will have tissues that feel normal to our hands, deform correctly, and even bleed when incised.

Today, virtual reality is a commercial product for teaching endoscopic and arthroscopic skills, even though it has yet to be convincingly demonstrated that surgical skills acquired in the virtual world are transferrable to the real world. This is a subject of tremendous controversy in the field of cognitive science.

While virtual surgery is in its infancy, another application of virtual reality technology, termed *augmented reality*, has reached adolescence. Accurate 3-dimensional representations of fractured bones, tumors and the defects that follow tumor ablation, and congenital deformities are now routinely used in many centers for evaluation and surgical planning. The ability to produce 3-dimensional images from 2-dimensional digital data has existed for many years. Current technology allows us to manipulate these representations in infinite ways. This ability far exceeds the now simple computational problems of turning perspectives. It is currently possible to remove elements to see underlying structures better, move parts to different locations and then redrape the skin and observe the effect, look at something from the perspective of living inside the object, and walk through, around, over, or under the object. Complex anatomy becomes clear. By adding various physiologic parameters we can now see the biomechanical effect of transferring a tendon arising from a muscle of a known cross-sectional area via one route or another. This biocomputational surgical planning should lead to optimization strategies for restoring function for complex paralytic problems, such as brachial plexus injuries or tetraplegia, or for designing a new artificial joint.

Computer-Assisted Surgery

The progression from computer-assisted learning to computer-assisted evaluation and planning to computer-assisted surgery has been rapid. This has been termed *augmented reality* to distinguish it from the total artificiality of virtual reality. Some surgical disciplines now routinely use computers in the operating room to augment their skills. Otolaryngologists performing endoscopic sinus surgery and neurosurgeons carrying out minimally invasive neurosurgical procedures have taken great advantage of the technology, primarily because the surgical field can be rigidly restrained and thus accurately registered to the computer-derived image.

As hand surgeons, we cannot so easily fix a hand or wrist into devices mimicking those used by neurosurgeons. The next generation of the technology, however, will permit us to operate on and move about an object because the computational language and speed will be able to instantly keep up. The proper term is *refresh rate.* Envisioned for us hand surgeons are such smart tools as virtual see-through mirrors that can overlay a precise image of the distal radius and carpal bones onto the patient's intact arm. Our wire-driver (some things won't change) will be instrumented and registered to the virtual skeleton. By voice command, we can ask to see how the trajectory that we have chosen for our fixation wire relates to the radial nerve and make adjustments if necessary. The computer can confirm that the wire or screw is going to engage the fragments as precisely as planned.

Medical Knowledge

The next meteor on this collision trajectory is the exponential growth of medical information or knowledge: article onslaught. This torrent of knowledge is threatening to sweep away traditional attitudes about ideal physician characteristics. Since Abraham Flexner issued his report in 1910, the working hypothesis driving medical education has been that the ideal physician, one ever alert, ever astute, and never in error, could be achieved given enough training. This paradigm is being severely tested by article onslaught and the information engines of today.

Those of us older than 50 years have been taught, as were Socrates's disciples, to locate and retrieve knowledge not stored in our heads by going to the primary source, for example, the experts who gather as the faculty of a course or symposium or the medical literature (some would consider this term an oxymoron.) We diligently attended courses and symposia, at least until current medical economics made it less feasible. We marched to the medical library, opened the *Index Medicus,* usually 6 to 12 months short of current, and wove back and forth through the stacks. When I was a medical student, I took a supply of 3×5 cards and made notes. When I was a resident, I photocopied whole articles and still have file drawers filled with these. All our younger colleagues and hopefully most of us former article copiers use different tools to do this now, modern tools such as a fast computer and the internet. The index is digital. The abstracts and even complete articles and illustrations are digitized, but the paradigm is centuries old. We still acquire information in a general didactic setting, such as this meeting, or in the format of a problem-based set, such as seeking the most recent recommendations regarding a specific clinical problem. In fact, for most clinical problems, we probably spend little time with the primary source or literature, depending instead on what is inside our heads. Tomorrow's clinicians will probably spend even less time with the primary literature, but the difference is that they won't feel guilty about it. We may eventually reach the point where we feel good about not knowing everything.

The greatest challenge brought about by this glut of medical information is that of validating the information. This gives rise to a critical question now being faced. Who should validate all this web-based information? Who can attest to its trustworthyness, its utility? Perhaps this is a coming role for a specialty society such as the American Society for Surgery of the Hand. I am not sure we can trust others such as the American Medical Association to be any more successful at this task than they were in assessing heating blankets.

Today, how are we dealing with the rapidly changing knowledge environment? One possible solution is to make use of modern information technology to allow nearly continuous updating of key knowledge. A conceptually attractive idea is that of the online textbook. Like a standard text, its content is the core knowledge of the specialty enhanced by expert commentary and, in the case of hand surgery, by the latest validated surgical techniques. Unlike its printed corollary, the online textbook is never outdated because it is continuously updated, even on a daily basis if the rate of acquisition of new and valid information demands it. Online texts, accessed through the internet, already exist and are proliferating rapidly. What are some of the potential benefits for the clinician of such an educational product? While it is designed to provide general didactic information, its real purpose is to be used at the point of service, delivering educational intervention at the point of care.

If today's answer to the rapid expansion of medical knowledge is the online textbook, never out of date, what about the future? How shall we as clinicians manage in this new knowledge environment where the scope of knowledge threatens the human capacity to process knowledge?

First, we will need to accept that machines can enhance our cognitive skills and, once that paradigm is accepted, begin to deploy machines to compensate for our human weaknesses, especially critical ones such as memory subsets. It is this weakness that leads to medical errors. Are medical errors perceived as a significant problem? Just read your newspaper. Recent studies indicate that between 50,000 and 90,000 people die each year because of medical error. If the same rate was applied to the airline industry, the result would be the equivalent of 3 Boeing 747 airplane crashes every 2 days.

We will surely experience even more explosive growth of knowledge, but new tools will make the management of this information much easier. These tools will be radically different than the familiar, all-purpose computer of today. They will be specialized, limited-purpose, networked tools, more than likely wireless. Data will be entered by voice, pen, or, sad to predict, keyboard. The goal according to such medical futurists as Yale University's Richard Satava[7] is the "personal professor" and the product, patient-specific/problem-specific knowledge, will be delivered at the point of service, just in time for the correct decisions and interventions. This soon-to-be-next generation can be conceptualized as a smart computer, one possessing the ability to "think" for its user and thereby artificially enhance his or her capabilities. What is envisioned are strongly trusted systems that provide knowledge; not information, but synthesized information that can be trusted enough to base decisions on. This has been referred to as *distributed medical intelligence*, referring to a system of medical communication that intelligently channels critical knowledge to where it is needed most at any given time. The role of medical education will become more one of how to use this information than of how to obtain the information itself.

The driving force will be an economic one, the contest to transform what is today a cottage industry, generating a few billion dollars each year (last year about $12 billion), into a trillion dollar industry. What will feed the information engine is the need to provide the right information, in the right form, in the right quantity, and at the right time. The smart tools to assist us are on the drawing board somewhere, their development driven by advances in artificial intelligence.

The next buzzwords will be *telemedicine cyberculture*. The goal is to have medical knowledge on demand worldwide. A European consortium is developing guidelines on structure so that the telemedicine information society does not develop in an ad hoc manner.

Attaining this goal means creating new clinical protocols for the practice of medicine, the emergence of new types of practitioners (even new types of hand surgeons), and the "webification" of medicine, meaning networked databases that dispense medical information off the world wide web together with a layer of human filtration. This will change the way we make decisions about patient care. Knowledge vending (ie, selling one's expertise) will take on a very new meaning. Medical content is currently being packaged for online delivery and brand-name educational products are on their way to a computer near you.

Since validating knowledge will assume an importance perhaps surpassing that of generating new knowledge, the education of tomorrow's physicians and hand surgeons must be refocused away from filling the head with facts and toward information management, or informatics. The role of medical education will become more one of how to use this information than of how to obtain the information itself. Within a few years information about a patient will come from a large variety of sources. Many of these sources will be tomorrow's consequence of today's nanotechnology incorporating biological microprocessors and molecular-sized motors. One greatly disquieting consequence of nanotechnologic advances that will enhance our physical and mental performance is predicted to take place in 30 to 40 years, when we will be faced with the choice of considerably altering ourselves by accepting the implantation of brain-enhancing materials, either mechanically or biologically derived.

Economic Issues

The last comet on the collision course is that medical practice is also undergoing great transformation; some would say that the transformation is detrimental. I do not refer to the economics of practice, of restraints brought about by managed care. I speak instead about the coming transformation that will surely be the consequence of evidence-based medical decision making. The demand from all sources, patients and payers alike, will be that decisions be based on validated information. They will demand that surgical competence be demonstrated before approving or accepting a procedure.

The cardinal ethic of medicine will become demonstrated competence: the possession and use of the requisite knowledge, technical skill, and humanism. During the next decades the points of medical power may no longer be the revered institutions, such as Stanford or Harvard or other great universities, Massachusetts General Hospital, or the Mayo Clinic, which have long represented themselves as the historical primary sources. Their replacements may be virtual knowledge centers.

Telemedicine, telementoring, surgical robots, and the personal professor: we must prepare the way for the digital physician. From what computer will the digital hand surgeon arise, however? Tomorrow's hand surgeons are of course today's and tomorrow's undergraduates, medical students, and residents. If we are to attract the best and brightest to our specialty we should understand what things influence the best students to choose a field. This has been well studied, both in graduating medical students and residents. The single greatest factor for both medical students and residents is the influence of a role model. As Albert Einstein is quoted as saying, "Setting an example is not the main means of influencing others, it is the only means."

Young physicians and physicians-to-be have identified the features most important in a role model as personality, clinical skills and competence, and teaching ability. Least important were research achievements and academic position. We all cannot take full advantage of what technology provides or will provide. Yet, all of us can strive to be good role models for tomorrow's hand surgeons.

Like you, I have been influenced by role models who exemplify exactly those attributes identified in the scientific studies I just mentioned. And, like most of you, the members of the American Society for Surgery of the Hand, I am here today because of the influence of my role models. Two are past presidents of this organization and the third willed it otherwise. First is my teacher and Stanford colleague, Robert Chase; next, my teacher and friend, Richard Eaton; and, finally, my teacher and guide to the world beyond surgery, J. William Littler. It pleases me to be able to publicly recognize them for culturing an engaging personality (theirs, not mine), for possessing formidable clinical skills and competence, and for being superb teachers and learners.

My final words are also words of gratitude to you, the members of the American Society for Surgery of the Hand, for allowing me the privilege to serve as your 53rd President. The word *more* characterizes this last year for me. More work, more stress, and more time than anticipated, but also more fun, more inspiration, and more satisfaction than I had ever envisioned.

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