

Theoretical Insights

We are only just realizing that the art and science of education require a genius and a study of their own; and that this genius and this science are more than a bare knowledge of some branch of science or literature.

Alfred North Whitehead, *The Aims of Education*

Learning Theory in Medical Education

If medical educators are to perform at our best, it is vital that we understand how people learn. Learning, not teaching, is the ultimate outcome of medical education, and we are unlikely to foster it effectively if we do not understand what it is and how it takes place. Yet most medical educators have little or no background in formal educational theory. If we are good teachers, it is frequently because we were blessed with good educational instincts, or because we had the good fortune to study with and emulate other good teachers. We need not leave our capabilities as teachers entirely to chance, however. Those of us who are not particularly accomplished educators can learn a great deal from the educational literature, and even those who are already very good can hone our skills even further. Happily, thoughtful people have been studying learning for many years, and important insights are readily available, if only we are prepared to look beyond the boundaries of our own field.

This section reviews four important learning theories that powerfully influenced educational practice during the twentieth century. They are not the only learning theories that were developed during this period of time, nor were they necessarily the most important. They do, however, provide a broad overview of the spectrum of theoretical approaches to learning. The very fact that there are four theories indicates that no single one has achieved universal dominance.

Unlike Newton's theory of gravitation, which largely put to rest attempts to develop alternative explanations for the attraction between objects, educational theorists have not achieved a single consensus. Each of the theories has its own strengths and weaknesses, and no one answers all questions. The purpose in presenting four different theories is not to suggest that we must choose one and completely eliminate the other three. Instead, each illuminates certain aspects of learning, and may provide valuable insights in certain situations. The goal in

reviewing these theories is to provoke our own reflective educational practice, and to inspire new approaches that improve our educational efficiency and effectiveness. Efficiency refers to the resources expended to achieve a particular goal. They may include time, effort, personnel (educator full-time equivalents [FTEs]), money, and so on. If we can achieve the same educational results with a lower expenditure of resources, then we have improved our educational efficiency.

For example, it might turn out that medical students can learn certain aspects of human anatomy using an interactive computer-based anatomy tutorial as well as when working one-on-one with an anatomy tutor. If that is the case, and if the computer-based tutorial requires substantially fewer person-hours of instructor time, then it offers greater educational efficiency. Effectiveness, by contrast, refers to the quality of the educational result; that is, what the learners actually take away from learning activities. If we better understand how we learn, we should be able to enhance the quality of education we offer. To a substantial degree, our implicit, perhaps even inchoate, theories of learning shape our educational practice. What are we trying to teach? How are we trying to teach it? How do we determine whether learners have learned it? The answers to these questions reflect our understanding of the nature of learning itself. What we are trying to teach is often referred to as curriculum. At first, curriculum seems quite straightforward, but it can be divided into at least two components: the formal curriculum and the informal curriculum.

The formal curriculum consists of the reading assignments, lectures, and other learning activities formally assigned to learners. In addition to the formal curriculum, there is also an informal curriculum, which consists of what learners learn that educators do not explicitly tell them to learn. For example, medical students and residents learn by observing how to interact with other health professionals, how to handle failure, and how to balance their professional and personal lives. Our sense of the boundaries between the formal and informal curriculum, as well as the content of each, is powerfully shaped by our theoretical perspective on learning.

How we teach is often referred to as instruction. What is our instructional approach? Do we think of instruction as consisting primarily of what we ask learners to read? Do we expect learners to learn primarily by doing? To what degree do we believe that all instruction should be planned out in advance as part of the formal curriculum? To what degree do we tolerate, or even seek out opportunities for ad hoc learning, seizing the so-called teachable moments that arise over the course of the workday?

If we think that all learning should be highly programmed in advance, or if we are simply so busy clinically that we think we do not have time to teach while caring for patients, then teachable moments are likely to pass below our radar screen. On the other hand, if we think that lessons that arise out of daily practice are among the most memorable for learners, then we are likely to pause from time to time during the workday to make sure that we take advantage of important learning opportunities.

Determining what learners have learned is frequently referred to as assessment. Are the medical students doing a good job of learning what they most need to know? How can we tell? What is the best assessment technique? Is it written multiple-choice examinations? Is it interviews? Is it watching the students in action, demonstrating the knowledge and skills they have acquired in caring for patients, either simulated or actual? Again, whether we recognize it or not, our theories of learning are in play.

How does the assessment process look to learners? How useful do they find our assessments in improving their own learning performance? Which would be better: a single letter grade at the end of a month-long rotation, or weekly or even daily performance appraisals that include advice on how to do better? Do we see assessment as primarily summative, that is, providing an overview of how learners have done? Or do we see it in primarily formative terms, aimed at helping learners do a better job of learning? If our learning theory says that improving learning is more important than selecting and sorting learners, then our practice is likely to incline in the latter direction.

Consider a crude learning theory. Suppose we thought that learning is really just the pouring of information from full vessels (the educators) to empty vessels (the learners). On this theory, doing a better job educationally might mean pouring more information, and educators might aim to convey to students the greatest possible amount of information. Learning, on this view, is simply retaining what has been poured into you. The best way to teach is the one that enables you to convey the most information in the least amount of time. Reading assignments should be long, lectures are a good way to teach, and educational interactions should be modeled after data transmission.

How do we know whether learners are performing well? We open them up, metaphorically speaking, and see what spills out. That is, how much of what they have read and heard are they able to reproduce on an examination that tests recall? Although most of us would see some serious shortcomings in such a model, we might also acknowledge that it is not too far removed from the practice of some educators and institutions.

The first learning theory to be considered here is behaviorism. The great progenitor of behaviorist psychology was the Russian experimentalist Ivan Pavlov. Pavlov demonstrated that dogs that had initially not reacted to the sound of a bell but heard a bell ring each time they were fed learned to salivate at the sound of the bell, a process he called operant conditioning. The dog, in other words, had developed a new and reproducible behavior, salivation, in response to the stimulus of the bell.

Behaviorism developed in the early and mid-twentieth century as a reaction to psychological theories that were regarded as difficult to operationalize in empirical research methods. In an effort to develop an experimental approach to psychology and learning, early behaviorists such as John Watson developed the stimulus-response model. A stimulus is an externally administered sensory cue that might be visual, auditory, tactile, or even painful. A response is simply the

subject's behavioral reaction. By manipulating stimuli appropriately, behaviorists thought, it is possible to achieve control of the subject's behavior. New behaviors might be learned, and old behaviors might be extinguished. Watson argued that the same conditioning that Pavlov had achieved with his dogs could be equally well applied to human beings. In the human case, additional stimuli and responses might be involved. For example, the stimulus might be praise, and the response might be correctly answering questions on a multiple-choice exam. Fundamentally, however, the stimulus–response model was the same. It did not matter what was going on inside the subject, in the case of learning theory, the mind of the student. What mattered was the subject's externally observable behavior.

The mind was a kind of black box, into which it was impossible to peer. In fact, it seemed doubtful to some behaviorists that the very notion of mind was meaningful. We should simply stop talking about minds, ideas, and emotions altogether, and instead focus on behavior. B.F. Skinner took this model even further, arguing that from a strict behaviorist perspective the very ideas of human freedom and dignity had become outmoded, and should be dispensed with (Fig. 2.1).



Fig. 2.1 Burrhus Frederic Skinner (1904–1990). One of the most influential psychologists of the twentieth century, Skinner's 21 books advanced radical behaviorism, the view that psychologists should focus on observable behaviors rather than hidden thoughts and emotions, and that reinforcements including rewards and punishments are the most important shapers of behavior. What would our accounts of education look like if we ruled out any reference to unobservable perceptions, thoughts, and emotions? Do great educators need to concern themselves with things they cannot directly observe? (Courtesy of Wikimedia Commons)

In the longstanding debate over whether nature or nurture exerted more influence over human character, the behaviorists were firmly on the side of nurture. As John Watson wrote: Give me a dozen healthy infants, well formed, and my own specified world to bring them up in, and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant—regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors. Building on Darwinian biology, some behaviorists stressed the exigencies of biological existence in their accounts of what makes human beings tick. The learner, like every biological organism, exists fundamentally to survive. To a living being, survival comes first, and the most important stimuli for educators to focus on are those that pertain most directly to survival. What are our most basic biological needs? They include the needs for air, water, food, sleep, and relief from pain. To produce the greatest changes in learner behavior, educators should focus on such stimuli.

For example, if the only way learners can reduce painful stimuli such as electric shocks is by exhibiting a new behavior, they will quickly learn to exhibit that new behavior. Likewise, if access to food or water depends on a change in behavior, new behaviors are likely to be learned relatively quickly. What is learning? Change in behavior. What motivates behavior change? Stimuli. Thus, the educator is above all a manipulator of stimuli. When it comes to learning new behaviors, educators should avoid creating negative associations and seek to create positive associations.

The learner, then, is little more than a collection of stimulus–response associations. When new stimulus–response associations need to be created, as in the educational setting, there are only two types of responses. There are correct responses, and there are incorrect responses. The educator's mission is to withhold reward, or better yet punish the incorrect responses, and withhold punishment, or better yet reward, the correct responses. How do we know which responses are correct and which are incorrect? The answer is in the mind of the educator. Over time, a determined educator who brooks no opposition can engrain the correct responses and extinguish the incorrect responses.

From the behaviorist's point of view, the curriculum is little more than a set of behaviors that educators want to engrain in their learners. These behaviors might take the form of facts that can be recited or procedures that can be demonstrated. From the behaviorist's point of view, every learner is pretty much the same as every other learner. Their past experiences, knowledge, and habits do not matter, except insofar as they make it more or less easy to engrain new behaviors. Certainly, by the end of the educational experience, every learner should behave just like every other, reliably manifesting the desired behavior. What does instruction look like? Basically, the learners do what they are being told to do, or at least rewarded to do. The feedback learners receive should tell them in as straightforward a manner as possible whether they are responding correctly or incorrectly, rewarding the former and punishing the latter. In terms of assessment, behaviorists stress uniform procedures, such as standardized, written, multiple-choice exams. The difference between correct and incorrect responses is obvious, and performance is easily scored. If a learner is not performing well, you simply lean on them harder until they get it.

The next learning theory is gestalt psychology. Gestalt psychology is frequently associated with optical illusions, images that can be interpreted in two or more very different ways. Examples include well-known paintings that can be interpreted as a vase or two faces looking at each other, or the line drawing that can be interpreted as a young woman looking away from the viewer or an old woman looking to the side of the viewer. *Gestalt* is a German word that denotes shape or form, and one of the key ideas behind gestalt psychology is the view that a set of sensory stimuli can be interpreted in different ways, or remain fundamentally incoherent, depending on what is happening in the mind of the observer.

Unlike the behaviorists, the gestalt psychologists believed that it is vital to attempt to peer inside the mind of the learner, to see how we find or create meaning in the world around us. Examples of the construction of more complex orders of meaning from simpler components include a motion picture, where the eye sees a rapid sequence of static images that the mind assembles into a continuous sequence of motion. Other examples include our perception of constellations among the stars, melodies from successions of notes, and medical diagnoses from collections of symptoms, signs, physical exam findings, laboratory results, and so on.

The gestalt psychologists sought to identify rules by which we find order in the world around us. In terms of visual experience, one key rule is similarity. We are more likely to see coherent order where visual objects are relatively alike in terms of size, color, shape, and so on. Proximity is likewise important. If objects are close to one another, we are more likely to see them as belonging together in some way. In the case of music, if the notes are separated too much from one another in time, we may not discern a coherent melody, but only a series of disconnected tones.

Continuity is also important. If we can establish a series or sequence, then an object's boundaries will likely appear to lie where that sequence is broken. For example, we might turn one row of dots into two rows of dots, simply by removing the middle dot.

Finally, there is the principle of closure, which says that we have a natural tendency to see limits to things. For example, even if there is a small gap in a circle, we are still likely to see it as a circle, because doing so brings it to a kind of perceptual closure. Likewise, it can be difficult to detect certain spelling errors, because our mind tends to correct them before they reach consciousness.

In education, gestalt psychology emphasizes problem solving. The behaviorists are largely interested in learners' abilities to repeat something they have seen or done, but the gestalt psychologist especially prizes the ability to solve problems in novel situations. In the nonhuman sphere, an example is that of an ape placed on a ledge separated from another ledge by a chasm too wide to traverse. On the other side is food. How can the ape get the food? Apes have been observed to solve the problem by using a stick to reach across the chasm and retrieve the food.

In the human sphere, oncologists sought some means to deliver a lethal dose of radiation to a tumor in the center of the brain without damaging the surrounding normal parenchyma. How could they do it? A brilliant inspiration was the idea of using two or three lower-dose beams that converged only at the site of the tumor,

where a lethal dose was delivered. In both cases, the learner has a sort of “Aha!” experience, where the solution to a puzzle emerges in a new form or pattern.

How would a gestalt psychologist tend to approach curriculum, instruction, and assessment? First, the curriculum would consist less of facts or techniques that learners are simply expected to memorize and more of problems that learners are expected to solve. The goal is to foster the ability to solve novel problems. The aim is not so much to challenge learners’ mental storage capacities as their ability to improvise and invent, perceiving new distinctions and connections where none were apparent before. The emphasis is on creating new and meaningful wholes. How is that possible instructionally? It is important to challenge learners to organize and reorganize their knowledge. Learning tasks should invite them to examine their most basic assumptions in the search for new ways of putting together what is before them. Knowledge is not a collection of facts, but an array of habits by which to examine the world from multiple perspectives. Assessment is less focused on regurgitation and more focused on problem solving and creativity. The assessment becomes a kind of learning experience in itself.

Cognitive psychology is similar to gestalt psychology in that both stress the development of meaning from experience. In cognitive psychology, however, greater stress is placed on the idea of information processing. Particularly, as computer science has developed, cognitive psychologists have tended to employ models drawn from computers for understanding what goes on in the minds of learners. Cognitive psychologists developed one of the most widely accepted models of how the memory functions.

In one widely discussed model, the memory consists of three principal parts, the sensory registers, short-term memory, and long-term memory. To an educator, the sensory registers are important because learners cannot retain what they do not notice. Thus, educators need to make their material appealing to the senses. Short-term memory is important because learners may be able to retain facts in short-term memory long enough to reproduce them on a test, but not really retain them. The real goal of education is to implant ideas in long-term memory, so that learners can use them throughout their lives.

More perhaps than gestalt psychology, cognitive psychology seeks to open up the black box of the mind and discern how information is processed by it. One way to do this is to ask learners to speak out loud or otherwise record what they are thinking. Again, the focus is less on merely repeating what has been seen or heard than on solving problems. Responses are not simply right or wrong, they are also important clues to what the learner is thinking. Incorrect responses can be even more revealing than correct ones in helping educators to better understand the mind of the learner.

Rather than simply classifying responses as correct or incorrect, we should be asking ourselves this question: what are we learning about how the learner is approaching this problem, and how could we use that knowledge to improve problem solving in the future? Memory is important, but so is creativity, and the learner’s own ability to learn from failures. Another important capacity to foster is

metacognition, learners' awareness of and insight into their own learning. Are they not only learning but learning about learning, and can they put that learning to use to learn better?

From an educational point of view, cognitive psychology prizes curriculum that not only conveys information but helps learners become better problem solvers and develop their own metacognitive abilities. Learning activities should foster the self-awareness of learners. Educators should determine what separates novices from experts and help learners to make that transition as effectively and efficiently as possible. It is not only what experts know in the sense of facts, but how they do what they do. When showed a game in progress, a chess expert instantly recognizes where the strategic advantage lies.

Similarly, expert physicians can often see the diagnosis very quickly, whereas novices may never arrive at it. Instruction involves helping novices see the minds of experts at work, observing not only what they say but how they arrive at their impressions. In terms of assessment, learners should be presented with challenges that require them to try out different strategies. Which cognitive map best matches this particular terrain? And what can we do to help learners become more self-aware?

Constructivism is associated with the work of pioneers such as John Dewey and Lev Vygotsky. Behaviorism, gestalt psychology, and cognitivist approaches all tend to focus on individual learners, but, constructivism emphasizes the social dimension of learning. In the late twentieth century, constructivists became disenchanted with the computer as a model of the human mind. They believed that information cannot be properly understood apart from the social situations in which it is embedded. There is no such thing as decontextualized information or skills. Instead, what we know and what we can do are powerfully influenced by culture.

Constructivism takes its name from the view that knowledge is not really discovered at all, but rather constructed by human beings. What we know is the product of two highly interrelated factors, the nature of the known and the nature of the knower, which can never be completely disentangled from each other. Hence, we need to focus on what is going on in the minds of learners, and in particular, among learners. Learning is not an individual sport but a team sport.

Different constructivists have viewed learning in different ways. Some take a largely rational view of learning, and suggest that educators and learners should be seen as engaged in a process of systematic inquiry that is governed by objectively established methodological rules. Others take a more sociopolitical view of learning, arguing that all rules are themselves social constructions, and there are no objective standards to which educators can appeal. From this point of view, learning is often regarded in terms of power relations, where powerful teachers attempt to impose their views on their relatively weak and impressionable students.

From both points of view, however, the knower and the learning environment are inseparable. The educator's task is to support inquiry on the part of learners, helping them to collaborate with one another as they develop their own understanding of the subject matter. The collaborative approach applies to educators and

students as well, who become coinvestigators and cocreators of meaning. The constructivist approach places special emphasis on challenging learners as members of groups, rather than as individuals.

From the constructivist point of view, curriculum is not a received body of knowledge but a set of challenges to which learners should respond. The educator's mission is to present them with the sorts of problems they will confront in real-life practice in their field. Knowledge does not flow from educators to learners, but is developed collaboratively when the two are encouraged to work together. There is no single fixed body of knowledge that every learner must acquire, and the best educators can do is to prepare learners to continue to learn for themselves.

Instructionally, learners are not recipients of information, but active explorers of the field. Learning is an adventure, and missteps and failures are an inevitable and even desirable part of the learning process, as long as they are seized upon as learning opportunities. It is more difficult to separate instruction and assessment, inasmuch as both are going on simultaneously in the best learning environments. We cannot compare learners' performance to some prescribed answer key, but must instead watch learners in action.

Each of these four learning has strengths and weaknesses, and none is perfect by itself. By deepening our understanding of what takes place in the minds of learners, we can enhance our educational effectiveness.

Expertise

In thinking about how to educate physicians, it is important to consider the end product we hope to produce. What is our vision of a well-educated physician? What would it mean to excel as a physician, and how can we best prepare medical students and residents to attain that level of performance? It is unrealistic to expect new graduates to function at the same level as physicians with decades of experience, but it would be a mistake not to launch them on a trajectory that leads to genuine expertise. First-rate physicians are not merely competent, they are experts, and we should prepare our trainees to achieve this level of excellence. In order to prepare them to function as experts, however, we must first understand what it means to be an expert. What distinguishes experts from novices, and what does it take to move from mere competence to expertise?

The word expert is drawn from the Latin root *experientia*, which means proof, trial, or experiment. An expert is someone who has attained a high level of understanding or proficiency as a result of a great deal of experience, and is recognized as a resource to whom other people should turn for advice. A novice, by contrast, is someone who has little or no experience. Drawn from the same Latin root as our word novel, a novice is literally new at some field of endeavor, like a medical student or resident on the first day of training. Competence comes from the Latin root *competere*, which means to be capable or qualified. Before novices can become experts, they must first become competent, and many of us become competent at particular tasks or fields of endeavor without ever becoming truly expert.

If we are serious about promoting expertise, genuine excellence as opposed to mere competence, then we must distinguish between two different types of educational outcomes, processes and performances. One means of academic and professional credentialing is based on processes. How many years of training has an individual completed? Where did the training take place, who were the instructors, and what enrichment opportunities were provided? Has he or she passed the requisite examinations? Such credentials provide important information about a physician, but they do not themselves prove that the individual performs well in practice. To know professionals' level of excellence in practice, we need to observe them in practice. Frequently, if we are to make a high-quality assessment, we need an expert to do the observing.

What makes an expert truly expert? To say simply that experts are the people in a group who perform best at particular tasks is to beg the question. It is similarly unhelpful to say that experts simply know more than everyone else. Expertise is not the mere accretion of facts, nor is it merely repeated practice. Knowledge and skills can be inert. The expert not only knows a lot and can perform some tasks very well, the expert can use that knowledge and those skills to successfully negotiate new challenges. It is not merely that the expert sees all the pieces of the puzzle. The expert can see how those pieces fit together, and perhaps even combine and recombine them in novel and productive ways. The expert functions at a higher level of imaginative integration, seeing important patterns that others miss.

This higher level of integration enables the expert to perform tasks more quickly. A merely competent practitioner may have to go through a whole mental checklist, or may require hours or even days to perceive a pattern that is apparent to the expert almost instantly. In some cases, the pattern is visible only to the expert. The expert knows what is most important in a particular picture, and focuses right away on those features, whether it be a constellation of signs and symptoms or a collection of experimental results. It is not only that the expert knows the answers, but the expert knows what questions to ask. An expert radiologist knows how to interrogate a CT scan to extract the relevant information effectively and efficiently. To the expert's eye, some features are simply more interesting—that is, they offer a higher cognitive yield—than others.

The expert's ability stems in part from what cognitive psychologists have called chunking. Chunking is the ability to group multiple data together under a single coherent rubric. A novice looking at the starry night sky sees innumerable randomly situated points of light. When experts look at the same thing, they see numerous constellations, and can instantly call to mind the astronomical properties of the different stars they see. The operation of memory provides a well-known example of chunking. Most of us would have great difficulty recalling a string of 28 random numbers. If, however, those numbers happen to represent a sequence of the four phone numbers we dial most frequently, then they may become quite easy to recall. Experts are able to organize their perception and thinking in such a way that they can process large collections of information as coherent chunks.

When novices look at a patient, they do not know where to begin. What is germane to the diagnostic task at hand, and what is irrelevant? What represents a mere distractor, such as the vehicle that brought the patient to the hospital, and what is a

vital bit of information, such as what the patient was doing when the symptoms began? Experts can often tell in a split second whether a particular finding is normal or abnormal, because they hone in instantly on the key distinguishing features. It is not just that they have seen dozens or hundreds or thousands of such cases, but that they have learned from those experiences to focus their attention on the features with the highest diagnostic yield. They are not merely experienced practitioners, but reflective practitioners, who have thoroughly mined their clinical experience for whatever lessons it can offer. From an educational point of view, the crucial question is whether expertise can be shared with learners, and if so, how to do it.

It is possible that there are no real shortcuts to expertise. To become a truly world-class chess player, for example, may require something on the order of 50,000 h of chess playing (Fig. 2.2). No one can sit down with a book about chess, or attend chess classes, and become an expert in several hundred or several thousand hours. Perhaps even more significant is the realization that expertise tends to be highly domain specific. Just because people become experts at chess does not mean that they will be expert mathematicians, linguists, or psychologists. Similarly, a physician who is an expert in cardiology may not perform better than average in another discipline, such as gastroenterology. Likewise, expert physicians are not necessarily good leaders, managers, or businesspeople.



Fig. 2.2 Robert James Fischer (1943–2008). One of the greatest chess players in history, Bobby Fischer first encountered chess at the age of 6. He became obsessed with the game, devoting most of his waking life to playing and reading about chess, and winning his first US championship as a 14 year old. He is pictured here playing the reigning world champion in Leipzig at the age of 17. Some experts estimate that the development of true expertise requires approximately 10 years or 10,000 h of dedicated practice (Courtesy of Wikimedia)

Chess offers another interesting insight into expertise. It turns out that a world-class chess player can absorb a great deal of information about a chess match in a very short period of time. Shown a particular chess game in progress, an expert can often reproduce the position of most or all the pieces on the board after looking at it for only a second or so. By contrast, a novice might have great difficulty reproducing the position of more than a few pieces. However, the expert's ability is limited in a particularly revealing way. Experts can only reproduce the position of the pieces when their position represents an actual game of chess. If the pieces are randomly positioned, the expert performs little better than the novice. This indicates that expertise requires meaning. That is, the expert must understand the pieces as fitting into some larger strategic configuration if their position is to be memorable.

How could we capitalize on these insights in medical education? First, we need to focus our educational efforts in ways that highlight integrating concepts. Our aim is not to download reams of data, but to help learners locate and begin to exploit approaches that bring order to what they will see in daily practice as clinicians, scientists, and educators. Although it is important to give learners an overview of the terrain in which they will be working, we sometimes err on the side of excessive breadth, at the expense of adequate depth. There are some things that future physicians merely need to know about, and others that they genuinely need to know well. Among the latter are organizing concepts, and especially concepts with leverage, that can be put to use in many different novel situations.

When lecturing, good introductory overviews can be invaluable. What are we going to talk about here? What are the key concepts that we hope to take away from this discussion? How might these concepts prove useful in daily practice? We cannot simply transfer such concepts into the minds of learners and expect them to begin using them productively, but we can provide them problems to work on and guidance about how to get started. We can provide valuable guidance by working on the problems ourselves, and doing so "out loud," so learners can see how we approach them. Confronted with a welter of data, how does an expert set to work? What sorts of questions help to get the ball rolling? What sorts of questions prove most helpful when you get stuck? How do you avoid latching onto the first idea that comes to mind, thereby truncating the search for even better ones?

One powerful element of medical expertise is a thorough understanding of pathophysiology. A variety of seemingly disparate and unconnected symptoms, signs, physical examination findings, and laboratory results may fit together very nicely once we understand their common basis in pathophysiology. The expert is able to use extensive pathophysiological understanding to sift from a huge body of knowledge the particular ideas that are most likely to be relevant to the case at hand. None of us ever use everything we know to solve a problem, and one of the first tasks in solving any problem is to determine which of our prior experiences offer insight. The novice must thumb through a large reference work page by page, looking for a similar example, whereas the expert is able to turn quickly to the relevant section. The expert's understanding may be likened to a handy index that organizes a much larger text.

If we take this lesson seriously, we should ensure that our evaluations of learners reflect this principle. Exams should not merely test the ability to recall specific facts, but to organize facts in larger contexts. As long as knowledge remains at the level of individual facts, it is inert. To bring it to life, we must invite learners to use that knowledge in solving problems. Suppose a patient presents with hematuria, blood in the urine. We should not merely ask for a laundry list of pathological processes that may cause hematuria. We should invite learners to begin developing ordered diagnostic hypotheses based on their understanding of pathophysiology and the facts of the particular case at hand. For example, is the bleeding painful or painless? Does the patient have an abdominal mass? Are there bacteria in the patient's urine? By using case scenarios to assess learner understanding, we encourage learners to think in ways that will serve them best in caring for patients.

Experts not only get the right answers. They also look for better questions. When a novice asks a question of an expert, the expert may do more for the novice by asking a question than by providing the answer. For example, the novice may present a choice between two different options for diagnostic testing, but the expert may, by asking a question of the novice, point out that additional history taking might render both tests unnecessary. Our ideal of expertise should not be a person who knows all the answers. Our vision should be someone who is able to pose and recognize good questions, and who knows how to go about finding out the answers. We need to foster a certain skepticism among our trainees, so that they eventually ask better questions than we have managed to ask. The future advance of medical knowledge depends on such inquisitiveness.

We should also bear in mind that expertise has its limitations. In some cases, expertise can serve as much as a barrier as a springboard. For example, experts do not always make good teachers. An expert may understand a subject so well that it is difficult to appreciate what it looks like to novices. The expert may know where the learners should be headed, but find it very difficult to discern where they are, and thus experience difficulty moving them from point A to point B. In some cases, merely competent individuals may make better educators, because they can better understand and relate to the people they are teaching. In some cases, residents may make better teachers than faculty members, and medical students may make better teachers than residents. This is not to say that experts cannot understand learners better than anyone, but only that they do not always do so.

For one thing, expertise in education itself can be quite valuable in the development of educational excellence. People who understand learning may be better equipped to teach than people who do not. The same might go for curriculum design, the development of new instructional techniques, and the assessment of learning. Although medical education clearly enjoys the services of many people who seem to be born educators, it is likely that everyone, even the best among us, could do a better job of teaching if we knew more about our students and how they learn. For those of us who are not naturally effective educators, such lessons might prove especially valuable.

We must also guard against the temptation to regard expertise in a close-minded way that stunts further investigation and learning. Having an expert in our midst

should not make the rest of us lazier. Instead, it should act as a stimulus to further improvement for us all. The expert should not push us out of the way as though we were irrelevant, but challenge us to grow and develop. The goal is not to avoid getting caught having to admit that we do not know something, but seeking out the things we do not know and investigating them. Lack of understanding, unless it is the result of incuriosity or indolence, is not a sign of weakness, but an opportunity for learning. We should encourage our learners not to cover up what they do not know, but to grab it by the tail and follow it where it leads.

If being an expert means simply having all the answers, then the search for new understanding will inevitably be seen as a sign of weakness. Somebody who has to go looking for an answer must not have them all. In fact, however, we must first recognize that we do not know before we go looking for new knowledge. An expert is not someone who has stopped learning, but someone who learns every day. One of the most characteristic features of a physician expert is the habit of learning. The moment we stop learning is the moment we begin to become extinct. Moreover, learning is one of the most fulfilling aspects of a professional career, because learning is intrinsically enjoyable and enables us to do our jobs better.

Memory

Memory failures are universal. We bump into an old acquaintance, proceed to introduce the person to a companion, and then suddenly realize to our horror that we cannot recall the acquaintance's name. Or checking in for a flight at the airport to depart for a long-awaited vacation, we make the disheartening discovery that we left the passports at home. Or, about to offer a brilliant diagnostic opinion on a difficult clinical case, we discover that we cannot call to mind the name of a disease that we have dealt with on dozens of occasions. Such memory lapses are a familiar feature of the human experience. And it is their very familiarity that leads many of us not to devote to them the attention that they deserve. We simply take them for granted, like rainy days. As a result, many of us do not grasp the true complexity of memory and the many ways it can fail.

Few people need a rich and nuanced understanding of memory more than physicians. We use memory to detect findings, offer differential diagnoses, and arrive at recommendations for further evaluation and treatment. If our memory fails us, it can lead us to overlook a finding or to point out a finding when none is, in fact, present. It can cause us to offer incomplete or inaccurate diagnostic hypotheses. It may even lead us to draw mistaken conclusions from our own observations and hypotheses, resulting in harm to the patients for whom we care. To avoid such pitfalls and enable future physicians to do the same, we need to study memory with the same curiosity and dedication we bring to the practice and teaching of medicine. Our memory is at least as important a professional resource as our facilities and equipment. In some respects, in fact, memory is even more important, since none of our professional activities would be possible without it, and the quality of our all work hinges very much on the reliability of memory.

In his 2002 book, *The Seven Sins of Memory: How the Mind Forgets and Remembers*, Harvard University Psychologist Daniel Schacter discusses seven stereotypical ways in which memory can fail us. The discussion is premised on the view that if we better understand how memory lets us down, we can better protect against lapses and reduce the frequency and severity of adverse consequences. As a highly cognitive field requiring a high level of mnemonic performance, medicine needs to understand these patterns of failure and the steps we can take to counteract them. The point of briefly reviewing each of Schacter's categories of memory failure is not to suggest that they provide us with a final and infallible list of all errors mnemonic, but to begin to trace out the complexity of the subject.

Before reviewing each of the seven ways memory can fail us, it is important to highlight some categorical differences between them. The first group of three includes what we commonly call forgetting, the different ways in which we can fail to recall something. These are transience, absent mindedness, and blocking. Yet these are not the only ways in which memory can let us down, and the next group of three consists of failures not of forgetting but of remembering. Memory can cause just as much trouble when it leads us to recall something incorrectly as it does when we fail in our efforts to bring it to mind. These are misattribution, suggestibility, and bias. The final of the seven failures of memory belongs to still another category, namely, situations where we would like to forget something but are unable to do so. This is persistence.

The first failure of memory is the most familiar, transience. This refers to the general tendency for memories to diminish over time, such that more distant ideas and events are typically more difficult to call to mind than more recent ones. The adage, "Use it or lose it," applies no less to memory than to physical conditioning. Happily, however, such material can sometimes be relearned more quickly and easily than when it was first acquired. Hence, the value of "refresher" courses, which tend to operate on the assumption that we have seen the material before.

It is important to recognize that memory does not decay at a constant rate over time. Generally speaking, decay is relatively rapid in the near term, and then slows down. In other words, forgetting is a nonlinear process, a rule that holds for a wide variety of different cognitive settings. Moreover, forgetting is not all bad. It would be a curse to remember everything, because then our memories would be clogged with so much trivial and irrelevant information that it would be more difficult to call to mind what really matters. We select what is worth remembering by many means.

One way of enhancing the recall of learners is to highlight upcoming information as important. One means of doing this is to ask learners questions about a topic before introducing new information. Another is to make it clear to learners how new information will prove useful in the future. For example, an educator preparing to teach about adverse reactions to cardiopulmonary resuscitation might first present a scenario in which a patient collapses, and then ask learners how they would handle it. Simply getting learners to admit that they do not know and recognizing the magnitude of the potential consequences can make the material more memorable.

The next type of memory failure is absent mindedness. This refers to situations in which we intend to do something but fail to remember to do so. A memorable

example involved the cellist Yo-Yo Ma, who was traveling by taxi to a performance. When he arrived at his destination, he suddenly realized that he had left his cello, valued at \$2.5 million, in the cab. Had a hypothetical bystander asked him at any point where his cello was located, he would have immediately recalled that it was in the trunk of the cab, but because he was thinking about other things when he arrived at his destination, he failed to remember it. Such lapses tend to occur when we are operating on “auto pilot” and do not receive a cue we normally rely on to carry out a particular action. The difficulty is not so much failing to bring to mind something we are searching for, but rather failing to search in the first place.

Such lapses can befall any physician. Interruptions in our normal routine can deprive us of clues we normally rely on to recall certain tasks. Such failures can be hazardous, in part because, by definition, we do not even recognize that they are occurring. This is one reason that healthcare organizations have been adopting “time out” policies to ensure that teams verify basic assumptions (Correct patient? Correct site? Correct dose?) before administering medications and performing procedures. We cannot teach learners to remember everything, but by encouraging them to identify high-stakes situations and put in place systems to detect and compensate for occasional lapses, we can help them reduce the frequency and magnitude of costly errors.

The third memory lapse is blocking. Though blocking might seem identical to transience, the two are in fact very different. When a memory is blocked, it is not merely unavailable, it is also actively screened out by other memories. We have not completely forgotten the information, but have temporarily lost access to it. We may be able to recall something similar to what we are seeking, but the sought-after item does not come to mind. For example, a physician might be able to recall many features of a particular disease, such as Langerhans cell histiocytosis, including its different types and varied manifestations, yet fail to recall its name. Sometime later—whether 5 min, 5 h, or 5 days—the sought-after information effortlessly comes to mind. The difficulty in this situation seems to lie in search and retrieval, a mismatch between what we are looking for and how we are looking for it.

Blocking is so familiar that many different human languages have a phrase that corresponds to having a word “on the tip of the tongue.” It represents an active process, at least to the extent that we can think of words or phrases like the one we are searching for, and make determinations about whether or not we have found the right one. Somewhere in the mind is a judge who knows whether we have come up with the word we are looking for. At times it seems that we have caught hold of it for a second, but then, inexplicably, it slips away. Generally, we experience a small sense of victory and relief when we finally find the right word or it finds us. Such lapses sometimes occur at embarrassing moments, but we can take some comfort in the fact that the people we are speaking with have undoubtedly experienced the same thing. By helping learners develop the habit of attempting to access such information from multiple points of view, employ effective electronic search strategies, and sometimes just wait patiently for its return, we can help them deal more effectively with blocked items.

The next category of memory lapses concerns situations where a memory is present but wrong. In other words, this is a form of memory distortion. The first of

these is misattribution. This occurs when we remember something, but we ascribe it to an incorrect source. Consider, for example, the misidentification of a suspect in a criminal case. A witness saw or heard something, but attributes it to the wrong person, with potentially devastating legal consequences. This phenomenon can also lead to serious problems in medicine. For example, a physician may misattribute a doubtful idea to a highly reputable and trustworthy source, promoting an unwarranted level of reliance on it when closer inspection is indicated. Another example of misattribution would be thinking that we did something when we in fact did not, because we imagine ourselves having done it. In such a case, we attribute to memory something that in fact occurred only in the imagination.

In short, misattribution can lead us to remember things that never happened. Consider the following well-known and reproducible example of this phenomenon. If someone recites a list of words including candy, sour, sugar, bitter, taste, cake, eat, pie, and so on, and then asks us whether the word taste was on the list, most of us will say correctly that it was. However, if we are asked if the word sweet was on the list, we will likely say yes again, even though it was not. The mind is not a mere transcriptionist, taking down and reading back what we say and hear. Instead it also finds meaning in experiences. When all of the words on a list we are being asked to recall belong to a category that would include the word sweet, we think we heard it.

Something similar can happen in medical reasoning, when a constellation of findings points strongly to a particular diagnosis, and soon we find ourselves accepting the diagnosis without sufficiently exploring the counterevidence and evidence in favor of other diagnostic possibilities. This phenomenon is sometimes referred to as premature closure, a phenomenon that becomes more common as we age, and therefore represents a form of memory lapse against which more mature radiologists should be particularly aware of. We can help learners to avoid such pitfalls by encouraging them to develop the habit of stepping back and reexamining hypotheses from alternative points of view.

Suggestibility refers to the proclivity of questions and manners of questioning to shape the answers we offer. Consider the following demonstration: "What color is snow? What color are clouds? What color is a bride's gown? What do cows drink?" Most people will respond milk, even though the correct answer would be water, because the preceding questions have prepared us to respond with something associated with the color white. In a court room proceeding, questions can be posed in a leading fashion that tends to suggest a certain answer, independent of whether the suggested answer is correct. This form of memory lapse has precipitated grave consequences in legal cases concerning trauma and abuse, where witnesses have recalled events that never happened or happened quite differently from what they recall. The way in which questions are posed can particularly powerfully influence what children do and do not seem to recall.

An example of this pitfall in medicine concerns clinical history. Absent or erroneous clinical history can lead a physician to over- or underestimate the true probability of a particular diagnosis. For example, if a clinical history of immunodeficiency is omitted, the physician may fail to consider the possibility that respiratory symptoms and signs may represent opportunistic infection. On the other

hand, a clinical history of infection may lead to the assumption that bone pain is due to infection, when in fact it is a malignancy such as a Ewing sarcoma.

Medical learners need to be mindful of suggestibility. One way of counteracting it is to make sure to review records thoroughly, thereby ensuring that other important information is not omitted from the discussion. Another means is to be sure to look and think for oneself, not simply relying on the reported observations and conclusions of others. It is vital both prospectively and retrospectively to avoid allowing the way a clinical question is presented to preclude additional and potentially more momentous observations that a colleague may have discounted or failed to consider all together.

The next type of memory error is bias. This involves the tendency for more recent knowledge and beliefs to distort our recollection of others situated in the more distant past. For example, physicians' general assessment of the intensity and stress of after-hours on-call duties may be especially strongly influenced by their last few on-call shifts. If those shifts proved to be particularly demanding, they may regard on-call duties, in general, as more strenuous than had their few most recent shifts been light. This phenomenon reminds us again that the human memory is not merely a data storage device like a voice recorder. Instead interpretation is taking place at every step of the "storage" and "retrieval" processes, and our memory (or lack thereof) for any event or idea is powerfully affected by the meaning we attribute to it.

In clinical practice, one common manifestation of bias is to consider more strongly diagnoses that we have recently encountered in clinical practice, sometimes referred to as recency bias. We ask ourselves, "What has turned out to be the diagnosis in patients who presented similarly in the past?" but all cases that come to mind are not recalled with equal prominence. The recent cases are generally more memorable, or at least more likely to influence diagnostic reasoning. As a result, we may place too much emphasis on what we have seen recently, and overlook less immediately familiar but nonetheless important diagnostic possibilities. To guard against such bias, we need to make learners aware of this bias and encourage them to assess probabilities based on large case series that do not rely solely on the memory of any particular individual.

The final form of memory failure, which differs from the other six, is persistence. This refers to the unwanted recollection of things that we would prefer to forget. For example, a physician who has been named in a malpractice suit may be haunted by memories of the experience long after the matter has been resolved, even if it was decided in the physician's favor. This phenomenon lies behind what has been called "post-traumatic stress disorder," where well-intentioned efforts to help victims "process" and "work through" difficult experiences have sometimes made it even more difficult for them to put the experience behind them and move on. Less dramatically, some physicians who have made an error may be so preoccupied by it that they find it difficult to concentrate on other work for the rest of the day.

All unpleasant memories should not be forgotten. To recall only the pleasant experiences of life would be to leave out an important part of the story, and thereby

prevent the discovery of important lessons. Making mistakes is no fun, but every mistake is also a learning opportunity, and it is important that we recognize errors, explore them, and attempt to apply lessons learned to improve future performance. Often, at least a portion of each intrusive memory is related less to the actual event itself than to the way we interpret it. By encouraging learners to talk about the experience with a counselor, colleague, or friend, it is often possible to help them see the experience in a new light that makes it both less threatening and easier to live with. Merely discussing such memories with someone else can often prove therapeutic in itself.

It would be tempting to suppose that a “perfect” memory would be a blessing. Recent media reports have described several individuals with “hyperthymestic syndrome,” a kind of super memory. One such individual, sometimes described as the “person who could not forget,” is a middle-aged woman who is able to reproduce highly detailed accounts of every day of her life since she was 14 years old. In fact, however, her memory is only out of the ordinary when it comes to recalling autobiographical details, and she lacks any extraordinary ability to recall facts that do not pertain to her own life. Her condition may be less a manifestation of exceptional memory than an extreme form of obsessive-compulsive disorder, centered around her own life and past.

As this case reminds us, mnemonic performance is a much more complex matter than merely whether or not we are able to recall a particular item. The inability to bring something to mind has multiple possible causes. Likewise, the mere fact that we are able to recall an idea does not necessarily imply that we have recalled it correctly or that our lives are going to be enriched by retaining it. By helping learners to explore memory more deeply and apply an understanding of its stereotypical forms of failure to their professional and personal lives, we can help them recall what is most worth remembering, avoid the pitfall of supposing they know something when they really do not, and prevent intrusive memories from undermining the quality of their lives.

Concepts of Health and Disease

At the core of medicine lie the concepts of health and disease. Medicine aims to cure disease, or at least relieve the suffering related to it, and where possible, to prevent it from arising. Moreover, health promotion is increasingly recognized as an important part of the physician’s mission, so that people can lead lives as full and rich as possible. Yet the concepts of health and disease are not so simple and straightforward as we might first suppose. For example, do we distinguish between a person who is merely feeling badly and a person who is really sick? Do physicians and hospitals bear responsibility for treating every form of human suffering? Is health a mere absence of disease and injury, or is it a positive state of well-being? If today’s medical students and residents are to achieve their full potential as physicians, it is important that they base their practice on a complete and rich vision of what it means to be healthy.

Let us suppose that a patient presents to a physician's office complaining of not feeling well. How do we determine whether patients are sick, and if so, what ails them? One approach would be to obtain sophisticated diagnostic tests on the blood, or to order radiological studies in order to glimpse the anatomy and physiology of the patient's internal organs. In most cases, however, such sophisticated diagnostic studies are not indicated, and the history alone or the history and the physical examination provide more than adequate diagnostic information. Despite the fact that more sophisticated diagnostic studies are usually unneeded, they shape our vision of medical practice to an ever-greater degree. For example, some patients who present with headaches may feel cheated if their physician does not order a computed tomography (CT) scan to ensure that they do not have a brain tumor. Likewise, physicians may feel that we are not doing our best for our patients if we do not avail ourselves of medicine's full diagnostic armamentarium.

We need to understand more deeply what it means to be ill, and to clarify our vision of the state of health in which we seek to enable our patients to live. The World Health Organization's Second International Classification of Functioning, Disability, and Health (ICIDH-2) provides a useful point of departure in this regard. As modified here, it approaches health and disease in terms of four levels or tiers: structure, function, activity, and participation. The underlying presumption is that health and disease cannot be adequately understood on any single level, and a multitiered approach is necessary. Like the molecular, cellular, organic, organismal, and communal approaches to understanding living organisms, we need to look from multiple different angles if we aim to understand fully the impact of illness on a patient's life.

The most basic level of health and disease is structure. This is the traditional forte of the anatomist, the pathologist, the surgeon, and the radiologist. In order to discern what is wrong with a patient, we must discover what portion of their structure is out of shape. To know whether someone is ill, we seek a structural abnormality. If the appendix has a normal appearance, with no trace of inflammation, then we dismiss the diagnosis of appendicitis. If a patient with cough and fever has a normal chest radiograph, we know that they do not have pneumonia, although they could have a raging case of bronchitis. If a febrile patient has a normal white blood cell count and blood smear, we know that bacterial infection is not the culprit. When a patient presents with abdominal pain, we work our way through the organs of the belly until we find one that accounts for the patient's symptoms.

In so doing, we are continually weighing the appearance of the patient's anatomy against that of our mental image of normalcy. The crucial determination we are always trying to make is both stunningly simple and mind-bogglingly complex: is this normal or abnormal? If the finding is within the range of normal, we dismiss it. If we suspect that it is abnormal, we set about attempting to determine what it might be. We formulate a differential diagnosis, and then take additional steps to sort out which option is most probable. In some cases, we arrive at a definitive diagnosis, as when a bone radiograph clearly reveals a fracture. In other cases, we never know for sure what the matter with the patient was, or even whether the patient was really sick to begin with. Yet where the structural tier of health and

disease is concerned, it is worth remembering that even a completely normal diagnostic test does not definitively rule out the possibility of disease. The bone radiograph may be initially normal, and it is only a week later, after demineralization has taken place and some periosteal reaction has formed adjacent to the fracture that we are able to recognize a nondisplaced hairline fracture. Even our most sophisticated imaging studies may not show us the pathology. For example, a patient with severe psychosis may have a normal magnetic resonance imaging (MRI) exam of the brain. Conversely, there is no guarantee that every patient with an abnormality of diagnostic testing actually has the disease. A solitary pulmonary nodule may represent a granuloma, and not a lung cancer at all.

We need to recall that no diagnostic test is 100% accurate, and the accuracy of every test varies depending on the circumstances in which it is used. We can generate costly false positives by employing a test in circumstances where the initial probability of disease is very low. If medicine is to provide optimal value to patients and our communities, it is important that we educate future physicians to understand not only how to interpret diagnostic tests, but when to use and when not to use them. It is a mistake to suppose that the quality of medical care is directly proportional to the number of tests the physician orders. In many situations, the best test is no test at all. If learners are to understand how to employ diagnostic testing effectively, they need to recognize that ferreting out abnormal structures is not the highest objective of medicine.

The second tier of health and disease is function. To understand function, we must look beyond the snapshots of the structural tier and think of health and disease as unfolding in time. The coronal, sagittal, and axial dimensions do not tell the whole story. We must see how they are changing from minute to minute, day to day, and year to year. It is not enough to know that there is a hole in the heart. It is necessary to know what that hole means to the function of the cardiovascular system. Is it permitting too much deoxygenated blood to enter into the systemic circulation? Is it jamming the lungs with too much blood, and thereby making the heart work too hard to supply an adequate amount of blood to the brain, heart, and kidneys? To know what a structural abnormality really amounts to, we must understand its functional implications.

Although the functional level of understanding cannot simply supplant the structural level, it does enjoy a higher level of explanatory power. We can suffer structural insults of one kind or another, yet through functional redundancy or retraining, return to our formal level of function. For example, some patients recover virtually completely from a stroke, despite the fact that they have suffered the irreversible loss of a portion of their brain tissue. The dominance of function over structure is apparent in the design of prosthetic devices, such as artificial joints. The material of which the joint is constructed changes completely, from cartilage and bone and ligaments to a metal or ceramic. Likewise, the structure is drastically changed, so that the blueprints for the native joint and the artificial joint look quite different from each other. And yet the joints may function quite similarly, enabling a knee that formerly could barely move to regain a virtually full range of motion.

Function refers to the operation of a molecule, a cell, a tissue, an organ, or an organ system, and activity refers to the operation of the whole organism. Consider the example of sickle cell anemia. The structural abnormality is a base-pair substitution in a portion of the gene that codes for the hemoglobin molecule. This translates into a defect in the structure of the protein, which causes it to assume an abnormal sickle shape and to become lodged in capillaries through which it should pass easily. This is a functional defect. The tendency of patients with sickle cell hemoglobin to develop anemia and sequestration crises creates limitations that interfere with daily activities, and abnormality at the level of activity. Patients with sickle cell anemia are unable to win foot races, and may not even be able to get out of bed comfortably on some days.

It is vital that future physicians understand the linkages between structure and function, and between function and activity. If we simply treat the structure, we will miss important functional implications, and if we simply treat function, we will miss important implications for what the patient is able to do. To appreciate the full implications for activity, we need to understand who patients are and what they do. Pain that one patient can easily endure may prove overwhelming to another, depending on what is going on in their lives at the time. To one patient, the ability to swing a golf club may be a crucial feature of a full life, whereas another might value especially highly the ability to sing. Because of this, the same surgical procedures might be tolerable to one and intolerable to the other. We need to ask certain questions. What does the patient care most about in life? How will different diagnostic and therapeutic options differ depending on this particular patient's point of view? We really understand the disease only insofar as we know what it means to the patient.

Participation involves the social dimension of illness. What does a letter or phone call bearing news about an abnormal diagnostic test mean to a patient? For example, suppose a patient receives a message that her screening mammogram showed an abnormality that requires further workup. What does that message mean to her? It may produce so much anxiety that she cannot sleep well or carry out her daily activities at her usual level of performance. It may upset not only the patient but her friends and family, as well. It is vital that physicians understand the human implications of such interactions, and tailor not only our bedside manner but our practice patterns in such a way that we spare patients unnecessary suffering and do what we can to promote the psychological and social well-being of patients. How can we do a better job of delivering bad news? How can we better prepare patients and families for the trials and tribulations of major surgery or anticancer chemotherapy?

When patients are told that they have cancer, they are not thinking primarily in terms of the abnormal structure of some of their cells, or the fact that a nonfunctional mass of cells is proliferating out of control and threatening their normal tissues. They think primarily in terms of what it means for their careers, their families, and their very lives. They begin to think about what it will be like to tell their spouse, their children, and their friends. They think about whether their affairs are in order. They think about all the horrible stories they have heard about

the therapy for cancer, and the experiences of people they know who died of cancer. The diagnosis may incite fears of impairment and disfigurement. To young medical students, the loss of a breast or a testicle may not seem so terrible, but perhaps this is because they do not really believe it could happen to them. The more we can help learners understand the threat of illness and what it is like to cope day to day with it, the better we prepare them to care for patients in an effective and compassionate matter.

We also need to understand the social dimension of healthcare, so that we appreciate the complex relationships between different healthcare providers. How do the contributions of the family physician, pathologist, the oncologist, the surgeon, the radiologist, the dietician, the occupational therapist, the nurses, the technologists, and a host of other workers fit together to provide good care to a patient, the kind of care we would want for our spouse or sibling? Each of us needs to know what the other does, what the other needs, and what the other can offer. The more effectively we can help each of our colleagues to do their jobs, the more integrated and beneficial will be the care we provide. We need to understand not only our own specialty but the entire profession of medicine and the field of healthcare in a comprehensive fashion. If our view is fragmentary or overly simplistic, everyone suffers. On the other hand, if we can see health and disease from a truly comprehensive, multitiered perspective, both we and our patients stand to gain much.



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