


anny of the requirement to “cover” everything. Since acquisition of information is accomplished by the student outside class, interactions between teachers and students can focus on content that is difficult to understand and on the application of new concepts to real-world problems.

So is the lecture dead? If “lecture” refers to the traditional picture of a professor standing in front of and talking at a large group of students who are passively absorbing information, then yes, we believe medical schools should be largely abandoning that teaching format. But if it describes large-group interactive learning sessions with students who have prepared in advance,

 An audio interview with Dr. Schwartzstein is available at NEJM.org

with frequent questions directed at the audience, time set aside for group discussion, and use of audience-response systems (to poll students on a question to assess for understanding, for example), then we

believe an interactive lecture-style format should remain an option and can be an effective teaching tool.

As we look to the future of medical education, we believe it’s important to avoid zealotry with respect to pedagogical approaches, including the insistence that team-based learning methods must adhere to specific criteria or that no deviation from pure problem-based learning is allowed. We can often serve our students best by fusing elements of various methods, such as team-based or case-based learning and interactive large-group learning sessions, rather than feeling obliged to adhere to a particular format. But we must also use evidence-based approaches whenever possible and rigorously evaluate our innovations, acknowledging that important outcomes may include student engagement and problem-solving skills, team dynamics, and the learning environment as much as exam scores.

In our daily lives as clinicians, we aim to create a culture of continuous quality improvement. We should strive to create the same culture in our educational lives.

Disclosure forms provided by the authors are available at NEJM.org.

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## Medical Education in the Era of Alternative Facts

Richard P. Wenzel, M.D.

Students currently entering U.S. medical schools arrive in an era of increasing distrust of large institutions, expanded use of social media for information, a political lexicon in which uncomfortable facts are derided as “fake news” while fabrications masquerade as reality, and the erosion of truth that such trends entail. The challenges for medical education are imminent and formidable. How do we, as teachers, merit the trust of future physicians? How do we pass on to

them science’s preeminent legacy of propelling advances in understanding, preventing, and curing illnesses? How do we instill in them a lifelong appreciation for the importance of hypothesis testing, peer review, and critical analysis of research? These questions should prompt an immediate review of the goals and processes of education and the values we need to emphasize in day-to-day interactions with students.

A useful early step in earning the warrants of students is a

transparent review of the history of ideas in medicine. Such a survey would make clear that some ideas have worked, some have failed, and some have turned out to be built on scientific fraud — but that developing and testing hypotheses that might not pan out are essential to the scientific method. New ideas have often been rebuffed strongly by people in authority who had reason to fear challenges to the status quo. Some investigators didn’t live long enough to see their novel ideas

become widely accepted. Those who succeeded, however, evinced not only unyielding perseverance, but also integrity and dedication not for personal gain but for the public good. Renewing a strong curriculum in the history of medicine would thus lay a foundation for a realistic yet hopeful appreciation for the potential, advances, and truths of science.

On the hopeful front, a related and necessary building block for students is the intellectual curiosity to both identify and question those truths. We can let medical students know that whereas throughout their previous schooling they were judged by their answers, in their medical education and their careers they will often be judged predominantly by their questions. We should applaud students for curiosity and inquiry and for showing reasoned doubt about what they read and hear. We can challenge them to pursue reliable information beyond the classroom or ward discussions, as we avoid the pitfalls of trying to transfer all our knowledge to them during our face-to-face time. As William Butler Yeats (probably paraphrasing Plutarch) wrote, “Education is not the filling of a pail but the lighting of a fire.” Providing the spark is our job.

On the realistic front, lest the fire of scientific inquiry be extinguished by setbacks, we also need to acknowledge to students that advances in science are slow and nonlinear and are often made by observing something unusual and unexpected, perhaps unrelated to the original hypothesis. Discovery requires not just curiosity but also a passion for clarity — a goal that requires time to achieve, and time is a fading indulgence in modern medicine. Students need

to understand that opportunity is an intermittent visitor, often arriving in disguise and unannounced. If we fail to recognize and engage her, like a shy guest at a large reception, she moves quietly in another direction. Pursuing such opportunity requires what Pasteur called a “prepared mind.”

Given the sometimes elusive and often provisional nature of scientific truth, we need to emphasize that our books are vastly incomplete and that current concepts represent only a temporary resting place for understanding, continually requiring testing and further analyses. They are not the final word but a brief stop on the path we seek: truth through science. To paraphrase the protagonist of Bertolt Brecht’s *Life of Galileo*, the goal of science is not to open the doors to everlasting wisdom but rather to close the doors to everlasting ignorance.<sup>1</sup> Not all faculty members can model a genuine passion for new knowledge, but those who do should be recruited, selected, and rewarded for their talents. This long-recognized need is even more urgent today.

But such educators will have to make clear to students that science and the pursuit of truth require not just passion, but also critical thinking, which can’t easily fit into a tweet or brief social media post. Describing key values to impart to college students, Kim Benston, president of Haverford College, asserts that “we are unequivocally choosing analytical precision over untested assertion.”<sup>2</sup> Medical school deans can encourage the inculcation of these ideals by colleges and universities that prepare students for medical education. And medical schools themselves can re-

double their commitment to clarity and truth by emphasizing critical thinking. Critical review of the literature, for example, is such an essential skill that I believe it should be taught, practiced, and honed throughout all 4 years of medical school and even formally in postgraduate education.

While encouraging students to question both new information and received dogma, we need to support respect for one another, tolerating disparate views without creating unnecessary polarization. The legacy of our field is now frequently challenged by uncritical acceptance of sound bites, a common but unfortunate pattern of our social fabric. We cannot sit by helplessly — our students and their future patients deserve more.

Clinician-educators will face special challenges in an era characterized by the erosion of our time for reflection, for identifying new syndromes, for social contact with colleagues, and for teaching.<sup>3,4</sup> The pressure to see more and more patients for increasingly brief visits is of concern for clinicians, students, and patients alike.<sup>5</sup> But despite time constraints, it is up to us as teachers and role models to reinforce the highest values of our profession, to examine our curriculum and teaching faculty, and to remind our students of the discipline, the great calling, the passion and mystery, and the elegant adventure that define medicine. Reflecting on the current challenges to our profession, we can have a firm response: There is no alternative to truth. So as medical educators, we need to focus increasingly on the rigorous pathway of reason, guiding our students past the barrage of misleading signals

designed to divert their attention from the course to truth.

Disclosure forms provided by the author are available at NEJM.org.

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## Signs

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Not long after my mother died, my father lay disconsolate in a darkened hotel room begging his deceased wife to send him a sign. Wherever she was in her ghostly habitat, would she please smuggle him some affirmation of their enduring love? Suddenly, the overhead light switched on. Other people might have said that signaled her presence. But my father, actually passionately secular, discounted the idea. He did not find this strange electrical event sufficiently convincing: how unimaginative, after all. If my mother were to send notice from the afterlife, she would have chosen something more delicate — perhaps a white petal plucked from one of her beloved cymbidiums, fluttering onto his chest.

When someone dies, the survivors often look for otherworldly messengers. Birds, especially when they hop on a windowsill and peck at the glass, are said to represent ghostly incarnations of the recently departed. It helps if they're ravens, or at least black of wing.

After my father's death, I, too, longed for a sign. But none came, not even in a dream. In the many weeks since he died, I've dreamt of him only once. In that dream,

he sat propped up in a chair, his face wearing the eerily rejuvenated expression that appeared in the hours before his death, when the morphine relaxed and then erased his wrinkles, as though unwinding time. What should I make of this dream? That my father was dead.

So I was left to forge my own signs, hoping to give grief meaning. I'd connect random conversations or events to make sense of my father's death. For example, his second wife, who had angina, had had to go to the hospital for a scheduled cardiac catheterization on the morning of my father's stroke. Terrified that the procedure would go awry, my father had told her the night before, “You mustn't die before I do.” Maybe to secure his place first in line, he took ill.

Or this: One of my father's doctors showed me the CT of his hemorrhagic stroke. The bleed was located in the exact same part of the brain as the one that had afflicted my mother when she had a stroke in 1999. Now my father, like her, was paralyzed on the left side, as though he were demonstrating through imitation his loyalty to her as he followed her to the grave.

Or: How is it that my father

waited to die until my sister and I returned to his hospital room from a several-hour break for eating and showering?

We can't help but look for ways to reconcile ourselves to what is fundamentally unacceptable. In the United States, 7000 people die every day. To paraphrase poet laureate Billy Collins: while you are lying in bed reading your magazine, all the dead of that day are starting their journey.

After my dad's death, I kept telling myself it couldn't be true. Why did he die at 94? Why not at 96? He was, after all, still in great shape. At breakfast, he liked to narrate the formative stories of his youth — how, for example, after he had escaped from Hitler, he'd arrived alone and penniless in an unfamiliar South American town in the middle of the night and had suddenly remembered that distant relatives had migrated there and that they might take him in. He was able to find out where they lived. Awakened by my father's knocking, his cousin rushed to see who it was and immediately folded him into her arms. He was saved.

My father was a storyteller. Just as he could recall the plot of