I entered medical school in 1968, hard on the heels of anti-war demonstrations and civil rights activism. There weren’t many student-activists entering the University of California San Francisco (UCSF) that year. Those few of us quickly sought each other out to set our agenda. High on the list was the need to demand of the Dean of the medical school that students be placed as full members on the school’s Committee on Admissions. They chose me to confront the Dean with our demand.

Never one for direct confrontation, I uttered our “demand” to the Dean in what must have seemed a diminutive voice. White-haired and distinctive in his blue suit, white shirt, and tasteful tie, the Dean looked at me, paused, and replied, “OK—You’re on.” For the next 5 years I sat as a full member of the admissions committee, spending several hours each week reviewing files, interviewing applicants, and meeting with the committee. I quickly learned the norms by which the committee selected its matriculants from among the pool of applicants. “His grades in science are strong—he’ll do fine. Admit.” “Sure he was the leader of his volunteer organisation, but he got a C+ in organic chemistry. Reject.”

As I look back on this process, one applicant in particular comes to mind. I held his admission interview in the medical school cafeteria. I sensed his passion to become a physician. He communicated easily. He described the strong sense of connection he had felt with the patients at the free clinic at which he had volunteered. While I wasn’t yet sure what a great physician was, I had an intuitive sense he would become one. Yet the decision was “His science grades aren’t strong enough. Reject.” I felt personally bruised. But then, I was only the student—what did I know?

25 years later I began advising undergraduates at Stanford University, many of whom had come to Stanford with the hope of eventually becoming a physician. From many of these students I heard what would become a mantra. “I used to be pre-med, but...” It seemed common knowledge among these students that a C+ in organic chemistry was simply incompatible with hopes of becoming a physician. If you can’t do science, you can’t succeed as a physician. If all you can pull is a C+ in chemistry, it’s unlikely you’ll get into medical school. By then I had more than two decades of clinical practice experience to teach me what a great physician was. A great physician creates a bond of communication and trust with his or her patient; a great physician can sense the feelings the patient is struggling to express or afraid to try; a great physician is also technically competent and conversant in medical science. For so many of these students, as for the applicant in the cafeteria, I had a clear, intuitive sense that, given the chance, they would become great as physicians.

A quarter of a century after the interview in the cafeteria I had the confidence I was correct. To use a mediocre score in an undergraduate science class to disqualify these students from a medical career seemed indefensible.

By then, however, my confidence was tempered by the scepticism of a social scientist. As part of my doctoral training in sociology I had learned the importance of scientific evidence. I knew I must somehow test both my intuitive hypotheses regarding the students’ qualities and the assumptions on which admissions committees based their decisions. Is greatness in sciences such as chemistry and physics a prerequisite for greatness in medicine? What was the scientific evidence in support of this assumption?

My research took me to the close of the 19th century. The profession of medicine in the USA was struggling to establish an identity. That identity, and the assumptions underlying it, became clear between 1893, with the founding of the Johns Hopkins School of Medicine, and 1914, with the tenth annual convening of the Council on Medical Education (CME) established jointly by the American Medical Association and the Association of American Medical Colleges. Addressing the CME in 1914, Dr Victor Vaughan, a founding member of the Council, spoke the core belief on which the American medical profession by then was built.

“No man is fit to study medicine, unless he is acquainted, and pretty thoroughly acquainted, with the fundamental facts in physical, chemical, and biological subjects...The facts of the biological, physical, and chemical sciences are the pabulum on which medicine feeds. Without these sciences, everything that goes under the name of medicine is fraud, sham, and superstition.”

Was there evidence to support Vaughan’s words? Is science the pabulum that nurtures young physicians? I went back in the literature of medical education 40 years before the time...
of Vaughan’s comments, and found no scientific evidence to support his assertion. I went ahead, through more than 90 years of published research. I did find evidence that performance in the undergraduate sciences can predict failure in the initial sciences courses in the medical school curriculum. Those who score in the bottom 10–20% on standardised tests of scientific knowledge are the most likely to fail the early years of medical school (although more than half would succeed, given the chance). I also found evidence of a correlation between one’s grades in undergraduate sciences and one’s grades in the preclinical science courses that initiate the curriculum in many medical schools. That, though, was where the evidence stopped.

Students learn the practice of medicine through clinical instruction, gained in the final years of medical school and through graduate medical education. I found no scientific evidence that supported the power of performance in undergraduate science courses as a way to predict clinical or professional quality as a physician. Professional quality—the “art” of medicine—is based on something other than knowledge of chemistry. My search found something else, though—something troubling. It found consistent evidence that performance in the premedical sciences is inversely associated with many of the personal, non-cognitive qualities so central to the art of medicine. I first found this evidence in my own educational back yard.

Harrison Gough, a psychologist at the University of California, Berkeley, administered a series of psychological tests to 1071 students entering medical school at UCSF between 1955 and 1967. Gough reported that students’ undergraduate science grades and MCAT science scores were associated with grades in the first 2 years of medical school, but were, “almost completely unrelated to performance in the fourth year and to faculty rating of general and clinical competence”. He then compared the psychological profiles of these students with their performance in premedical sciences. He found that the students who did better in science were, “narrower in interests, less adaptable, less articulate, and less comfortable in interpersonal relationships”. What startled me when I first read the results of Gough’s research was that, through the 5 years of my participation on UCSF’s admissions committee, we were never informed of the results of his study. Our committee used performance in the sciences as its metric of quality, without appreciating that our metric may have been inversely associated with our target outcome of professional excellence.

A number of others have found the psychological profile of students who perform best in the premedical sciences to be the reverse of what one might hope for in a physician. Writing in the 1970s, Witkin found students who were most successful in the sciences, “have an impersonal orientation: they are not very interested in others”. Tutton’s studies of medical students in Australia in the 1990s found that students who did the best in the premedical sciences scored lower on standardised measures of empathy and tended to be “shy”, “submissive”, “withdrawn”, or “awkward and ill at ease socially”, characteristics the author suggested are, “the antithesis of what most of us would want in a clinician”.

If, as Vaughan suggested in 1914, and as many medical school admissions committees seem still to believe, the premedical sciences are the “pabulum” that provide early intellectual nourishment to the young people who are to become our future physicians, then we have been raising generations of malnourished physicians. With an intellectual diet abundant in chemistry, biology, and physics but lacking essential psychological nutrients, we may have weakened the ability of many physicians to practise the art of medicine. The scientific evidence in support of this conclusion is convincing. I do not mean to suggest that knowledge of science is irrelevant to medical education and medical practice. There is a critically important threshold of scientific knowledge that forms the foundation on which a medical education is built. However, once one has exceeded this cognitive threshold, additional scientific knowledge adds little to subsequent performance as a physician. In response to growing data that balancing cognitive and non-cognitive strengths of applicants does not compromise eventual medical quality, some medical schools in the UK and USA have either adopted, or are evaluating, alternative admission criteria. A leader in this area has been McMaster Medical School in Canada with its “Multiple Mini Interview” used to assess psychological and personality aspects of potential students. The Humanities and Medicine Program of the Mount Sinai School of Medicine in New York offers another example.

If we seek from what we see in our students is professional excellence, we must be careful to base the manner in which we select these students on scientific evidence, not on superstition. Beyond its religious connotation, The Oxford English Dictionary suggests that superstition represents an, “irrational or unfounded belief”. The belief that one’s knowledge of science represents a continuous metric of the quality of one’s preparation for the study of medicine represents precisely such an “unfounded belief”. There seems to be no scientific evidence to support it. Great physicians base their professional practice on a threshold of scientific knowledge they have acquired throughout their career. Upon this foundation they build an artistic display of communication, compassion, empathy, and judgment. In selecting students for the study of medicine, we must be careful to avoid superstition, and to adhere to the evidence that equates as metrics of quality a preparation in fundamental scientific principles and the non-cognitive characteristics that are conducive to professional greatness.

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Further reading
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