Commentary: Translational Medicine and Neurosurgery: Chance and the Prepared Mind

The term “translational medicine” has become an essential part of the contemporary discussion about priorities in the funding of medical and healthcare research, particularly in view of the investment in translational research contemplated by important institutions in the US and the UK.1-4 This was not always the case. The work of Robert White, whose inspired career (described elsewhere in this volume) exemplified ways in which translational research could be pursued in conjunction with clinical academic practice, was unusual. It reflected, moreover, the discipline and persistence of one individual rather than a systematic manifestation of translational competence.5

Indeed, the idea of a system-wide commitment to translational research is only just emerging even though the profession of neurosurgery has historically invited and included a broad range of research programs. True translational research requires investigators to learn specific skills. While they can be learned by doing, as many individual neurosurgeons have done, there is reason to suggest that these skills and these competencies ought to become part of the required research curriculum for neurosurgical trainees.

The term “translational medicine” seems to have appeared first in the 1990s. Its definitions and ambitions were initially ambiguous. At first it was applied simply to describe cross-disciplinary research. Soon after, it came to refer to cutting-edge investigation bridging the laboratory and the clinic, and something of an ideal.2,6

Some researchers objected to positioning translational research as an ideal. Their concerns were based on a number of historical prejudices and perhaps even anxieties. One was the historical “superiority” of pure science as opposed to applied science. Another was the fear that good science would suffer from being forced into human applications before it was entirely ready. That was already a point of contention between laboratory investigators and clinicians. A third pertained to the mission of the academy.

There were debates about skills required: what were they and were they desirable in the scientist. On the one hand the debates focused on whether scientists not trained in human medicine ought to become involved in the clinical applications of their work. On the other, they focused on the risks of diluting or perverting the mission of science by worrying about factors like competition, competitiveness, “drugability,” or market acceptance.

Ethical concerns were raised about scientists moving from the laboratory to the bedside. Could a scientist act as a principle investigator in human trials, especially if his or her own patients were involved? What did that mean for surgeons? Was a surgeon precluded from developing new devices for his or her own patients and then using them? A number of translational efforts became start-up companies funded by venture capitalists and eventually as publically traded companies. Was that a distraction? What would that mean with respect to conflicts of interest and pressure on the investigator? What were the implications of sponsored research for commercial purposes?

Each of these concerns was realistic and many were based in significant controversies of the past. Still, the proliferation of MD–PhD and clinician–investigator programs supported by the National Institutes of Health increased the number of individuals drawn to translational medicine. So did opportunities for market-based funding as grant money began to diminish in the 1980s.

As a result, a number of structural initiatives were undertaken to legitimize the role of translational medicine as part of medical research. These included programs and protocols to protect human subjects in experimental medicine, the development of active institutional review boards, safeguards against conflicts of interest, standards for voluntary fully informed consent, disclosure rules regarding financial interests, and formalized guidelines for sponsored research and collaborative ventures between research institutions and the biomedical industry.
By the mid-2000s, translational medicine was mainstream. There were journals devoted to the subject, and articles dedicated to translational subjects began to populate the medical literature. In parallel, the concept of translational medicine was expanded. Whereas at first it was concerned primarily with the removal of disciplinary barriers in research, the application of findings from basic research to medicine, the goal of focusing on discoveries applicable to patient benefit, and development of new products and approaches to health and disease, it came to include the problem of implementation of new technologies, the assessment of new treatment strategies and cost-effectiveness research. The preimplementation part was called the “first gap in translation” or T1, and implementation was called “the second gap in translation” or T2.7

The NIH published a definition of translational medicine, which reflects broadened ambit:8

Translational research includes two areas of translation. One is the process of applying discoveries generated during research in the laboratory, and in preclinical studies, to the development of trials and studies in humans. The second area of translation concerns research aimed at enhancing the adoption of best practices in the community. Cost-effectiveness of prevention and treatment strategies is also an important part of translational science.

Why should translational medicine matter to the neurosurgeon? Lasting technological advances often require contributions from multiple technologies. The underlying sciences may be physical, mathematical, biological, chemical, genetic, or social. The skills needed to identify and integrate these go beyond invention and ingenuity: they depend on synthesis, creativity, and resourcefulness. The path to technological integration, like the gap between T1 and T2, is real and not always obvious. Nevertheless, it is becoming increasingly clear that the skills needed to increase the efficiency of the translational process can be learned and can be taught.9 Formal academic programs in translational medicine have been developed.

Upon the opening of the new Faculty of Sciences at the University of Lille on December 7, 1854, Louis Pasteur emphasized the importance of the faculty by declaring: “In the fields of observation, chance only favors the mind which is prepared.” At the time, Pasteur was alluding to the discovery of electromagnetism by Hans Christian Ørsted in 1820, which was considered an enormous advance.10–12 The same could have been said unreservedly of many other discoveries, and the aphorism became part of the scientific canon, often restated as “chance favors the prepared mind.” In any case, the importance of preparation, both in the transitive and intransitive sense, cannot be overstated.

What is remarkable about Robert White, besides his vision of practical applications of basic research, was his prescience with regard to scientific applications. His greatest contribution may have been in teaching a generation of neurosurgeons who learned to think translationally before the term came to exist. He had learned how to ask questions and sought to answer them practically drawing on the best combinations of science he could find.

Neurosurgery as a profession has stood out among the specialties for its appreciation and indulgence of audacious and innovative problem solving. Many factors, including the regulatory and legal environments, make the pursuit of patient-directed innovation more complicated than it once was. The new rules require more care, broader expertise, and, perhaps, a depth of courage somewhat different than before. Fortune favors not only the prepared mind, but also, as the Romans taught, the brave.13 It is clear that translation can be taught. Here we suggest that it should be, not only because translational skills might usefully inform neurosurgical investigation, but because it is the best way forward for patient care.

Disclosure

The author has no personal, financial, or institutional interest in any of the drugs, materials, or devices described in this article.

REFERENCES