Erosion of William Henry Welch's Concept of the Hygienic Laboratory in our Nation's Schools of Public Health and Medicine

Peter J. Hotez, MD, PhD[a]

The last two decades have witnessed significant changes in American medical student education. Among the most obvious of these changes is the disappearance of laboratory instruction. At all but a handful of medical schools, our nation's physicians-in-training no longer spend blocks of time in laboratories of biochemistry, physiology, and microbiology.[1] This is a far cry from the early parts of the 20th century when, as a consequence of the Flexner report and the vigorous efforts of leading university presidents such as Daniel Coit Gilman (Johns Hopkins), Charles Eliot (Harvard), Paul Rainey Harper (Chicago), and others, laboratory instruction provided the core of U.S. medical education. The erosion in laboratory time for American medical students may partly account for the absence of physician-scientists in U.S. universities and biomedical research institutes. The Commonwealth Fund and other organizations have documented parallel reductions in the number of physicians who become National Institutes of Health (NIH) funded scientific investigators.[2] Together, these findings have led some to call for reforms. Are the Masters of Public Health (MPH) students in our 32 nationally accredited schools of public health also being deprived of laboratory training?

THE ORIGINS OF AMERICAN HYGIENIC LABORATORY INSTRUCTION

The medical education reforms introduced by Abraham Flexner, following his landmark report in 1910, paralleled a similar revolution in the first-generation of American schools of public health. The foundation of the early schools of public health in the United States was partly derived from a Rockefeller Foundation-led initiative to merge laboratory investigation and laboratory instruction with public health practice. This movement launched the so-called "West Points of Public Health" (referring to the U.S. Military Academy) comprised of the Johns Hopkins School of Hygiene and Public Health (1916), Peking Union Medical College (1917), Harvard School of Public Health (1922), London School of Hygiene and Tropical Medicine (1924), and the University of Toronto School of Hygiene (1924).[3] The origin of these flagship schools was anchored

[a]Department of Microbiology and Tropical Medicine, The George Washington University Medical Center, Washington DC

Address correspondence to: Peter J. Hotez, MD, PhD, Dept. of Microbiology and Tropical Medicine, George Washington Univ. Medical Cntr., Ross Hall 736; 2300 Eye Street NW, Washington DC 20037; tel. 202-994-3532; fax 202-994-2913; e-mail <mtmpjh@gwumc.edu>.

© 2003 Association of Schools of Public Health

in the early writings and thoughts of William Henry Welch, who trained as a pathologist in Germany and went on to become the inaugural public health dean at Johns Hopkins. As early as 1884, Welch, while touring scientific institutes in Germany, became deeply impressed with the new science of bacteriology then being practiced at the Institute of Hygiene founded at the University of Munich by Professor Max von Pettenkofer. Physical sciences, including chemistry, were also central to the mission of the Institute. Welch wrote to Johns Hopkins President Gilman, "I have been particularly impressed with the hygienic institute which is the pride of the medical school in Munich. I hope that we may have a similar institute in Baltimore, and if possible in connection with the institute someone who has been trained in the Pettenkofer school of hygiene."[4]

Towards the end of the 19th century, the Munich model helped to stimulate the nation's first hygienic laboratories located at state and city health departments in Massachusetts, Michigan, New York City, and Providence, Rhode Island. Welch maintained that university laboratories of hygiene could serve in parallel with these state-operated laboratories, and that they were needed to both train scientific hygienic workers and to advance knowledge by making new discoveries on behalf of the state laboratories.[5] He regretted that "one could count upon the fingers of one hand the laboratories connected with medical colleges and universities in this country which are appropriately called hygienic laboratories."[5] For that reason, Welch lobbied hard to include the word *hygiene* into the school's name and mission. In addition to the subjects taught at von Pettenkofer's Munich institute, the Johns Hopkins School included parasitology in order to accommodate the growing interest in hookworm public health practice being conducted by the Rockfeller Sanitary Commission. As Simon and Thomas Flexner pointed out in 1941, "The [Johns Hopkins] School of Hygiene had a double purpose: it prepared students in the scientific as well as the practical aspects of public health administration, and it instructed active public health officers in the foundations of their calling . . . the practice of public health, like the practice of medicine, was lifted to a more scientific plane, and in both fields there was a harvest of new knowledge."[6]

THE DISAPPEARANCE OF LABORATORY INSTRUCTION

By 1950 most of the 11 schools of public health in existence at that time—California, Columbia, Harvard, Johns Hopkins, Michigan, Minnesota, North Carolina, Pittsburgh Toronto, Tulane, and Yale[7]—were heavily grounded in bacteriology, parasitology, and virology. Students enrolled in the MPH degree programs at these institutions had ample opportunity to obtain laboratory instruction in microbiology and benefited from the presence of strong departments devoted to laboratory investigation in these subjects. However, over the next 50 years this situation shifted. Almost none of the newest schools of public health established in the last two decades have invested in laboratory instruction, while flagship departments previously devoted to public health laboratory sciences subsequently closed at Columbia (Department of Tropical Medicine), Harvard (Department of Tropical Public Health), North Carolina (Department of Parasitology and Laboratory Practice), and Yale (Yale Arbovirus Unit). Just as medical education lost its basis in laboratory instruction so did our MPH public health training.

CALLS FOR REFORM

Almost 14 years before the intentional release of anthrax spores in the autumn and winter of 2001–2002, a committee charged by the National Academy of Sciences Institute of Medicine (IOM) reported that the 25 schools of public health in existence at that time had become isolated from public health practice and no longer placed a sufficiently high value on training professionals to work in health agencies.[8] Although the report did not specifically mention public health laboratory practice, the schools were cited for "movement away from their research mission," and their failure to "capitalize on their unique location in research universities, which prevented them from advancing knowledge and producing well trained professional practitioners."[8]

Since the IOM report, molecular microbiology has advanced to the point where a wide range of new tools can be employed for the prevention of infectious diseases. This includes the polymerase chain reaction and genomics and bioinformatics that have made it possible to characterize emerging infectious disease agents, and molecular tools to track their transmission.[9] The diagnosis and prevention of infections caused by Hepatitis C, Nipah virus, and West Nile virus are modern examples of the fruits of these new technologies, as is the post–September 11, 2001 molecular forensics of anthrax infection. According to B. J. Turnock, "Had AIDS emerged 100 years ago, when laboratory-based diagnostic methods were in their infancy, the disease might have remained a mysterious syndrome for many decades. Moreover, the drugs used to treat HIV-infected persons and prevent perinatal

transmission (e.g., replication analogues and protease inhibitors) were developed based on a modern understanding of retroviral replication at the molecular level.[9]

Because of both the enormous potential and realized benefits of introducing laboratory-based training in the public health arena and the critical needs (in part revealed by the events post–September 11) to have public health workers trained in microbiology, new mechanisms need to be considered in order to infuse public health education with formal didactic and laboratory instruction in bacteriology, virology, parasitology, and entomology. There will also be unprecedented opportunities to apply the nascent fields of genomics, proteomics, and bioinformatics to the study of microbial agents.[10,11] For the flagship schools of public health founded in the early part of the 20th century, this may require expansion of existing basic science departments and hiring of new faculty who will be committed to laboratory instruction. For the newer schools of public health, which have no tradition of laboratory investigation, the transition will be more daunting. Either these new schools will need to cooperate more closely with other components of their larger research universities as first recommended in the 1988 IOM report, or they must consider inaugurating new departments. Both situations will require a considerable investment of private and federal funds.

It has been 118 years since William Henry Welch first wrote to his university president about the possibilities of merging the laboratory with public health practice. We now need to revisit Professor Welch's vision.

REFERENCES

1. Hotez PJ. Loss of laboratory instruction in American medical schools: erosion of Flexner's view of scientific medical education. Am J Med Sci 2003;325:10-14.
2. Commonwealth Fund Task Force on Academic Health Centers. From bench to bedside: preserving the research mission of academic health centers. New York: The Commonwealth Fund; 1999. p. 23, 28.
3. Fee E. Designing schools of public health for the United States. In: Fee E, Acheson RM, editors. A history of education in public health. New York: Oxford University Press; 1991. p. 188.
4. Flexner S, Flexner JT. William Henry Welch and the heroic age of American medicine. Johns Hopkins ed. Baltimore: Johns Hopkins University Press; 1993. p. 341.
5. Flexner S, Flexner JT. William Henry Welch, p. 344.
6. Flexner S, Flexner JT. William Henry Welch, p. 360.
7. Fee E, Rosenkrantz B. Professional education for public health of the United States. In: Fee E, Acheson RM, editors. A history of education in public health. New York: Oxford University Press; 1991. p. 240.
8. Institute of Medicine (US), Committee for the Study of the Future of Public Health. The future of public health. Washington DC: National Academies Press; 1988. p. 15-7.
9. Turnock BJ. Public health: what it is and how it works. Gaithersburg (MD): Aspen Publishers; 2001. p. 26.
10. Broder S, Hoffman SJ, Hotez PJ. Cures for the Third World's problems: the application of genomics to the diseases plaguing the developing world may have huge medical and economic benefits for those countries and might even prevent armed conflict. EMBO Rep 2002; 3:806-12.
11. Pang T. The impact of genomics on global health. Am J Public Health 2002;92:1077-9.