

Integrating medical and engineering undergraduate training

Academic programs that allow students to study core material from multiple subject areas in an integrated fashion have existed at North American medical schools for many decades and have included MD/PhD, MD/MBA and MD/MPH options. Interest in innovative programs to train potential clinical scientists, policy-makers and business leaders continues to be strong.^{1,2}

Engineering with Medicine has been available since 1998 at the University of Western Ontario to students who are interested in combining expertise in engineering, mathematics, computing and the physical sciences with careers in clinical or academic medicine (Fig. 1). The dual MD/BESc program requires 7 years of study instead of the 8 that would be required to attain the degrees separately.

Students complete engineering coursework at the same time as they study the normal medical curriculum. They undertake a research-based thesis during the first 2 years of medical study. This thesis must demonstrate an application of engineering principles to current medical problems, and supervision is provided by members of both faculties. Projects have included a prototype apparatus to evaluate elbow joint mobility in-



Fig. 1: Brent Lanting (left) and Joe Barfett (right) are students in the MD/BESc program at the University of Western Ontario.

traoperatively and a microencapsulation-based artificial cell implant for drug delivery to the central nervous system.

Although the MD/BESc program is academically demanding, it offers several important advantages. Many engineering concepts such as transfer phenomena, thermodynamics and mechanical vibrations are studied in a more medical context than would be possible in a traditional engineering or physical sciences program. In addition, the simultaneous acquisition of engineering and clinical skills provides unique insights into ways that technology can be used to improve health care.

We hope that this program can serve as a model for the implementation of a similar curriculum at other institutions and welcome correspondence (jjbarfett@uwo.ca) concerning course structure and students' experiences.

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Global IDEA

Recent *CMAJ* commentaries^{1,2} have promoted the view that improved medical technologies are the most promising means of improving population health in developing countries. Although we support an increase in research into global health issues, we feel

that clinical research into novel technical solutions will have less success in achieving improvements in population health than these commentaries suggest, for 3 reasons.

First, history shows that improvements in population health status in Western Europe have come largely in the absence of disease-specific control measures. The technologic improvements that coincided with large increases in life expectancy in the late 19th century related to improved sanitation, expanding access to safe water supplies and improvements in living conditions, not to specific medical interventions.³ Similarly, 90% of the reduction in mortality from tuberculosis in England and Wales predated the introduction of BCG (bacille Calmette-Guérin) vaccination or streptomycin.⁴

Second, in developing countries where significant improvements in population health have occurred in recent decades, other, so-called “upstream” determinants of health (such as female literacy^{5,6}) appear to be more highly correlated with these changes. Developing countries that have achieved high levels of life expectancy and low levels of mortality, such as China, Sri Lanka and Cuba, have done so primarily because of investments in the social determinants of health (universal education, food subsidies) and a commitment to egalitarian principles.⁷

Third, the effectiveness of any clinical intervention in the community is always much less than that determined through clinical research, because of problems in health service access, diagnostic accuracy, and transport and management of supplies, among others. The oft-repeated example of vaccination is one of the few exceptions, likely because the intervention is relatively simple, needs to be applied only once or a few times, and does not need to target only those who are already ill.

Operational research is needed to assist developing countries in creating public policies that allow for the expansion of approaches already shown to have a greater impact than medical