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# Why Medical Education is Being (Inexorably) Re-Imagined and Re-Designed

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The last widespread reimagining and substantive reform in medical student education followed the Flexner Report (published 1910). Given the dramatic changes in educational methods, pedagogy, and technology, and the dramatic changes in society, medical education has inexorably evolved in intentional and unintentional ways. The transition from the post-Flexnerian model (university-based education with the first 2 years organized around classroom didactics, laboratory/anatomy learning followed by 2 years of inpatient and outpatient clinical experiences organized around a distribution of block and elective rotations) to the models of today (highlighting early clinical exposure, integration of foundational and clinical sciences, longitudinal learning experiences, promotion of self-directed learning skills, and competency-based education) is underway. The focus now is to prepare graduates for the continued explosion of medical knowledge, technological development and expanded patient and societal

expectations that increasingly characterize this century. The following five important developments in medical education drive these re-imagining and re-design efforts: (1) patient, societal and governmental pressure to deliver on the Triple Aim; (2) conceptualization of medical education as a translational science; (3) medical knowledge and technology will continue to expand and accelerate the pace of new development; (4) new expectations of present and future generations of learners; and (5) better understanding of the neurobiology of learning. The impact of these developments, and our responses as those dedicated to educating the present and future physicians, will determine much of the outcomes in this journey to evidence-based medical education. With all of the information and techniques available to the inquisitive and diligent teacher, there will be ample rewards for teaching well done.

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**T**he last widespread reimagining and substantive reform in medical student education followed the Flexner Report, which was published in 1910.<sup>1</sup> In the ensuing 100 years, everything has changed, yet we see medical education thoroughly mired in the methods that proved so successful in improving the quality of physicians and medical care over the last century. And how Everything else in society has changed! A century ago, the world completed the transformation from a largely agricultural society, still largely dependent on manual labor, to that of a full-fledged industrial society based on management of technology, capital, and labor. Since the 1980s with the advent of personal computers and internet connectivity, our society has increasingly developed into a knowledge-based society where knowledge is the primary currency and product rather

than capital and labor. Improvements in technology, access to information, new mass media, trade, material resources, transportation, molecular biology, therapeutics, and learning have re-fashioned our world. How has medical education evolved?

The advancements proposed and adopted in response to the Flexner report focused on providing a medical school education that was university based in the first 2 years organized around classroom didactics and laboratory/anatomy learning followed by 2 years of inpatient and outpatient clinical experiences organized around a distribution of block and elective rotations. Post-graduate training, based mostly in inpatient settings, was focused on varied clinical experiences accompanied by limited formal instruction and varying degrees of patient care responsibility designed to prepare graduates for independent careers. This educational format has resulted in a medical education system, and continuing medical education system, that has been very productive in the US but appears to be now ill prepared to prepare graduates for the continued explosion of medical knowledge, technological development, and expanded patient and societal expectations that increasingly

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characterize this century.<sup>2</sup> Irby,<sup>3</sup> as well as many other commentators,<sup>4</sup> has called for a fundamentally different medical education and continuing education system that is informed by current and future innovations in educational methods and new understandings about how people learn.

Five inexorable developments should inform the reimagining of our medical education system.

## **Patient, Societal, and Governmental Pressure to Deliver on the Triple Aim**

As Berwick<sup>5</sup> so aptly described, society's expectations have grown beyond expecting cures to now the expectation that the Triple Aim will be delivered and health will be promoted for all in society. Improving the U.S. health care system requires simultaneous pursuit of *three aims*: improving the experience of care, improving the health of populations, and reducing per capita costs of health care. These expectations involve *the right care in an accessible manner at a cost commensurate with value*. Attention to the health of populations involves increasing emphasis on systems integration and improvements; partnership with individuals and families, in patient-centered care, that is coherent and effective delivers on the expectation of the Triple Aim. The best methods to prepare physicians for these roles are still to be imagined.

## **Conceptualization of Medical Education as a Translational Science**

Medical education is now being recognized as a science that must be used to improve the process of delivering well-trained and effective physicians who can deliver compassionate, effective care and improve the health of everyone in society.<sup>6</sup> As new understandings of the neurobiology of learning and methods to leverage these understandings emerge,<sup>7</sup> medical educators will be tasked to develop teaching and instructional methods that are evidence-based and that address how adults best learn, form desired professional identities, gain and retain significant knowledge, develop rich skill sets, and are prepared for careers centered on self-directed learning and continuous professional development, all with the ultimate goal of improving the health of patients and society.<sup>4</sup>

## **Medical Knowledge and Technology Will Continue to Expand and Accelerate the Pace of New Development**

The explosion in medical knowledge is difficult to grasp and visualize. Improvements in computational power, information sharing and connectivity all promote this massive expansion of medical knowledge. Search engines like PubMed are essential portals to the ever-expanding corpus of knowledge. One example of the knowledge explosion is the continued growth in PubMed citations (e.g., in April 2009—information on 18,782,970 medical citations) with 670,000 new entries added in the next year.<sup>8</sup> How physicians and educators account for this expanding knowledge base has been facilitated by the parallel development of new media and technologies that have emerged to make the task of searching, organizing, and retrieving relevant information easier.<sup>9</sup>

The explosion in medical knowledge is also augmented by enhancements in the organization and coordination of new knowledge. This growth in knowledge is an outcome of increased innovation and technological advancements in biomedical research. In the medical setting, knowledge coordination is a distributed process that cuts across and connects complementary realms encompassing the organization of scientific research, the design of regulatory rules, the evolution of communities of practitioners, the organization of patient care, and the creation of new biomedical market processes.<sup>10</sup> Such sociological and organizational factors greatly affect the ability of physicians to benefit from the advances of the day.

## **New Expectations of Present and Future Generations of Learners**

The new generation of learners challenges the standard medical education pedagogies in multiple ways.<sup>11,12</sup> Compounding the difficulty for educational leaders and teachers is that currently, four generations are actively working in today's complex health care environment. Predictable and engrained differences between these generations lead to conflicts of expectations and styles with issues related to impaired communication, productivity, and the satisfaction of all ages. Each of the generations had different experiences and has developed different and sometimes

conflicting value sets. Teaching and learning methods must benefit the learner and as such methods that address abilities, preferences, and values of those in the Millennial generation and Generation X should be the standard choice to promote learning and skill development. This requires instructors from other generations to be aware of this foundation and be able to adapt methods that meet the newer generations of learners in their best learning zone.

In particular, members of the Millennial generation (born 1980–2000) tend to prize working for the social good and global issues; value morality, diversity, and achievement; and tend to be optimistic, like their Boomer parents. They also value having fun at work and expect lifework balance. They desire meaningful careers and will often sacrifice income for meaning in work.<sup>12</sup> Their comfort level and emphasis on technology in life and in learning specifically defines a different type of learner—one who will look for instruction that is technology enhanced, personalized, and linked to important meanings. The methods by which our medical education systems (faculty, staff, and infrastructure) respond to this new type of learners are now being defined.

## Better Understanding of the Neurobiology of Learning

Advances in molecular biology, biochemistry/pharmacology, and imaging techniques have resulted in new, evidence-based understanding of how humans learn and apply knowledge and skills in performance. Exploration of how adults best learn, pioneered by Knowles and colleagues<sup>13,14</sup> more than 50 years ago, emphasized the impact of motivation, attention, and emotion on learning. These premises about adult learning are now being complemented by evidence that learning represents combinations of enhanced neuronal synaptic transmission, increased neuronal connections, and new neuron generation, particularly in brain areas where new memory is formed and how neuronal circuitry represents learning and memory. The dynamic, always structured and yet highly plastic nature of learning networks in the brain define the physiology and reality of learning—*learning requires neurons to change!*

## Summary

As Prober and Khan<sup>2</sup> have stressed, the conflation of ever-expanding medical knowledge, increasing

complexity in the health care system, heightened expectations, and advances in learning methods and technologies offers both a call for change in medical education and exciting methods to do things different and better. We know that our learners' time will not expand so we will all need to teach and learn more efficiently and effectively.

This issue of CPPAHC will detail what we now know about knowing and learning (Mahan and Stein), how we can best leverage new e-learning technologies (Lewis et al.), and how innovative pedagogical techniques, such as significant learning, backwards design, and team-based learning, can be employed in the continued improvement and re-design of medical education (Hurtubise and Roman). The final article details five examples of how specific pedagogical methods can be employed to utilize the practices that define how adults best learn to improve the medical education process (Reed et al.). The journey to evidence-based medical education has just begun, the desired outcomes are clear, and the information and techniques available to all of us will reward the inquisitive and diligent teacher.

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