

Enhancing surgical innovation through a specialized medical school pathway of excellence in innovation and entrepreneurship: Lessons learned and opportunities for the future

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The mission of an academic medical center and academic departments of surgery focuses on teaching, scholarship/research, and expertise of clinical care. The standard 4-year medical school curriculum and general surgery residency training are well balanced to expose trainees to these missions in varying degrees, yet the advancement of medicine as a field is predicated on the creation, development, and successful implementation of medical innovations. Surgeons, by virtue of their clinical training, are immersed in medical technology and are continually required to use this technology effectively in combination with their own technical skills and judgment to provide optimal patient care. As such, they routinely face the challenges of current technology and the need for innovation and improvement, leading many to become natural inventors. Having a good idea or innovation to improve patient care, however, is just the starting point of the complex process of implementing that idea in the clinic. Unfortunately, the vast majority of surgeons and medical students have no formal educational training on the innovation process regarding how good ideas can be developed successfully for clinical and commercial implementation. Added to this lack of formal education are the limited resources and time constraints that surgeons, residents, and medical students face in acquiring the educational skill set to adeptly navigate this innovation and entrepreneurial landscape. To address these challenges, the University of Michigan recently created the first pathway of excellence for medical students to focus their passions and interests in medical innovation and entrepreneurship. This program has been transformative for building a new culture of young, motivated medical innovators, many of whom have dedicated their talents already to addressing several key problems in surgical patient care. (Surgery 2017;■:■-■.)

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MEDICAL SCHOOL EDUCATION AND RESIDENT TRAINING IN SURGERY continues to evolve as technology and the breadth of medical knowledge expands. In this environment, trainees are forced to become

more efficient with their time. The increase in medical information given to students and surgical trainees has resulted in many schools and programs around the country shortening their

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standard courses to squeeze more content into the curriculum. Yet, they are still expected to create newly minted physicians after 4 years of medical school and competent surgeons after 5 years of clinical residency training. In today's medical environment, surgeons must learn to use and evaluate new technologies for their practices and are constantly at the forefront of the explosion in current medical technology. Although it is one thing to be able to evaluate the utility and benefit of a new technology, it is an altogether different skill set to troubleshoot problems in medical or surgical practice and create innovative solutions to improve patient care. For many medical students and surgery residents, however, it is this second area that they find the most exciting and where they seek to channel their efforts.

THE MEDICAL SCHOOL PATHWAY OF EXCELLENCE IN INNOVATION AND ENTREPRENEURSHIP

To meet the needs of learners working in the constraints of today's busy academic medical centers, innovation resources and educational opportunities need to be flexible and adaptable and avoid being onerous or impractical to yield meaningful participation and engagement. Added to these time constraints are the different learning styles of academic learners: Millennials engage and learn in ways different from the Baby Boomers and even individuals from Generation X. One highly successful solution adapted at the University of Michigan was the creation of a team and network of dedicated individuals who can work with all facets of academic learners, from students to senior faculty and chairs, and provide a large variety of educational programs, including online modules, formal courses, workshops, and mentoring expertise from successful entrepreneurs, leaders in industry, and venture capital managers.

After vital educational programs have been implemented, the next crucial step is financial commitment. An idea without financial resources is unlikely to be successful. For most ideas, financing in the form of a startup may require capital investment from angel or venture capital partners; however, to garner this type of substantial financial commitment, an idea needs to be advanced or de-risked enough to have a reasonable or high chance of commercial success in the market. Academic institutions recognize the value of discovery and advancement of medical innovations into the clinic, but only recently have many academic centers started to put financial resources more fully into their

development and de-risking. This financial commitment has been variable across the country, ranging from small pilot grant mechanisms for innovations to institutional venture funds capable of supporting a full A-series capital raise. With an increase in the value being placed on innovation and entrepreneurial opportunities at academic centers, these resources will continue to evolve and expand as more trainees, scientists, and clinicians engage and invest in their institutional offerings to help advance ideas to the clinic and market more efficiently. Given the current trajectory of technologic advances observed across multiple domains, the next decade will likely see the greatest growth in academic innovations ever produced. This environment creates an important role for academic centers regarding how this surge of productivity will be harnessed and implemented for the advancement of medical science and our professions, including issues like conflict of interest, industry engagement, and reimbursement.

The Paths of Excellence program was created in 2013 at the University of Michigan Medical School to provide students with an extracurricular outlet to concentrate their passions in medicine outside of the standard curriculum. A 2015 survey asked first-year medical students if they would participate in a pathway of excellence in innovation and entrepreneurship program if it were developed. More than 30% of the respondents said that they would. This idea led to the development of the first-of-its-kind Pathway of Excellence in Innovation and Entrepreneurship (I&E), which was launched in the fall semester of 2015. In its inaugural year, the program admitted 31 first-year medical students and 9 students in the second or third years of medical school. The infrastructure of the pathway was designed with the help of several experts on the medical campus, including members from the Fast Forward Medical Innovation team, the business school, and the engineering school, along with input from several champions of the medical students. The mission of the I&E pathway is to give physicians-in-training the resources, perspective, and exposure they need to incorporate innovative strategies and tools that can improve the accessibility, quality, and equity of medical care. In doing so, it strives to develop medical students who can discover, examine, and address patient needs creatively through medical innovation and entrepreneurial opportunities and to give them the tools to explore the transformational role physician-innovators can play in the future of health care.

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