

Entrepreneurship in the Academic Radiology Environment

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Rationale and Objectives: Innovation and entrepreneurship in health care can help solve the current health care crisis by creating products and services that improve quality and convenience while reducing costs.

Materials and Methods: To effectively drive innovation and entrepreneurship within the current health care delivery environment, academic institutions will need to provide education, promote networking across disciplines, align incentives, and adapt institutional cultures. This article provides a general review of entrepreneurship and commercialization from the perspective of academic radiology departments, drawing on information sources in several disciplines including radiology, medicine, law, and business.

Conclusions: Our review will discuss the role of universities in supporting academic entrepreneurship, identify drivers of entrepreneurship, detail opportunities for academic radiologists, and outline key strategies that foster greater involvement of radiologists in entrepreneurial efforts and encourage leadership to embrace and support entrepreneurship.

Key Words: Entrepreneurship; commercialization; academic radiologists.

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Health care innovation offers incredible potential for solving many of the complex and pressing problems that physicians are facing today, such as an increasing proportion of patients with chronic diseases, childhood and adult obesity, and an aging population. New diagnostic and treatment paradigms in the United States spurred a 4% increase in life expectancy, 16% decrease in annual mortality rates, and 25% decline in disability rates for the elderly from 1980 to 2000 (1). However, the cost of delivering health care in the United States has increased at an alarming rate with many health policy analysts indicating that the adoption of new and advanced health care technologies is one of the primary drivers (2). Moreover, advanced diagnostic imaging modalities such as computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography have been targeted as expensive health care technologies responsible for driving up costs, despite their integral role in producing substantially better health care. As a result, the

field of radiology has been significantly impacted by decreases in reimbursement and a prolonged decline in imaging volume (3).

The critical role of innovation in health care is relevant to academic radiologists for two reasons. First, as a result of the current health care crisis, academic radiology departments are likely to experience further declines in reimbursement and volume without broadly applicable strategies to compensate for financial losses that will eventually (if not already) impact the academic mission. Second, given that imaging is widely used and plays an integral role in patient care, entrepreneurial radiologists are well positioned to drive innovation in imaging technologies and services. The purpose of this article was to provide a general review of entrepreneurship and commercialization in the academic setting in an effort to increase awareness, foster greater involvement of radiologists in entrepreneurial efforts at their institutions, and encourage leadership to embrace and support entrepreneurship. This review provided by the Entrepreneurship and Commercialization Task Force draws on information sources in several disciplines including radiology, medicine, law, and business. Although written specifically for radiologists in academia, several sections provide a broader perspective because of a relative paucity of information specific to academic entrepreneurship for radiologists.

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ROLE OF UNIVERSITIES IN SUPPORTING ACADEMIC ENTREPRENEURSHIP

The general mission of an academic institution is twofold: to advance scientific knowledge and to share this knowledge for

the benefit of the society. This latter ambition typically comes in the form of training students who then spread out into different sectors hosting conferences, consulting and collaborating with public and private interests, and publishing research results. Often overlooked is the intellectual property (IP) patented by academicians and licensed to private industry, a form of information transfer that can have significant societal and economic impact (4). This arrangement can have numerous beneficiaries; principals, and shareholders benefit from the direct financial success of the product, while researchers see wider and more rapid adoption of their ideas (5) and concomitant academic recognition.

History

The modern era of academic commercialization in the United States traces its roots to the 1980 Bayh–Dole Act and its subsequent amendments. Before 1980, federally funded research remained the IP of the sponsoring government agency, and very little effort was directed toward commercialization. Passed in an effort to stimulate a languishing economy, the Bayh–Dole Act allowed researchers to claim ownership of an invention and subsequently commercialize it (6). This change in policy re-established interest in commercialization of academic research, and in the years since, most major research universities in the United States have established dedicated technology transfer offices (TTOs) (7) to help manage patent searches and filing, market evaluation, industry partnerships, and license negotiations.

From the perspective of the university, the benefits of fostering entrepreneurship are manifold. A closer relationship with private industry can yield new sources of funding, knowledge, and access to private facilities. Building a reputation of commercialization success can potentially attract higher-caliber students and faculty who could in turn contribute further to the success of the institution. As public funding of higher education declines, additional revenue generated through licensing of technology, consulting, private donations, and the sale of spin-off companies becomes more attractive. This added revenue may be substantial; the most recent survey of the Association of University Technology Managers estimated total licensing income from US academic institutions at \$2.6 billion for FY2012 (4).

University Policies

As a condition of the Bayh–Dole Act, inventions resulting from federal research funding must be disclosed to the institution's TTO. Nonfederally funded inventions must generally also be disclosed in accordance with most university policies. In the traditional model, the TTO then facilitates the licensing of the IP to a private firm. The ensuing royalty revenues are divided among multiple parties within the institution. Review of the royalty distribution policies for the top 10 patent-producing universities in the United States (Table 1) shows that the inventor's share ranges from 15% to 50%

(policies available online). Institutions then generally distribute the remaining share to TTOs (15%–35%); the laboratory or department of the inventor (15%–50%); and school or university system (5%–65%). Funds may also be distributed to separate patent or research funds to support future commercialization activity.

The problem with the licensing model is that few inventions have the potential to cover the costs of bringing them to market. Only approximately 1% of revenue-generating licenses bring in more than \$1 million per annum (4). Of that licensing income, the university receives only a fraction, typically a third, to be invested toward its academic mission and to fund the TTO (8). Once booming in the wake of the Bayh–Dole Act, TTOs have more recently been criticized as cost centers, often spending more in legal, administrative, and patent fees than the revenue brought in from licensing (8). The more profitable TTOs are part of institutions with large research budgets, to the point where more than 50% of US commercialization revenue in 2011 was captured by fewer than 15 institutions (9). Faced with limited resources, TTOs may preferentially focus on inventions deemed most likely to be commercially successful (10). The TTO then tries to maximize profit from its more limited portfolio by seeking licensing agreements with draconian provisions. Many academic entrepreneurs have reported hard-line negotiating tactics and inflexibility on the part of the TTOs (11). Such a system finds itself at odds with the guiding principle that novel ideas of academia should be readily and rapidly shared for the common good.

Shifting to Start-ups

Rather than licensing technology to an existing firm, a university may choose to form a spin-off company. Typically, these start-ups are comprised of one or more of the original researchers. In this context, the role of the TTO may shift into an advisory role, helping recruit a management team, providing business and legal guidance, and attracting investors. In contrast to the licensing model, the up-front cost to the University of forming a spin-off can be defrayed by seeking financial support from the local government in exchange for building local business or from the federal government through the Small Business Technology Transfer (STTR) or Small Business Innovation Research (SBIR) programs. Friends and family can also supply seed money. The return on investment of a spin-off company to the university would be deferred as compared to a licensing arrangement; however, the knowledge could be kept in the same geographic region and help promote local economic activity, as most start-ups are formed near their parent universities (4). A successful start-up could further contribute to the research budget of the university either directly or indirectly by raising the profile and stature of the university. To wit, this alternative to the traditional licensing model has grown popular, with the number of start-ups formed annually by universities having nearly doubled in the last decade (4).

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