


# Academic entrepreneurship

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Enacted by the U.S. Congress to more readily advance inventions to practical benefit, the 1980 Bayh–Dole Act allows U.S. institutions to take the title of federally funded inventions. Thus, it effectively removed the U.S. federal government as the gatekeeper for technology transfer.

Since its inception, the Bayh–Dole Act can be credited with well over US$1.3 trillion in U.S. economic growth, more than 4.2 million jobs, and greater than 11,000 new start-up companies from the

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nation's universities. Furthermore, the Bayh–Dole Act has fostered an entrepreneurial culture among academic institutions and seated intellectual property (IP) professionals in academia as well as at their respective technology transfer offices (TTOs). In addition, although U.S. agencies and foundations, such as the U.S. Departments of Energy and Defense, National Institutes of Health (NIH), and National Science Foundation (NSF), have earmarked substantial funding to bridge technologies to commercialization, there remain challenges in moving inventions from the lab to market or bench to bedside.

Furthermore, although the United States leads university-sponsored international patent applications, Chinese and South Korean academic institutions are also among the top 10 universities. Thus, there exist worldwide opportunities to advance academic discoveries to commercialization and societal benefit. In this article, we discuss some challenges and present opportunities through the lens of an academic entrepreneur. Additionally, we present a top-10 list of suggestions for academic entrepreneurs, underscoring that those who are successful are leaders and change makers [see "The Top 10 Tips for an (Academic) Entrepreneur"].

## Balancing academic and entrepreneurial considerations

In most research settings, idea generation is ubiquitous. Many may recall a laboratory or group meeting where science and innovation move with fluidity. Schemes ranging from "harebrained" to "elegant" or "simple" are exchanged and debated. If translation to practice can be envisioned, the next logical steps are to design, build, and validate or disclose.

While the TTOs at many universities have astutely streamlined the invention disclosure process to ease the burdens on an investigative team, an early hurdle faced is the question of how to assign the proportion of contributions among the team members in the disclosure. Assigning equally is the default, assuming all members of the team have equal rights to the IP. This brings us to step one: understand the IP policy in your country and at your institution, as it is likely to vary among groups, such as faculty and staff or graduate and undergraduate students.

Ideally, the institution's IP policy should be clearly articulated in a handbook for the target audience and written for someone without expertise with legalese. TTO personnel may be helpful in sorting out IP assignment issues early in the process if approached in an amicable manner. Beware that if the TTO senses contentious issues among inventors, it may be leery of pursuing a patent because of the potential for subsequent litigation.

Another important source of support is industry partnerships, and it is worthwhile to sort out these agreements in advance. Most universities do not allow faculty to negotiate on their own behalf, and agreements are made at the university level prior to accepting any funds from an industry partner.

By design, academic settings are hierarchical, ranging from senior, established investigators; to junior

## The top 10 tips for an (academic) entrepreneur

1) Know your IP policy: read, understand, inquire, and participate before embarking on an entrepreneurial venture.
2) Know your conflict-of-interest policy: read, understand, inquire, and participate, again before embarking on an entrepreneurial venture.
3) Partner with senior investigators either as collaborators or mentors. Develop a clear understanding of expectations on both ends of the relationship.
4) Decide if this is the right time in your career. Find the right balance between your academic career goals and promotion and your entrepreneurial interests. Consider if there are graduating students or postdoctoral researchers in your group who may be excited to translate your research into commercial products, so you can focus on your research goals and serve in an advisory capacity to the company.
5) Discuss with the school chair and chair of faculty development. A frank discussion may help you find the balance discussed in tip four.
6) Team science: understand and ask about how your lab and group operate. Entrepreneurial teams tend to be more flat than hierarchical, with junior members having as much power to propose, debate, and vote against more senior members. Again, for graduating students, it may be easier to transition from a hierarchical role to the flatter teams required for entrepreneurship.
7) Read books about leadership: you are among trailblazers.
8) Seek the right type of funding to pursue commercialization. Traditional National Science Foundation (NSF) (CAREER and unsolicited grants) and National Institutes of Health (NIH) (K-series and R01) grants are not generally geared toward supporting commercialization. Familiarize yourself with Small Business Innovation Research and Small Business Technology Transfer (STTR) grants from various agencies that are explicitly geared toward commercialization, particularly STTR grants, which can support the majority of the research activity at the academic partner site.
9) Get trained in customer discovery. Make sure that your inventions solve a real-world problem and there is a product–market fit. Both the NSF and NIH offer Innovation Corps programs providing such training.
10) Chase ideas not merely because they have potential commercial value but because the work excites you. You are more likely to succeed in a line of work that you are passionate about. You are likely to be most pigheaded and persistent with ideas that deeply resonate with your interests.

**Is there a matrixed environment or, at least, a healthy hierarchy among faculty members on the collaborative team?**

faculty; to trainees (postdoctoral, graduate, and undergraduate students). Discussing IP assignment and its value may be uncomfortable in this innate hierarchy, but it is an essential first step.

Furthermore, the structure of academics can be leveraged. For example, as with all other evaluators, the IP professionals in the TTO at most institutions are heavily influenced by the prior successes of inventors. A disclosure by a senior inventor, who has successfully licensed out IP, is more likely to be viewed favorably than the same disclosure by a junior investigator without a history of successful bench-to-market translation.

Successful patent prosecution is expensive for academic institutions, and they need to see some promise of success before they will invest in the legal and administrative costs of pursuing patents. Junior investigators may succeed by fleshing out their ideas in a disclosure and seeking experienced inventors for their advice on a well-thought-out document. In return, a small percentage of the IP may be negotiated with the more senior researcher for his or her feedback, advice, and credibility with the TTO.

Of course, true and authentic mentors may provide their feedback as well as introductions and recommendations to TTO personnel without seeking ownership of what are largely the ideas of the junior inventor. Less-experienced researchers should seek out appropriate senior collaborators or mentors and have clearly defined expectations from both ends of the relationship.

An alternative strategy is to take the portfolio approach and create a broad range of IP without focusing acutely on IP assignments. The view is that students and trainees will launch start-ups with this IP, and the faculty member will step back and remain rooted in the academic setting. Essentially, this enables the faculty member's lab to create IP at a steady clip and increases the pipeline of technologies coming into the TTO for evaluation.

The NSF in its Innovation Corps Teams (NSF I-Corps) program actively flattens the academic hierarchy by placing the entrepreneurial lead (the trainee) at the forefront of the team and on equal footing with the principal investigator (a professor). A central tenet is that the trainee, who is less tied to academic career demands, is more likely to succeed in translating discoveries and technology to practical use and overall benefit to the American people.

If we drill down further from the perspective of a student entrepreneur, asking about the IP assignment process gives you a window into your lab culture. For example, do you feel that the cutting of the IP pie is fair and just, i.e., is it equitable? Is there a matrixed environment or, at least, a healthy hierarchy among faculty members on the collaborative team? Is your lab taking the broad portfolio approach with all shares being equal? Lastly, does the protection of IP even matter for you moving forward with your career? Admittedly, after the fact, it is legally challenging to decouple and distribute credit. Furthermore, idea generation is a catalytic event and not necessarily linear or incremental.

For a junior to midcareer faculty member, entrepreneurship and spinning out a company may not be the highest priority, as conventional scholarly output, such as external grant funding, students graduated, and high-impact publications, are used as indicators of an individual's worthiness of tenure and promotion. However, it is absolutely essential to understand both the IP and conflict-of-interest policies at one's institution. Equally important is how IP is assigned to students and trainees as well as the obligations to sponsors.

Thus, while the Bayh–Dole Act moved the gatekeeper to the academic institution, there may be complexity for junior and midcareer faculty to decipher before embarking upon the path of commercialization. Discussions with experienced colleagues as well as your school chair are a good place to begin. Timing is critical, and understanding the impact of technology translation on your career trajectory is essential.

Focusing further on timing, junior inventors should be cognizant that most start-up ventures fail, and failed commercialization efforts are unlikely to be viewed favorably by promotion and tenure committees. Thus, investigators need to seek balance between publication and pursuing patents and commercialization.

A possible approach is to focus heavily on publications after submitting a provisional patent application—these publications will not only be useful in establishing the record for promotion but, eventually, also may serve as "earned media" and provide the commercial value of the invention. Finally, these publications and the possible funding that follows them may help convince the TTO of the potential value of the invention before it invests in converting an inexpensive provisional patent to a nonprovisional patent application.

## Resources for student entrepreneurs

There are a host of resources that a faculty member and trainees may access to learn more. Researched and written by a faculty member herself, Dr. Michele Marcolongo

outlines how to bring scientific discovery to a successful commercial product in her book *Academic Entrepreneurship*. To further acquire knowledge on commercialization, an emerging entrepreneur may also attend seminars at his or her own institution as well as access a wealth of information through the IEEE Entrepreneurship Initiative (described elsewhere in this issue), podcasts, and TEDx talks designed for investigators and trainees in clinical and translational research.

The NIH National Center for Advancing Translational Science (NCATS) connects emerging entrepreneurs to customer discovery and lean start-up methods through I-Corps@NCATS. Additionally, most academic TTOs encourage faculty to gain knowledge and become comfortable with the language of start-ups, business models, licensing, and fundraising.

## The importance of leadership

Inherent in the process of becoming an entrepreneur is taking on the mantle of leadership and embracing team science. You will be assembling and guiding teams throughout your career. Getting a head start on how teams form, storm, norm, and perform can set you up for success. Moreover, developing the team framework serves as a platform for discussions ranging from IP assignment to publication coauthorship.

Integral to leading teams is understanding your leadership philosophy. While there are many books on leadership and teams, three notable texts include *Discover Your True North* by Bill George, *Dare to Lead* by Brené Brown, and *The Five Dysfunctions of a Team: A Leadership Fable* by Patrick Lencioni.

In summary, based on our own experiences teaching, coaching, and leading technology translation, we have compiled a list of the top 10 tips for an academic entrepreneur. When combined with an eagerness to explore the multiple facets of entrepreneurship and translation, we hope that these will help start and/or enhance your journey as a creator and contributor.

**Getting a head start on how teams form, storm, norm, and perform can set you up for success.**

## Read more about it


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