

Rewarding inventions and inventors

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Morteza Gharib, Caltech vice provost and the Hans W. Liepmann Professor of Aeronautics and Bioinspired Engineering

"Would Thomas Edison Receive Tenure?" This was the provocative title for a panel at the 2013 Annual Conference of the National Academy of Inventors (NAI), an organization founded in 2010 in partnership with the United States Patent and Trademark Office to support invention and innovation in universities and nonprofit research institutes.

Morteza Gharib, Caltech vice provost and the Hans W. Liepmann Professor of Aeronautics and Bioinspired Engineering, is a Charter

Fellow of the NAI and was a participant in the 2013 panel discussing how Edison would fare before a contemporary tenure committee. That discussion led to a recent publication in the *Proceedings of the National Academy of Sciences* titled "Changing the academic culture: Valuing patents and commercialization toward tenure and career advancement."

Edison makes an interesting test case. With more than 1,000 patents, Edison was a prolific inventor. He arguably created the very concept of a dynamic research laboratory, building a facility in Menlo Park, New Jersey, that was stocked with every conceivable material and staffed with scientists and engineers. However, Edison never published papers in peer-reviewed scientific journals, which is the standard marker for academic success in the sciences today. If we want more Edisons—and given the technological challenges of the 21st century, it is safe to say that we do—how will their research be evaluated and rewarded? Can three patents equal two [academic papers](#)? Is one start-up company worth the same as three academic papers, or five, or 10?

Gharib insists that while all universities need to recognize invention as a desirable outcome of research, no single metric will make sense for every academic or research setting. However, Gharib says, given its long experience partnering with industry, Caltech can take the lead in this area, helping other universities to place an appropriate value on invention.

Gharib recently sat down with us to discuss the role of inventions in evaluating [faculty](#) and the place of industry partnerships in the modern university.

Is Caltech facing new challenges in its relationship with industry?

At Caltech, we have been partnering with industry for a hundred years. We have had and still have very good relationships with large companies like Boeing, BP, and Dow, just to name a few. But there have been some historic changes in how academia and industry interact that have impacted Caltech.

For example, Caltech was really a pillar of the aerospace industry in its early years. It was due to innovations at Caltech, and the use of our wind tunnel here, that the industry really learned how to design better, safer, and more efficient airplanes. But after a while the big aerospace companies in Southern California began investing in their own R&D departments, giving them a lot of resources to do basic research. Caltech wasn't involved as much then.

That scenario has really changed in recent years, not just in aerospace, but in many industries dependent on scientific and technological innovation. Due to tighter budgets, industries have increasingly only taken on very targeted research, more like production R&D. Riskier and more basic research is being outsourced to universities.

Now the challenge to universities is to be mindful of which projects they pick up, choosing only those that are going to help them keep the quality of their research high and do work in keeping with their educational mission.

What does Caltech do to ensure that collaborations with industry partners are productive and appropriate?

It's really grass roots. We rely on the integrity of the faculty here.

Also, we don't expect faculty to go out and sell their ideas or inventions

to industry. We have an office of corporate partnerships and an office of technology transfer, which I supervise, and that duo enables faculty to step forward and say, "I need to find a strategic partner for this project," or "I want to license this technology and then give it away," or "I need a start-up to develop the things my team has invented."

The offices of corporate relations and technology transfer actively involve faculty in the process of patenting their inventions and partnering with external corporations, so faculty gain experience in choosing the best solutions for their research groups.

Of course, we don't encourage faculty to build a shop to manufacture a specific device for industry. We do not allow our facilities to be used for routine manufacturing or the kind of research that does not benefit students.

Commercial partners understand this though. They're not going to come to us with a request to design a new bolt, because they know we'll say no. But if they come and ask, "Why do you think that 747 exploded?", then someone like Joe Shepherd [C. L. Kelly Johnson Professor of Aeronautics and Mechanical Engineering and the dean of graduate studies] will take that question and turn it into basic research in his lab.

How does Caltech evaluate patents or the commercialization of inventions to determine career advancement for faculty?

This is something that many provosts and presidents are concerned with, and it's why we wrote the article for PNAS. But it's something we already do at Caltech. It's important to realize that you can't come up with a single external model and expect it to work everywhere. You have to tailor this to the culture of the faculty at each institution. At Caltech, I

feel what's most important is not simply to consider patents as a marker of faculty success, but to ask about the nature of the process that results in a patent or a start-up company.

You see, we aren't looking for faculty who sit down and think, "Today, I am going to invent this." Such a person might be a genius, they might invent wonderful things, but we are looking for something more from faculty. We want faculty who have a process in place that encourages basic research as well as innovation and invention; faculty who encourage publishing and the protection of intellectual property, and who create an atmosphere that promotes entrepreneurship.

How do you create an atmosphere for entrepreneurship?

Entrepreneurship is not just about monetary gains; it's a lifestyle: to be bold, to be fearless in tackling the toughest science and engineering issues that industry and our culture as a whole face. Caltech wants to instill in its students a mentality of taking risks, questioning everything, not being afraid that you're wrong. These are the elements that make a dynamic research group, and a group like that will be productive, regardless of whether that is through basic science, published papers, patents, inventions, or start-up companies.

In fact, these research groups have a lot in common with start-up companies themselves. There's just a lot of dynamism and adrenaline, ideas always popping. Some of the research groups here at Caltech are like a pack of lionesses, hunting down their research prey. If something commercial comes out of it, good. If not, it will still impact other aspects of science and technology. This may not bring a penny back to us, but it's our social contribution, and we're happy with it.

We're never going to encourage faculty to drop basic research at the expense of making patents, but then we don't see those two undertakings as exclusive. They're really inclusive. The most productive faculty in patent innovation—not only at Caltech, but at other universities too—are also the most productive in terms of the papers they publish.

What role can Caltech play in the larger debate about the role of invention in scientific research?

Our culture at Caltech is already a model for other universities in terms of invention and discovery and its transmission to the wider world. We get more out of faculty and students and postdocs by allowing them to be free of some of the conventional limitations and constraints that other universities put around their research teams. We have been able to do this in part because we have a culture that encourages collaboration. If you look at breakthrough innovations, most of them come at the interface between different scientific fields.

It is our moral obligation—and that of other universities, or course—to keep our example of collaborative work and partnering with industry alive and present. We are small, but other universities with much more muscle can do the same kind of thing.

More information: Paul R. Sanberg, Morteza Gharib, Patrick T. Harker, Eric W. Kaler, Richard B. Marchase, Timothy D. Sands, Nasser Arshadi, and Sudeep Sarkar. "Changing the academic culture: Valuing patents and commercialization toward tenure and career advancement." *PNAS* 2014 111 (18) 6542-6547; published ahead of print April 28, 2014, [DOI: 10.1073/pnas.1404094111](https://doi.org/10.1073/pnas.1404094111)

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