

# Opinion: Do universities help or hurt innovation?

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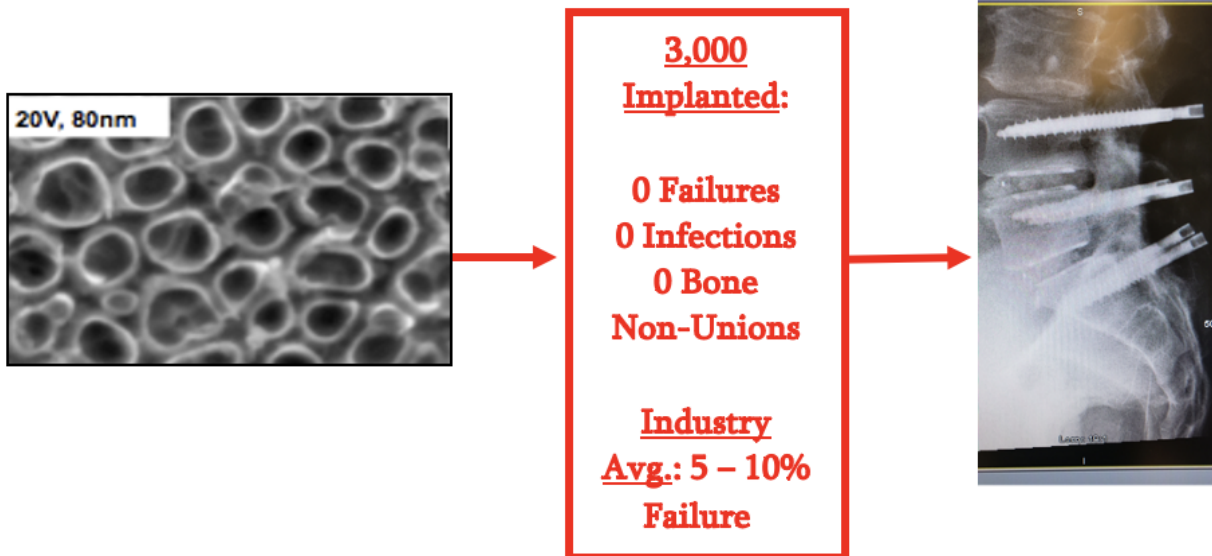


Figure 1: Early research at Purdue University in the Webster lab that led to the formation of Nanovis, which now has over 3,000 FortiFix™ pedicle screws inserted in humans with no cases of implant failure, according to the Maude database. The industry standard of pedicle screw failures lies between 5 – 10% depending on the data assessed.

## Do Universities help or hurt innovation? Find out in this 25-year academic entrepreneur’s anecdotal perspective of starting companies and developing implants. Thomas J. Webster shares his opinion here

Top research U.S. Universities and others worldwide, sometimes along with respective government funding agencies (like the NSF and the NIH in the U.S.), have spent billions of dollars trying to translate their faculty’s research to industry to develop real commercial products.

Whether establishing University technology transfer offices (whose objective is to foster faculty research translation), paying IP lawyer fees for patents, establishing incubator spaces for University faculty spin-out companies, or issuing grants aimed at research primed for industry adoption, it is clear that U.S. Universities are in the high stakes and high funding game of entrepreneurship, and have been so for the last several decades.

And such efforts are growing. U.S. Universities are also using donations and investments, to name new technology transfer offices and recruit top-notch entrepreneurial faculty, researchers, and the next generation of student entrepreneurs. But is it working? Are Universities really helping faculty spin out their technologies into successful start-up companies or industries to develop viable commercial products?

Or is all this money and effort just building frustration and unrealistic expectations? In some cases (like the University of Florida's sports drink Gatorade®), I believe the answer is yes, such efforts do work. But for most Universities, the answer is "no," they are just sitting on the sidelines wishing they had that magic Gatorade®.

And their efforts are really just frustrating those faculty at the intersection of academic research and industry translation who can do better on their own, often providing false hopes for success.

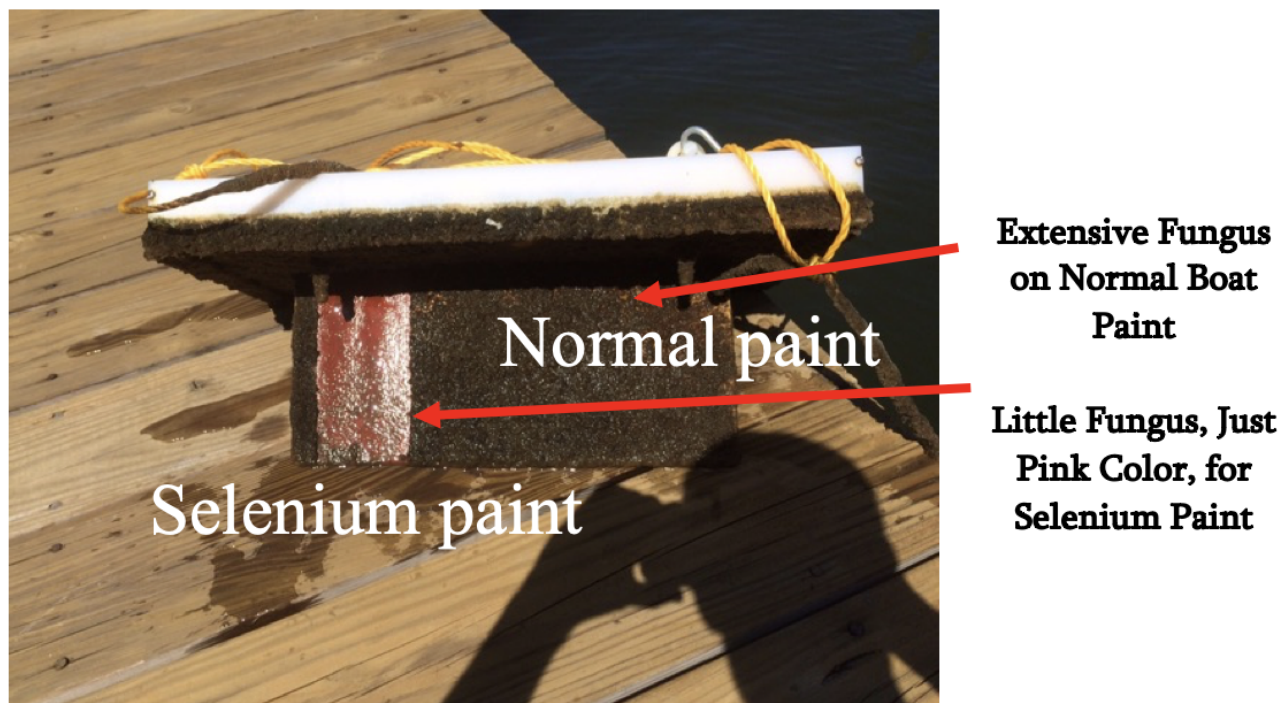


Figure 2: Boat panels coated with selenium nanoparticles that reduced fungus formation when placed in river water. SynCell is commercializing such research.

## U.S. Universities and technology transfer

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As someone who has been in academia for nearly 25 years, mainly at U.S. Universities and now at my own start-up companies, I can offer several reasons why U.S. Universities are not good at technology transfer. The first is cultural. While slowly changing, when I was just starting as an Assistant Professor at Purdue University in 2000, bright-eyed and ready to

develop implants that can actually save human lives, I was told by senior faculty that I would never get tenure by focusing on commercializing my own research. Senior faculty, not a University technology transfer office, decide one's tenure. So, who would you listen to?

Universities have never been able to articulate the seeming contradiction between publishing papers (needed to get tenure) and filing for patents (in which publications constitute disclosure impeding patentability). But can't one's research impact be measured not by publications in high-impact journals but by developing real commercial products that help society? Some would say that developing research that leads to products is actually more impactful than lines of text on a piece of paper. Even today, I believe there are far too many examples to count where a University publishes a graduate student's Ph.D. thesis inadvertently prohibiting patentability. Good luck if you try starting a company without a patent or patent application.

## **The ground-breaking FortiFix™ pedicle screw**

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Fortunately, I did not listen to such senior faculty at Purdue and became the scientific founder of a Purdue spin-out company called Nanovis. In October 2023, we surpassed our 500th surgery using the ground-breaking FortiFix™ pedicle screw (in the spine) today with no cases of implant failure, according to the Maude database. <sup>(1)</sup>

Over 3,000 pedicle screws have been implanted, improving the quality of and even saving lives. The FortiFix™ pedicle screw has the distinction of being the first FDA-cleared pedicle screw with a nanotechnology designation. If I had listened to senior faculty at Purdue University, my innovation would have been stifled, and these people never helped (Figure 1). Think of all the other technologies lost to such advice. (By the way, I also received tenure at Purdue.)

Financial incentives for innovation Financial incentives (or lack thereof) are another way U.S. Universities often stifle innovation, in my view. For example, I remember waiting for a check years later for my portion of the revenue generated from Nanovis' products – which never came. When I asked Purdue University what was happening, they said they decided to reinvest my portion of the revenue into Nanovis.

Interestingly when I was recruited to Purdue (and this happens everywhere at U.S. Universities), I was told that all inventors of commercialized technology would split one-third of the revenue received by the University – only to learn later in the Purdue Faculty Handbooks that revenue distributions to inventors are at the discretion of the University (specifically, the Vice President for Research).

So, all faculty entrepreneurs, be careful when a U.S. University tells you that you will share in the revenue your technology creates since, in most of the U.S. University Faculty Handbooks I have read, Universities don't have to pay you a dollar. Oh and by the way, if you start a

company outside of a University, you will most certainly get significantly more than the 1/3 you have to share with the other inventors, if you are lucky enough to even get that.

### Nx3 (self-assembled chemistry)

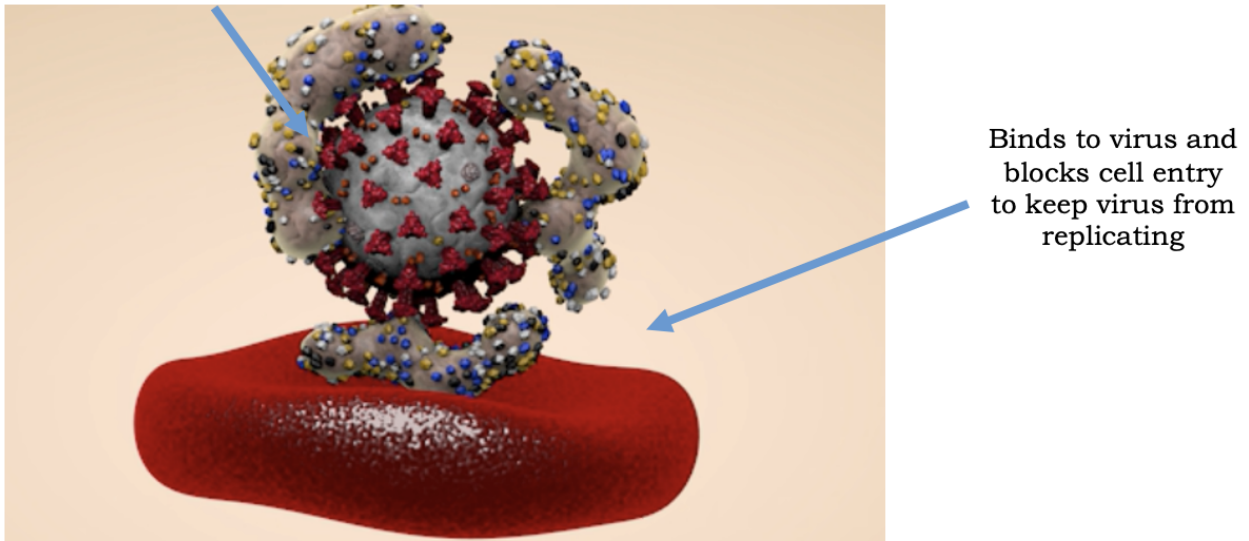


Figure 3: Nx3 is currently being commercialized by Audax Medical as an antiviral prophylactic and therapy for SARS-CoV-2 (COVID), RSV, influenza, rhinovirus, and others. Research only progressed through a start-up company when it was stifled due to U.S. University lab closures during COVID-19.

## More on Universities and technology transfer

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Another reason Universities often fail at technology transfer is because they have not developed a clear, well-articulated policy around the conflict of interest for entrepreneurial faculty. Specifically, as an Associate Professor at Brown University, I served on the inaugural conflict of interest committee, in which we interviewed faculty members for whom it was suspected that they were researching for their “for profit” company in their “not-for-profit” University lab space.

But how does one separate a Ph.D. thesis developing antibacterial chemistry from a company spun out by a faculty member on the same topic? Of course, entrepreneurial faculty will continually pursue research that leads to a start-up company, and it is unrealistic to assume that such research will stop in an academic lab as soon as a company is formed.

One worthwhile area we investigated as a committee was whether faculty pressured their students to falsify data because a start-up company existed – but shouldn’t such insurance exist with or without a start-up company? Conflict of interest committees and documents at Universities are misleading and confusing and send a message of negativity when just the opposite exists. If you have a conflict of interest, your research is excelling in commercialization, which must be celebrated, not hampered by time- consuming committee investigations.

During this time, many of my faculty colleagues stopped forming start-up companies from their research for fear of losing their jobs. Although this committee also investigated me, fortunately, I did not stop a specific research program that today has led to a successful start-up company (SynCell) developing antibacterial and antifungal properties of selenium nanoparticles (Figure 2).

Another area Universities often need to improve for technology transfer involves the licensing term sheet and simply (in general) taking too long to license such technology. Both areas can easily be fixed. Specifically, when I started as the Department Chair of Chemical Engineering at Northeastern University, licensing fees for faculty start-up companies were \$0 to help start-up companies succeed. Start-up companies obviously do not have resources for licensing fees, and even if they did, that money would be better spent on product development. By the time I left Northeastern nine years later, some of my technologies had licensing upfront fees of over \$100K – an amount that would cripple a new start-up company and is simply unfeasible.

When asked what changed, I was told that the University needed to recoup patent lawyer costs. Really? Filing for a patent on LegalZoom.com costs less than \$200. <sup>(2)</sup> Many Universities will readily admit that they use technology transfer to make money, which seems to be the bottom line for today's top research U.S. Universities, instead of the traditional spirit of academic and faculty freedom.

If that's true, I would love to see U.S. Universities publish how much money they are actually making from technology transfer and if they really believe it will be a profitable venture to provide student scholarships, rather than cover astronomical upper administration salaries (some U.S. University Presidents make in excess of 8 million dollars supported on the backs of a student's \$86,000 annual tuition and room and board fee) – with these salary amounts, of course, they need their technology transfer offices to make money.<sup>(3)</sup>

Further, when entrepreneurs approach me to start companies using my University patents, it takes months to get a simple, confidential agreement from such Universities. I have lost dozens of business partners who lost patience working with Universities, many of whom will no longer work with Universities to license faculty research. For one particular technology around treating COVID and viruses, Northeastern University even shut down my lab during COVID-19 because everyone was concerned with COVID-19 spreading.

Fortunately, rather than lose investors and time developing an antiviral therapy that the world badly needed in 2022, I spun such technology into a start-up company (Audax Medical) that accelerated, not decreased, such research activity that is now on the verge of a commercially available antiviral prophylactic and therapy for SARS-CoV-2 (COVID), RSV, influenza, and rhinovirus (or the common cold) (Figure 3). This is just another example of a University stifling innovation rather than promoting it.

Unfortunately, I have also seen another disturbing trend at Universities. While it is true that Universities own faculty (and sometimes students', even undergraduate students') research, they do very little to communicate with that faculty member or student when their technology is being licensed. At all of the U.S. Universities I have been to, I have had to actively inquire about the status of my own inventions, and in some cases, my inventions have even been licensed to others when my own start-up companies have requested such technologies. How does this promote faculty innovation, knowing that you cannot even develop your own technology at your own start-up company?

## Translating inventions for Commercialization

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So, where do we go from here? The above is just a partial list of obstacles I have encountered over the past 25 years in academia trying to start companies and translate my inventions to industry for commercialization. While I have started over two dozen companies during this time frame as a University Professor, it has been challenging, and it is getting harder with numerous faculty entrepreneurs realizing that some U.S. Universities stifle innovation more than they help it.

At a time when student interest in entrepreneurship is at an all-time high, perhaps Universities should do what they do best – educate and only educate students. Maybe they should inform students of entrepreneurship but stay out of the game of technology transfer and owning faculty inventions. Give freedom back to faculty and University-based researchers to translate their research on their own terms and in their own way. Unfortunately, it seems to me that the only way to foster innovation and technology transfer at U.S. Universities is for them to simply get out of the way.

## References

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2. <https://www.legalzoom.com/business/intellectual-property/provisional-application-for-patents-overview.html> , accessed Dec. 5, 2023.

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