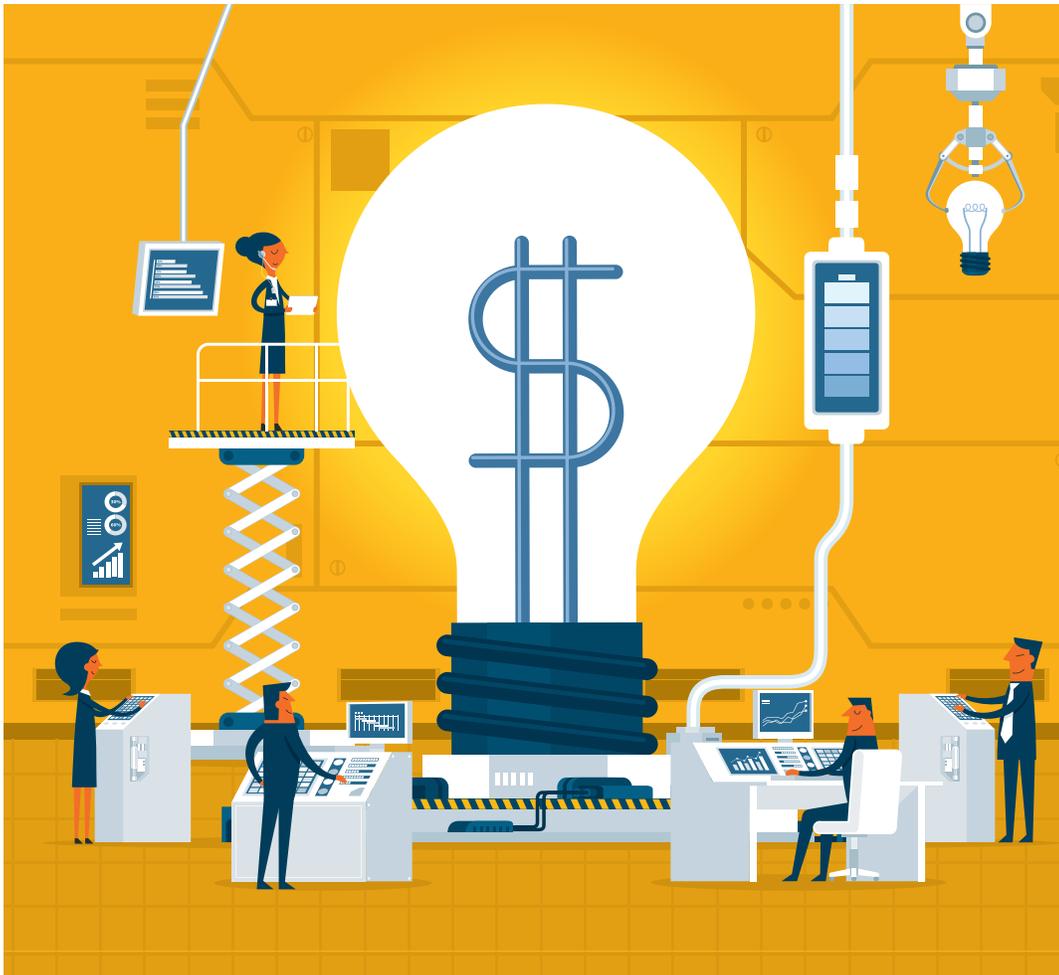


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Think like a child

That's how Kristen M. Waterfield runs the Malvern School.

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COVER STORY

SPINOVATION

Data shows Philadelphia's academic institutions are well on their way to making the region a leader in commercializing research

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COVER STORY

SPINNING OUT SUCCESSES

DATA SHOWS PHILADELPHIA ACADEMIC INSTITUTIONS ARE GETTING BETTER AT COMMERCIALIZATION, BUT BIGGER POWER PLAYS AWAIT

BY MICHELLE CAFFREY
mcaffrey@bizjournals.com

Sitting at one of the small lounge areas that dot the cavernous first floor of the Pennovation Center – a gleaming, 58,000-square-foot, industrial-chic building that’s just under a year old – John Swartley describes a sea change.

The University of Pennsylvania is known as a global leader in academia and groundbreaking research, but within the region, it hasn’t been known for taking the same kind of leading role in commercializing that research and translating it into real-world impact. As associate vice provost for research at the University of Pennsylvania and managing director at the Penn Center for Innovation, Swartley’s been working on changing that – in major ways at the \$37.5 million Pennovation Works campus.

“This building exemplifies what is different, what is happening,” he said.

What’s happening is progress, a building up of momentum at academic institutions through tangible efforts, like Pennovation, to take the billions of dollars in federal research



Scott Andes



Amanda Christini

funds that flow into Philadelphia, spin them into real-world impact and fuel Philadelphia’s economic fire at the same time. The progress is borne out in both empirical data and what more than a dozen regional experts in law, academia, technology and economic development describe as a collective mental shift in how technology transfer, a crucial link between academia and industry, is viewed.

An in-depth study of these initiatives and Philadelphia’s potential recently released by the Brookings Institution however, showed far more can and should be done to leverage the city’s unique assets – especially the concentration of major research institutions

and large corporations in University City and the west side of Center City, an “innovation district” Brookings said was the envy of major metropolises the world over.

“Those are things that are really transformational and should be celebrated, but you’re also talking about a city that receives more federal R&D dollars than almost any other city in the country,” said Scott Andes, a senior policy associate at Brookings and an author of the study. Only one other city, biomedical heavyweight Boston, has a higher concentration of federal research dollars in its geographic area, but Philadelphia still falls behind its peers when it comes to total U.S. patents issued and new firm creation.

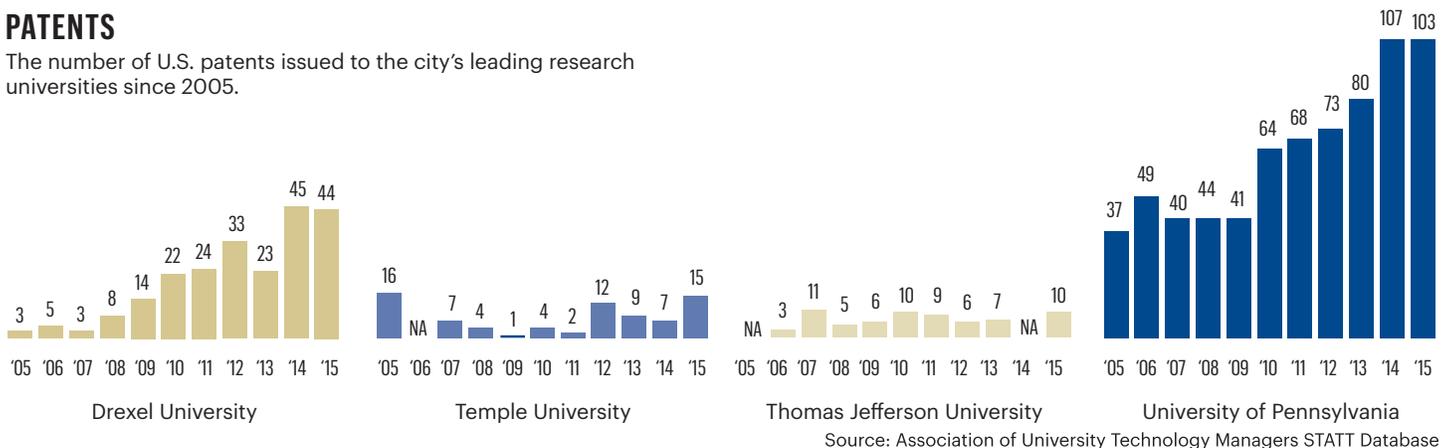
A centralized, organized campaign across a large swath of institutions, as well as a dramatic expansion in the scale and scope of current commercialization activity, is needed in order for Philadelphia to become the global powerhouse it can be, according to the Brookings study, and it’s already laid out a road map to get us there.

‘Pay attention to the upward trend’

A Philadelphia Business Journal analysis of

PATENTS

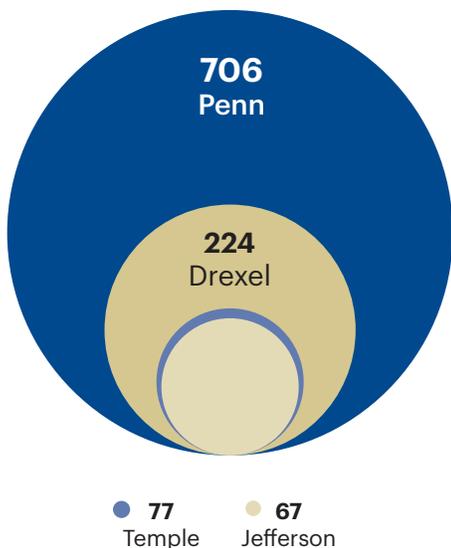
The number of U.S. patents issued to the city’s leading research universities since 2005.



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TOTAL PATENTS ISSUED 2005-2015



JEFF FUSCO

Associate Vice Provost John Swartley is working to increase Penn’s commercialization of its research.

data collected by the Association of University Technology Managers show two decades of ups and downs in more than 15 collective data points related to tech transfer, including patents issued, total accumulated license agreements and startup spinouts, but they outline an overall upward trend in commercialization activity.

In 2005, Drexel University, Temple University, Thomas Jefferson University and Penn – the four leading research institutions in the city according to a recent Milken Institute study – recorded a combined, cumulative amount of 524 licensing agreements in which commercial entities make upfront cash payments, or agree to provide the universities royalties, milestone payments or equity agreements, in exchange for rights to use intellectual property developed at the institution.

Ten years later, that figure is 975. An increasing number of deals are also either being done with existing or spun-out startups, from eight in 2006 to 14 in 2010 to 35 in 2015. While the number of patent applications filed by the universities has hovered between the 400-500 range with spikes and drops, the number of U.S. patents issued steadily grew in nine years out of the 10-year span, swelling from 56 in 2005 to 172 in 2015.

“You really have to pay attention to the upward trend ... The trending is the silver lining,” said Sandra Stoneman, a partner at Duane Morris and co-head of its life sciences

practice group who has extensive experience in guiding companies ranging from startups to public companies in organization, exits, financial agreements, intellectual property arrangements and related issues. “Despite the sometimes frustration I think people might experience, it’s not for a want of trying, and you have to see how the trend is working to really be at a much better place.”

A ‘sea change’

Drexel University President John Fry describes the university’s increase in commercialization as “huge.”

“It’s been like this,” Fry said, motioning a hockey-stick lift.

The AUTM data backs him up. In 2005, Drexel’s IP was issued three U.S. patents. In 2015, it was issued 44. Ten years ago, it counted 15 cumulative active licensing agreements under its belt, a figure that grew to 60 in 2010 and 85 in 2015. The progress has been enough to land the university at No. 46 on the Milken Institute’s recent ranking of the best universities for technology transfer, second in the region to Penn at No. 6.

Fry attributes that boost in part to the Wallace H. Coulter Foundation’s establishment of a \$10 million endowment solely focused on commercializing Drexel’s medical science. In its report, Brookings signaled out the Coulter endowment as a sign of that mindset change,

“The University of Pennsylvania was terrible in the ‘80s ... they were an Ivy League institution that didn’t care about industry,” said Andes. “That is very, very different today.”

SCOTT ANDES, Brookings Institution

but when analyzing its weak points, noted just 2.4 percent of Drexel’s research budget comes from industry partners.

Outside of specific data points, Bob McGrath, Drexel’s Senior Associate Vice Provost and Executive Director of Technology Commercialization. He came to Drexel in 2005 from Penn, where he was interim director of technology licensing, and testifies to the overarching change in attitude he’s seen toward commercialization.

“I’ve been doing this in the region for 17 years now, and there really is a sea change when you compare 10 to 15 years ago versus today,” McGrath said. “All the institutions in the region, everybody sees this as a core mission along with everything else. We all receive hundreds of millions of dollars in funding from the federal government to make discoveries. There really is the need and expectation we should turn it into

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something.”

Something like iBreastExam, a portable, wireless breast scanner that’s being distributed worldwide to countries where most women don’t have access to early detection technology. It’s powered by technology developed by Drexel and licensed by startup UE LifeSciences.

Its CEO Mihir Shah described the licensing process as smooth, with direct one-on-one contacts with Drexel’s tech transfer department and no “bureaucratic rundown.” The term sheet, which included payments and no equity, was also favorable, he said, given the investment Drexel made in developing the technology and the readiness of the concept by the time they licensed it.

“To date I remain happy about our agreement with Drexel,” he said. “It was an equitable, fair deal.”

Negotiating agreements that serve a university’s financial interests while not discouraging commercialization through a high equity percentage – which could dissuade investors down the line who don’t want to fund an over-diluted company – is a key sticking point. Experts interviewed for this article said deals in which the university has greater levels of equity or control over intellectual property rights can drive researchers to seek out institutions where they feel any upcoming research would have more favorable commercialization terms. It’s difficult of course though for universities to quantify or analyze the deals that never happened.

At Drexel, McGrath said his negotiating style has evolved over the years, as each university has to take its own individual needs, and the situation of the company on the other side of the table, in mind.

“The approach I was using when I first came to Drexel is very different than what we do now,” McGrath said. “Now we try to make it much more investor-friendly. There are not a whole lot of 1s and 0s in the term sheet. We’re trying to make it so investors can pick it up and say ‘This is not a problem,’ so it’s not a barrier to investment. I know a lot of my counterparts here do the same thing.”

The backbone

Without argument, the biggest player in the regional commercialization game is Penn, but the institution has not had a stellar track record for engaging with the corporate world.

“The University of Pennsylvania was terrible in the ‘80s ... they were an Ivy League institution that didn’t care about industry,” said Andes. “That

is very, very different today. They do care. They are making progress. The question is can they get to this next stage of multilateral relationships?”

Swartley is bullish they can. He echoed McGrath’s perspective that the old way of doing tech transfer is fading as approaches change and he’s avoiding cookie-cutter deals in favor of company-specific negotiations. A major backbone in Penn’s progress in the tech transfer space are research and development alliances with commercial partners, where all financial and legal details are laid out before the research work begins. While that initial negotiation process can take six months to a year, he said it’s worth the time.

“Everybody knows what they get, everybody knows what they’re responsible for, everybody knows how they’re getting paid so that all we’re doing then is focusing on our common goal of getting this product to market,” Swartley said. The flagship example of this is the Novartis-Penn Center for Advanced Cellular Therapeutics. Now a \$27 million, 23,610-square-foot facility on Penn’s campus that opened last year, the center’s work is based on a 2011 groundbreaking discovery by Penn researchers that uses personalized immunotherapy to attack cancer cells. The pharmaceutical giant and Penn formed an agreement in 2012 to leverage the research into new treatments and build the center, with Novartis receiving worldwide exclusive licenses to the Penn-developed technology. Novartis also invested \$20 million toward building the center, and will pay royalty and milestone payments to Penn as outlined in the agreement.

“Basically for the last five years, we’ve really just been working on the science,” Swartley said. “That’s a huge difference from past practices.”

According to data provided by Penn’s Center for Innovation – the one-stop shop Penn created in 2014 to merge its previously fragmented tech transfer and research services offices as well as its PCI Ventures, which facilitates startup spinoffs – PCI signed six research agreements in 2012, the year it launched the Novartis partnership. That grew to 15 in 2012, spiked to 50 in 2014, went down to 40 in 2015 and hit a high of 56 in 2016. Sponsored research agreements saw an even larger jump, from 14 in 2012 to 178 in 2016. Penn also went from being below the national average when it comes to research funding from industry in 2010 to now reaching twice the national average at 11.8 percent, Andes noted.

For a broader perspective, all agreements, including options, patent licenses, copyrights, tangible research materials, license agreements, research agreements and sponsored research

PENN ON THE RISE

Annual commercialization agreements (options, patent licenses, copyrights, tangible research materials license agreements, research agreements and sponsored research agreements) signed by the University of Pennsylvania from 2012-16.



Source: Penn Center for Innovation

agreements combined steadily increased in the past four years, from 186 in 2012 to 616 in 2016.

In the past, Penn’s commercialization activity was heavily transactional, Swartley said, but it’s become more nuanced with the adoption of the PCI model, where building relationships, hosting events and connecting with entrepreneurs are also part of their mission. A new glossy Commercialization Guide for faculty and graduate students aims to clarify the process as well.

There’s also been a skew toward startups, said PCI’s Chief Marketing, Communications and Programs Officer Laurie Actman, as they can take a risk on unproven technology that larger corporations might shy away from.

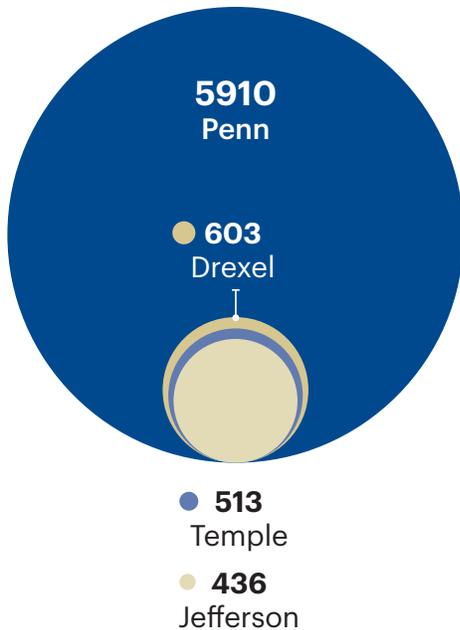
“Startups are a great way for us to further develop our early-stage technologies a little bit and get them further down the commercialization pathway so companies have a better idea of how they can leverage the technology,” Actman said.

In 2012, 15 startups were formed through PCI Ventures, and an additional five were formed by Penn faculty. In 2016, 22 came through PCI Ventures, and six from Penn faculty IP.

Blackfynn, a software startup that’s created a platform to help researchers make better drugs and devices for patients with neurological

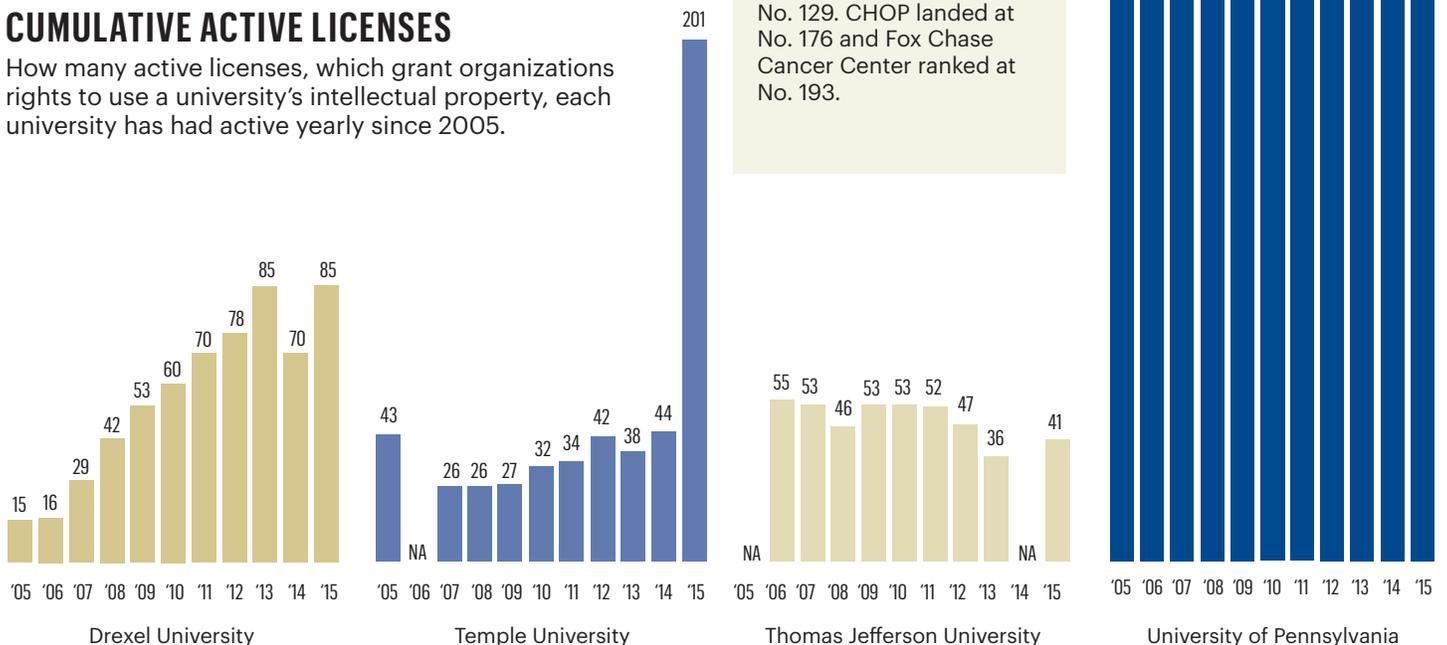
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TOTAL ACTIVE LICENSES 2005-2015



CUMULATIVE ACTIVE LICENSES

How many active licenses, which grant organizations rights to use a university's intellectual property, each university has had active yearly since 2005.



▶ ABOUT THE DATA

For clarity and focus, the analysis was boiled down to center on four of the city's biggest university heavyweights when it comes to research — University of Pennsylvania, Drexel University, Temple University and Thomas Jefferson University — from 2005 to 2015, the last year data for which AUTM data was available.

It's important to note other institutions, such as the Children's Hospital of Philadelphia, the Fox Chase Cancer Center, the Wistar Institute and the University City Science Center, conduct research and commercialization of global importance. This report limited its scope to comparable academic institutions, which operate under a different structure than the research institutions.

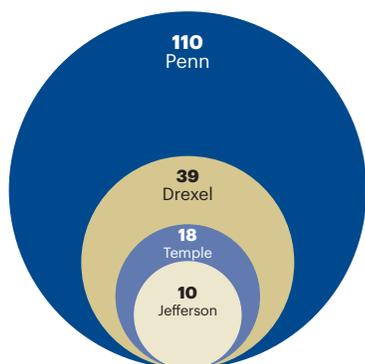
The universities were also the top four city institutions included on a recent ranking of the best universities in the country for commercialization, with Penn ranking No. 6, Drexel ranking No. 46, Temple ranking at No. 99 and Jefferson ranking at No. 129. CHOP landed at No. 176 and Fox Chase Cancer Center ranked at No. 193.

Source: Association of University Technology Managers STATT Database

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TOTAL STARTUPS FORMED

2005-2015



Source: Association of University Technology Managers STATT Database

diseases, spun out of Penn in early 2015. Its two co-founders, President Amanda Christini and Head of Scientific Product Joost Wagenaar, are rarities when it comes to university spinouts, as both left their positions at the university to launch the Center City-based company.

At a startup, they said they're able to advance and scale that technology more efficiently, and thus impact patients lives faster.

"In academia, discovery is enough because that might lead to a publication. Here, you need to turn it into something someone can use, that they find useful and is willing to pay for. Translating a discovery into something that actually functions is not what academia is set up to do. It's just not their mission," said Christini, the former director of strategic initiatives for Penn Medicine's Center for Healthcare Innovation.

"It's a lot easier for us to really make a difference," Wagenaar added. The startup, which employs 15 with plans to hire at least four more people, has raised more than \$3 million in seed and Series A rounds, in addition to another \$4.5 million in Small Business Innovation Research grants that bring in nondilutive capital.

Christini described their spinout experience as "quite good," with Penn recognizing how they needed to set up the company in order for it to succeed with the financing it anticipated.

Universities nationwide have struggled with providing that kind of flexibility in the past, said Christini, who worked in tech transfer for arguably the best institution for commercialization, MIT, when she first began her career.

"For a very long time there was this feeling like interacting with industry where there

money's being made is kind of a dirty thing," she said. "But now people recognize that if you're going to actually get something to a place where it's going to help someone you've got to invest in that. That requires investment and resources and a culture that can actually do that."

Much of Penn's progress, from her perspective, comes from its top leadership. When laying out Penn Compact 2020, President Amy Gutmann's vision to radically change the university's engagement and purpose on a global scale, she made commercialization a priority.

Both the Brookings and Milken's report recognizes Penn's leadership as a high point in its progress, but also found that while Penn's commercial output has consistently improved, "it is still middling among its peers" in that it ranked eighth in licensing deals, sixth in licensing income and eighth in patents. An area where it did shine? "An impressive fourth in number of startups," the report reads.

The solutions

The partnerships between Penn and Novartis and Drexel's Coulter endowment are major advancements, but they're not a place to stop, experts said.

The region still struggles with a lack of venture capital supplied by successful serial entrepreneurs, a dearth of multilateral collaborations, and while commercialization has improved, it's not where it should be.

"One of the biggest findings of this report is that you're crushing it in academic research, and there is a lot of improvement in terms of corporate relationships and tech transfer, but we would expect to see more," said Andes, of Brookings.

Philadelphia, however, doesn't have to come up with a plan to maximize its recent momentum in commercialization on its own – the Brookings report outlines broad initiatives and on-the-ground efforts, based on successful ventures in regions like Boston and Atlanta, some of which can be put into place in relatively short order. That's especially important, it notes, as federal R&D dollars are likely to be reduced in the new administration.

A major way to increase partnerships and thus the likelihood of research commercialization is to bring the pharmaceutical and life sciences giants in the suburbs inside the city's innovation district to mimic the kind of proximity and cluster-based growth that turned MIT and its surrounding area in Cambridge into the biomedical and technological giant it is today.

It's an easier move than it seems, experts

said, as entire companies don't need to relocate whole operations or headquarters, it would be enough just to establish R&D presences nearby. That's what's paid off dividends in Atlanta, Andes said, as its universities and civic government coalesced to create conditions where collaborations could flourish.

With that kind of concentration of knowledge, the city will be better prepared to launch one of Brookings most immediate and concrete recommendations – create a Precision Medicine Catalyst Initiative focused on making the city a center of excellence for the field. Assisted by existing organizations like the Chamber of Commerce, the initiative could find strength in appointing staff with deep industry commercialization experience, broaden its search for funding that can be leveraged and built upon existing grants, external funding and philanthropy.

"[Penn] has made substantial progress, particularly around precision medicine," Andes said. "Penn would be the game-changer in a lot of ways around this if they decided they really want to own this initiative."

One suggestion was to create a "joint research space and attract star faculty" with about \$20 million in those kinds of funding sources, as well as a research fellows program and industry-endowed professorships that can draw star faculty members. An intellectual property framework and template for joint research partnerships, modeled after one in place at the Wistar Institute, would also reduce friction and clarify the commercialization process to incentivize action, the report suggested.

The key takeaway from the progression Philadelphia has seen is that the efforts and intent to grow collaboration between industry and academia already exist, Andes said, but they need to connect better and grow faster, from version 1.0 to 2.0. It's going to require real movement of resources, deployment of patents, new organizational structures and new initiatives, he said, but the conclusion of the Brookings report was clear. Few cities can do this the way Philadelphia can.

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