Business

Research behind COVID-19 vaccines reaps close to $1 billion in royalties for Penn

Penn officials said they are plowing the money back into early-stage scientific research.

The 2022 Benjamin Franklin Medal in Life Sciences went to University of Pennsylvania researchers Katalin Karikó (left) and Drew Weissman for their landmark research t ... **Read more**
ELIZABETH ROBERTSON / Staff Photographer

by Harold Brubaker
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The University of Pennsylvania has reaped extraordinary financial gain from COVID-19 vaccines — approaching $1 billion since the beginning of last year — thanks to patents on a process Penn researchers developed more than 15 years ago.

It ranks among the biggest short-term royalty wins ever by a university.

Penn will use the proceeds for a $750 million expansion of scientific and medical research in Philadelphia, where it is already the main driver of a burgeoning cell and gene therapy sector. Those plans include a $350 million addition of laboratory space.

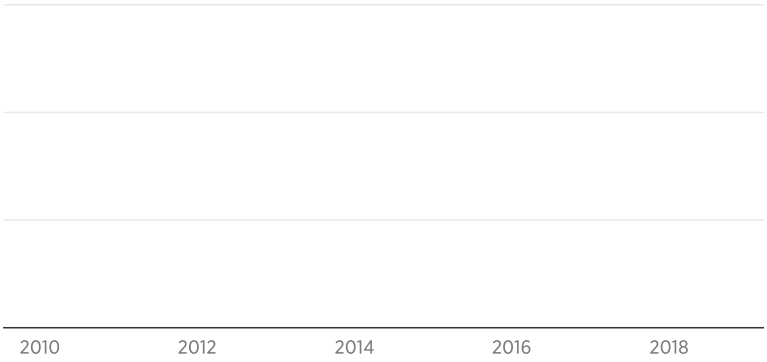
Citing confidentiality agreements, Penn officials aren't disclosing the exact amount of royalties the university has collected from Moderna's and Pfizer-BioNTech's COVID vaccine sales, which through March totaled $73.5 billion.

"It's a big number," said Craig R. Carnaroli, Penn's senior executive vice president, referring to Penn's slice of that revenue.

Already in the year that ended June 30, 2021, Penn's overall royalties, not just from the vaccines, soared from $30 million the year before to $310 million. "That is a huge number," said Stephen J. Susalka, CEO of AUTM, an association of university tech transfer managers.

And this year's figure, based on 12 months of vaccine sales, will be even larger.

University of Pennsylvania Licensing



From invention to vaccine

The path to Penn's bounty from COVID vaccines, which have saved an estimated 2 million lives in the United States, started with a little-noticed paper that biochemist Katalin Karikó and immunologist Drew Weissman published in 2005.

The research focused on messenger RNA (ribonucleic acid), which are molecules that carry genetic instructions for making protein. It had long been thought that messenger RNA, or mRNA, could be used to give the human body instructions that would enable it to fight off infectious diseases or fix other ailments.

The problem was that the body attacked the foreign mRNA and destroyed it before it could do its job.

No one knew where the discovery would lead. In an Aug. 23, 2005, news release, Penn said the “findings could lead to new types of therapeutic RNAs for cancer [and] genetic diseases.”

The years that followed are sometimes called the Valley of Death, where some university discoveries wither and die because no one advances them, according to Susalka, the expert in technology transfer.

“Universities do a fantastic job of developing the technology as far as they can,” but there’s often a big gap between what comes out of a university research lab and what a company needs to get a product to market, Susalka said.

» READ MORE: ***Penn scientists play important role in making the mostly used COVID-19 vaccines possible.***

In 2010, Penn followed a common practice of exclusively licensing the patent based on the original discovery, along with related patents, to a Madison, Wis., company called mRNA RiboTherapeutics, which, in turn, sublicensed it to an affiliate, Cellscript LLC.

Cellscript’s CEO, Gary Dahl, and associates soon started appearing on subsequent patents with Weissman and Karikó.

“That group, led by Gary, made significant and important contributions

Dahl did not respond to a request for an interview about his company, which sells kits for making modified RNAs on its website and has drawn little attention, despite the key part it played in getting the Penn mRNA technology into the hands of Moderna and BioNTech.

Those deals were signed in 2017, a few years before COVID turned the world upside down.

Estimating Penn's share of vaccine sales

Without inside information, it's impossible to know exactly how much revenue Penn is collecting from the Moderna and Pfizer-BioNTech vaccines because key financial details of licensing agreements typically are kept under wraps.

Moderna's Securities and Exchange Commission filings, however, provide unusual insight. The vaccine is the Cambridge, Mass., company's only revenue-generating product, which means the company must disclose details to investors.

Each quarter, Moderna reports how much it pays to Cellscript. From the beginning of last year through March 31, the total was $848 million, or 3.5% of quarterly vaccine sales. The only exception was the first quarter of last year, when it was 5%, likely because of a one-time bump — known as a milestone payment — from the initial sales.

If BioNTech has the same terms with Cellscript, then the Pfizer-BioNTech joint venture would have paid an additional $1.82 billion to Cellscript.

BioNTech did not respond to a request for details on its Cellscript license, which calls for "milestone payments of up to approximately $26 million as well as royalties in the low to mid-single digits on net sales of

"It's still likely to be a sizable chunk," said Jacob S. Sherkow, a law professor at University of Illinois at Urbana-Champaign who specializes in intellectual property and biotechnology.

If Penn's share were as high as 40%, it would have received roughly $1 billion of the estimated $2.7 billion Moderna and Pfizer-BioNTech paid to Cellscript through March 31.

» READ MORE: *The future could be wide open for mRNA treatments.*

That level of royalties puts Penn in rare company, but not at the top of the heap. Other universities, such as Northwestern, UCLA, and New York University, have collected far more over longer periods of time from pharmaceuticals.

Northwestern, for example, sold part of the royalty rights to Lyrica, an epilepsy and nerve-pain drug, for $700 million in 2007, but still collected more than $1 billion in royalties over the following six years.

Promising future for mRNA treatments

The COVID vaccines were the first commercial successes in the field of mRNA biology, which has vast potential not just for vaccines but many other treatments, scientists say.

Researchers at BioNTech, Moderna, and other companies are working on mRNA vaccines against influenza, HIV, RSV (respiratory syncytial virus), Zika, and other viruses. Cancer is another major focus for mRNA researchers.

"Because RNA is a lot like biological software, we can rapidly write the code for the proteins that are necessary, that might be deficient or dysfunctional in a cell," said John P. Cooke, medical director at Center for RNA Therapeutics at Houston Methodist. That's an efficient way to get the body to fix itself.

"I personally think the opportunity for RNA therapeutics is almost

at the Massachusetts Institute of Technology devised a circular RNA rather than a strip — that lasts longer in the cell, giving the RNA more time to deliver its instructions, Cooke said.

Penn's mRNA patents start expiring in May 2027. It's impossible to know if any of the patents that expire later will generate royalties. What's more, odds are very long that any of the prospects will be as big as the COVID vaccines.

Carnaroli, the university's senior executive vice president, cautioned that the huge revenue stream won't continue for long. "This will have a short life to it," he said.

Jonathan Epstein, Penn Medicine's chief scientific officer, suggested that many of the new treatments would appear after the expiration of Penn's original patents.

"The more important thing is that there could be additional cures for diseases, which is what we're really interested in," he said.

Penn's plan for the money

Penn cannot spend the vaccine royalties however it wants, Carnaroli said. Under 1980 federal law that allows universities to benefit financially from government-funded basic science research, Penn must put the money back into early scientific research.

In November, Penn outlined a $750 million set of investments in medical and scientific research. "That is what these proceeds will fuel," Carnaroli said.

Preliminary plans include the construction of a seven-floor addition of laboratories to the top of a relatively new building at 3600 Civic Center Blvd. at an estimated cost of $350 million, he said. Penn is also considering an expansion and then what Carnaroli called "a massive renovation" of the David Rittenhouse Laboratory at 33d and Walnut Streets in University City, where "we have incredible faculty in physics, astrophysics," he said.

The law, the Bayh Dole Act, also requires institutions to share some of the money with the inventors. Penn's patent policy calls for inventors to receive 30% of the royalties — which could be several hundred million

dollars split between Karikó and Weissman and possibly others

application of mRNA therapeutics to new diseases through vaccines, gene therapy within the body, and protein therapies in the near future."

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I write about the business side of health care and the nonprofit sector.