

AUTM 2017 Licensing Activity Survey

**A Survey of Technology Licensing and
Related Activity for US Academic and
Non-profit Research Institutions**



AUTM 2017 Licensing Activity Survey

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Executive Summary

Every year, universities, hospitals and research centers around the globe develop inventions — more than 380,000 in the past 26 years — from lifesaving drugs to strawberry varieties. Many have undoubtedly touched your life. It is thanks, in part, to technology transfer.

At its core, technology transfer is the process of transitioning scientific findings from one organization to another with the aim of development and commercialization. This process involves identifying new technologies, safeguarding them with patents, copyrights or other types of intellectual property protection, and licensing those rights to industry. As a membership organization supporting the efforts of the thousands of professionals within the technology transfer industry, AUTM has seen the profession evolve and expand beyond core functions to include corporate engagement, business creation and economic development, which today are vital components of the academic commercialization ecosystem.

This year, AUTM invited 312 institutions to participate in its US Licensing Activity Survey and 193 responded. The highlights of the survey are thought-provoking and shine a light on the changing tech transfer profession.

Start-ups Flourishing

According to the survey, start-up formation increased 32 percent in 2017 from the 818 start-ups formed in 2013. In addition, 6,050 start-ups were reported to be still operational, a 43.8 percent increase from 2013. Given those facts, the role a technology transfer office (TTO) plays within an entrepreneurship ecosystem is growing and becoming more impactful. Recognizing that most university start-ups are formed around patented technology, this prolonged growth and increased survival rate are reflective of research showing that start-ups with patents are 35 times more likely to be successful than start-ups without patents.¹

Growing Uncertainty

While patents are shown² to be a major driver of long-term economic performance, recent court decisions have significantly increased the uncertainty regarding their true value. This concern can be illustrated by examining the invention disclosure and new patent application rates. In 2017, universities reported 24,998 disclosures, 3.2 percent lower than the all-time high reported in 2016 and the first-ever decrease. And in 2017, there was a much larger decrease of 7 percent in new patent applications compared with 2016. Therefore, it appears that offices are filing patent applications on those disclosures at a significantly reduced rate than in previous years. While this observation has been made using just a year of data, it may portend a shift in strategies. Other factors may also contribute to this metric — from potential changes to federal technology transfer being led by the National Institute of Standards and Technology, to challenges to the Bayh-Dole Act and the growing concern regarding *inter partes* review.

If you'd like more information beyond the Survey, consider our STATT database, which contains the past 26 years of collected data.



Ragan Robertson
Cabinet Chair
AUTM Metrics and Surveys Portfolio

1. https://sites.nationalacademies.org/cs/groups/dbassessite/documents/webpage/dbasse_172827.pdf

2. **Patenting Prosperity: Invention and Economic Performance in the United States and its Metropolitan Areas**
Brookings Institution - Metropolitan Policy Program at Brookings - 2013



Honeycrisp: The Apple of Minnesota's Eye

University of Minnesota

Jim Luby and David Bedford's laboratory features a 30-acre orchard that is ground zero for the renowned apple breeding program at the University of Minnesota (UMN). It's where, in 1991, the two researchers introduced a new apple that captivated consumers around the globe and revived a flagging industry back home. They named it Honeycrisp.

"It had this amazing texture in your mouth — an explosive crunch, and then the juice filled your mouth," said Luby, who supervises UMN's fruit breeding programs.

New apple varieties take two decades or more to develop. Honeycrisp required pollinating blossoms by hand, grafting seedlings onto rootstock, cloning and growing test trees, and then passing the all-important taste test.

From the start, growers gushed about Honeycrisp's amazing taste: simultaneously tart and sweet. The New York Times excitedly called it "the iPod of apples" and "already a legend in its time."

Honeycrisp was just the 27th new apple variety released by the Minnesota Agricultural Experiment Station since 1908. The odds of any variety becoming a commercial success are usually listed as 1 in 10,000. Luby said Honeycrisp "raised the bar for everyone" to two or three times that level.

Patented in 1990, it's now one of the top six apples grown in the United States. That customers proved willing to pay double or more for Honeycrisps was great news for growers, especially small, family-run orchards in the Upper Midwest and New York looking for an economic booster shot.

It was also a welcome boon for UMN, where royalties on Honeycrisp and Honeycrunch (as it's known in Europe) have exceeded \$14 million, making the apple the university's third-most profitable invention ever.

Small wonder, then, that — at the urging of elementary schoolchildren — it was named Minnesota's official state fruit.

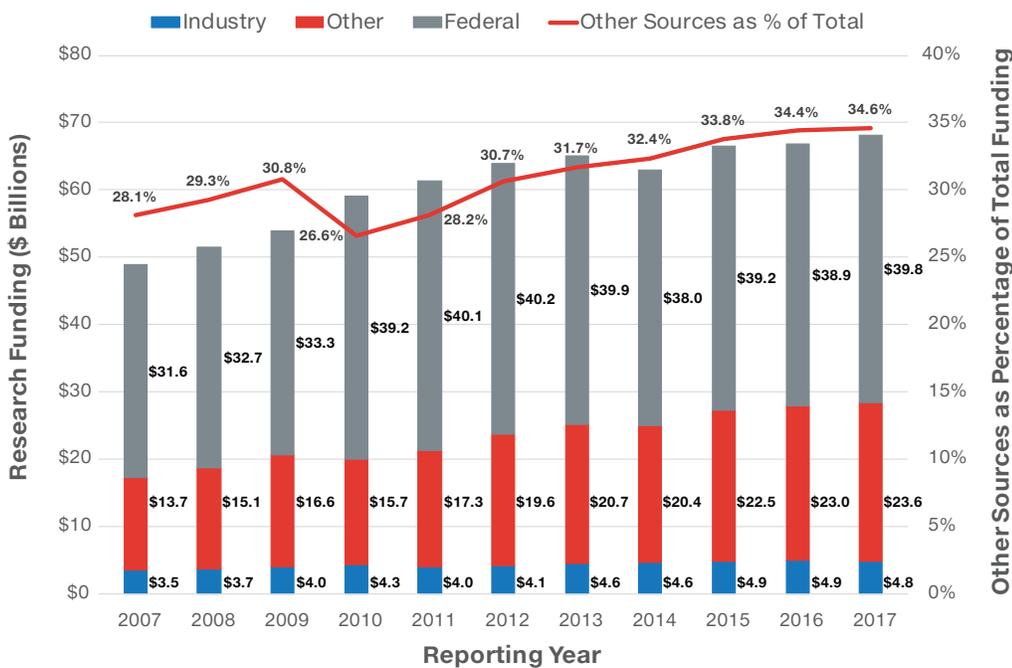
Research and Development

Funding the work of researchers and scientists at colleges, universities and other research institutions is the first step in developing technologies that eventually improve our world. Funding comes from the federal government, industrial sponsors and other sources.

In 2017, total research expenditures were up nearly 2 percent or \$1.3 billion over 2016. Federal funding, which has largely remained stagnant since 2010, increased slightly, but is not expected to grow substantially in the near term. The biggest funding change occurred in the “Other” research dollars category, which increased 2.7 percent from 2016 levels. This category can include funding sources such as grants from non-profit organizations or state and city grants. However, over the past 10 years, growth in this category has steadily outpaced relatively flat federal and industrial funding. This trend indicates that institutions are successfully pursuing more non-traditional funding sources and partnerships.

Key Findings

- Research expenditures grew to \$68.2 billion, an increase of almost 2 percent over 2016.
- Research funding is trending toward new sources: “Other” research dollars have increased 14.3 percent over the past five years.
- In 2017, industrial funding declined for the first time in seven years, decreasing 2.1 percent or \$105 million over the prior year. Over the past five years, industrial funding has shown modest growth of 5 percent.



Other Funding Sources Playing Bigger Role in Research



Taking a Chance on Google

Stanford University

In 1996, Stanford University graduate students Larry Page and Sergey Brin created PageRank, a sorting system for the burgeoning World Wide Web. This led to a new search engine called Google, which expanded to become one of the most profitable tech companies in the world and one of the most financially successful inventions ever licensed by a university.

Google provides a host of cutting-edge, internet-related services and has fanned out into other fields with creative products such as smart glasses and self-driving cars.

Intrigued by the mathematical relationships they observed on the rapidly expanding web, Page and Brin designed an algorithm that used all the links on different webpages to search and rank various sites.

They launched their search engine on Stanford's website in March 1996. Within six months, PageRank's popularity had overloaded Stanford's bandwidth, shutting down the university's internet access several times. "We were lucky there were a lot of forward-looking people at Stanford," Page said. "They didn't hassle us too much about the resources we were using."

The university's Office of Technology Licensing (OTL) undertook marketing the technology to prospective business partners. Frustrated that investors were failing to recognize PageRank's value, Page and Brin founded Google (derived from googol, the name for the numeral 1 followed by 100 zeroes) to market and commercialize their search engine.

"Two of our graduate students had developed what they passionately believed was the best search engine in the world, yet existing companies didn't believe them," said Katharine Ku, then head of Stanford's Office of Technology Licensing. "They also had no business experience or knowledge about how to build a company. Who would take a chance on them? We did."

After Google incorporated in 1998, Stanford licensed the PageRank algorithm to the new start-up. In just two years, Google became the world's largest search engine, with more than 1 billion webpage addresses in its index. The company went public in 2004.

Supporting Google was a gamble for Stanford, but it paid off handsomely. Google is far and away the most financially successful invention ever licensed by the university.

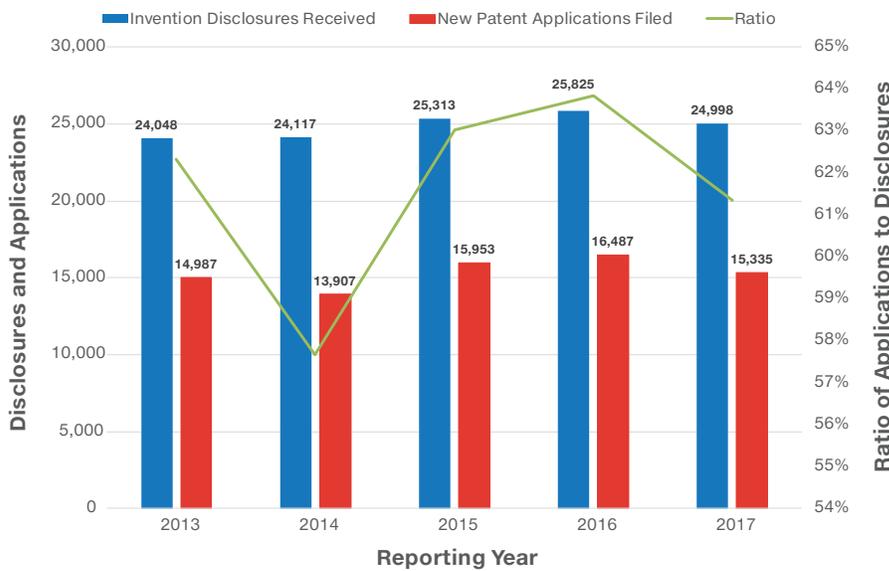
Invention

The disclosure is the launching pad for evaluating new inventions, analyzing market potential and developing strategies for protecting the intellectual property.

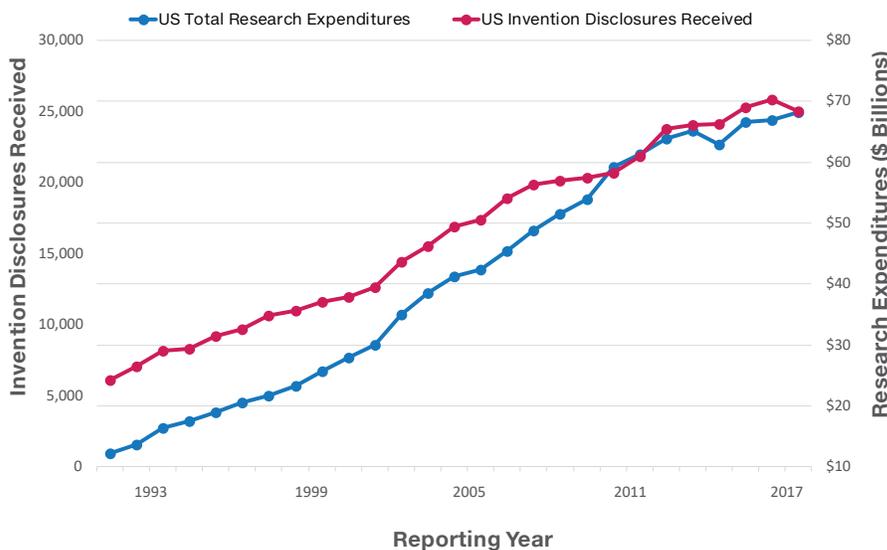
In 2017, disclosures fell 3.2 percent over the previous year, the first decline reported in this category since we began collecting data in 1991. Although disclosure rates have increased 4 percent over the past five years, the 2017 dip is consistent with the headwinds that TTOs are feeling regarding institutional research and TTO funding, inventor outreach and commercialization. It is unclear if disclosures have reached a plateau or if they will regain an upward trajectory.

Key Findings

- 24,998 invention disclosures reported in 2017.
- More than 440,000 inventions reported since 1991.
- On track to reach 500,000 inventions within the next three years.



Disclosures Received and New Patent Applications Filed for US Research Institutions



Invention Disclosures Grow with Increased Research Funding

Intellectual Property Protection

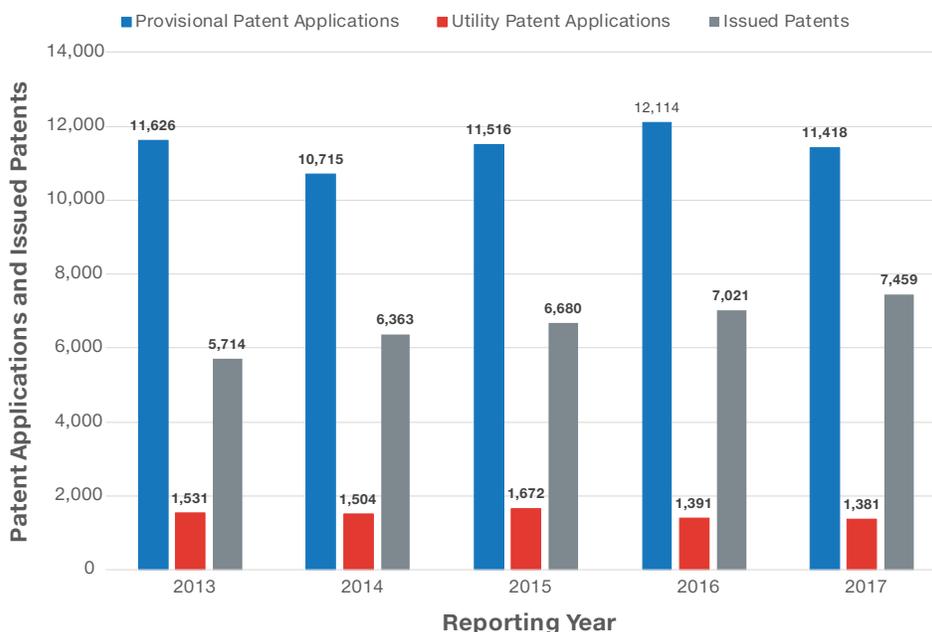
A key step in the transfer of technology is the protection of new inventions. Patent protection provides both economic opportunities for sponsoring research institutions and an incentive for entrepreneurs and companies to invest in new technologies.

The number of patent applications, including new provisional and utility patents filed in the United States by research institutions, decreased in 2017. While this drop in provisional patents represents a one-year dip, filings for US utility patent applications have been in decline for three years. This trend may reflect concerns over the erosion of patent rights in the United States resulting from recent US Supreme Court rulings. The 7,459 US patents issued in 2017 were the most in the history of the survey.

Key Findings

- 7,459 US patents were issued in 2017, the most ever reported.
- Provisional patent applications (down 5.7 percent in 2017 from 2016) have essentially remained flat for the past five years.
- US utility patent applications, although down 0.72 percent in 2017 from 2016, have essentially remained flat for the past five years.

US Provisional, Utility and Issued Patents





Small Chips Tackle Big Problems

Harvard University

People all over the world who have never heard of George Whitesides owe him a debt of gratitude, or will one day.

Among his many research interests, the Harvard chemistry professor is known for groundbreaking work in microfluidics, the manipulation of minute amounts of liquids in tiny spaces.

Whitesides invented a paper-based microfluid chip the size of a thumbnail — a miniature, portable laboratory that can test a tiny sample of bodily fluid for signs of health or disease.

The paper-based thumbnail-sized chip is inexpensive to make, easy to use and, most important to its inventor, ideal for helping people in the developing world and other resource-poor areas.

In 2007, Whitesides and like-minded colleagues started a non-profit company, Diagnostics for All (DFA), aimed at making the patterned-paper technology available worldwide.

The paper is patterned with water-averse polymers, forming a series of channels that guide a fluid sample to a specific location on the chip that is pretreated with a reagent. When the reagent is exposed to the fluid sample, it results in a color change that can be translated into a diagnosis.

Citing its commitment to acting with flexibility and speed to improve global health, Harvard, through its Office of Technology Development, in 2009 provided DFA exclusive licensing rights for diagnostic technology developed by the Whitesides Research Group at the university.

DFA's first paper-based diagnostic chip test was for liver function. This simple procedure, in which a drop of blood is assessed in about 15 minutes, could save thousands if not millions of lives once the test receives full approval. Early diagnosis of impaired liver function could help people with AIDS or tuberculosis. More than 400,000 people in Africa died from TB in 2016, according to the World Health Organization.

Other uses for the paper-based technology include measuring micronutrient levels in children and assessing vaccination coverage and disease incidence in the developing world. In fact, DFA's scientists say the sky's the limit on the types of tests that can be embedded on a paper chip.

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Licensing

The next step in the commercialization process for protected intellectual property is licensing. The number of exclusive licenses executed is a leading indicator of licensing revenue and the commercial development of new products and services five to 10 years later.

Since generating more than \$1 million in licensing revenue is a rare event (accounting for less than 1 percent of all licenses in 2017), the more exclusive licenses executed, the better the chance at generating revenue. In 2017, 2,037 exclusive licenses were executed, a slight decrease of 1.3 percent from 2016 and down 3.3 percent from 2015. Conversely, there was a slight increase in the number of options and non-exclusive licenses over the past two years. Viewed together, these data points may be a sign of a declining risk appetite among commercial entities for university licenses.

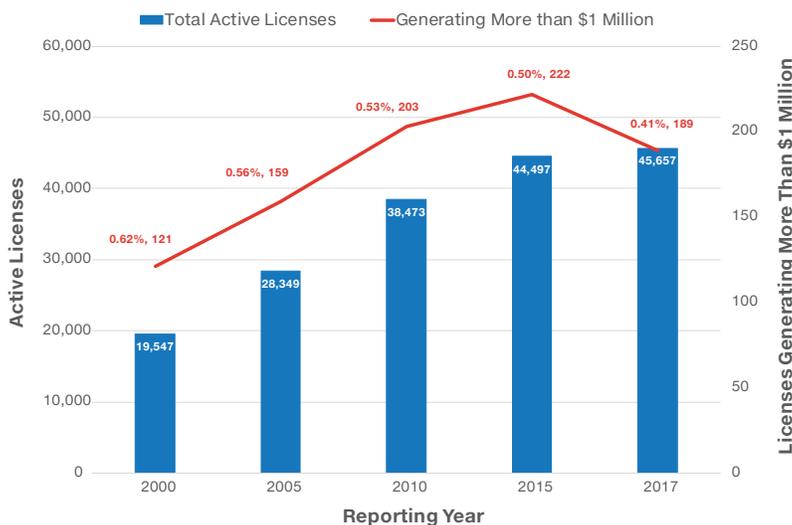
Key Findings

- All three categories — exclusive licenses, options and non-exclusive licenses — have been relatively flat when viewed over the past three years.
- Exclusive licenses were down 3.3 percent in 2017 (2,037) compared with 2015 (2,107).
- Options were up 1.2 percent in 2017 (1,566) over 2015 (1,547).
- Non-exclusive licenses were up 1.9 percent in 2017 (4,195) compared with 2015 (4,115).

Exclusive Licenses, Options, and Non-Exclusive Licenses



\$1 Million Mark Is Tough to Crack





Beating the Odds Against Prostate Cancer

Roswell Park Cancer Institute

About one in nine American men will be diagnosed with prostate cancer in their lifetime. With about 164,000 new cases annually, it is the most common cancer among US men. But what just a few decades ago was viewed as a near-death sentence today boasts a 10-year survival rate of 98 percent, due largely to earlier detection linked to a simple blood test.

“The PSA test absolutely revolutionized the way we approach prostate cancer diagnosis,” said Donald L. Trump, former president and CEO of what is now Roswell Park Comprehensive Cancer Center in Buffalo, New York, where initial research on the test was conducted.

“PSA” refers to “prostate-specific antigen,” a protein found in blood. Elevated PSA levels can, but do not necessarily, indicate prostate cancer. However, a PSA test can detect prostate cancer long before symptoms appear, giving “advance warning so [patients] can consider various treatment options before the cancer spreads,” said Richard Matner, director of technology transfer and commercial development at the institute.

Administered to millions each year, the PSA test has practically become routine for American men in their 50s and older. Besides being used for early detection, it is a valuable tool in monitoring the efficacy of treatments for those diagnosed with prostate cancer, and an effective predictor of the disease’s recurrence.

Although PSA levels alone do not offer enough data to distinguish between benign and cancerous prostate conditions, physicians and their patients use the test results to determine their next steps in checking for other signs of cancer.

The test’s origins can be traced to the pioneering work of Roswell Park researchers led by T. Ming Chu, who in 1979 reported the discovery and purification of the PSA. This led to development of a test to detect the antigen. A patent was issued in 1984.

The technology was eventually licensed to a California biotech company, which developed the first commercially viable PSA test. In 1994 the Food and Drug Administration approved its use as an early screening tool for prostate cancer.

“There is no doubt that thousands of men would not be alive today if the PSA test had not come along,” said Trump.

Product Development

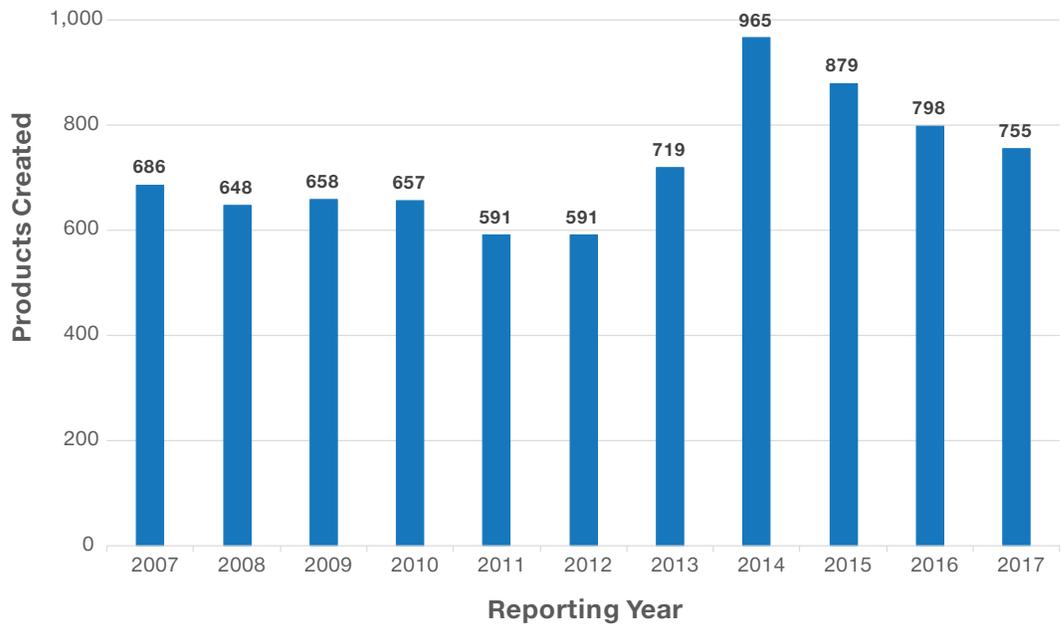
The arrival of new products in the marketplace is the culmination of successful tech transfer, from idea, research and development to intellectual property protection and licensing—a strategic, collaborative and often complicated process led by tech transfer professionals.

AUTM members reported 755 new products in the market in 2017, a 5.4 percent decrease from 2016. After a relatively flat period from 2007 to 2012, the number of new products spiked in 2014. The numbers have since retreated to 2013 levels, with minimal gains between 2016 and 2017. Viewed over a 10-year period, the gains are more tangible.

Key Finding

- 7,947 new products created over the past 10 years.

New Product Ups and Downs

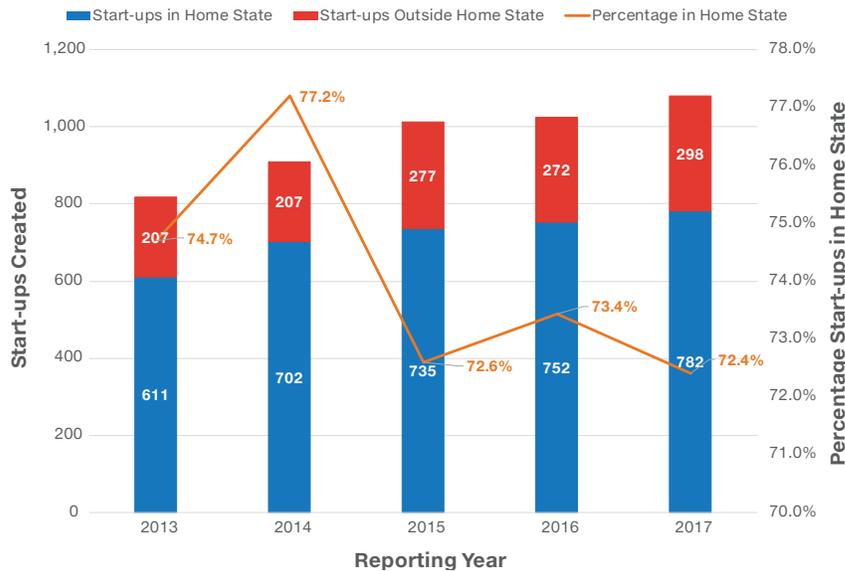


Public Use and Economic Growth

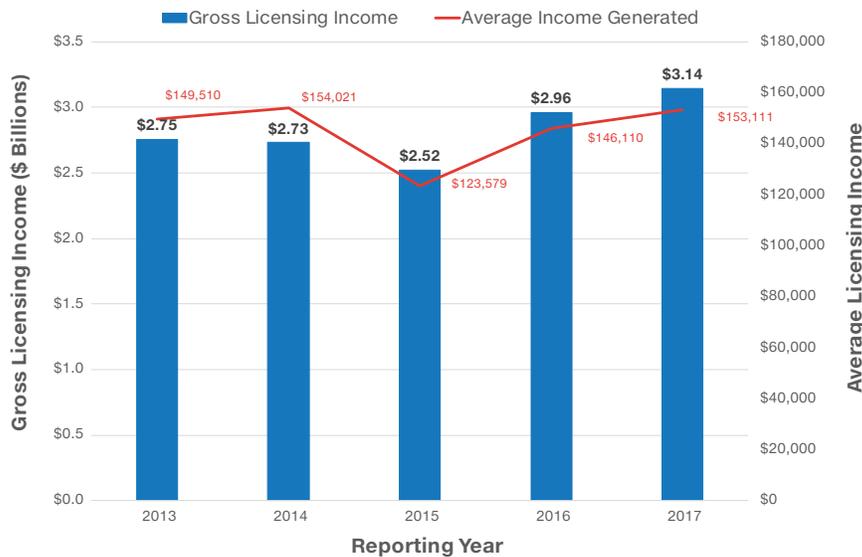
Start-ups continue to be a core focus of university technology transfer offices. In 2017, 1,080 start-ups based upon foundational university intellectual property were formed, an increase of 32 percent over the past five years. Of these start-ups, 72.4 percent were incorporated within the institution's home state. More than \$3 billion in gross licensing revenue was reported in 2017, the highest amount ever. Start-ups continue to be a core focus of university technology transfer offices.

Key Findings

- 1,080 start-ups formed.
- 72.4 percent of these start-ups were headquartered within the home state of the institution.
- More than \$3 billion in licensing revenue reported.



**Start-ups
Contribute to
Local Economies**



**Licensing Income
Hits Record High**



The Birth of Allegra

Georgetown University

When Raymond Woosley discovered fexofenadine's role as a safe and effective allergy medicine — you know it as Allegra — he didn't realize it would transform the science of drug development. Today, Allegra is one of the most popular antihistamines in the world, restoring an otherwise unattainable quality of life for serious allergy sufferers.

Woosley, then chairman of pharmacology at Georgetown University Medical Center, was part of a team investigating problems with the drug Seldane (terfenadine), marketed in 1985 as the first “non-drowsy” allergy medicine. He found previously overlooked reports suggesting that an interaction between Seldane and other common drugs could cause serious, sometimes fatal heart rhythm disorders.

During his research, Woosley also discovered that a breakdown product of Seldane — fexofenadine — was the actual ingredient that suppressed allergy symptoms, with no serious side effects.

With the help of Georgetown's Office of Technology Commercialization (OTC), Woosley patented fexofenadine as a non-toxic allergy medicine. OTC's critical role included managing key language in the development agreement.

Following approval by the Food and Drug Administration in 1996, the drug was marketed as Allegra. Shortly afterward, terfenadine and several other medications found to pose similar risks were pulled from the market.

Woosley's work transformed the drug development process at an international level. Based on his studies, the FDA and other regulatory agencies published guidelines requiring testing of new drugs for their potential to cause heart arrhythmias. These guidelines are essentially the same tests and protocols that Woosley conducted on terfenadine.

The FDA approved over-the-counter sales of Allegra in 2011. Five years later, sales topped \$221 million, making Allegra one of the five best-selling non-prescription allergy medicines in the United States.

Woosley has continued his mission to make drugs safer. He is founding president of the Arizona Center for Education and Research on Therapeutics, a non-profit dedicated to the safe use of medications.

“Patients are dying needlessly from drugs and drug combinations that are often taken to treat common, relatively trivial illnesses,” he said. “Although these kinds of side effects resulting in death are rare, they are preventable, and even one death is unacceptable.”



About the Survey

AUTM invited 312 US institutions (including universities and colleges, hospitals and research institutes, national laboratories and third-party technology investment firms) to participate in the AUTM US Licensing Activity Survey: 2017. AUTM received 193 completed surveys, for a response rate of 61.9 percent. Respondents for 2017 comprised 167 universities, 25 hospitals and research institutes, and one technology management firm. The numbers from these institutions reflect the significant role played by technology transfer in today's innovation economy.

Most of the data collected in this survey is also available in AUTM's Statistics Access for Technology Transfer (STATT) database. To access this searchable database of more than 26 years of academic licensing data, visit www.autm.net/statt.

Suggested Citation

AUTM report titled AUTM US Licensing Activity Survey: 2017, A Survey Report of Technology Licensing (and Related) Activity for US Academic and Non-profit Institutions and Technology Investment Firms can also be referenced by its abbreviated title, AUTM US Licensing Activity Survey: 2017, editors Douglas Hockstad, Rebecca Mahurin, John Miner, Kenneth W. Porter, Ragan Robertson and Laura Savatski.

About AUTM

AUTM is the non-profit leader in efforts to educate, promote and inspire professionals to support the development of academic research that changes the world and drives innovation forward. Our community comprises more than 3,100 members who work in more than 800 universities, research centers, hospitals, businesses and government organizations around the globe.



One Parkview Plaza, Suite 800
Oakbrook Terrace, Illinois 60181
Phone: +1-847-686-2244
Fax: +1-847-686-2253
info@autm.net