

Technologies that Emerged from Universities

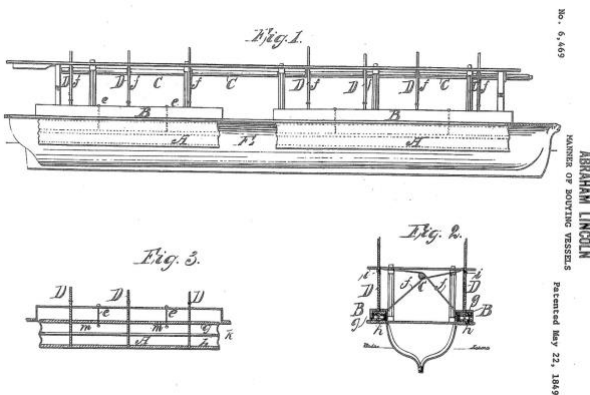
By: Steve Valentor

Disclaimer: I am not a lawyer, so please do not misconstrue this article as legal advice. I am however a technologist with many decades of experience in computer engineering, semiconductors, and software from entry level engineer to CEO. My firm is a Registered Investment Advisory and we can help you to make investments in technology companies.

Intellectual Property (IP) Law

Intellectual property is defined as products of human intellect that have commercial value, including copyrighted property such as literary or artistic works, and ideational property, such as patents, business methods, and industrial processes.

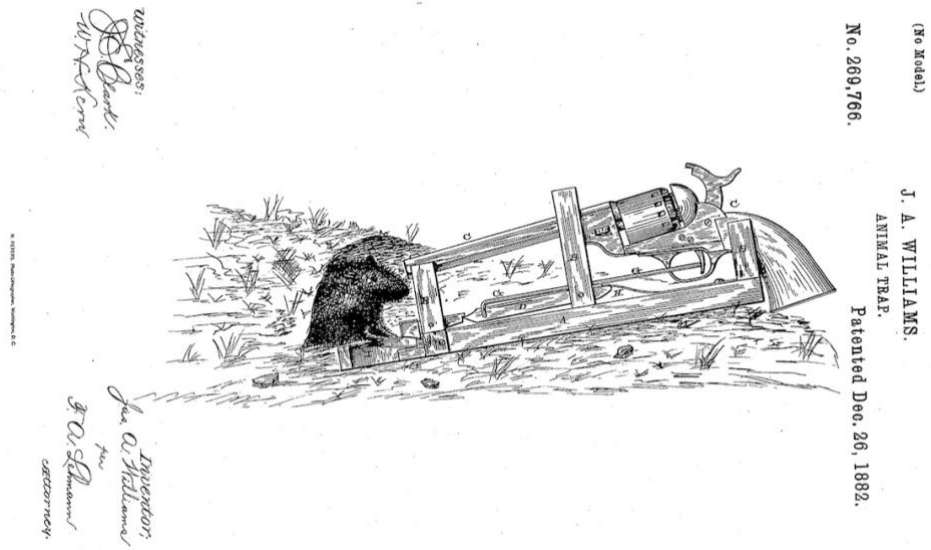
There are a number of laws that define and control the ownership and transfer of intellectual property in the United States. These laws have their foundation in Article 1, Section 8 of the US Constitution. It empowers Congress "To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries;"



George Washington signed the first US patent in 1790. It was issued to a Mr. John Ruggles and described a traction wheel for a steam locomotive. Congress established the United States Patent and Trademark Office (USPTO) in 1836. Only then was the system to assign numbers to patents instituted.

Abraham Lincoln is the only US President to own a patent. His patent, number 6469, was issued for his novel method of buoying river vessels over shoals.

The patent office does not test for practical application or safety as is clear with patent number 269,766 issued to J.A. Williams on December 26, 1882.



The USPTO issued its one millionth patent in 1911. As of 2024, the USPTO has granted more than 11 million patents with one million new patents added in the last 35 months. Many of these patents are generated by government funded research. According to the USPTO, the US government invests more than \$100 billion annually in research.



Before 1980, Universities had already developed some of the most important commercial technologies. Johns Hopkins developed artificial sweetener in 1879, Clark University patented solid rocket fuel in 1914, the University of Toronto created insulin in 1922. Other early university inventions included plexiglass, the electron microscope, the Drunk-o-meter (which became the modern breathalyzer), the Pap Smear, ultrasound technology, the electronic computer, toothpaste, seat belts, the MRI, and the kennel cough vaccine. While these technologies were patented and were used to build some of the most important companies in the world today, there was no formal process for controlling the technology transfer. A number of laws have been enacted to encourage the transfer of publicly funded research and other intellectual property from federal labs, universities and research institutions to commercial industry.

The Stevenson-Wydler Act of 1980 established the Office of Research and Technologies Applications to coordinate and promote a path to transfer technologies to the public. In the same year, the Bayh-



Dole Act allows institutions to license their IP to industry and collect royalties or even retain equity in the private companies that develop their IP.

The Federal Technologies Transfer Act was signed into law in 1986. It established the Federal Laboratory Consortium for Technology Transfer and enabled federal laboratories to negotiate Cooperative Research and Development Agreements, which are formal agreements with non-federal parties to provide access to government owned facilities, equipment, personnel, and IP.

Most recently, in 1995, Congress passed the National Technology Transfer and Advancement Act. It establishes uniform processes and procedures for all federal technology transfer and empowers the USPTO to centralize federal IP through the Patents 4 Partnership platform. It also established the Small Business Innovation Research (SBIR), the Small Business Technology Transfer (STTR), and the Federal Consortium for Technology Transfer.

Economic Impact

According to the Association of American Universities, the Bayh-Dole Act has led to the launch of over 11,000 new startup companies, created more than 4.2 million new jobs, and has added in excess of \$1.3 trillion in US economic growth.

Over the last 50 years, thousands of technologies have been licensed and transferred. Stanford University patented recombinant DNA in 1980. Genentech used the technology to synthesize human insulin which it then licensed to Eli Lilly and Company to manufacture and distribute.

During the 1960s and '70s, popular music was revolutionized by the analog Moog synthesizer. In 1983, Yamaha introduced the first digital version, the DX7, based on licensed technology developed at Stanford by John Chowning. More than 100,000 DX7 units were sold, making it one of the best-selling instruments in music history.

Patent 4,405,829 describing a “Cryptographic communication system and method” was granted to the Massachusetts Institute of Technology (MIT) in 1983. It involves the product of two very large prime numbers, Carmichael’s totient function, the Euclidean algorithm, take a modular multiplicative inverse to generate an equation in the form of Bézout's identity and you get an RSA private key. RSA stands for Rivest–Shamir–Adleman and is the encryption system used to secure the internet, on-line financial transactions, and Bitcoin.

The RSA logo consists of the letters 'RSA' in a bold, red, sans-serif font. A registered trademark symbol (®) is located to the upper right of the letter 'A'.

Rivest, Shamir, and Adelman formed RSA Security in 1982 and licensed their patent from MIT. RSA built a healthy business providing tools and collecting royalties until it was sold to EMC for \$2.1 billion. Dell then acquired EMC and sold RSA to a financial consortium that continues to operate it as an independent private company. The patent expired in 2000 and the IP is now free to use in the public domain. The value of this IP is clear.

Patent 6,285,999 B1 was awarded in 2001 and is described as “Method for node ranking in a linked database” and assigned to Stanford University. Specifically, it assigns importance ranks to nodes in a linked database, such as any database of documents containing citations, the world wide web or any other hypermedia database. The rank assigned to a document is calculated from the ranks of documents citing it. In addition, the rank of a document is calculated from a constant representing the probability that a browser through the database will randomly jump to the document. The method is particularly useful in enhancing the performance of search engine results for hypermedia databases, such as the world wide web, whose documents have a large variation in quality.

The inventor, Larry Page licensed the patent back from Stanford, where he was a PhD student. He and his partner, fellow PhD student Sergey Brin used it to form Google. You may have heard of it. The licensing transaction involved Stanford retaining equity in the fledgling company and is a superb example of a highly valuable university technology transfer. Stanford remains a shareholder in Google’s parent company, Alphabet.



And sometimes winning a Nobel prize isn’t even enough. Emmanuelle Charpentier and Jennifer Doudna won the 2020 Nobel Prize in Chemistry for the development of the gene-editing clustered regularly interspaced short palindromic repeats, more commonly known as CRISPR. It has been called the biggest biotech discovery of the century.

Several universities were involved in the development of this amazing technology. Yoshizumi Ishino and his team at Osaka University discovered the repetitive sequences in the DNA of E. coli while studying a different gene. Their function was not understood at the time.

Dr. Doudna met Dr. Charpentier at a conference in San Juan, Puerto Rico in 2011. Doudna was a professor and researcher at UC Berkely and Charpentier was a researcher at the branch of the Max Planck Institute in Berlin. During a walk the next day, they decided to collaborate. In 2012, they found a particular associated enzyme that can be used to edit genes withing living organisms. Their invention was patented in the European Union.



Despite those patents being issued in 2017 and 2019, they are being challenged on the grounds that they did not contain descriptions detailed enough for others to use the technology.

Meanwhile, Fen Zhang at the Broad Institute of MIT and Harvard claims to have invented the gene editing tool independently before Doudna and Charpentier. In 2014, Zhang was issued and has since defended a US patent for the main use of CRISPR.

It is clear that these technologies have significant value and the courts will decide which institutions will benefit the most from this remarkable IP.

The path that technologies like these follow from their inception through to the market is similar. Once the need for an innovation is identified, funding is initiated either by a grant application, or through a process involving a process involving a Request For Information (RFI) followed by a Request For Proposal (RFP). Once the grants are issued or the contracts are negotiated, knowledge creation begins.

At the point that the innovations can be sufficiently explained so that someone skilled at the appropriate art can reduce the ideas to practice, disclosures are made and the IP can be protected.

With their invention protected, the inventors can engage commercial interests and form or join companies to develop the technology, market it and deliver it to paying customers.

This entire process is referred to as Technology Transfer. Technology Transfers are usually horizontal in nature and move the underlying technologies to private industry for commercialization. In some more rare cases, the IP is transferred to business incubators at the institutions.

This is normally the point where the venture capital (VC) industry becomes involved and makes investments to form companies to develop transferred IP into products and services that can be brought to market. Often the brilliant scientists and engineers who invent new technology may not have the necessary skills or experience to build a company, satisfy investors, and service customers. VC partners ensure that the new companies are given the resources to improve their chances for success.



According to AUTM, formerly the Association of University Technology Managers, more than 1000 startup companies are launched annually using technology transfer. AUTM attributes these companies with creating 5.9 million new jobs and generating more than \$1.7 trillion in gross industrial output since 1969.

Information about available technologies is available from listing services such as Flintbox from Well Spring. Also, most Technology Transfer Offices host websites highlighting technologies which are available to license.

At Polynomial Ventures, we specialize in building technology businesses and we can help. Whether you are an investment officer directing university endowments, family offices, sovereign wealth funds, or pension funds, we can help. Contact us at the link below if you are a technologist or an investor.

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Steve Valentor is a 30+year technology industry veteran who has worked in computer engineering, semiconductor R&D, software development, and manufacturing for companies ranging from startups to the Fortune 200. He has held positions from entry level engineer to senior technical management, CEO and board chair. Currently the managing partner of Polynomial Ventures and an adjunct professor at DePaul University, Valentor holds an M.B.A. in finance and a bachelor's degree in math, both from the University of Illinois at Chicago.

Polynomial Ventures invests venture capital in early stage technology companies outside of Silicon Valley and Boston. The Chicago-based firm is a registered investment adviser (RIA) providing a range of wealth management services.