Innovation and Societal Impact

How humankind can get more out of academic research, and how technology transfer can help

Alan Bentley
Wed, Feb 20, 2019
What is Innovation?

• Development, refinement and new application of technology
• Conversion of knowledge and ideas into valuable business, products and services
• Evolutionary process of increasing the capability to apply a technology
What is Innovation?

If something is hard –  
make it easy.

If something is impossible –  
make it possible.
Not all great ideas are innovative

Innovation
it becomes critical during a recession
Innovation vs Invention
Innovation vs Invention
So, how do they get the vitamin D in the milk?
Early 1920s, Professor Harry Steenbock, University of Wisconsin:
- Researching ways to cure rickets in children
- Vitamin D deficiency was a known factor in the disease
- **Discovery**: irradiating rat food causes a chemical reaction resulting in the formation of vitamin D in the food.
- This process was applied to other food products, most notably cow’s milk
Wisconsin patent licensing activities ended up generating more than a $100M in revenues for Wisconsin – which is over $1B in today’s dollars!

In 1941, Wisconsin also licensed the drug product known as Warfarin (aka, Coumadin) – one of the most widely prescribed anti-coagulation medications in the history (and effective rat poison)
Many Lifesaving or Life Improving Blockbuster Products or Companies Emerged from University Research
Exemplary Vanderbilt Products on the Market
**PARKER HANNIFIN/INDEGO THERAPY**

**Product Description:** Indego Therapy, the latest in the Indego line of powered exoskeletons, is a lower-limb exoskeleton that enables therapists to deliver individualized gait training.

**Vanderbilt Innovators:** Michael Goldfarb of the Department of Mechanical Engineering

**Licensee Description:** Parker Hannifin, a Fortune 250 global leader in motion and control technologies, created their Human Motion and Control division exclusively to develop Vanderbilt exoskeleton technology.
Academic Research Cycle

Hypothesis → Grant application
Academic Research Cycle

- Hypothesis
- Grant application
- Funding ($)
Academic Research Cycle

- **Hypothesis**
- **Grant application**
- **Funding ($)**
- **Research**
Academic Research Cycle

- Hypothesis
- Grant application
- Research
- Discovery
- Funding ($)
- Publication

IMPACT

idea
Innovation Cycle

Research

Idea

Innovation
Innovation Cycle

- Research
- Royalties ($)
- Products, Services, Jobs
- Patents / Licenses
- Innovation
- idea

CTTC IMPACT
Impact Cycles

Research

Funding ($)

Grant application

Publication

Discovery

Royalties ($)

Innovation

Products, Services, Jobs

Patents / Licenses
Impact Cycles

Innovation Cycle
- Research
- Discovery
- Grant application
- Publication

Research Cycle
- Funding ($)
- Royalties ($)

Impact
- Products, Services, Jobs
- Patents / Licenses
Serve the Vanderbilt community by assisting University inventors in *bringing their innovations to practical application for the benefit of the public*
In other words:

Help ensure investigators’ research achieves **IMPACT** in the world
License inventions to industry

Help launch new Start Up Companies

Business Development / Industry Funding
### 10-Year Snapshot

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World's Most Innovative Universities | 2017

#10 Vanderbilt University USA
Website: www.vanderbilt.edu Students: 12,587

Can Cancer Care Be Industrialized? Vanderbilt And GE Are Teaming Up To Find Out

Vanderbilt and Lundbeck to Develop a Novel Approach for Treating Schizophrenia

New Approach to Schizophrenia Treatment

Recognition for Innovation
The process of protecting and commercializing new innovations created in universities and academic medical centers.

Commercializing = licensing to:
• Established companies, large and small
• New ventures, usually involving faculty entrepreneurs
What is the Purpose of Academic Technology Transfer?

• Support the academic mission
• Generate positive societal impact
• Contribute to local economic development
• Generate revenue to support research
• Legally required by the Bayh-Dole Act
• Positively impact brand value
What is the Bayh-Dole Act?

Birch Bayh

Bob Dole
• 1960s and early 1970s saw rapid expansion of Federal agency support of academic research:
  – NIH, NSF, ONR among major funders

• Federal Government owned all inventions made in academia sponsored by Govt agencies

• Govt had little infrastructure for protecting and commercializing inventions
  – A few percent of Govt patents were licensed
  – Default licensing approach was (and is) non-exclusive licensing
• The US Government wanted to find a way to bring the benefit of publicly-funded research to the general public, and to spur the lagging US economy.
• Birch Bayh and Bob Dole co-authored legislation to change the way inventions resulting from Federal support are owned and processed.
• In 1980, the Bayh-Dole Act was passed.
• Prior to 1980, any invention made under a Government grant was owned by the US Government
• The Government generally did not take any action to protect and commercialize all of its thousands of inventions – no infrastructure
• Under the Bayh-Dole Act, universities, research institutions, and other not-for-profit organizations are allowed to own, protect, and commercialize their Federally-funded inventions
Economic Impact of Tech Transfer
Last 20 years

From 1996 to 2015, up to...

- $1.3 trillion contributed to U.S. gross industrial output
- $591 billion contributed to U.S. gross domestic product
- 4.3 million jobs supported

380,000+ inventions disclosed...
80,000+ U.S. patents issued...

To research institutions in the past 25 years

11,000+ start-ups formed since 1995
70% of university innovations licensed to start-ups and small companies
200+ drugs and vaccines developed through public-private partnerships since Bayh-Dole Act enacted in 1980
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Last year alone

- $68.2 billion in Research Expenditures
- 6,050 Start-ups Still Operational as of FY2017
- 1,080 Start-ups Formed
- 755 New Products Created
- 7,849 Licenses & Options Executed
- 24,998 Invention Disclosures
- 15,335 New U.S. Patent Applications Filed
- 7,459 U.S. Patents Issued

Technology Transfer Lifecycle 2017
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BEWARE OF THE TIME LAG BETWEEN DISCLOSURE AND PRODUCT LAUNCH
What Does CTTC Do?

**Core Operations**
- Technology evaluation, protection and licensing
- New venture assistance
- Federal Government compliance (Bayh-Dole)
- Medical device regulatory affairs advisement (MDRAP)
- Industry engagement and alliance management

**Other Key Functions**
- Material Transfer Agreement processing
- Education/training
- Industry research contract support
- Committee/board participation
- Strategic consultation for VU and VUMC
The Academic Start-up Process

- Academic start-ups are generally driven by faculty that are aspiring entrepreneurs
  - Vanderbilt strongly suggests faculty partner with a business associate to manage day-to-day operations of company
- Entrepreneur responsible for forming the start-up company
- CTTC licenses rights to the start-up
  - Vanderbilt receives equity in the start-up as partial consideration under the license agreement
  - Vanderbilt generally avoids entering into “all equity” transactions with start-ups
- Vanderbilt may or may not receive a seat on the start-up board as part of the agreement
  - Often observer rights are secured if no board seat is received
CTTC Engagement with Start-ups

CTTC personnel provide assistance to the start-up in several ways

• COI Management
• Asset protection (patenting)
• Financial modelling
• Raising capital
• Identifying management, advisors
• Identify space and service providers

VU may not control, but still attempts to influence company’s business decisions

• Primary leverage provided through the license agreement
• Vanderbilt must obtain Fair Market Value in exchange for its license grant
• Many sources for academic start-up licensing comparables available
• Challenges forcing compliance on faculty members exist
“Anything under the sun made by the hands of man”

- New chemical compounds, e.g., drugs, pesticides
- Methods of producing new compounds
- New uses for old compounds
- Purified natural materials, e.g., DNA, enzymes
- New formulations or mixtures, e.g., alloys, shampoo
- Transgenic animals or plants (excluding humans)
- Methods of performing a function by computer software
- Methods of doing business
- Methods of processing digital signals
- Tire tread pattern, clothing (design patents)
Patent quick facts

• Patents are limited monopolies
• Patent applications typically take 1-2 months to draft and file
• Patents take **4-6 years** to secure
• Patents last for 20 years from first filing
• Patents are expensive:
  – ~$25,000 in USA
  – ~$150,000 in EU, CA, AU, and JP
• Disclosure of an idea before starting the patent process forfeits non-US rights and may jeopardize US rights as well !!!
How do companies benefit?

• Market exclusivity justifies big investments in producing the patented product
  – New drugs are said to cost $1 billion or more
  – New factories are sometimes needed

• Claims that go beyond the planned product provide “blocking” to prevent others from making similar products

Drugs, diagnostics and devices would never be developed without the upside provided by patent exclusivity!
A license is a contract in which the patent owner allows a company to make, use, offer for sale, sell, and/or import the patented article or use the patented method.

In exchange, the “licensee” company pays the patent owner royalties (usually a % of sales) and other payments (e.g., up-front, milestone fees).

Even big companies today license out their un-used patents, through internal “intellectual asset management” programs.

Royalties on successful products can be huge, but the batting average is very low:
- 15% of inventions get licensed out
- 20% of licensed inventions make any money at all
- 5% of inventions that make money make over $1M
Benefits of licensing

- Generates research revenue for Vanderbilt
- Inventors share in revenues as personal income
  - 40%-50% of revenues are shared among the inventors
- Creates notoriety for Vanderbilt
- Brings healthcare products to the marketplace for the benefit of patients
• The Center for Technology Transfer and Commercialization can help Vanderbilt researchers achieve impact for their inventions

• Commercializing academic research is a moral imperative
  – it is the only real way for taxpayers to receive benefit from the Government’s investment in basic research
  – More than 200 prescriptions drugs originated in academia + thousands and thousands of medical devices and diagnostics

• The Bayh-Dole Act of 1980 proved to be the groundbreaking legislation that enabled universities to leverage their innovations for public benefit
  – The economic impact of Bayh-Dole is massive and undeniable
Questions?