CTTC

Center for Technology Transfer & Commercialization

VANDERBILT UNIVERSITY

Osher Lifelong Learning Institute

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?

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- Development, refinement and new application of technology
- Conversion of knowledge and ideas into valuable better business, products and services
- Evolutionary process of increasing the capability to apply a technology

What is Innovation?

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If something is hard –

make it easy.

If something is impossible –

make it possible.

Not all great ideas are innovative

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INNOVATION

it becomes critical during a recession

Innovation vs Invention

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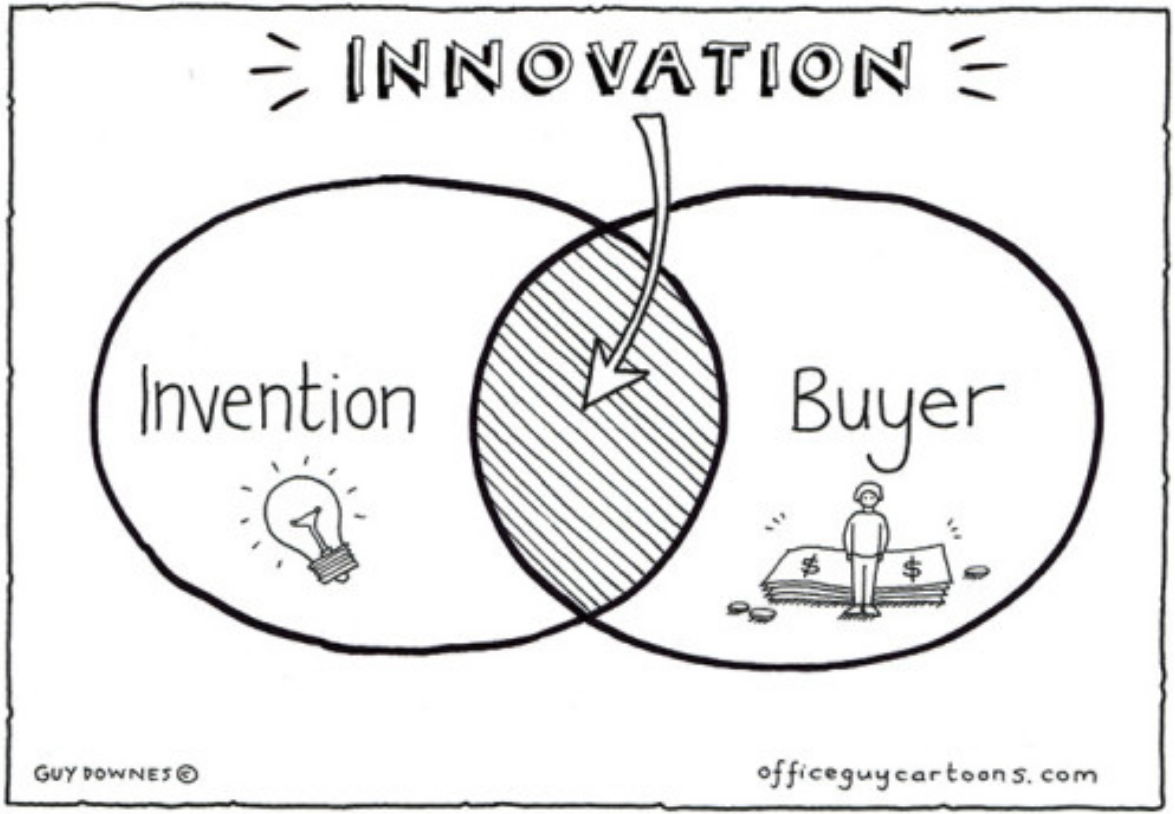

Innovation vs Invention

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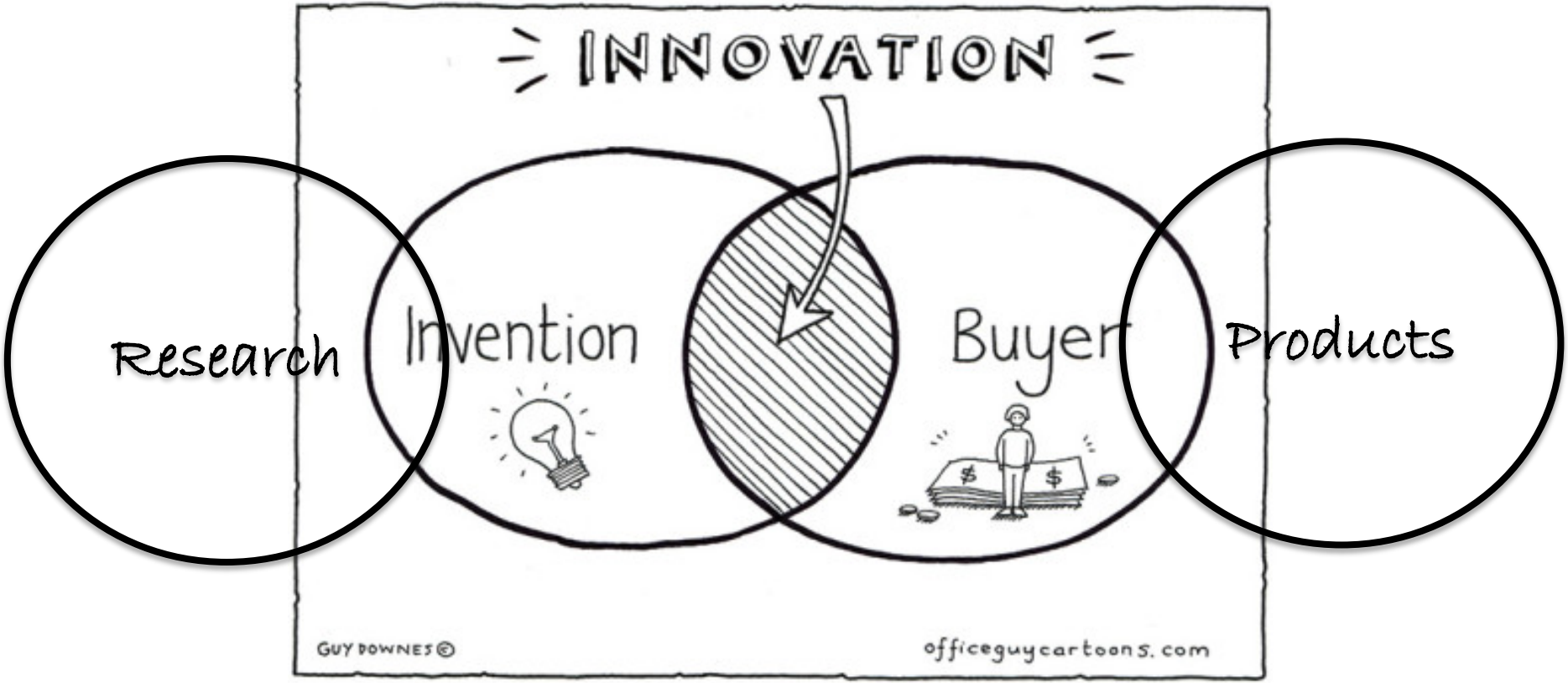

So, how do they get the vitamin D in the milk?

1st Academic Tech Transfer Success

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- 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

WARF – Model of Success

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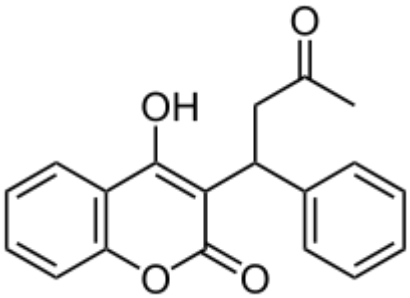
- Wisconsin patent licensing activities ended up generating more than a $100M in revenues for Wisconsin – which is over $1B in today's dollars!
- In 1941, Wisconsin also licensed the drug product known as Warfarin (aka, Coumadin) – one of the most widely prescribed anti-coagulation medications in the history (and effective rat poison)



Societal Impact

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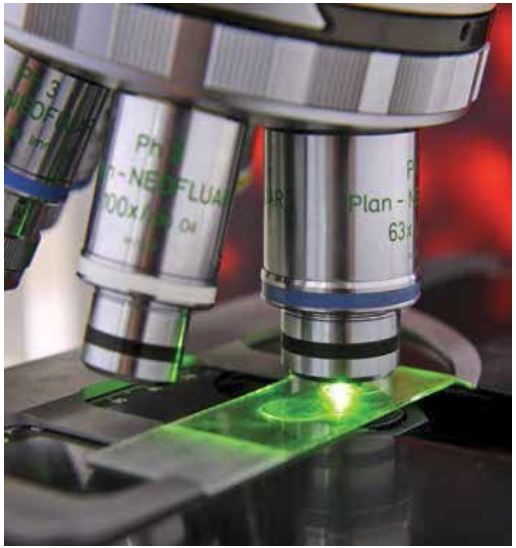

Hepatitis B vaccine
Allegra
Coumadin
Tyvaso
Pap smear
Streptomycin
Saccharin
Rocket fuel
Emtriva
Pacemakers
Gatorade
Neupogen
Taxol
Vitamin D milk
Cysplatin
LCDs
Penicillin
PET/CT scanner
Remicade
Magnetic memory
Fluoride toothpaste
Insulin
Restasis
Polio vaccine
MRI scanner
Plexiglas
Electron microscope

Many Lifesaving or Life Improving Blockbuster Products or Companies Emerged from University Research

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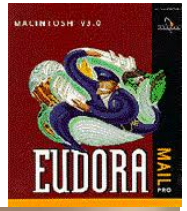
Genentech
A Member of the Roche Group

GARDASIL 9
Human Papillomavirus
9-valent Vaccine, Recombinant

Akamai

Google



Enbrel
etanercept

Lex Machina
a LexisNexis® Company

Xalatan

Bigliani/Flatow®
The Complete
Shoulder
Solution TSA
Surgical Technique

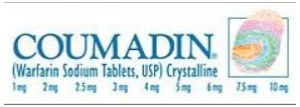
FireEye

Remicade
INFLIXIMAB

HONEYCRISP

vmware

RSA



CRISPR
THERAPEUTICS

editas
MEDICINE

Oculus

DVD

Blu-ray Disc

Kite
A GILEAD Company

JUNO
THERAPEUTICS

duolingo

Blue LED

Exemplary Vanderbilt Products on the Market

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Vanderbilt-related Products Newly on the Market

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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

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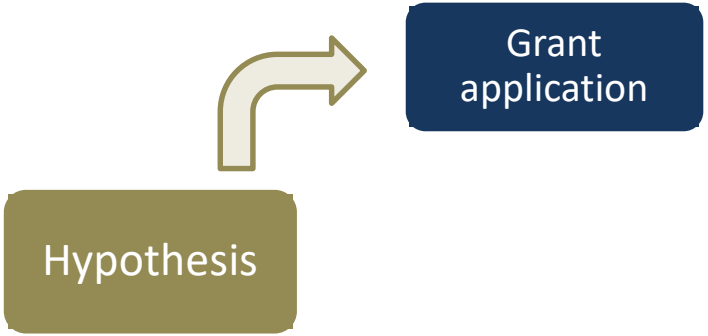

Academic Research Cycle

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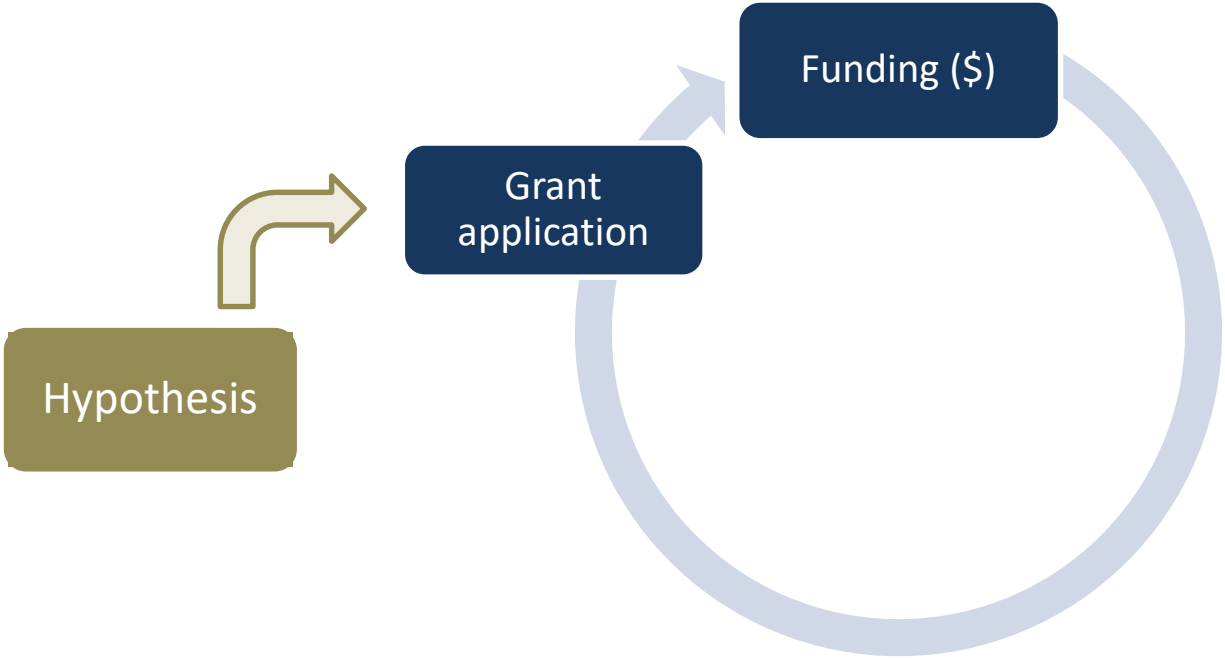

Academic Research Cycle

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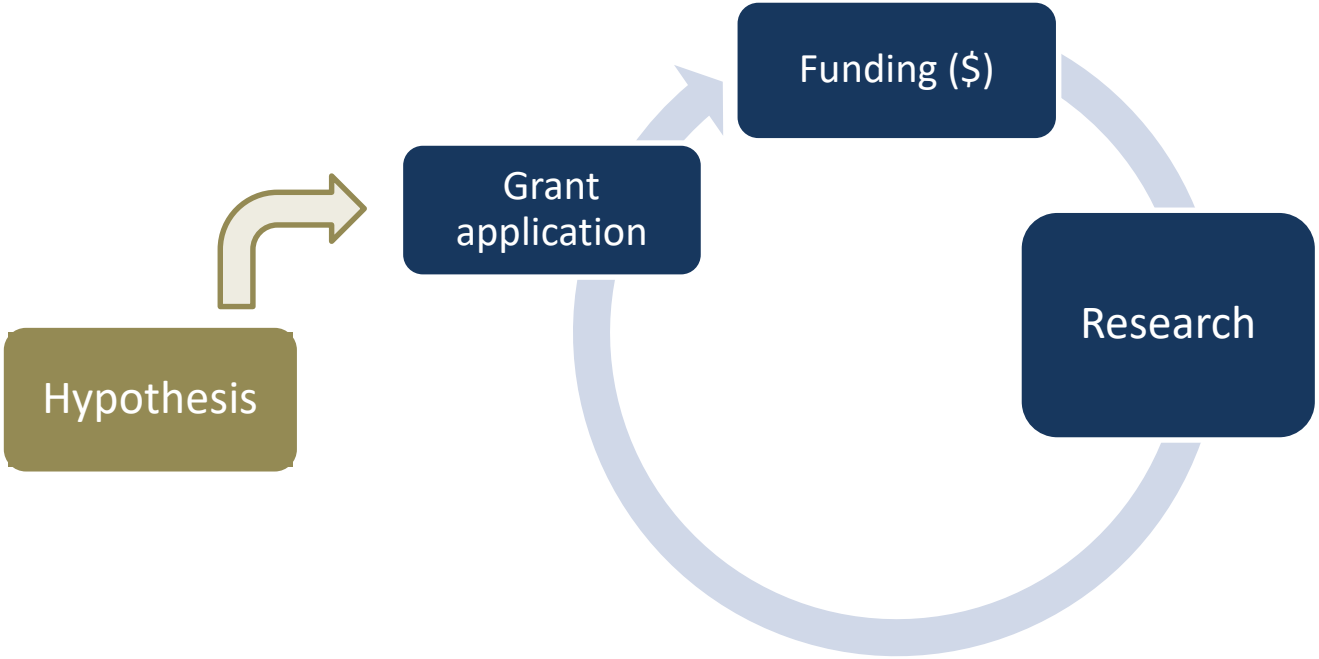

Academic Research Cycle

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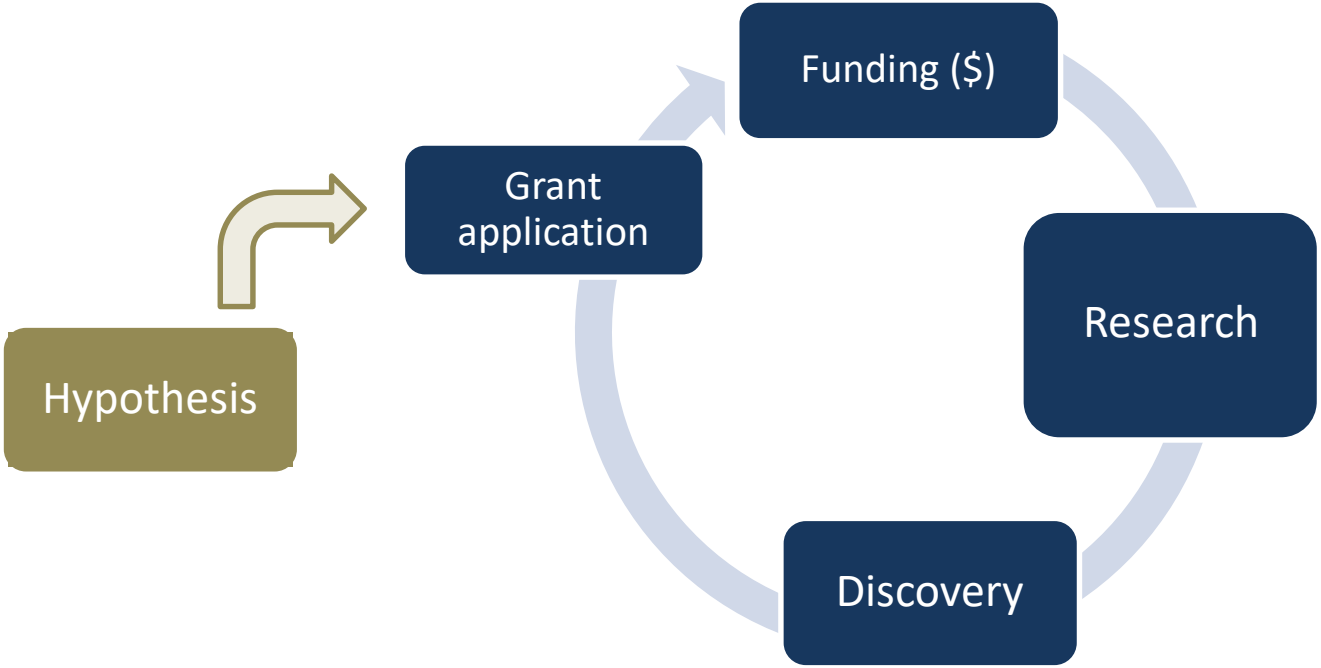

Academic Research Cycle

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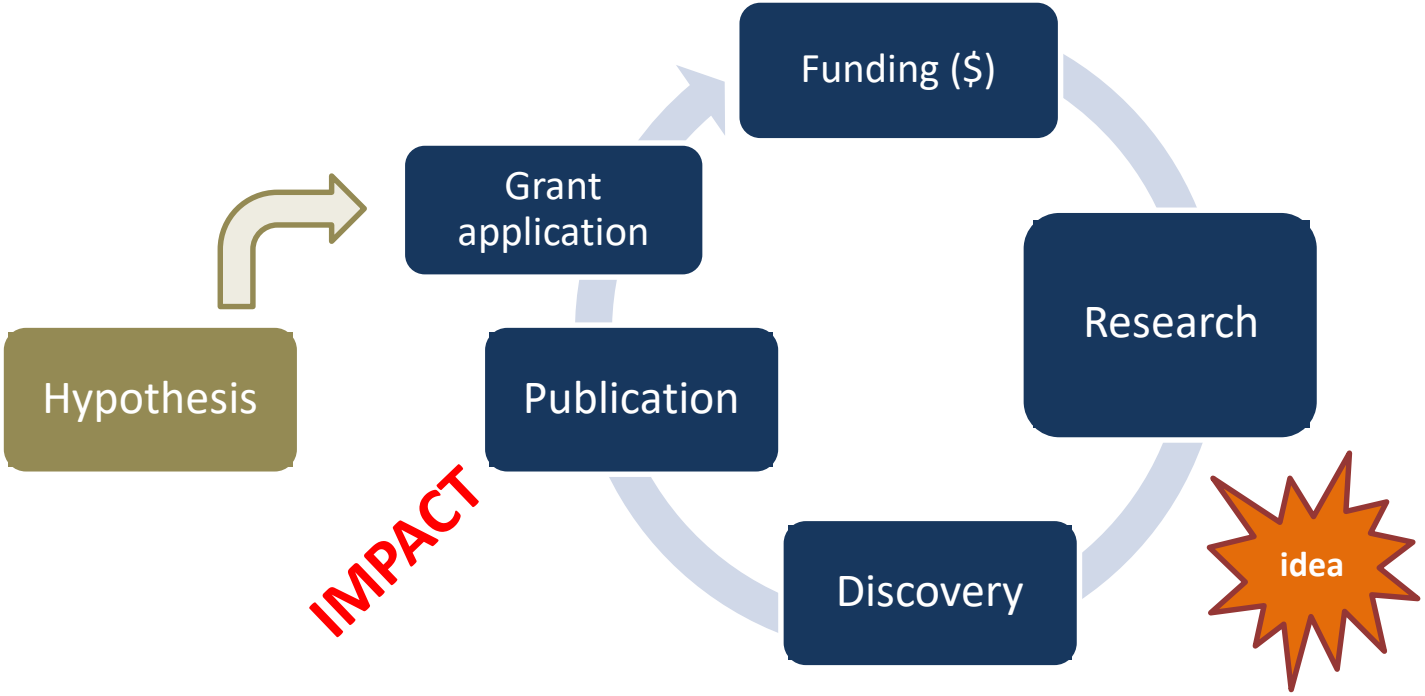

Innovation Cycle

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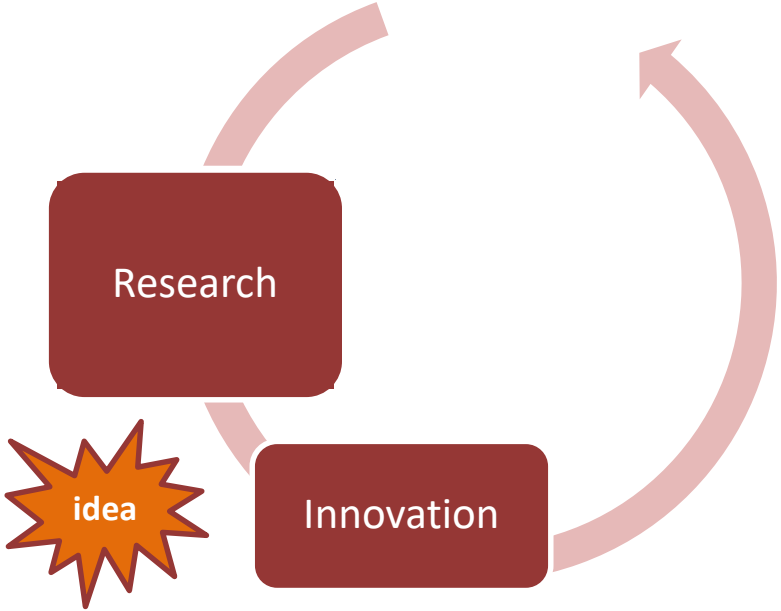

Innovation Cycle

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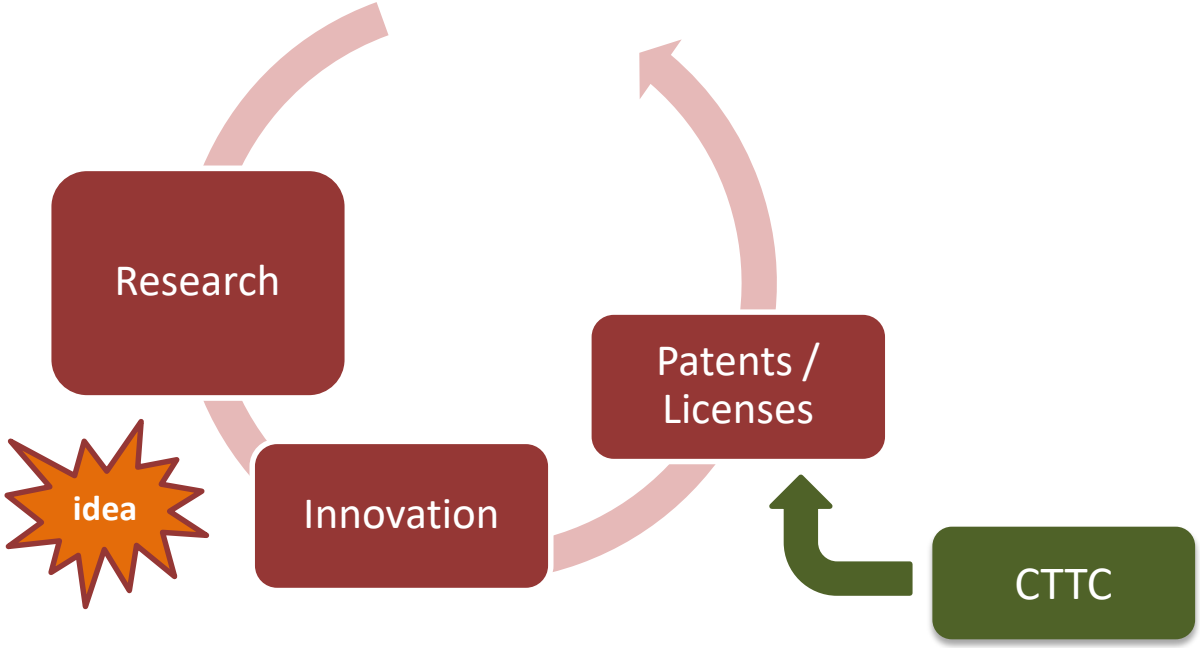

Innovation Cycle

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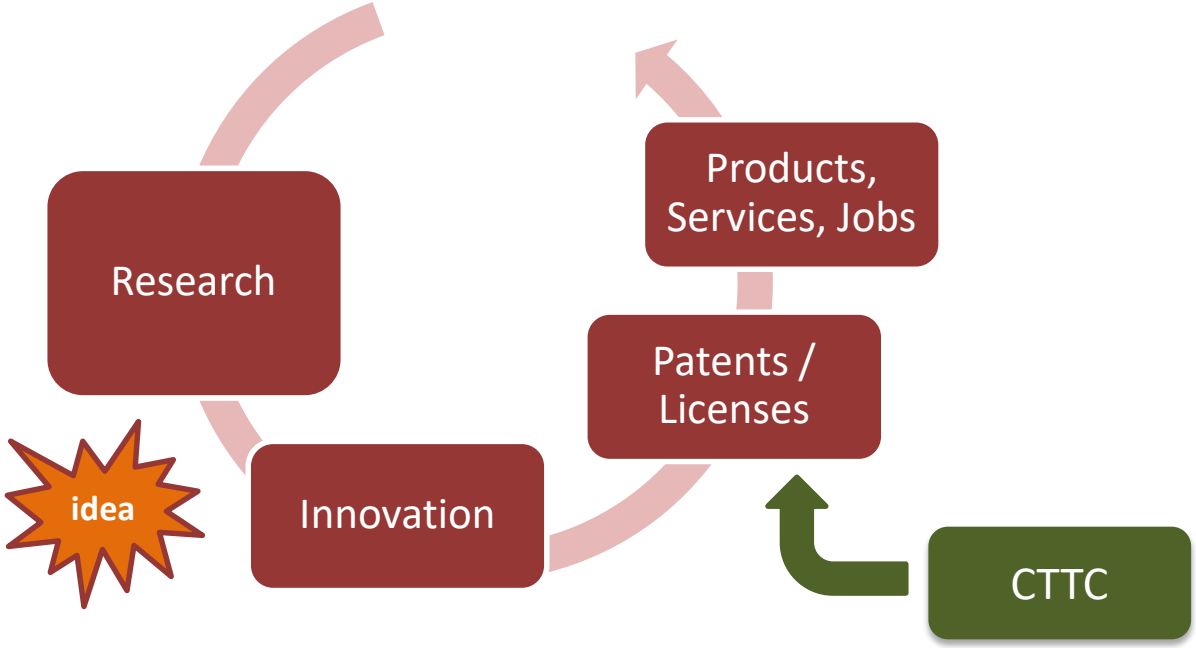

Innovation Cycle

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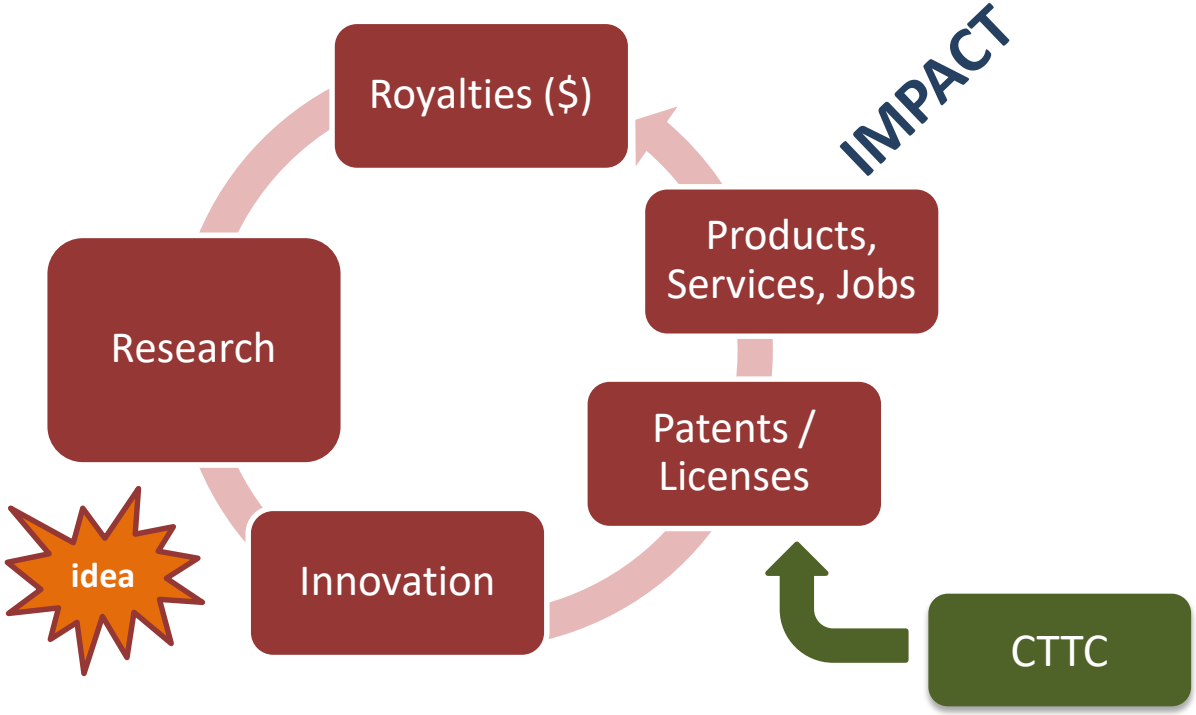

Impact Cycles

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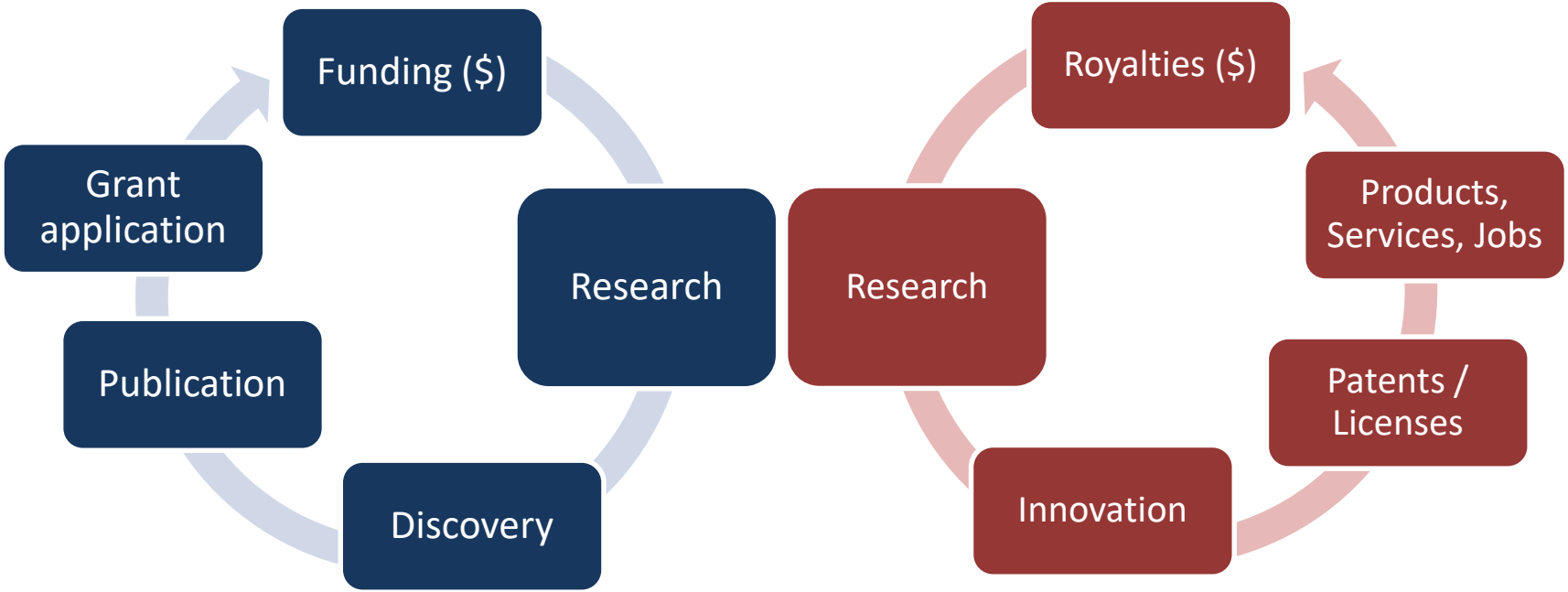

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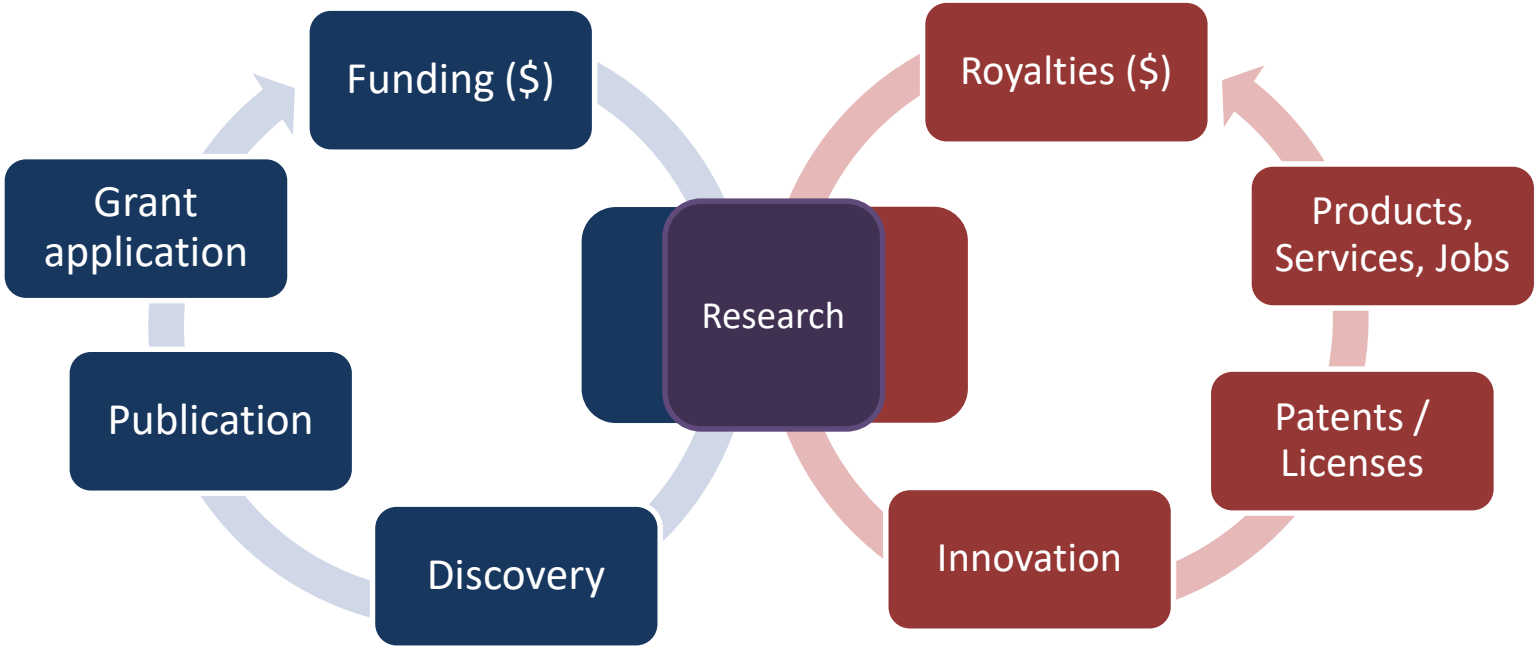

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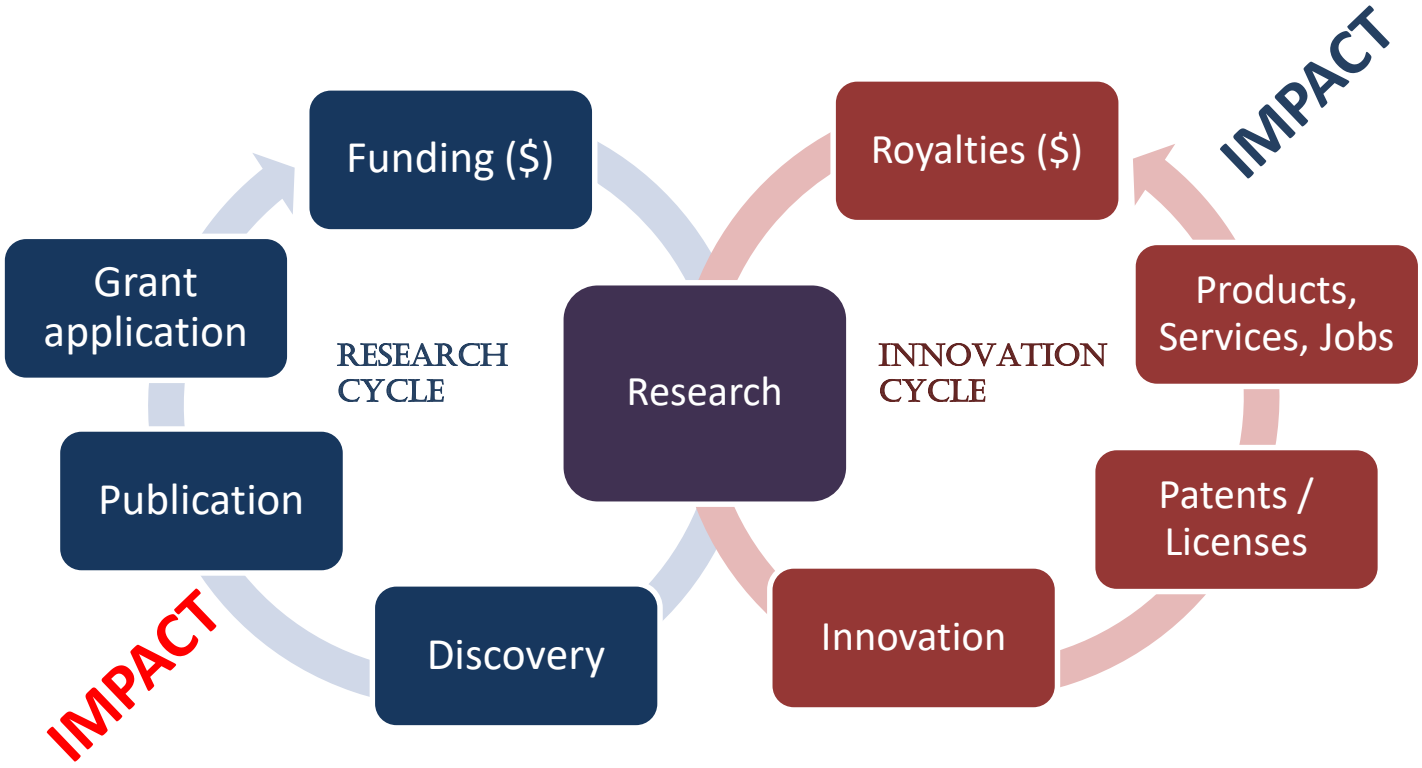

Role of CTTC

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Serve the Vanderbilt community by assisting University inventors in ***bringing their innovations to practical application for the benefit of the public***

Impact Cycles

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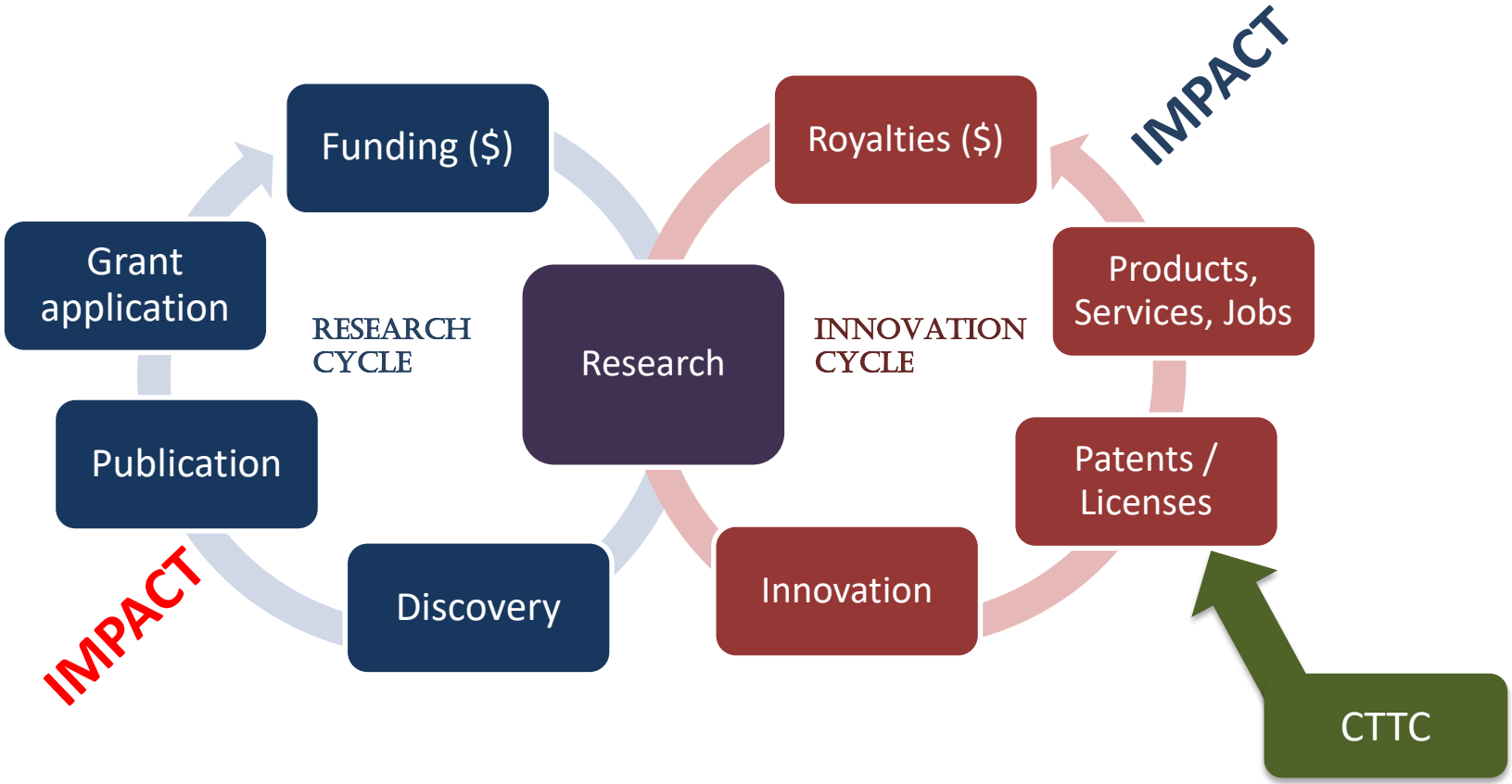

Role of CTTC

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In other words:

Help ensure investigators' research achieves **IMPACT** in the world

CTTC's Function

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License inventions to industry

Help launch new Start Up Companies

Business Development / Industry Funding

Commercialization Statistics

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10-Year Snapshot

Invention Disclosures Reviewed	1664
US Patents Issued	359
License Agreements Executed	685
New Startup Companies Formed	44
Total Licensing Revenue	$100.3M
Research Support from Industry*	$51.1M

*Last 5 years statistics only.

FY 2018

Invention Disclosures Reviewed	213
US Patents Issued	59
License Agreements Executed	81
New Startup Companies Formed	5
Total Licensing Revenue	$17.2M
Research Support from Industry	$8.8M

Commercialization Statistics

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Recognition for Innovation

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REUTERS

World's Most Innovative Universities | 2017

« Top University Rankings

#10 Vanderbilt University USA

Website: www.vanderbilt.edu Students: 12,587

REUTERS

TOP 100

THE WORLD'S MOST INNOVATIVE UNIVERSITIES

omson Reuters

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Research

Boehringer, Vanderbilt University to develop cancer M inhibitors in third team-up

by Angus Liu | Mar 15, 2018 9:58am

Vanderbilt and Lundbeck to Develop a Novel Approach for Treating Schizophrenia

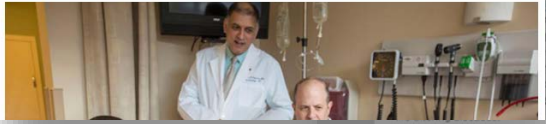
NEWS Jan 10, 2018 | Original story from Vanderbilt University

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

Ellie Kincaid Forbes Staff

Healthcare

Assistant editor covering medicine and health care.



VUMC Reporter

nagement, Vanderbilt University
nch of Ancora Innovation

nderbilt University announced
ovation, LLC ("Ancora"), a
pport Vanderbilt's innovative life
Deerfield's expertise in
g development. Ancora will
hanging the current paradigm of
hing novel therapeutics to cure

(iStock)

What is Academic Technology Transfer?

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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?

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- 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?

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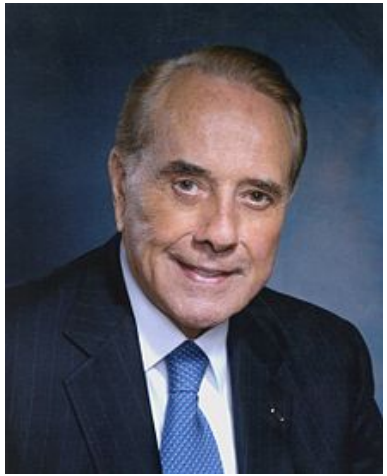
Birch Bayh



Bob Dole

Expansion of Government Funding of Academic Research

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- 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

Birth of Bayh-Dole

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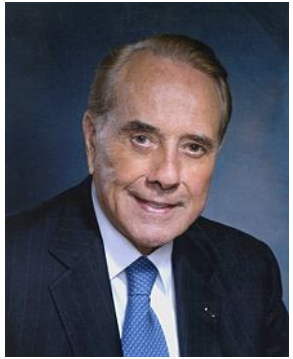
- The US Government wanted to find a way to bring the benefit of publicly-funded research to the general public, and to spur the lagging US economy
- Birch Bayh and Bob Dole co-authored legislation to change the way inventions resulting from Federal support are owned and processed.
- **In 1980, the Bayh-Dole Act was passed**



New Law – Extraordinary Impact

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- 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

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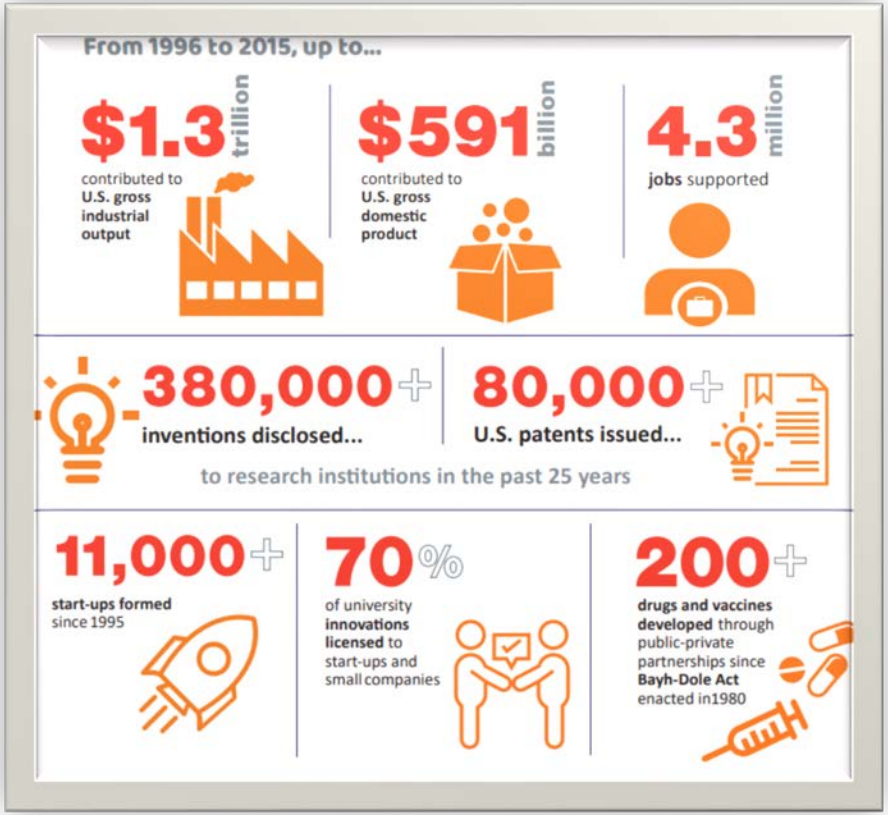

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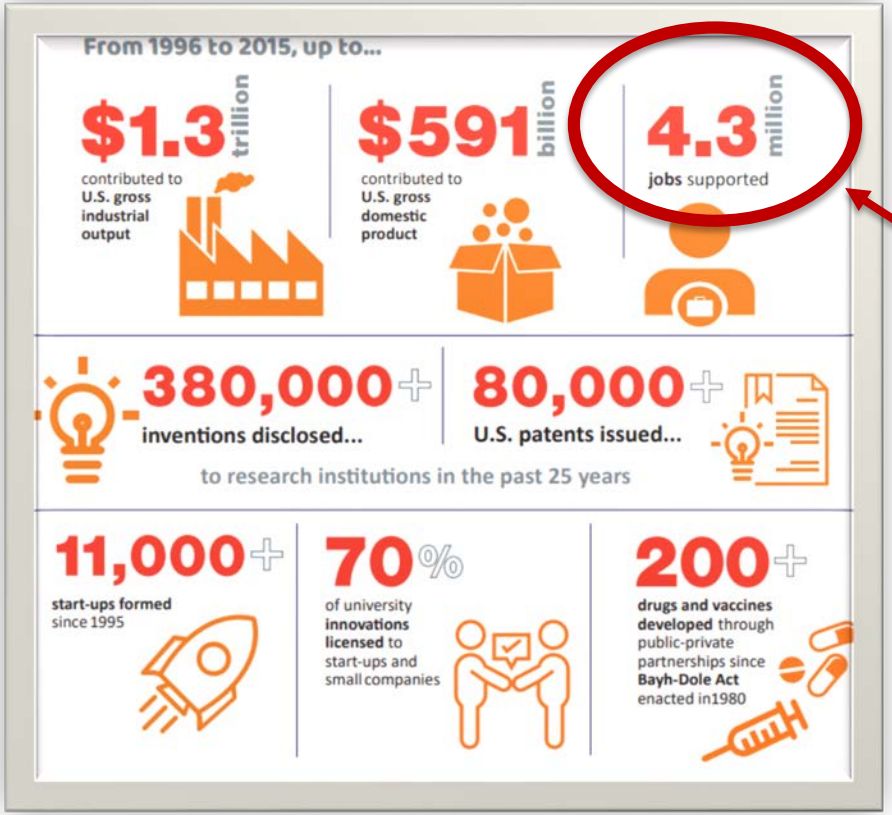

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Last 20 years

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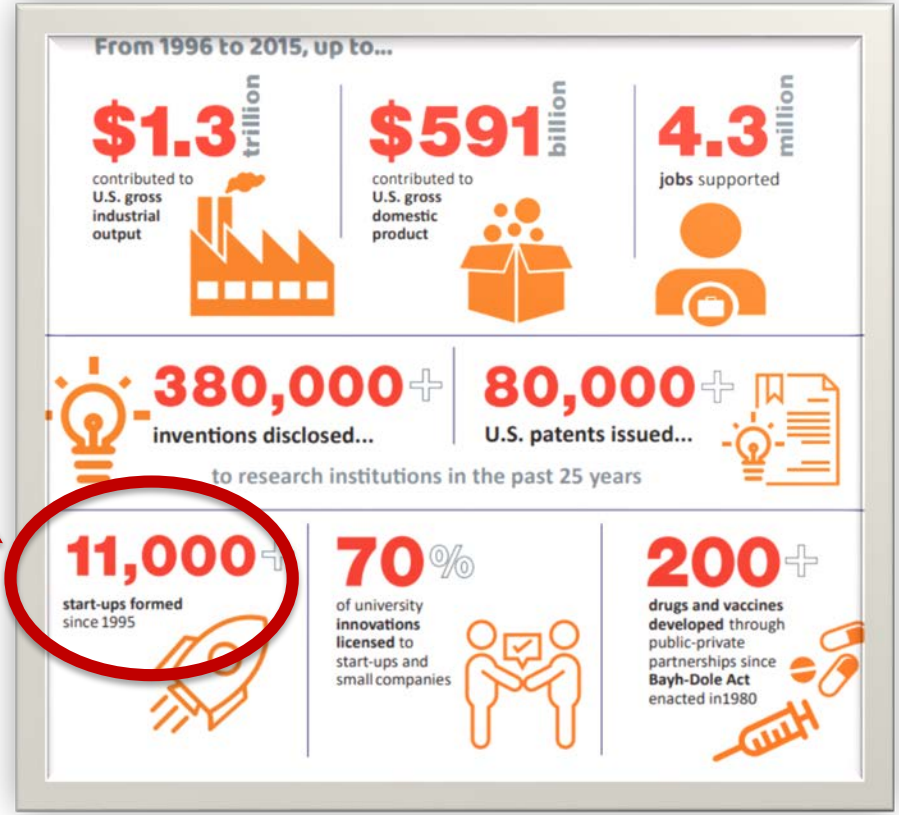

Economic Impact of Tech Transfer
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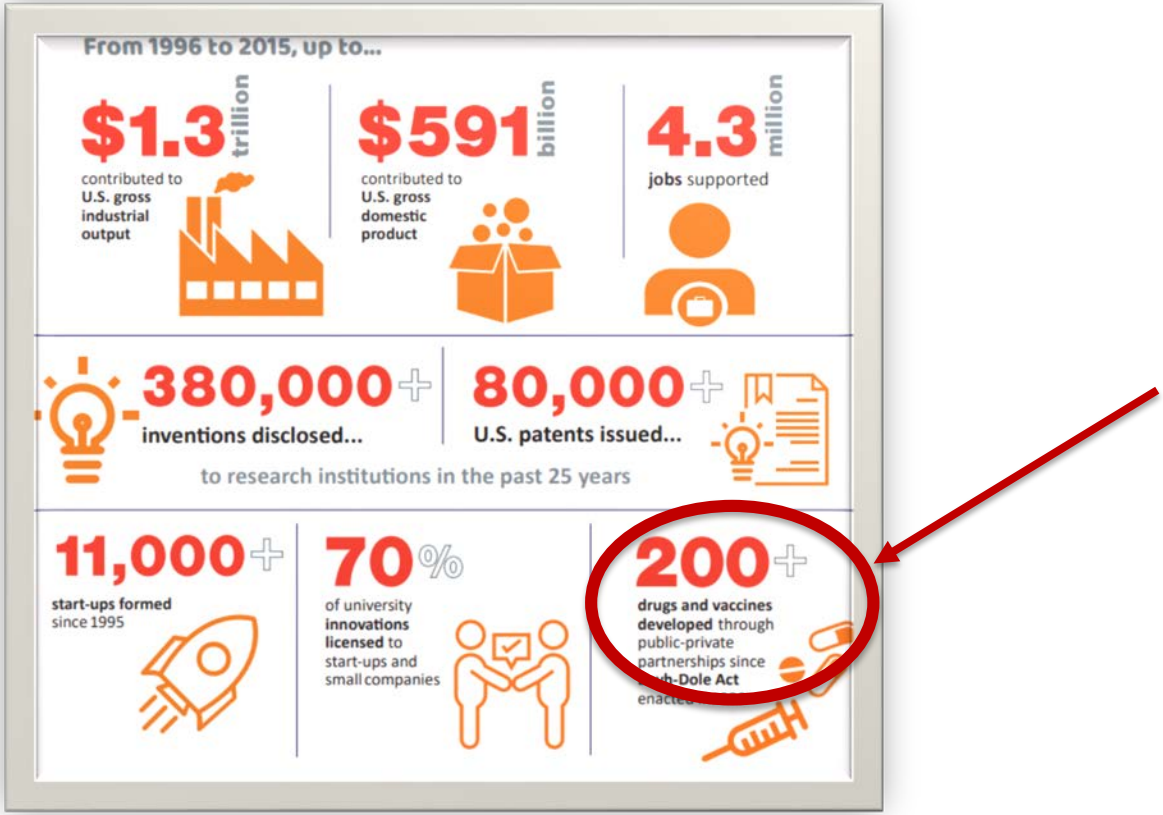

Economic Impact of Tech Transfer
Last year alone

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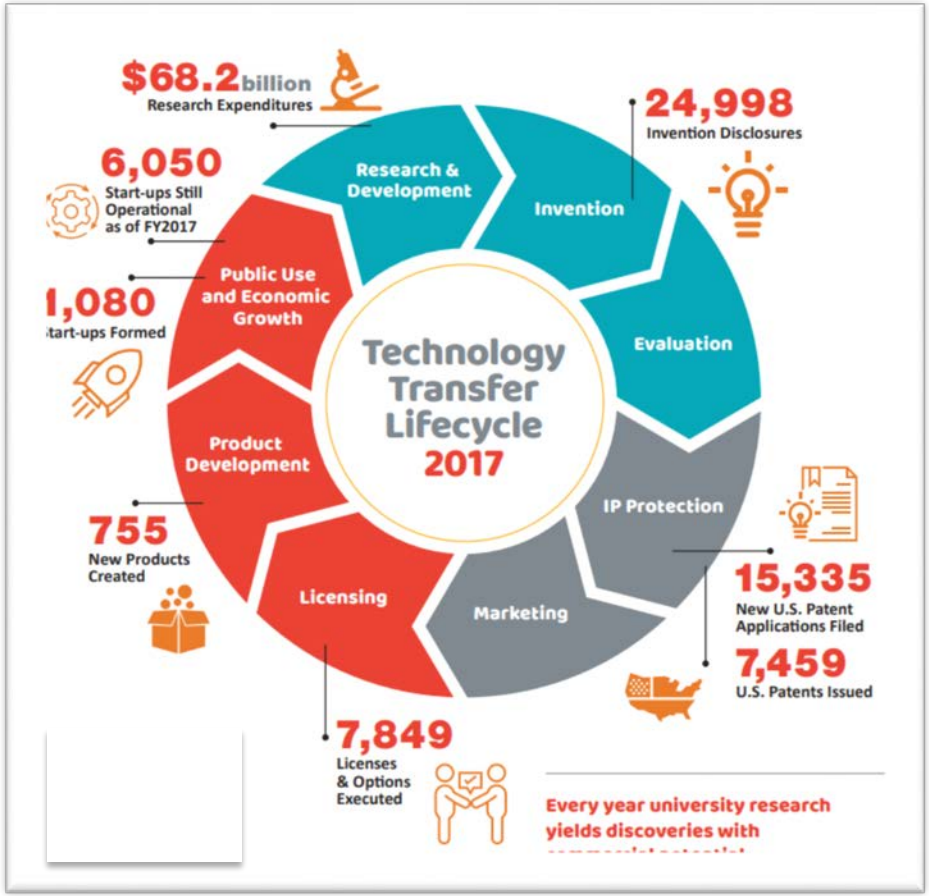

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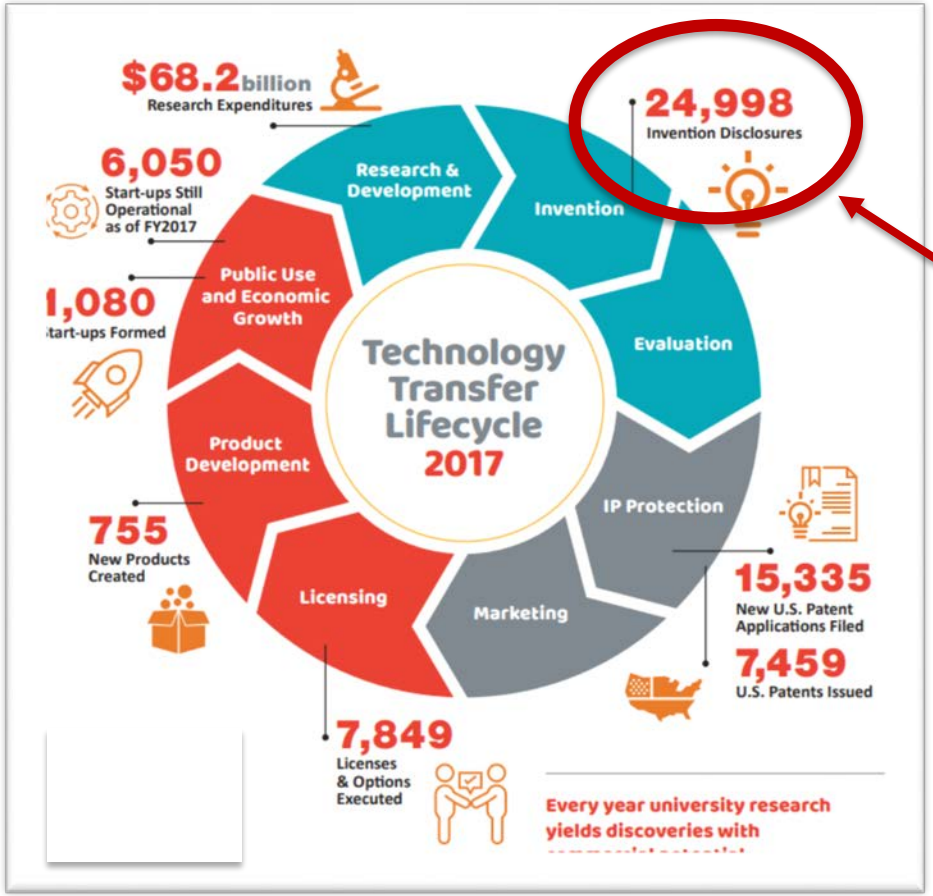

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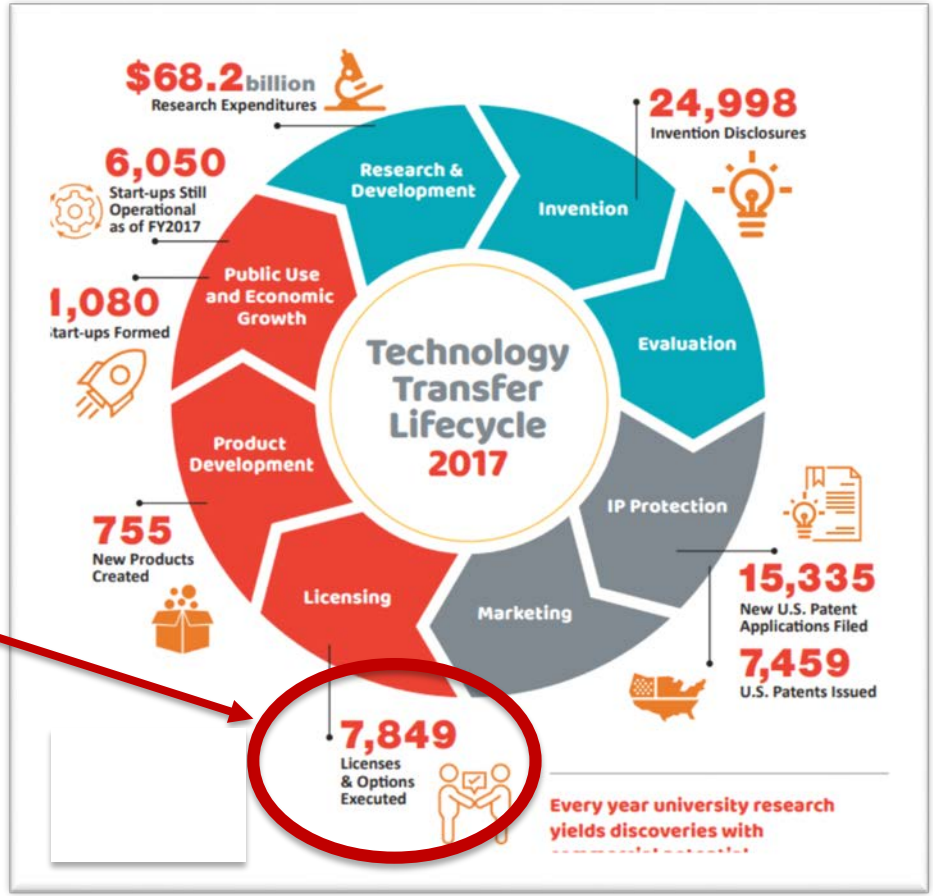

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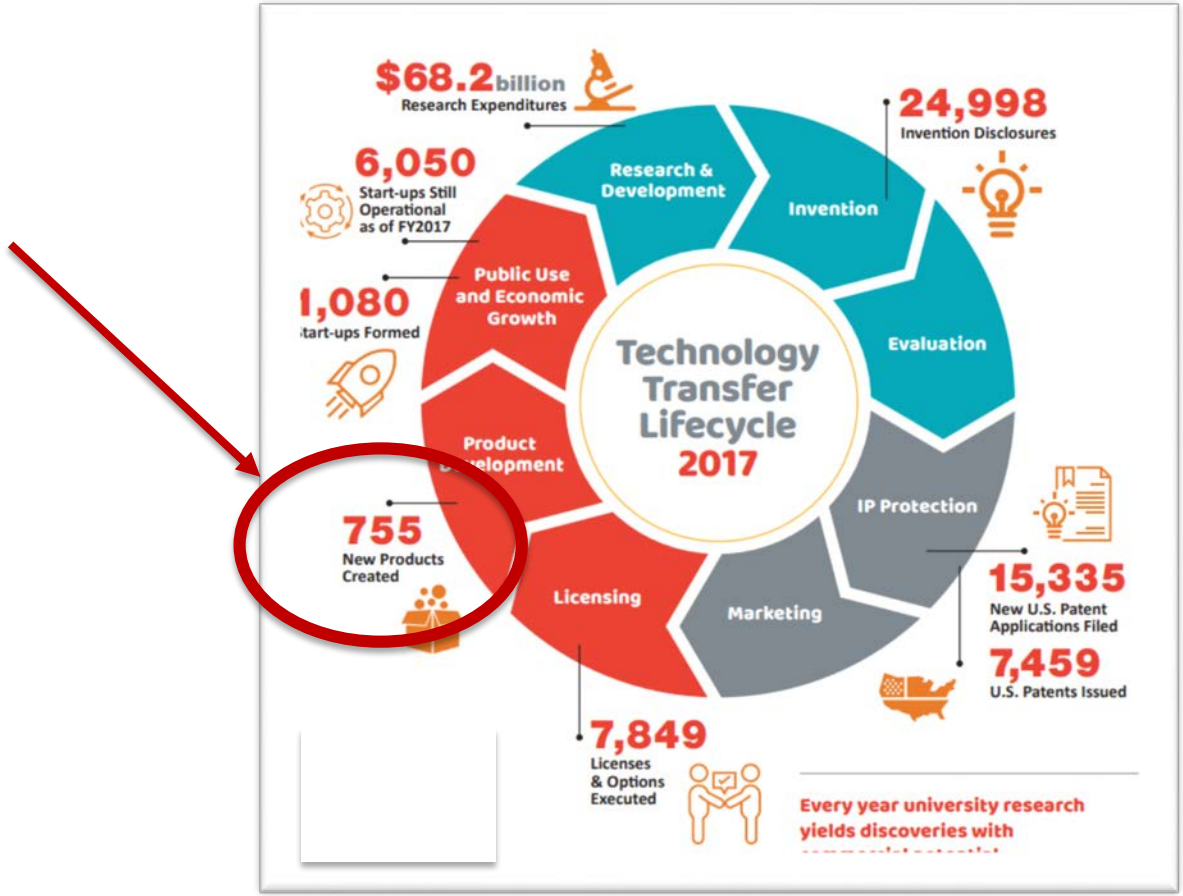

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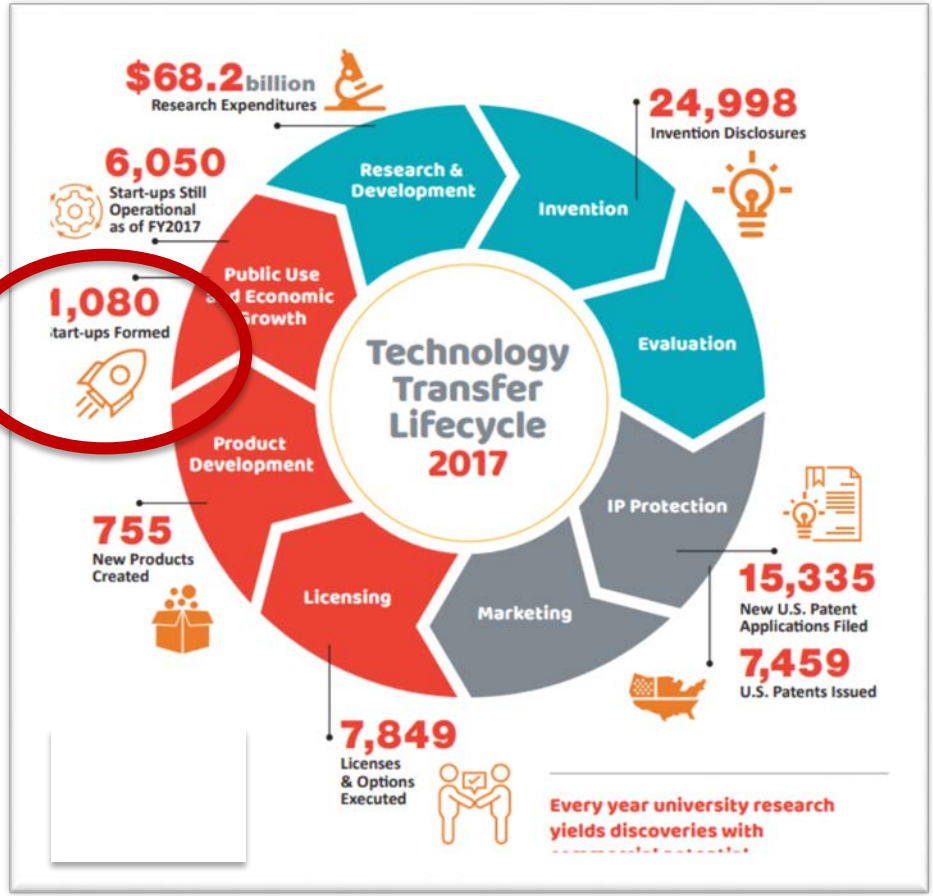

BEWARE OF THE TIME LAG BETWEEN DISCLOSURE AND PRODUCT LAUNCH

What Does CTTC Do?

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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

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- **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

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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

What is patentable?

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"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

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- 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?

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- 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!

Patent owners often license patent rights

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- 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

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- 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

Summary

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- 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

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Questions?