

## Fostering a Successful Career in Research: Developing a Corporate Research and Innovation Laboratory

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ViewRay, Inc.

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## Conflict of Interest

James F. Dempsey is the inventor, founder, member of the board of directors, corporate secretary, and chief scientific officer of ViewRay, Inc. (VRAY:NASDAQ). He owns stock and has stock options ViewRay. He also receives royalties for inventions from the University of Florida. As such, material presented in this presentation can directly result in his financial benefit.

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## Educational Goals

Discuss topics such as how to build a research program, how to develop your own lab, and how to initiate good collaborations are not generally taught explicitly but are integral to succeeding in a research career.

Learning Objectives:

1. Identify career paths built on interest in research
2. Understand basic steps to starting and maintaining a research career
3. Identify differences between research careers in academia and industry

Outline: 1. Why 2. How 3. What

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Why?

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Why Pursue a Career in Corporate Research?

Let's Ask Some Company Founders & Inventors ...

What Would Steve Say?

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"Here's to the crazy ones, the misfits, the rebels, the trouble makers, the round pegs in the square holes, the ones that see things differently"

"They are not fond of rules and they have no respect for the status quo."

"They push the human race forward"

"the people who are crazy enough to think they can change the world are ones who do"

— [Steve Jobs](#)




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## Corporate Research Can Change the World

An interview with Steve Jobs

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## Beliefs Regarding Academia & Corporate Research

- Academic Research - Pursuit will produce novel knowledge that will advance and benefit society
- Corporate Research - Pursuit will enable the production of novel goods and services that will advance and benefit society

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## What Has Corporate Research Achieved? - Only Everything We Use & Love Today

- G.E. & Thomas Edison
  - the phonograph, the motion picture camera, and the electric light bulb, the stock ticker, electrical power, & recorded music
- AT&T Bell Labs
  - communication satellites, mobile phones, the transistor, the laser, the charge-coupled device (CCD), information theory, Unix, and the programming languages C, C++, and S.
- All RT delivery companies are all born of innovation: Varian, Elekta, TomoTherapy, Accuray, Mevion, ViewRay... more coming Xcision, Reflexion...
- See Jon Gertner *The Idea Factory: Bell Labs and the Great Age of American Innovation* & Ernest Freeborn *THE AGE OF EDISON Electric Light and the Invention of Modern America* both by Penguin Press 2013.

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## How?

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## Pathways Into Corporate Research

No real difference in training or background

Need to be a great scientist and problem solver either way...

Universities Support Patent Licensing and technology transfer

Path 1 Invent your way in...

Path 2 Apply for corporate research funds, e.g. partnership R01, establish collaboration

Path 3 Take the leap and join a corporate research team



"I've seen out to the limit of the observable universe, and believe me, it's no better out there than it is here."

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## Differences: Academic vs Industry

Metric	Academia	Industry	Caveat
Goal	• Increase knowledge	• Provide Goods or Services	• Not Always the Same!
Score Card	• Curriculum Vitae (c.v.) - complete achievements & positions - longer is better	• Resume - Summary of Major Achievements & Positions - Short 1-2 Pages	• Quality & Conciseness is the Bottom Line
Value	• Past Accomplishments	• Present/Future Accomplishments	• Past Not Rewarded
Work Product	• Publications & Presentations	• Patents and Products	• Must Translate to Market
Venue	• Society Meetings, Peer Reviewed Manuscripts, & Textbooks	• Patent office, Trade Show, & Sales	• Sometimes It Remains a Secret
Ownership	• Individual	• Organization	• Company 1st!

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"None of our people are 'experts'!

"A person who knows a job sees so much more to be done than they have done, that they are always pressing forward and never gives up an instant of thought to how good and how efficient they are. Thinking always ahead, thinking always of trying to do more, brings a state of mind in which nothing is impossible."



"The moment one gets into the 'expert' state of mind a great number of things become impossible."

— [Henry Ford](#)

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"The reasonable person adapts themselves to the world: the unreasonable one persists in trying to adapt the world to them selves."

Therefore, all progress depends on the unreasonable person."

-[George Bernard Shaw](#)



Be Unreasonable

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## Everything in Business is a Process

All aspects of a good business follow a process: Management, Finance, Operations, Engineering, Sales, and Marketing

Executives run evaluate the process with defined metrics for inputs and outputs to determine how well the business is being run

To Survive and Thrive in a Business Environment Innovation & Research Needs to Follow a Process!

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## Proper Aspects of a Business Process

Definability : It must have clearly defined boundaries, input and output.

Order : It must consist of activities that are ordered according to their position in time and space (a sequence).

Customer : There must be a recipient of the process' outcome, a customer.

Value-adding : The transformation taking place within the process must add value to the recipient, either upstream or downstream.

Embeddedness : A process cannot exist in itself, it must be embedded in an organizational structure.

Cross-functionality : A process regularly can, but not necessarily must, span several functions.

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## 3 Step Process for Corporate Research

1) To find unsolved problems that, if solved, will do something better, cheaper, or both. The problems are best defined by practical desires of the customer - Note, this is not the same as asking the customer for solutions

2) To solve impossible problems. Problems deemed unsolvable by the current state of the art in engineering & Technology

3) To prepare solutions in a prototype form so they can be integrated and improved by engineering Prototypes can be hardware or software

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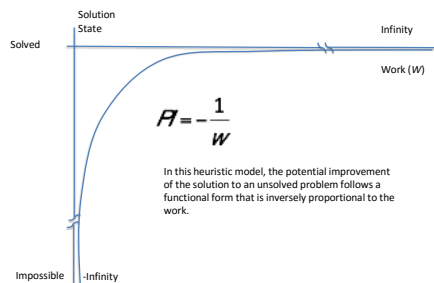
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## The Innovation Curve




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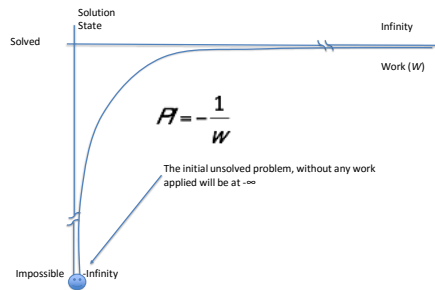
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### The Innovation Curve




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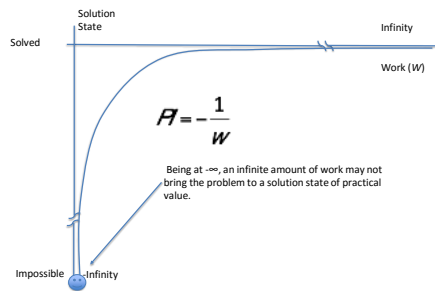
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### The Innovation Curve




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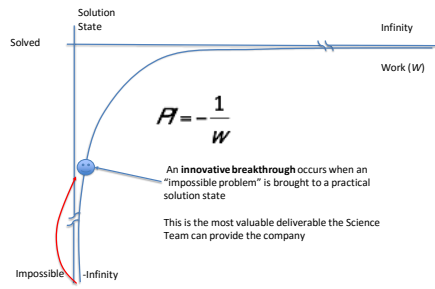
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### The Innovation Curve




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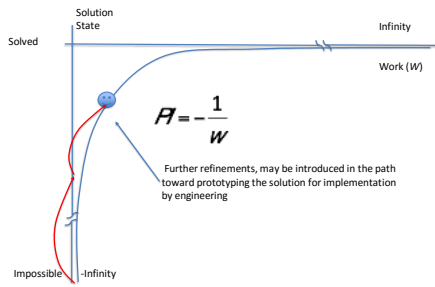
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### The Innovation Curve




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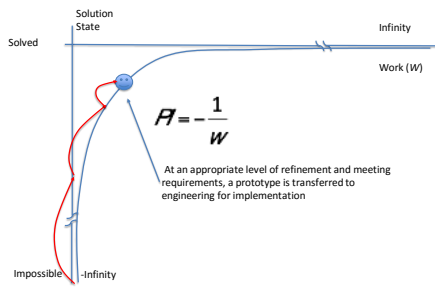
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### The Innovation Curve




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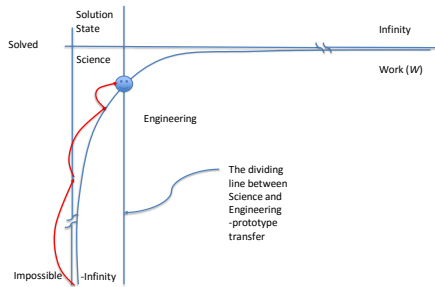
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### The Innovation Curve




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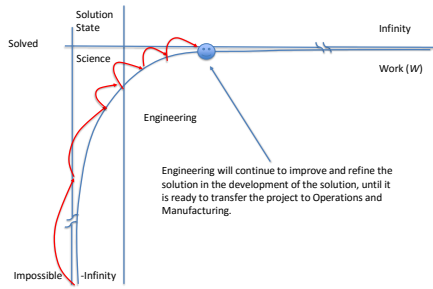
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### The Innovation Curve




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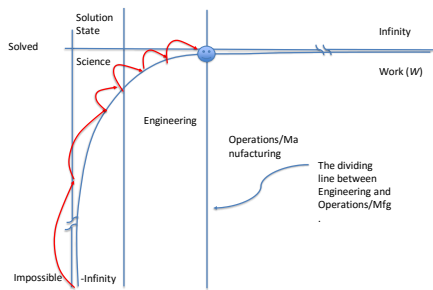
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### The Innovation Curve




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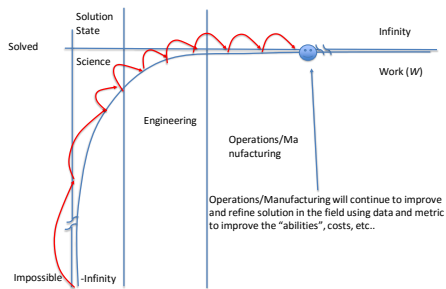
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### The Innovation Curve




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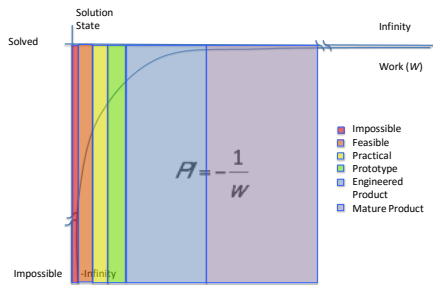
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## The Innovation Spectrum




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## What is the Value of Innovation?



- Innovation is hard
- Let individuals, startups, & universities do it & then integrate it
- Why? Because of the "Chasm"
- Geoffrey A. Moore *Crossing the Chasm*, 3rd Edition: Marketing and Selling Disruptive Products to Mainstream Customers (Collins Business Essentials)




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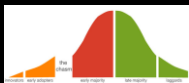
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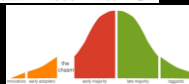
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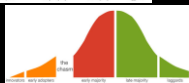
## Serial Innovation



iPod 2001



iPhone 2008



iPad 2010




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What?

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## The Work Product of Corporate Research: Functional Prototypes

I am not talking about Engineering or Marketing:

you must collaborate closely with them, but they do not need research.

If Engineering can already build it, they don't need your help.

Marketing needs publications, but it is even better coming from an independent and respected academic.

You need to discover unsolved problems, they can come from Eng. & Marketing or from a desire of the customer.

Then invent a solution.

Finally, innovate a working prototype that demonstrates the




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Example...

Desire - Compact MRI Linac that works with a split MRI and fits in the Vault

"Impossible" Problem: Shield a Linac from 3,000 Gauss to < 1 Gauss 1 meter from the FOV of a split MRI

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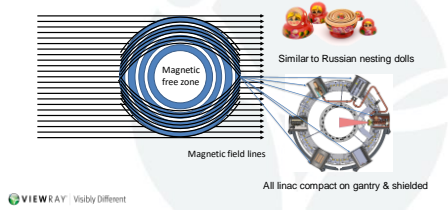
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**Invent: Building concentric ferromagnetic rings we create voids in the magnetic field to shield the Linac components**




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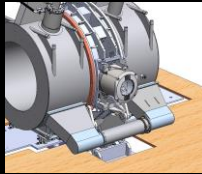
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## “Shield Bucket” Design



Shield Bucket w/ Linac



Shield Bucket assembled to MRI

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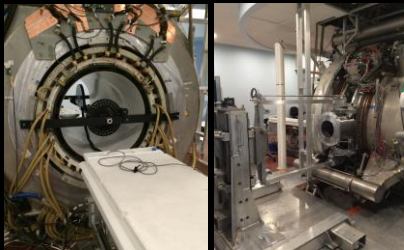
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## Map MRI w/ Magnet Camera & Shield w/ Probe




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## Moment of Truth: "Portions of Gauss!"



1st Test of the Magnetic Shielding Sleeve for the MRIdian Linac May 2014

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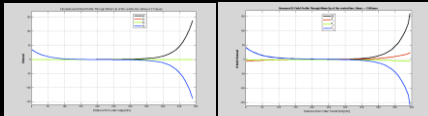
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## B Field Plots in the Bucket



Field at left is ~400 Gauss and at right is ~940 Gauss without Shield

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## Magnetic Shields

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M<sub>i</sub>

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## Summary

- Consider a Career in Corporate Research, invent, collaborate, or join
- Why - you can change the world, tackle hard significant problems, directly impact how cancer therapy is performed
- How - Become an excellent academic researcher, become an excellent clinician, then - either invent something or apply for corporate research positions or funding.
- What - Create a working prototypes - show it can be done - work for the company not your c.v. - produce devices that treat patients - ultimate gratification

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## Reading List

- Jon Gertner The Idea Factory: Bell Labs and the Great Age of American Innovation Penguin Press 2013.
- Ernest Freeborn THE AGE OF EDISON Electric Light and the Invention of Modern America Penguin Press 2013.
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