

The Changing Context of Industrial Innovation: From Closed to Open Innovation

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FOREWORD BY JOHN SEELY BROWN

HENRY CHESBROUGH

OPEN
INNOVATION

The New Imperative
for Creating and Profiting
from Technology

HARVARD BUSINESS SCHOOL PRESS

HENRY CHESBROUGH

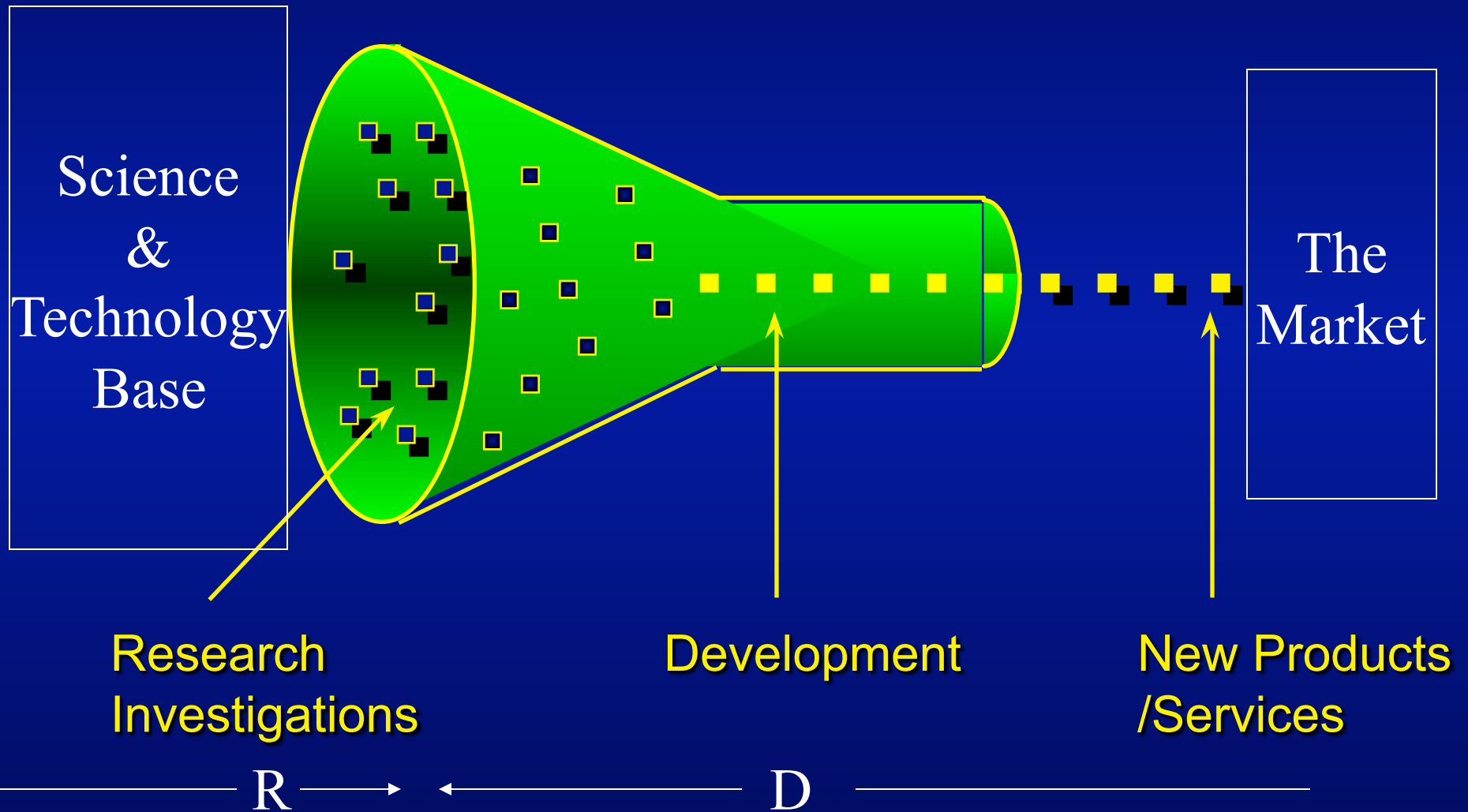
NAMED A "TOP 50 INNOVATOR" BY SCIENTIFIC AMERICAN

OPEN
Business Models

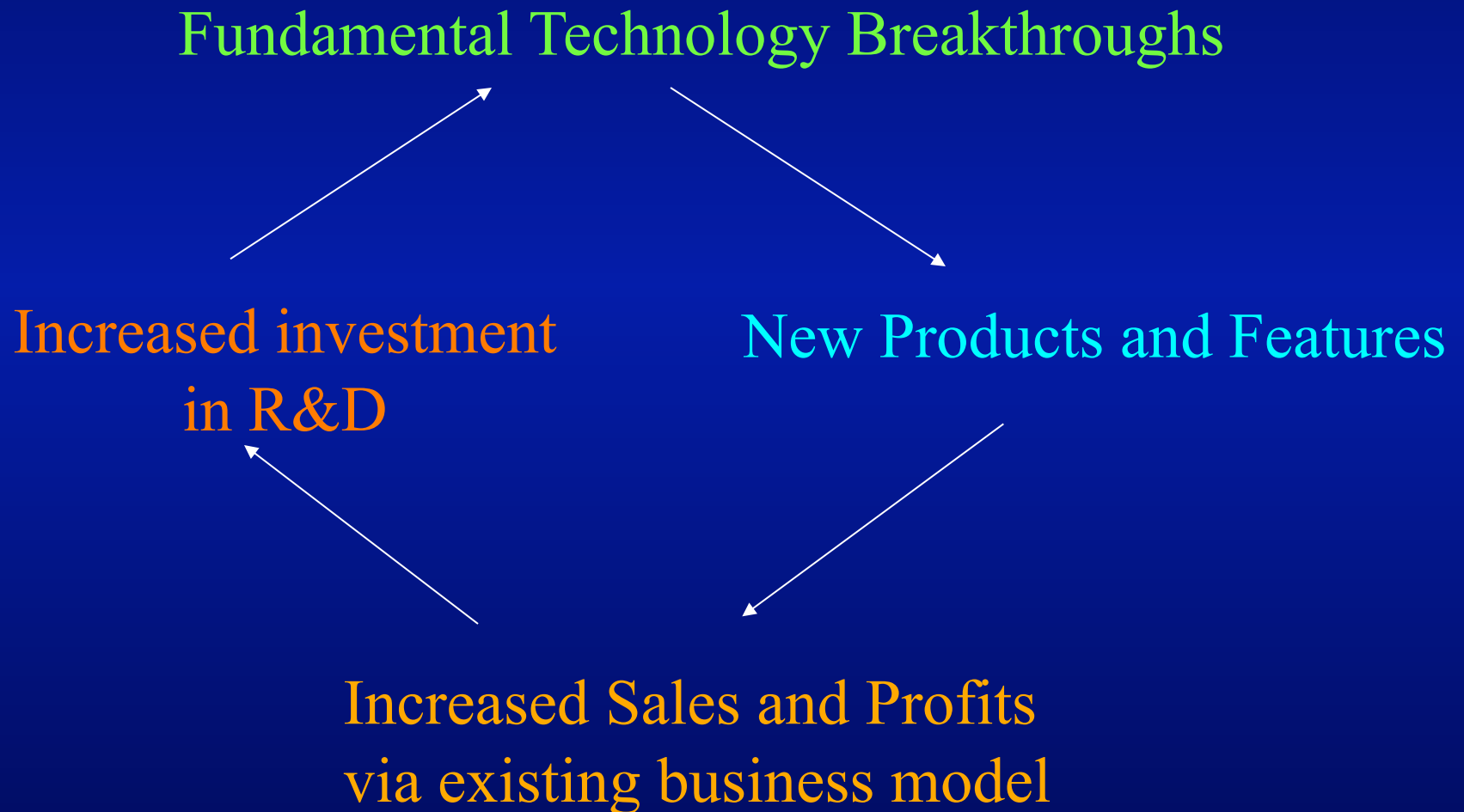
How to Thrive in the
New Innovation
Landscape

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A Closed Innovation System



The Virtuous Circle for R&D



Great Successes from the Closed Innovation Model

- The Chemicals Industry – Germany and later US
- Edison, GE, and the rise of electrification
- Rockefeller and Standard Oil
- World War II scientific achievements
- Chandler: internal R&D key to the rise of the modern US corporation in 20th century

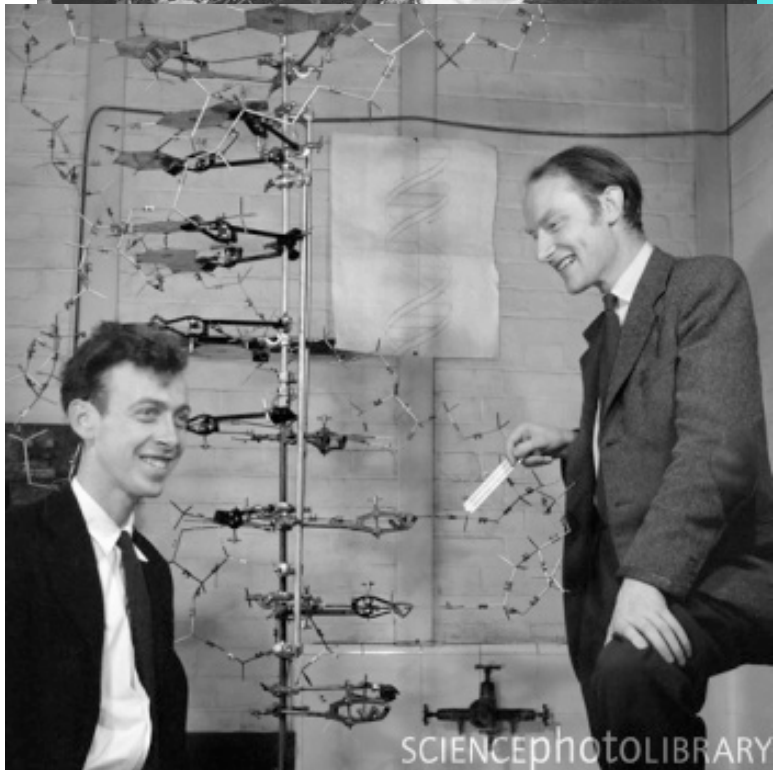
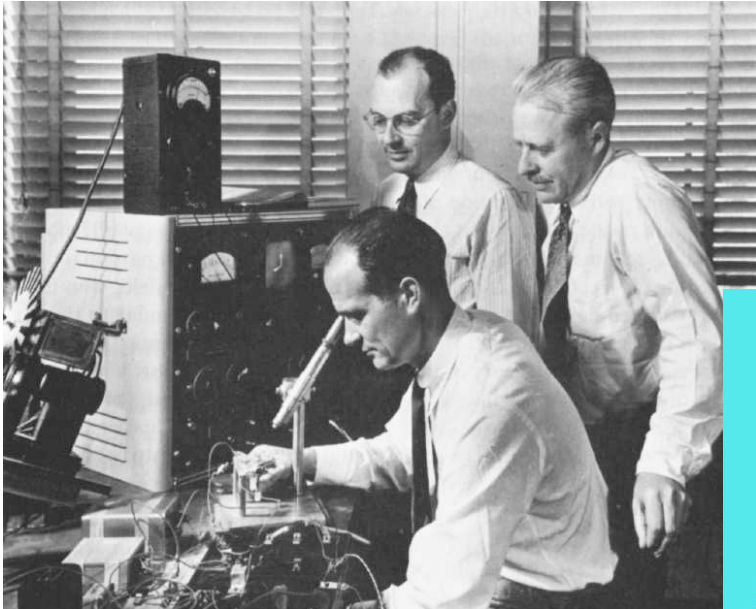
The Invention Perspective

“The key [to success] is to find a man of genius, give him money, and leave him alone.”

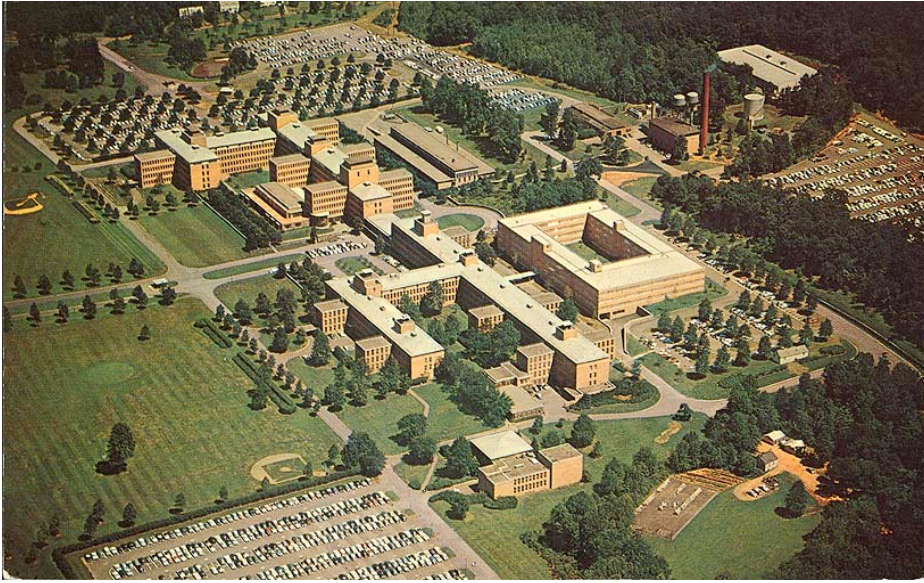
James Conant, former President, Harvard Univ.

“The best way to predict the future is to invent it.”

Alan Kay, computer scientist



SCIENCEPHOTOLIBRARY



Hidden Assumptions in the Internally-focused Innovation System

- If I discover it, I will find a market for it
- If I discover it first, I will own it
- The important technologies I will need can be anticipated in advance
- The best people in this field work for us

What changed?

Five Erosion Factors

- Increasingly mobile trained workers
- More capable Universities
- Diminished US hegemony
- Erosion of oligopoly market positions
- Enormous increase in Venture Capital

Diminishing Economies of Scale: US Industrial R&D by Size of Enterprise

Company Size	<u>1981</u>	<u>1989</u>	<u>1999</u>	<u>2005</u>
< 1000 employees	4.4 %	9.2%	22.5%	24.1%
1,000 – 4,999	6.1 %	7.6 %	13.6%	15.5%
5,000 – 9,999	5.8 %	5.5%	9.0%	8.0%
10,000 – 24,999	13.1%	10.0%	13.6%	14.8%
25,000 +	70.7%	67.7%	41.3%	37.6%

Sources: National Science Foundation, Science Resource Studies, Survey of Industrial Research Development, 1991, 1999, 2001,

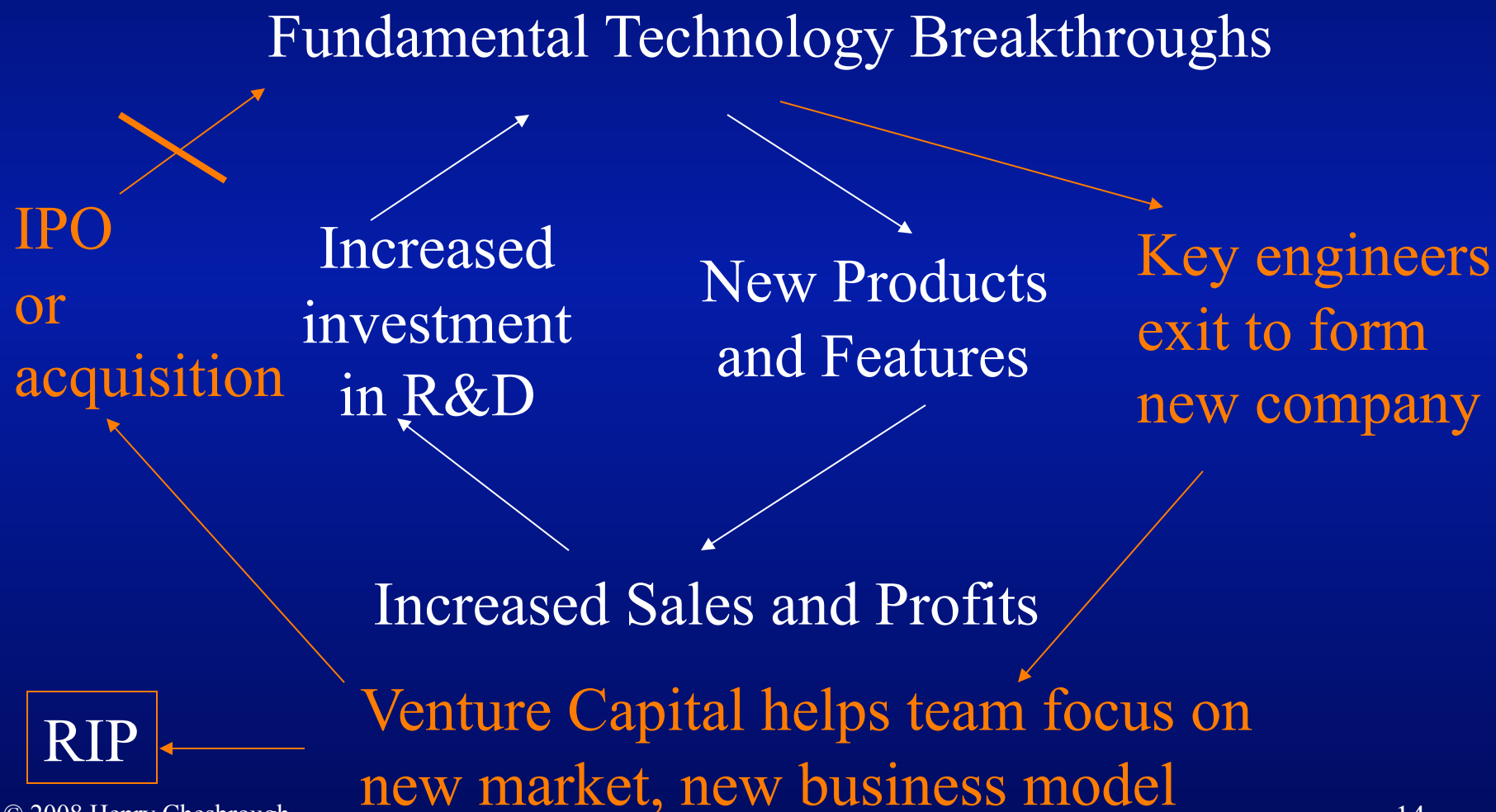
Merck's Conclusion

“Merck accounts for about 1% of the world's biomedical research. To tap into the other 99%, we must actively reach out....

“The cascade of human knowledge flowing from biotechnology and the unraveling of the human genome... is far too complex for any one company to handle alone.”

- “Not all the smart people work for you.”
 - Bill Joy, founder of Sun, currently VC

The Virtuous Circle Broken

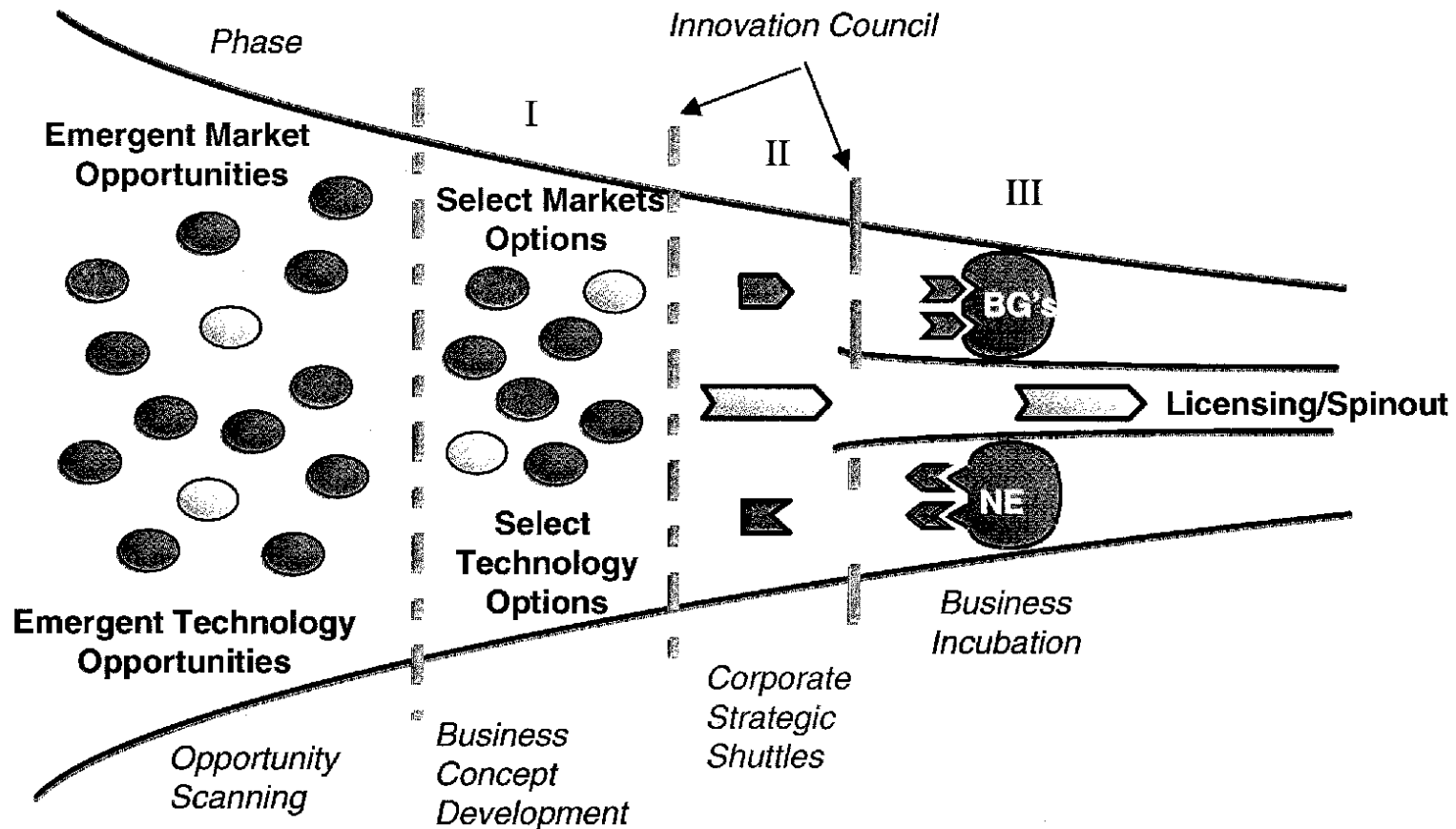


Why Xerox initiated a significant basic research program

- Growth and profits for Xerox in xerography market
- McColough's "Architecture of Information"
- Goldman: "remember what happened to RCA with vacuum tubes"
- Spillovers anticipated – "a necessary cost of fundamental research"
 - Adams: "so what if some of it falls off the wagon?"
 - However, budget risk of unlimited research is managed by restricting charter to "R" only, NOT "D"

A Typical Corporate Innovation System

The CIC/XNE Project Funnel



- ❑ Designed to minimize “false positive” errors
- ❑ Ignores risk of “false negative” errors

Xerox's experience with spinoffs

- 2 year field study at Xerox
- 35 companies that commercialized Xerox technology outside the firm
- Criteria for inclusion:
 - technology originated/fermented in Xerox for at least one year
 - at least one Xerox researcher went out with the technology
 - the technology was subsequently commercialized in a separate legal entity

3Com

- Metcalfe left PARC in Jan. 1979
- Did consulting work until Feb. of 1981
 - DEC, GE, Exxon
- Brokered alliance between Xerox, DEC, and Intel for IEEE 802 (aka Ethernet)
- Initial plan: sell to Unix workstations, via direct sales force

Then....

- As part of consulting, created directory of LAN dealers and VARs across US
 - first of its kind
 - sold many hundreds of copies at \$125 each
 - did this for 5 years
- IBM PC took the world by storm
- 3Com formed, Krause joined from HP
 - VCs financed:
- New plan: add-on boards for IBM PCs, sold through IBM retailers and VARs

Adobe

- Warnock and Geschke at PARC
 - creating fonts for Star Workstation
 - wanted to make into a standard
 - Xerox said no: “how can we make money if we give it away?”
- They leave, and form Adobe
- Initial plan: turnkey publishing system, complete with own hardware, software, and fonts

“We were originally going to supply a turnkey systems solution including hardware, printers, software, etc. We were then going to build a turnkey publishing system.

“In many respects Steve Jobs and Gordon Bell were key ingredients in getting things going the way they did. Gordon said, “don’t do the whole system”, and Steve said, “we don’t want your hardware, just sell us the software”. That’s how the business plan formed. It wasn’t there in the beginning.”

- Adobe created novel business model around licensing font library
- Partnered with Apple, Canon, HP and others to make PostScript a standard

Playing Chess, vs. Playing Poker

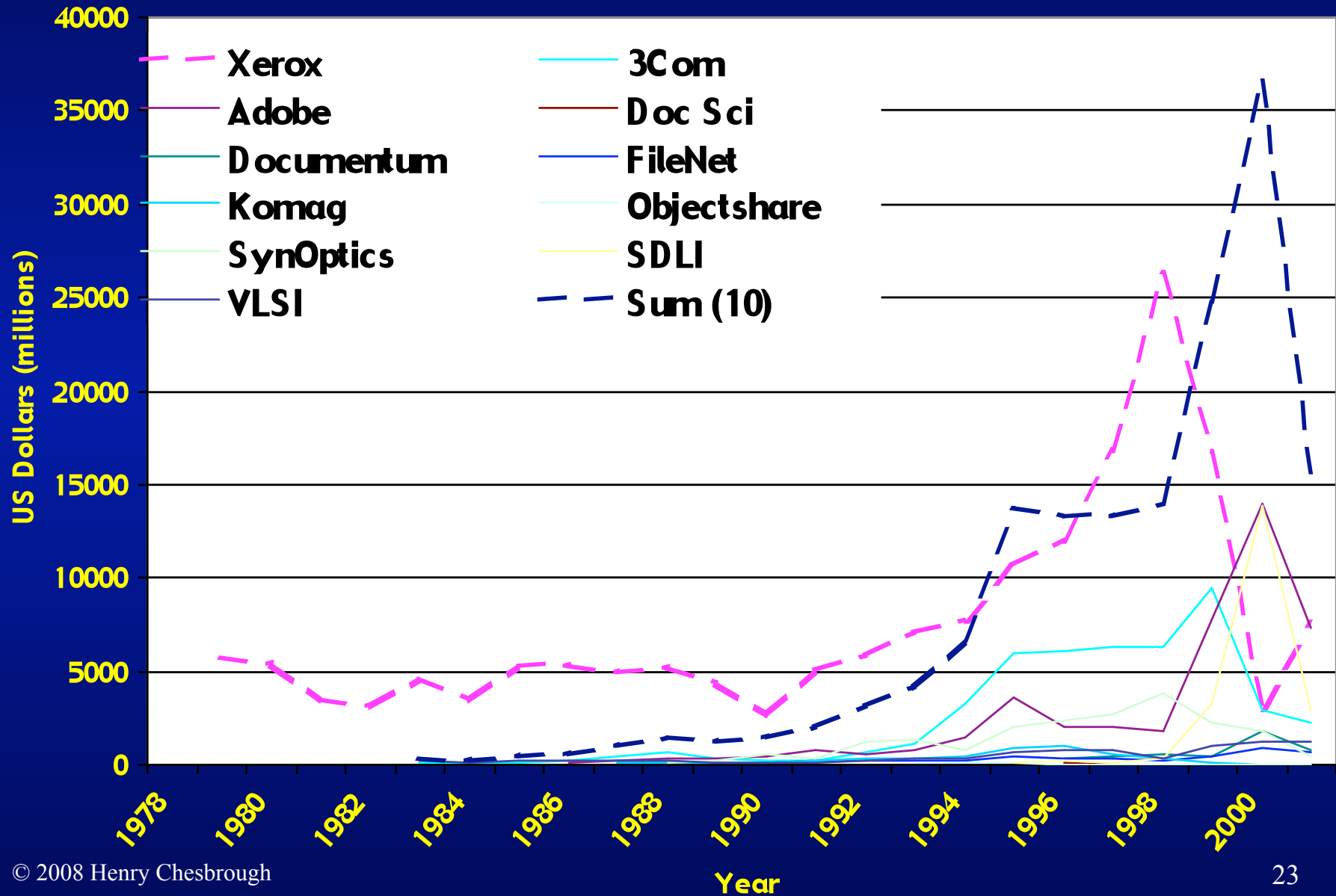
Chess: Type I errors

- Plan several moves ahead
- No new information needed
- You know what you've got, what opponent has

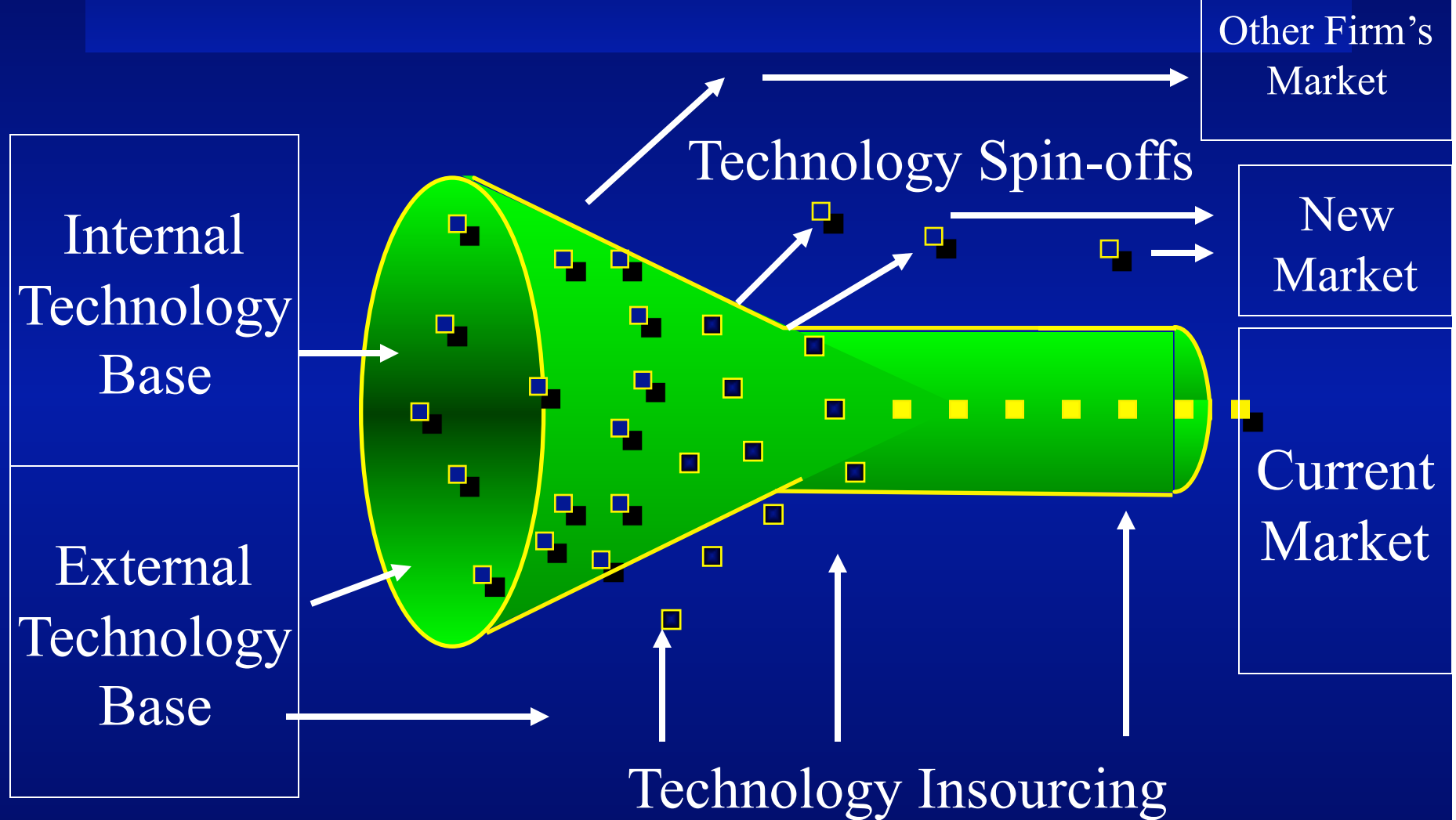
Poker: Type II errors

- Pay to play
- Pay for new information
- You discover what you've got, what other players have

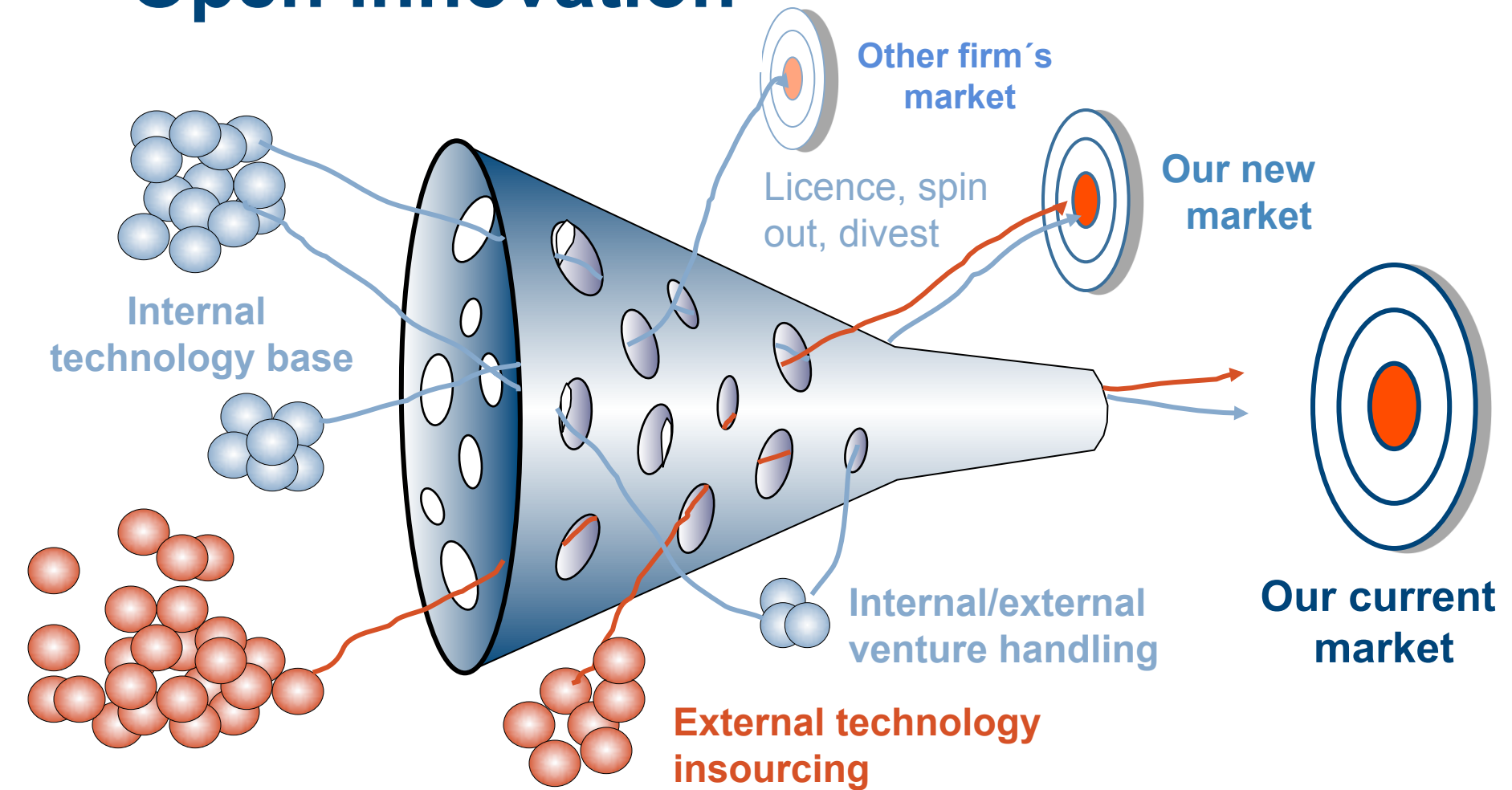
Xerox: Great at Chess, Lousy at Poker



The Open Innovation Paradigm



Open innovation



External technology base

Stolen with pride from Prof Henry Chesbrough UC Berkeley, Open Innovation: Renewing Growth from Industrial R&D, 10th Annual Innovation Convergence, Minneapolis Sept 27, 2004

The Logic of “Open Innovation”

- Good ideas are widely distributed today. No one has a monopoly on useful knowledge anymore.
- Industrial innovation processes must play poker, as well as chess
- We must manage IP in order to manage research:
 - need to access external IP to fuel our business model
 - need to profit from our own IP in others’ business model
- Not all of the smart people in the world work for us.

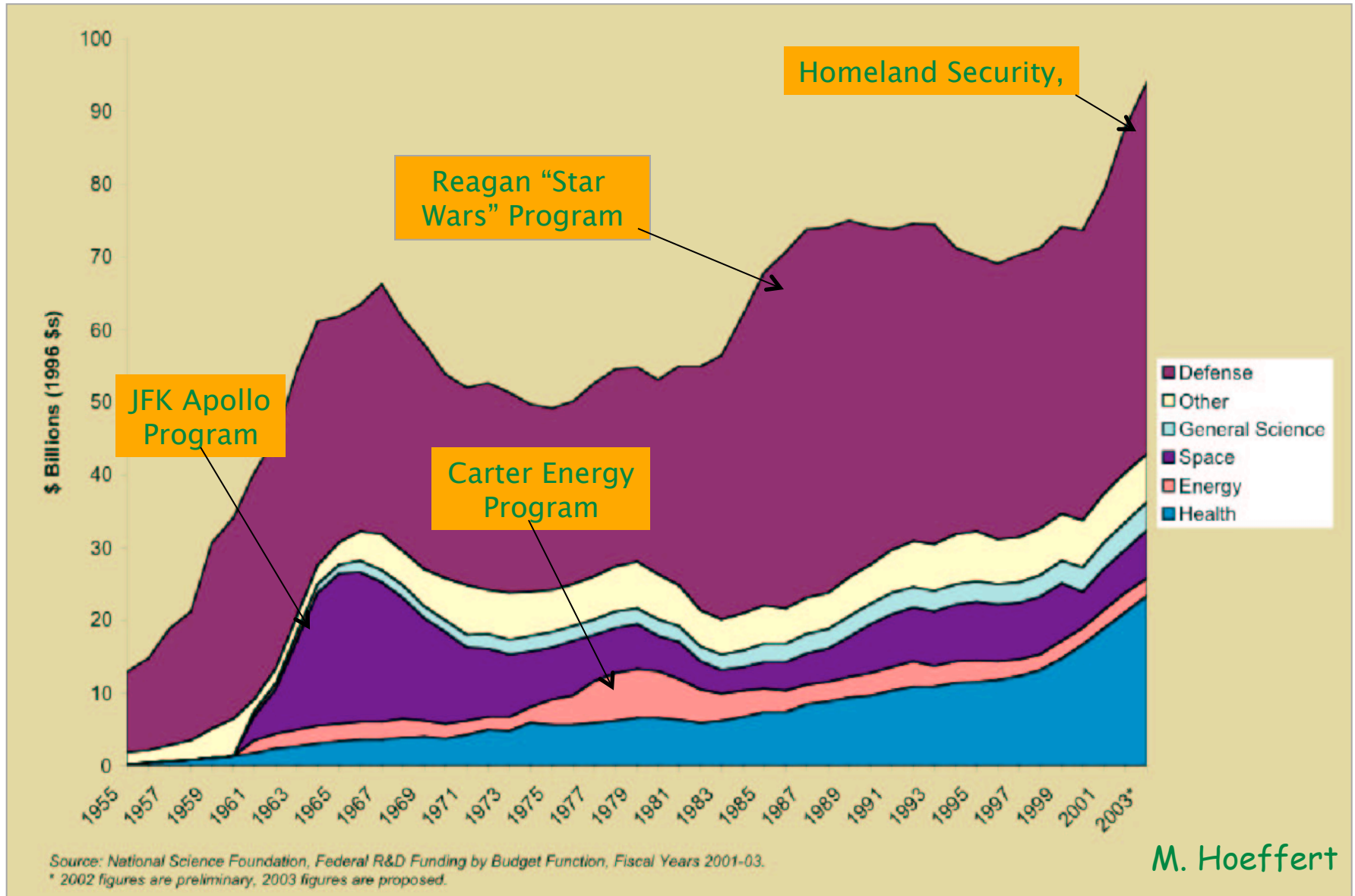
Universities as Industry Research Partners

- Bayh-Dole Act of 1980 – universities can claim an ownership right to its discoveries
- University research discoveries sometimes vital to industry activities
 - E.g., Cohen Boyer patent on recombinant DNA
 - \$255 million paid, product sales of >\$25 billion

Universities as Open Institutions

- Universities are intended to explore, discover, and disseminate new knowledge
- Society expects that, over time, much of this new knowledge will be useful
- Post World War II, government increasingly funded university research

U.S. Federal Government R&D History

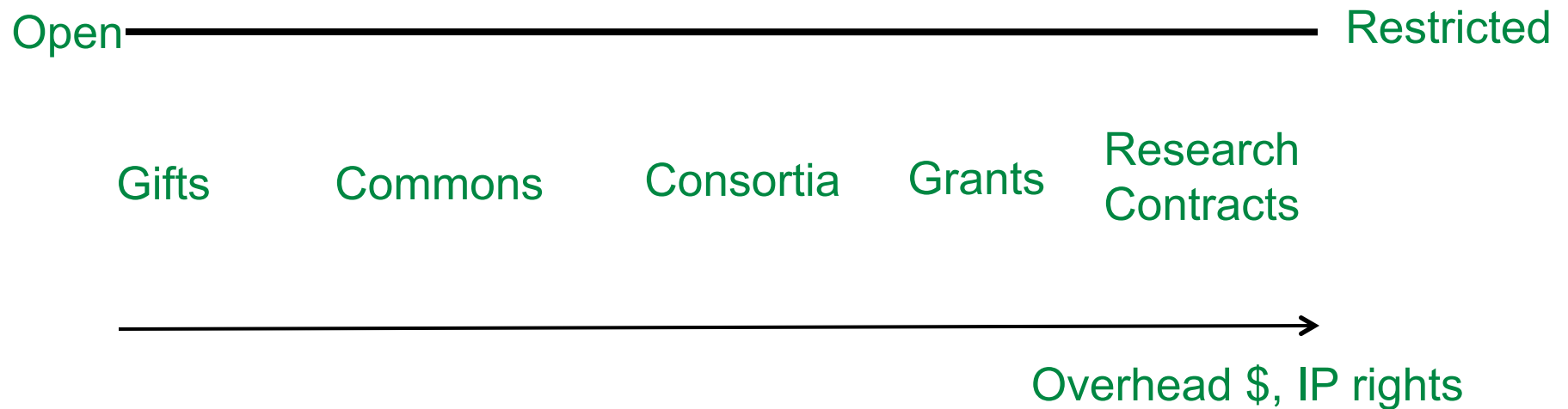


Courtesy of Chris Somerville

Pressures on University Research

- UC Berkeley received 74% of its funding from State and Federal sources in 1976
 - Industry contributed <3%
- Berkeley received just 48% of its funding from State and Federal sources in 2006
 - Industry contributed 12%
- Given the current budget crisis, State funding for research likely to decline further

Balancing Openness and Industry Needs: A Proposed Continuum



Adapted from Carol Mimura presentation, 9/29/2008

Open Innovation as a System

- Industrial R&D is today a distributed system
- Many new challenges arise in this system
 - Collaboration and Contamination
 - Intellectual Property
 - Business Models
 - Integration is now a critical skill

Implications for Corporate R&D

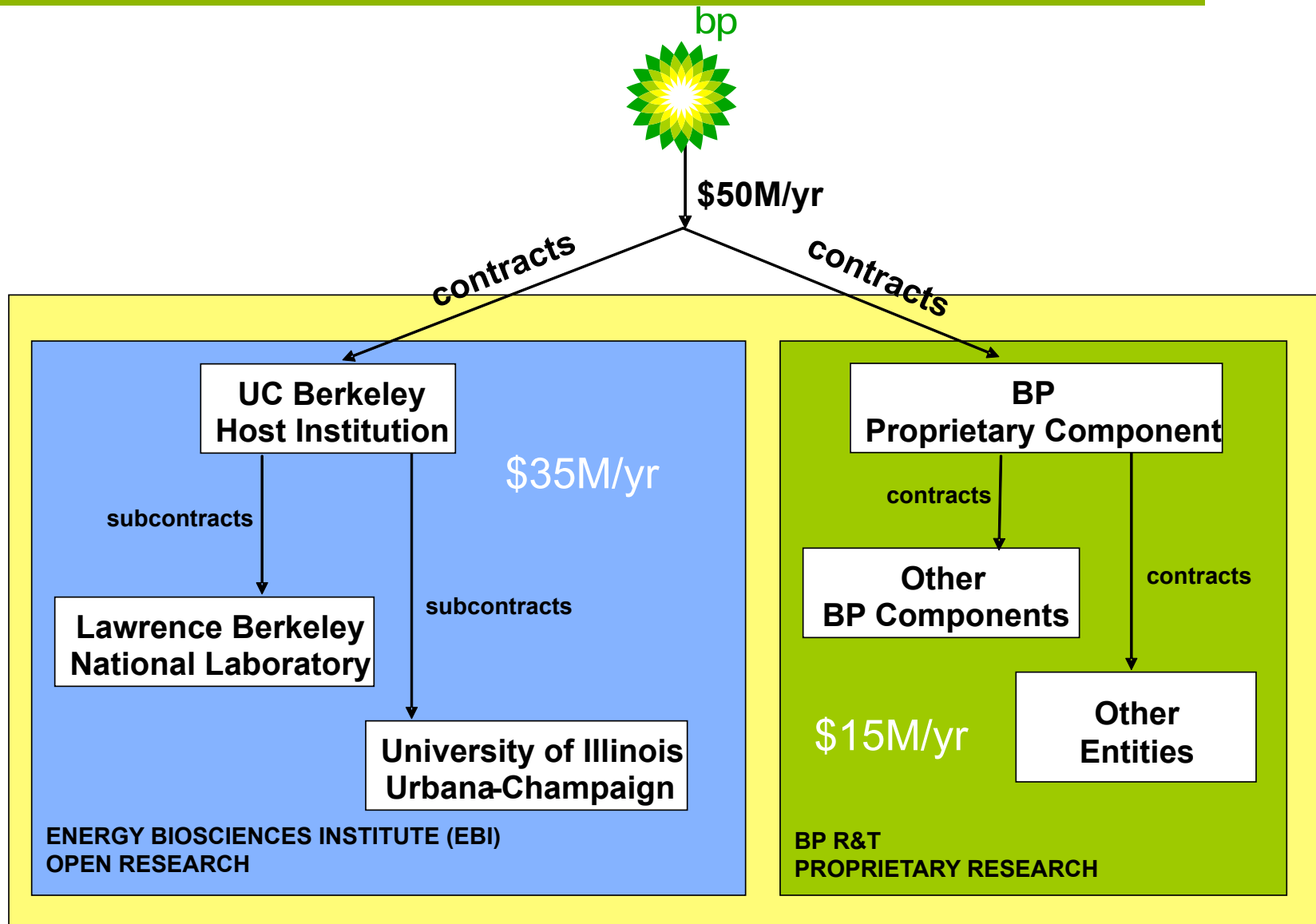
- Redefine the role of research:
 - knowledge discovery, plus
 - connection
 - integration
- Others can be sources of learning for your internal innovation processes
 - Technological alternatives
 - Alternative markets
 - A window on potential Type II errors
- Business models are too important to be left to the “suits”

BP's challenge in February 2006



- **Energy Bioscience looked promising (Senior Executive buy-in)**
- **How do we meld commercial/technology strength with biology/biotech?**
 - The company had no bio-expertise
- **How to reach out to biology/biotech communities**
 - **Not a corporate lab!**
 - Corporate labs too insular – can't tap broader expertise in a rapidly moving field
 - Where was the Energy/Bio talent pool anyway?
 - **Not the usual university research programme**
 - BP does many of these and knows strengths/weaknesses
 - Need to facilitate the development, demonstration, and commercialization of research results

Funding for Open and Proprietary Components



Licensing provisions



For inventions solely owned by UCB, UIUC and/or LBNL

NON-EXCLUSIVE

Non-exclusive, royal free (NERF) license in BP's area of interest, providing:

- BP will diligently pursue commercialization
- BP will underwrite the patent costs

EXCLUSIVE

BP may obtain exclusive license rights to sole or joint inventions.

- pre-negotiated capped fees
- "Bonanza clause" in case of extraordinary commercial success

Selecting the Research Projects – 1st Round



- 250 research preproposals submitted (wide diversity of topics)
- Evaluation by 15-member review panel
- 82 selected for further evaluation by peer-review panels
- 49 proposals selected for final funding (Programs and Projects)
- 12 in social sciences and economics, 37 in physical and life sciences
- Program and Project abstracts are posted on the EBI site
 - **<http://www.energybiosciencesinstitute.org>**

Assessment



- Who controls the assignment of research projects?
- Who controls the IP generated from the research?
- Who controls the dissemination of the research results?

Assessment – Academic Freedom



- Who controls the assignment of research projects?
- Who controls the IP generated from the research?
- Who controls the dissemination of the research results?
- Executive Committee proposes, Governance Board approves – Berkeley and BP each have veto over slate
- Yours, Mine, and Ours
- Berkeley controls, subject to patent decision

Assessment – Part II: Academic Impact



- Is Berkeley better or worse off for having this agreement?
- Would other universities accept these provisions?
- Will taxpayers view this agreement positively?

Assessment – Part II



- Is Berkeley better or worse off for having this agreement?
- Would other universities accept these provisions?
- Will taxpayers view this agreement positively?
- Yes – 10 new faculty positions, dozens of grad students supported
- In a heartbeat; 4 other finalists
- Tougher question. If no, may further reduce research funding support

BP Assessment – Is this more than charity?



- What is BP getting for its \$500M?
- How will BP learn from UCB and UI research?
- How will results transfer into useful industry development?
- BP is buying speed, and access to world class bioscience
- BP must invest additional resources to learn
- BP must create new receiving mechanisms inside BP to make use of results

Could This be a New Model for Industry-University Collaboration?

Named a “Deal of Distinction” in 2007

In The Industry-University-Government Interface (IUGI) Sector

By the Licensing Executive’s Society



“...hand sculpted glass by the artisans of Parris-Roche Design Studios, consisting of a pair of **entwined blue glass ribbons** encased in a **clear conic pinnacle symbolic of parties coming together...**”