University-Industry Cooperation, and the Emergence of Start-Up Companies

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History of U.S. industry-university cooperation

- Stanford's role in founding Hewlett-Packard (1937)
- MIT's critical role in radar development (1942-44)
- Univ. of Pennsylvania's key role in computer development (1944-50)
- MIT's influence along Route 128 (1950-)
- Stanford, UCB, UCSF roles in evolution of silicon valley and the biotech industry (1937-)
- Bayh-Dole Act of U.S. Congress (1980)

Goals of cooperative research

- More effective BS, MS, PhD education
- More world-class research
- Greater practical impact of research
- Prove feasibility of new technologies
- Regional & national economic development

What are the incentives for professors?

- Professors seek “real world” impact for their work
- Professors want to understand & help solve the difficult technical problems faced by industry
- Professors seek funds for campus research
- Professors may be paid as consultants, and profit from participation in new business ventures
- University’s performance review & salary increase processes for Professors reward impact!

What are the incentives for industry?

- Influence in setting research goals
- Better research through open exchange
- Continuous contact with work in progress
- May initiate proprietary development any time
- Best chance to hire graduating students
- Chance to hear other sponsors' questions
- Pay only a fraction of total program cost

Success factors for university-industry cooperation

- Participants have a base of common experience
- Mutually-agreed realistic goals
- Frequent candid communication
- Multiple sponsors: industry and government
- Agreed policy on intellectual property (patents)
- Long-term (3-5 year) mutual commitment

Base of common experience

- Professors have experience in industry
- Industry reps. have experience in graduate study
- Summer and/or semester jobs for students
- Industry sends occasional resident fellows
- Professors take occasional leaves in industry
- Mixed U/I participation in conferences and other professional activities

Realistic goals for cooperative activity

- Graduates well-educated in the field
- Research motivated by application needs
- Linked work: fundamentals to applications
- Theses rarely produce deliverable products
- University/industry teamwork, collaboration
- Attractive career opportunities for graduates

Expectations for university patents
(mostly incorrect!)

- Professors: fame & fortune
- University trustees: new revenues
- Industry managers: competitive success
- Lawyers: much well-paid work

Patent management goals

Industry:

- Produce & sell patented products
- Producers cross-license with other producers
- Producers seek protection against lawsuits for patent infringement

Universities:

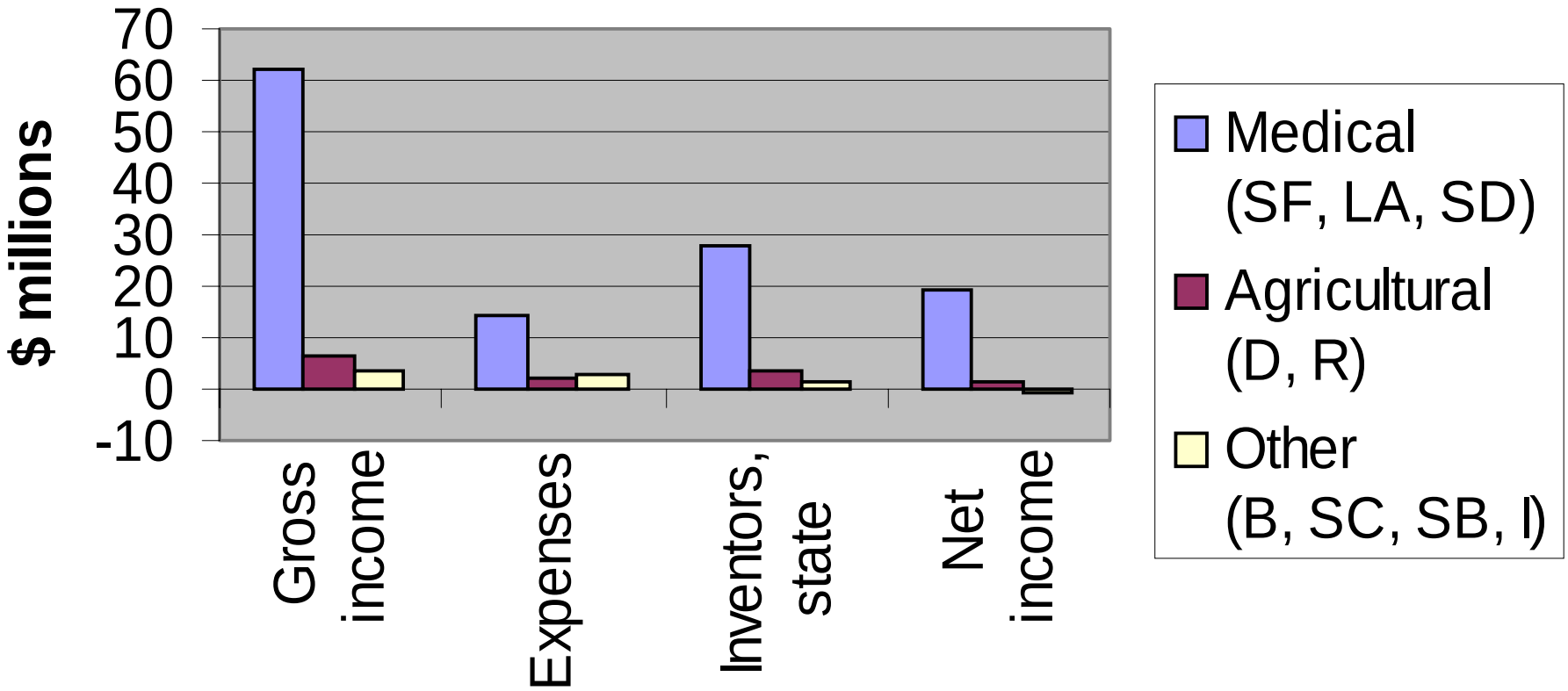
- Universities hope to license patents for royalties

UC system IP income & expense

(9 campus University of California results)

- 1998 total royalties & licenses = $88.5 million
- Number of inventions under management: 3,500
- Revenue produced by top 5 inventions: 73%
- Revenue produced by top 25 inventions: 87%
- Number of active licenses: 916
- Fraction of inventions producing revenue: ~15%
- Net income to UC system = $20 million

UC System Licensing Income



University intellectual property policy?
(for electronics & computer science)

- Few university patents are valuable
- Patents are not the basis for market leadership
- Early to market more important than patents
- Intellectual property emphasis is harmful to university's shared learning atmosphere!
- Best policy: public domain, or give industry sponsors royalty-free non-exclusive rights

Payoff to industry if results go into the public domain

NO protected intellectual property—BUT:

- Influence in setting research goals
- Better research through open exchange
- Continuous contact with work in progress
- May initiate proprietary development any time
- Best chance to hire graduating students
- Value in hearing other sponsors' questions
- Pay only a fraction of total program cost

Payoff to university when results go into the public domain

- At UC Berkeley (SPICE, BSD UNIX, INGRES, RISC, RAID, logic synthesis, wireless, etc.)
  - Research strengthened via industry contacts
  - No disputes with industry sponsors over IP
  - Industrial research support now ~ $15M/year
  - Industry gifts for major facilities ~ $30M, 1983-99
  - No legal expenses
  - No “jackpot mentality” among professors, students

Emergence of start-up companies from university programs
(partial list for California, 1980-2001)

Public companies:

- Broadcom
- Cadence Design
- Cisco Systems
- Inktomi
- Marvell Semiconductor
- Sun Microsystems
- Synopsys

Acquired or still private:

- Abrizio
- Atheros
- Bandwidth9
- Celestry
- Fast Forward
- OPC Technology
- Timbre Technologies

How are new technologies brought to market?

- Established firms face the *innovator's dilemma*; often do not pursue new technologies & products
- Entrepreneurs assess market opportunities and develop business plans
- Venture capitalists provide funding and essential help in correcting weaknesses of new firms
- Established firms acquire many new ventures
- Some new ventures become public companies

How can universities teach entrepreneurial skills?

- Encourage cooperation between engineering and business programs and Professors, in both teaching and research
- Develop courses on “Management of Technology”

  http://mot.berkeley.edu/intro.html
- Establish an “Entrepreneur’s Forum” with assistance from successful entrepreneuers

  http://www.haas.berkeley.edu/groups/lester/bef.html
- Create a “Business Plan Competition” for engineering and business students, judged by successful business people

  http://groups.haas.berkeley.edu/bplan/