Technology Transfer: Bringing University Research into the Economy

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Many forms of “Technology Transfer” from Academia to Industry

- The graduating student
- Publication
- The consulting professor
- Collaborative/sponsored research with industry
- Intellectual Property licensing to:
  - Existing companies
  - Spin-Outs

Formal Definition of “technology transfer”

- Purposeful transfer of the results of fundamental research from universities and research institutions into the economy via protection and transfer of intellectual property into the commercial sphere

Three major routes for IP transfer

- Collaborative Research followed by transfer of IP (licensing?) to industrial sponsor
- Licensing of IP to existing companies
- Spin-out of new companies formed to exploit IP

Purposes of University Technology Transfer

Research → Invention (and IP) → Innovation
Development

- New products and medicines
- Bring new technology into industry for economic competitiveness
- Encourage entrepreneurship for local and national economic development

The university/IP equation

- University technology is embryonic—neither its feasibility nor market is known
- Development will require high risk investment by industry
- Intellectual property protection can be used as an incentive to make the high risk investment
  - motivating the "first mover" by protecting against later competitors

Patent protection is particularly critical for development of pharmaceuticals

- Development of a new therapeutic or vaccine product is a particularly high risk activity
  - Time frames are long
  - Financial investment is very high
  - Clinical trials are very difficult
  - Probability of failure is high
- Patent protection of the final product is necessary before companies (or biotech investors) will take the risk and make the investment

Other breakthrough technologies are in a similar situation: requiring substantial investments at high risk

Examples:

- Alternative Energy technologies
  - Solar, batteries, etc.
- "Clean water" technologies
  - low energy desalination, nano-sorption, etc.
- New Materials
  - Superconductors, nanomaterials, etc.

- But does technology transfer make money for the university?

Financial Benefits of Tech Transfer

- Industry support of research the university
- Economic development, locally and nationally
- Revenues from licensing and spin-outs

Financial expectations from royalties and spinouts

- Based on the US experience, universities should not plan for large returns from royalties and spinouts, even from very successful technology transfer programs

25 years after Bayh-Dole, US Tech Transfer has matured: Fiscal Year 2007 results

- New Issued US Patents: > **9800**
- New License Agreements: >**4200**
- Total Licenses yielding income: >**11,000**
- New Startup Companies: >**480**

But direct financial income from technology transfer itself is usually not very large

- Licensing revenue from >200 research institutions in FY 2007: $2.0 Billion (U.S.)
- **BUT…**this is on a research base of:

  $ 41 Billion
- Thus, Licensing revenue, after 25 years of experience averages:

  only 5 % of research expenditures

And even the total revenue is very unevenly distributed

- Dominated by a few very large royalties from fewer than 1% of total patents from research institutions in the U.S.
  - Pharmaceutical royalties are high—but very rare
  - Equity cash-ins from spin-outs are only occasionally large, and are one-time events
- Most universities eventually break even or make a small amount—but very few get rich!

The Societal Impact is much Larger!

- More than 4000 new companies formed from US university intellectual property
- Spinouts are a significant contribution to “technology clusters” in some regions
- Estimate over 500,000 jobs in development and production of new products based on university licenses in the US
- Significant tax returns to the government
- Many new medicines developed based on patents from university research

- Significant number of new startups have developed into large, successful companies (e.g. Google! from Stanford)
- Biotech and Information Technology (IT) clusters in a number of cities with large research universities (Boston, San Francisco, San Diego, North Carolina, etc.)
  - Majority of new biotech companies spin directly out of university research

Key elements in developing a successful university technology transfer system

I. Strong, world-quality research consistently supported over decades

II. A Well-thought-out Mission

- Why is the university doing it?
  - If it's "about the money", they will likely fail
  - And if there is not a consensus on a clearly defined mission, tech transfer may languish or grow contentious

III. Program which wins the hearts and minds of the scientific investigators

- Clear policies that put the academic mission (and publishing) first
- Responsive tech transfer office
- Clear policies

The researcher's questions?

- Will my institution's emphasis on technology transfer mean I won't be able to concentrate on fundamental, exploratory research?
- Will patenting interfere with my ability to publish?
- How do I separate my academic responsibilities from my involvement with companies?

Academic values, basic research, publication are not incompatible with technology transfer

Doing both well relies on:

- Core institutional values and policies that give academic mission (basic research, publication) clear priority over technology transfer

- Clear definition of who owns the intellectual property (the researcher, the institution, the government, the company?)

- Well defined policies on researchers' involvement with companies (allowed time, consulting privileges, other "boundaries")

- (?) Clear separation of startup companies from the institution

The Tech Transfer office must be responsive to academics' needs

- The TTO must have "rapid response"
  - In evaluating invention reports for patenting
  - In getting patent agents to write the patents and filed them
- Educate researchers to get their cooperation: Patents need to be filed before publication—but publication may follow immediately thereafter
- Educate researchers to report inventions (several months) in advance of planned publication—when possible

IV. Policies

- Clear university policies on
  - Ownership of IP
  - Sharing of Royalties
  - Publication, confidentiality
  - Use of university resources by industry and particularly spin-outs
  - Right of faculty to participate in spin-out companies, consulting to industry, etc.

V. Investment

- It takes money to build a patent portfolio and to support a technology transfer office
  - **where will the funds come from?**
  - **Is the time frame realistic?**

VI. Realistic Financial Expectations

- The university cannot expect that financial returns will ever be a major source of income
  - **Unless you get lucky**

Technology Transfer is a talent-based endeavor!

VII. TLO staff

- Technically trained
- "Bilingual" in Academia and Industry
  - Industrial experience very, very helpful
- Can command respect of faculty and business
- Can handle complexity
- Good communicators and negotiators
- Motivated by "Getting it done"
- And Dedicated to the mission

VIII. Contact with Industry and Investors

Technology Transfer is done with people you know!

Sponsored Research:MIT Statistics

- About $80 million in industrial sponsored research
  - (ca. 15% of on-campus research)
- 150-200 industrial agreements negotiated/year
- 8-10 “Umbrella agreements” in place
  - multi-year (5-10 yr), multi-$million
  - all “project-by-project” (competitive proposals from faculty chosen jointly by steering committee)
  - No “department-wide” or “field-wide” agreements

Where do these sponsorships originate?

- No office formally in charge of “marketing” industrial sponsorship
- Many relationships start with a faculty member knowing someone from the company
  - Consulting
  - Scientific meetings
  - Former grad students/postdocs now at company
- Some come from senior faculty (deans, etc.) board memberships and other relationships
- Larger companies approach MIT to establish closer relationships (“Brand”)

Technology Licensing Office Statistics

- 500 new invention disclosures/year
- 100 new technology licenses/year
- 15-30 new spin-out companies/year
- Over 650 active licenses
- About 350 spinout companies total

Dependent on our “Entrepreneurial Eco-System”

- Activities on Campus involving continuous interaction with the business and investment community

MIT components of the "entrepreneurial eco-system"

- Deshpande Center: sponsors research "with startup potential"—with business "catalysts"
- $100 K Student Business Plan Contest
- Venture Mentoring Service
- MIT Enterprise Forum
- Entrepreneurship Center at Sloan School of Mgmt.
- Student Venture Capital and Entrepreneurship Clubs
- The Technology Licensing Office

Deshpande Center

- Funded by a philanthropic endowment from successful IT entrepreneur
- Investigators submit competitive proposals for research with spinout potential

Deshpande…continued

- Volunteers from business community (VC's, entrepreneurs, etc) on Judging Advisory committee
- Each funded project mentored by a "Catalyst" from business community for 1-2 years during research

100K Student Business Plan Contest

- Over 100 entries/year
- Volunteers from business community serve as mentors and judges
- Over 500 people (mostly from business community) attend the final awards ceremony

Venture Mentoring Service

- Over 100 volunteers from the entrepreneurial, angel investing, venture capital and other businesses provide mentoring to entrepreneurs (including alums) associated with MIT.

MIT Enterprise Forum

- Founded and run by volunteers from the business community
- Run separate monthly clinics for
  - "concept companies"
  - Startup companies
  - Early growth-stage companies
- Annual instructional and networking conference
- Several hundred audience attendees per month

Role Models!

- Students and faculty are continuously exposed to people who have started companies—and to people who fund them
- Students graduate with a sense that “I can do it too”. Changes life-time expectations
- And faculty develop a sense (watching their colleagues succeed) that “I ought to try that too!”

Entrepreneurship is in the air!

And our “incubator”—the City of Cambridge (and Boston)

A community experienced in forming, funding and growing new companies

- Early stage venture capitalists
- Lawyers, accountants, consultants
- Real estate managers

AND, the scarcest resource anywhere:

- Experienced managers who can run and raise money for new companies

IX: TIME: the Final Requirement for building a successful TT operation

- It takes time (and investment) to build an IP portfolio
- It takes time to educate faculty and win their trust
- It takes time and experience to develop technology transfer skills
- Developing contacts with industry and investors—and developing trust—takes time
- It will likely take a decade to become financially self supporting

Building a tech transfer system is a long-term societal investment

- To bring the results of basic research to the public in the form of new products, new cures
- To solve major societal problems (e.g. energy, clean water) through new scientific findings
- To enhance economic competitiveness of industry by incorporating new technology
- To build new industries based on new science and technology
- To build an entrepreneurial culture, bringing new companies, new jobs and new opportunities for the public

Thank you!