11: **Research administration and commercialization**

April 6, 2012

Announcements

- Presentation signup
  - http://goo.gl/YhNgh
  - Location 151 Chrysler
  - Upload .ppt/.pptx or .pdf on ctools by 1pm
  - Please practice (with an audience)
  - Please consult lectures 9 and 10 as you prepare

- I'm reading the proposals
  - Universal comment on clarity/detail of aims (1 → N)

Today's discussion

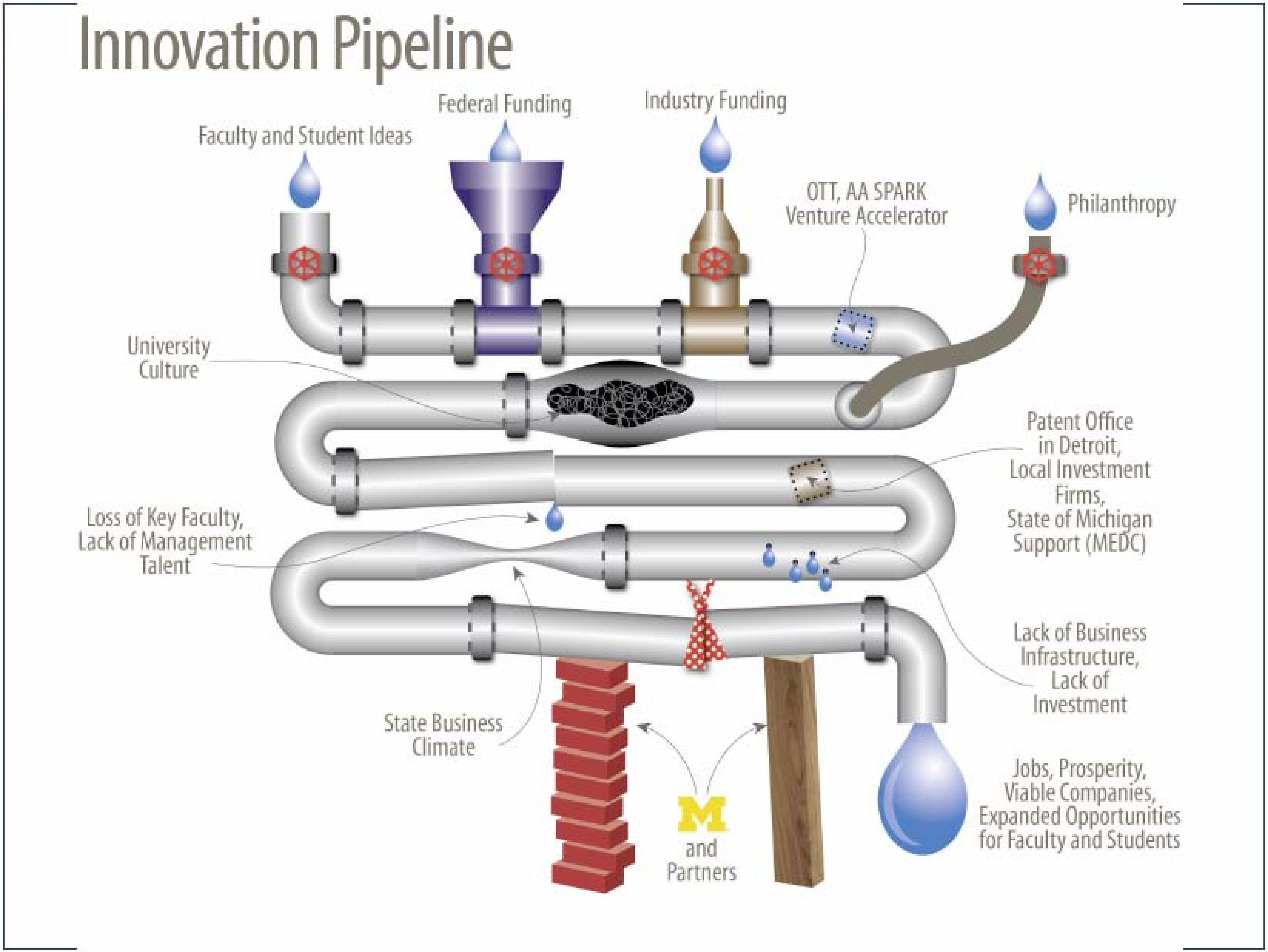
- More about proposal logistics and funding administration
- Commercialization and technology transfer
- Post-PhD careers …including faculty (if you like)
- Other topics of interest? Loose ends?

"Daddy works in a magical, faraway land called Academia."

References on ctools

- Lane and Bertuzzi, "Measuring the results of science investments".
- Thursby: 2 articles (2003, 2011) on university technology transfer and the Bayh-Dole* act
- Kaminski and Geisler, "Survival analysis of faculty retention in science and engineering by gender"
- Gladwell, "The order of things: what college rankings really tell us".
- Fiore, "Networking knowledge creation" (review of http://www.amazon.com/Reinventing-Discovery-The-Networked-Science/dp/0691148902)

*The Bayh-Dole Act of 1980 allows universities to patent and exclusively license federally funded inventions.



Graphic from UMich OVPR

A small amount of research exits the pipeline

fore use (*6*). A survey of 62 U.S. universities suggests that much university research fits this profile, with 45% of inventions no more than a "proof of concept" and only 12% "ready for practical use" at the time of license (*7*, *8*). The failure rate for these inventions is high, 46% for all inventions and 72% for those that are only a proof of concept (*9*). Exclusive patent rights provide an incentive for firms to invest in costly development, but only to the extent that patents are effective in protecting intellectual property (IP), which varies by industry (*10*, *11*).

Are technology transfer offices "profit centers"? In the 2000 AUTM survey, 156 U.S. respondents reported $1.24 billion in income from royalties and cashed-in equity net of unreimbursed legal fees (*1*, *15*). This income was about 4.7% of their research expenditure. For every dollar of income, there is about $0.20 in sponsored research tied to a license. The average income per active license is $66,465, but only 43% earned royalties and 0.56% earned more than $1 million in 2000.

Thursby. *Science* 301:1052, 2003.

February 15, 2010

Licensing Revenue and Patent Activity, 2008 Fiscal Year

Name of institution	Licensing income	Start-up companies formed	Licenses executed	Total active licenses	New patent applications	U.S. patents issued	Total research spending
Northwestern U.	$824,426,230	4	28	195	158	32	$368,169,430
U. of California system	$146,314,433	55	206	1,913	899	224	$4,403,662,006
Columbia U.	$134,273,996	10	36	34	264	59	$640,000,000
New York U.	$104,254,314	6	40	261	42	30	$310,699,000
Wake Forest U.	$90,005,640	2	11	N/A	N/A	10	$148,686,377
Massachusetts Institute of Technology	$88,924,500	20	98	818	282	140	$1,319,000,000
U. of Minnesota	$84,669,281	1	63	781	58	37	$583,524,000
U. of Washington, Washington Research Foundation	$80,330,765	9	212	1,122	149	56	$1,026,788,452
U. of Rochester	$72,264,249	6	18	99	74	25	$361,602,172
Stanford U.	$62,514,524	9	107	956	396	132	$694,217,484
U. of Wisconsin at Madison, Wisconsin Alumni Research Foundation	$54,130,000	6	75	547	144	98	$942,000,000
U. of Florida	$52,252,469	14	75	395	180	52	$483,798,009
U. of Massachusetts	$35,982,532	2	35	266	66	25	$435,247,000
Mount Sinai School of Medicine	$31,390,804	0	14	89	18	13	$296,379,952
U. of Utah	$26,211,372	20	78	224	119	33	$273,005,853
U. of Michigan	$25,008,033	13	91	339	132	75	$875,753,507
U. of Georgia	$24,128,536	2	130	651	60	33	$350,299,000

http://chronicle.com/article/Chart-Licensing-Revenue-and/64158/

http://chronicle.com/article/Table-Licensing-Revenue-and/125729/

December 17, 2010

Licensing Revenue and Patent Activity, 2009 Fiscal Year

Institution	Licensing income	Start-up companies formed	Licenses executed	Total active licenses	New patent applications	U.S. patents issued	Total research spending
Total	$1,782,113,228	555	4,624	28,763	11,260	3,088	$48,164,473,678
Northwestern U.	$161,591,544	3	31	223	168	28	$400,012,497
Columbia U.	$154,257,579	13	51	n/a	202	57	$604,660,000
New York U.	$113,110,437	5	38	296	50	29	$308,834,000
U. of California system	$103,104,667	47	237	2,034	928	244	$4,686,598,210
Wake Forest U.	$95,636,362	3	8	n/a	n/a	8	$162,084,439
U. of Minnesota	$95,168,525	3	53	795	65	37	$590,880,956
U. of Washington/Washington Research Foundation	$87,339,905	10	231	1,153	145	40	$1,076,044,801
U. of Massachusetts	$70,553,428	1	50	285	85	35	$489,060,000
Massachusetts Institute of Technology	$66,450,000	18	91	887	509	154	$1,375,073,000
Stanford U.	$65,054,187	9	77	976	221	128	$733,266,108
U. of Wisconsin at Madison	$56,714,000	1	57	528	129	119	$1,132,000,000
U. of Florida	$53,880,476	10	115	569	180	73	$496,063,499
California Institute of Technology	$47,665,535	18	37	97	381	94	$521,436,800
U. of Rochester	$46,025,270	2	15	106	63	27	$377,246,000
U. of Iowa Research Foundation	$42,922,081	3	21	278	18	30	$334,936,000
U. of Texas system	$32,428,040	22	161	1,297	330	107	$2,272,779,788
U. of Georgia	$30,531,425	6	124	687	71	20	$349,730,000
Mount Sinai School of Medicine of NYU	$25,081,703	n/a	8	95	36	11	$321,299,455
Institutions not identified	$23,297,010	9	59	806	335	44	$806,947,740
Duke U.	$19,048,244	4	97	689	155	34	$709,803,045
U. of Michigan	$18,311,368	8	78	321	153	72	$1,016,565,913
Case Western Reserve U.	$16,281,957	5	31	218	104	11	$332,661,000

http://chronicle.com/article/Sortable-Table-Licensing/129588/

November 1, 2011

Licensing Revenue and Patent Activity, 2010 Fiscal Year

Institution	Licensing income	Start-up companies formed	Licenses executed	Total active licenses	New patent applications	U.S. patents issued	Total research spending
Northwestern U.	$179,835,148	6	32	189	223	58	$491,628,943
New York U.	$178,389,513	6	40	328	71	58	$365,944,000
Columbia U.	$147,237,631	12	61	55	177	66	$662,048,550
U. of California system	$104,434,511	75	252	2,096	915	297	$5,171,519,289
Wake Forest U.	$85,991,743	3	14	-	40	12	$227,597,563
U. of Minnesota	$83,905,660	8	73	905	80	46	$653,616,819
Massachusetts Institute of Technology	$69,200,000	17	96	919	535	172	$1,400,945,000
U. of Washington/Washington Research Foundation	$69,032,163	7	196	1,309	125	69	$887,329,593
Stanford U.	$65,466,286	-	90	1,944	376	180	$805,973,770
U. of Wisconsin at Madison	$54,300,000	5	62	529	109	133	$1,029,000,000
California Institute of Technology	$51,582,149	10	47	94	415	138	$504,476,128
U. of Rochester	$41,664,036	5	19	128	46	21	$460,522,000
U. of Massachusetts	$40,019,174	2	42	281	77	44	$563,998,898
U. of Michigan	$39,822,113	10	97	396	153	82	$1,139,493,986
U. of Texas system	$38,309,487	33	175	1,160	368	150	$2,346,099,522
U. of Utah	$37,547,208	18	68	287	90	41	$450,488,999
U. of Florida	$29,235,006	9	92	619	171	59	$535,877,029
U. of Iowa Research Foundation	$26,991,145	3	21	120	23	32	$444,034,000
Duke U.	$25,733,526	5	99	738	125	43	$826,993,375
U. of South Florida	$17,411,625	5	37	155	84	67	$390,850,000
Rockefeller U.	$16,429,000	1	34	204	19	20	$162,000,000
Mount Sinai School of Medicine of NYU	$15,381,631	1	24	119	34	11	$371,088,109
Emory U.	$14,383,542	4	36	251	58	17	$450,204,168
Case Western Reserve U.	$14,333,273	5	38	250	54	28	$334,993,000
Indiana U.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8	[illegible]

Catalyzing new and risky ideas

June 25, 2010

The Idea Incubator Goes to Campus

By BOB TEDESCHI

DOUGLAS P. HART, a professor of mechanical engineering at the Massachusetts Institute of Technology who sold his last start-up for a tidy $95 million, is already on to his next big thing.

On Tuesday, he expects to lock up $1.5 million in funding for his new start-up, Lantos Technologies. The company has developed a 3-D scanner that it hopes will streamline the current generation of earphones and hearing aids by precisely fitting them to the dimensions of the ear canal, right up to the eardrum.

"We're hoping people will be able to walk in the store and have their ears scanned like people get their ears pierced today," he says. "That'll lower the cost because they don't have to go to a specialty doctor."

Unlike other academics often left to their own devices, Professor Hart was able to bring his hearing aid concept closer to reality with $50,000 in backing last year from the Deshpande Center for Technological Innovation, an M.I.T. entity originally funded by two private investors, Jaishree Deshpande and her husband, Gururaj.

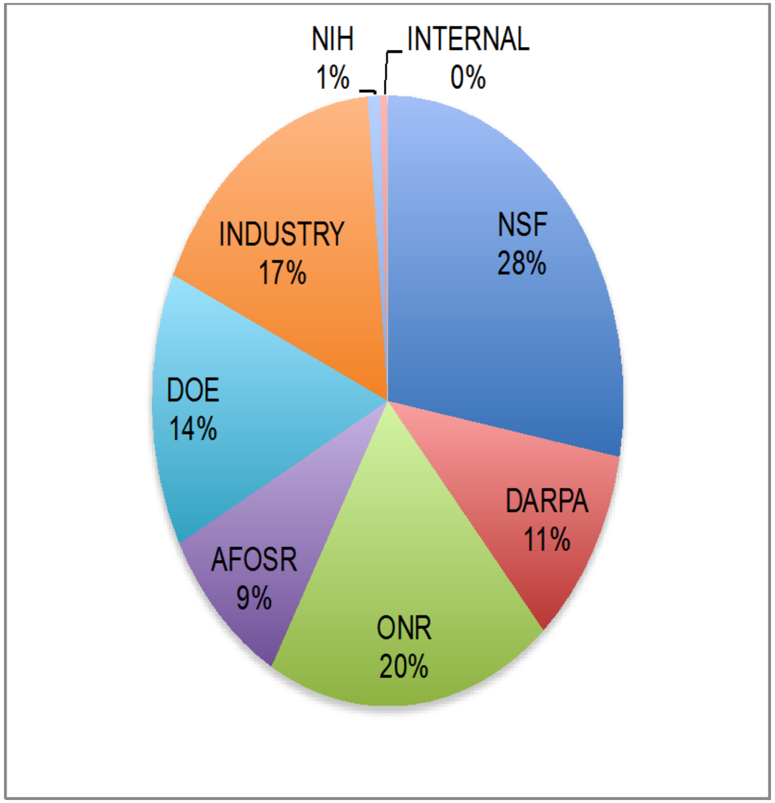
"I wouldn't have known the first thing about doing all of this," says Professor Hart. "The people from the Deshpande Center led me through."

By providing academics like Professor Hart a bridge to the business world, M.I.T. is in the vanguard of a movement involving a handful of universities nationwide that work closely with investors to ensure that promising ideas are nurtured and turned into successful start-ups.

At first glance, the centers look like academic versions of business incubators. But universities are getting involved now at a much earlier stage than incubators typically do. Rather than offering seed money to businesses that already have a product and a staff, as incubators usually do, the universities are harvesting great ideas and then trying to find investors and businesspeople interested in developing them further and exploring their commercial viability.

In the jargon of academia, the locations of such matchmaking are known as "proof-of-concept centers," and they're among a number of new approaches to commercializing university

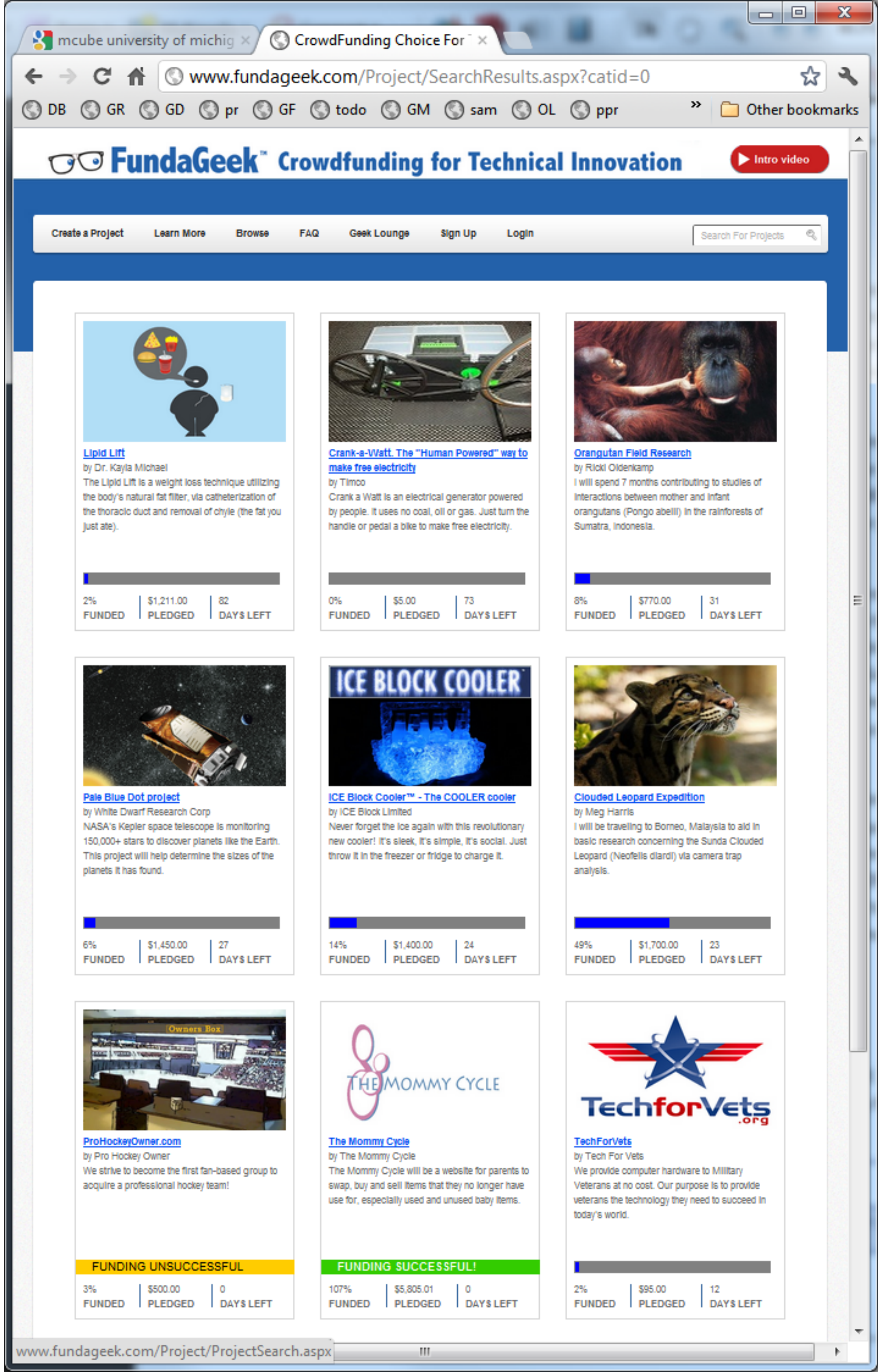
Funding distribution for my group



ME department

(from annual report)

	08–09	09–10	10–11
NIH	1,403,643	1,996,237	2,168,238
DoE	1,773,858	2,390,860	5,407,039
NSF	2,460,177	2,701,330	3,104,779
DoD	10,195,017	10,992,316	9,796,979
All Other	14,608,221	13,792,756	14,092,339
Total	**$30,440,916**	**$31,873,498**	**$34,569,374**


mcube university of michig
CrowdFunding Choice For
www.fundageek.com/Project/SearchResults.aspx?catid=0
DB GR GD pr GF todo GM sam OL ppr
Other bookmarks
FundaGeek Crowdfunding for Technical Innovation
Intro video
Create a Project
Learn More
Browse
FAQ
Geek Lounge
Sign Up
Login
Search For Projects
Lipid Lift
by Dr. Kayla Michael
The Lipid Lift is a weight loss technique utilizing the body's natural fat filter, via catheterization of the thoracic duct and removal of chyle (the fat you just ate).
2% FUNDED | $1,211.00 PLEDGED | 82 DAYS LEFT
Crank-a-Watt. The "Human Powered" way to make free electricity
by Timco
Crank a Watt is an electrical generator powered by people. It uses no coal, oil or gas. Just turn the handle or pedal a bike to make free electricity.
0% FUNDED | $5.00 PLEDGED | 73 DAYS LEFT
Orangutan Field Research
by Ricki Oldenkamp
I will spend 7 months contributing to studies of interactions between mother and infant orangutans (Pongo abelii) in the rainforests of Sumatra, Indonesia.
8% FUNDED | $770.00 PLEDGED | 31 DAYS LEFT
Pale Blue Dot project
by White Dwarf Research Corp
NASA's Kepler space telescope is monitoring 150,000+ stars to discover planets like the Earth. This project will help determine the sizes of the planets it has found.
6% FUNDED | $1,450.00 PLEDGED | 27 DAYS LEFT
ICE BLOCK COOLER
ICE Block Cooler™ - The COOLER cooler
by ICE Block Limited
Never forget the ice again with this revolutionary new cooler! It's sleek, it's simple, it's social. Just throw it in the freezer or fridge to charge it.
14% FUNDED | $1,400.00 PLEDGED | 24 DAYS LEFT
Clouded Leopard Expedition
by Meg Harris
I will be traveling to Borneo, Malaysia to aid in basic research concerning the Sunda Clouded Leopard (Neofelis diardi) via camera trap analysis.
49% FUNDED | $1,700.00 PLEDGED | 23 DAYS LEFT
Owners Box
ProHockeyOwner.com
by Pro Hockey Owner
We strive to become the first fan-based group to acquire a professional hockey team!
FUNDING UNSUCCESSFUL
3% FUNDED | $500.00 PLEDGED | 0 DAYS LEFT
THE MOMMY CYCLE
The Mommy Cycle
by The Mommy Cycle
The Mommy Cycle will be a website for parents to swap, buy and sell items that they no longer have use for, especially used and unused baby items.
FUNDING SUCCESSFUL!
107% FUNDED | $5,805.01 PLEDGED | 0 DAYS LEFT
TechforVets.org
TechForVets
by Tech For Vets
We provide computer hardware to Military Veterans at no cost. Our purpose is to provide veterans the technology they need to succeed in today's world.
2% FUNDED | $95.00 PLEDGED | 12 DAYS LEFT
www.fundageek.com/Project/ProjectSearch.aspx

New universities and partnership strategies

- Middle east: KAUST, KFUPM, Masdar
- Many in Asia (China especially, Singapore)
- Cornell's new NYC campus (+ big donation from duty free founder alum, partnership with Technion

Big plans. New York Mayor Michael Bloomberg (*left*) congratulates the presidents of Cornell and Technion on their winning proposal for an applied science campus in the city.

U.S. GRADUATE EDUCATION

Cornell's Plans for the Big Apple Rely on Quality, Cash, and Dreams

Now comes the hard part. After besting some of the world's top universities in a months-long competition and winning access to some of the choicest real estate on Earth, Cornell University and Technion-Israel Institute of Technology must actually build the applied research university that, they hope, will transform New York City into Silicon Valley East.

In December 2010, New York Mayor Michael Bloomberg offered land and $100 million in incentives to institutions willing to build a new graduate applied science and engineering school in the city. Seventeen groups of elite research universities—from the United States, India, South Korea, Canada, and Europe—submitted proposals, and Stanford University, with its roots in Silicon Valley, was widely touted as the favorite.

On 19 December, only 3 days after Stanford unexpectedly pulled out of the competition, Bloomberg chose Cornell and Technion's bid to build a 4.5-hectare campus on Roosevelt Island, between Manhattan and Queens. It certainly didn't hurt that Cornell pledged to invest $2.1 billion over 30 years in the project, nor that its president, David Skorton, demonstrated the university's fundraising prowess by announcing a $350 million gift from billionaire Charles Feeney only a few hours after Stanford bowed out.

The new campus, dubbed NYCTech, could support up to 280 faculty members and 2500 students by the 2040s, say Cornell officials. These students and researchers would focus on science, mathematics, and computer science with commercial applications that the city hopes will generate $23 billion in economic activity over 30 years, including $1.4 billion in taxes. Their presence would increase the number of graduate engineering students in New York City by 70%, according to the mayor's office.

Cornell has proposed creating a series of interdisciplinary hubs, says Daniel Huttenlocher, dean of Cornell's school of computing and information science, who helped craft the school's bid. The hubs will likely change each decade, he says. The initial trio will consist of "connective media," focused on providing new ways for people to interact socially; "healthier living," focused on providing technologies for day-to-day and preventative medicine; and the "built environment," focused on making our daily physical environment more energy-friendly or comfortable.

Huttenlocher says the hubs will have their roots in traditional academic departments, especially applied mathematics, computer science, operations research, information science, and electrical and computer engineering. Those choices play to Cornell's strengths, he says. The latest National Research Council rankings of U.S. graduate programs, drawn from data collected in 2006, list Cornell among the top five in applied math, the top 10 in computer science and in operations research, and the top 30 in electrical engineering. These rankings compare quite favorably with the city's current lineup of research universities (see graphic).

Opening a New York City satellite campus will also help Cornell attract students and faculty, says Steven Pedigo, director of research at Creative Class, a think tank that studies urban life. Cornell's hometown of Ithaca "is sort of isolated," he says, but New York City has amenities such as hip restaurants and art institutions that creative young people crave. Plus, Cornell officials say the university's medical school in Manhattan and the 50,000

CREDITS (LEFT TO RIGHT): COURTESY OF CORNELL UNIVERSITY; KRISTEN ARTZ/NEW YORK CITY MAYOR'S OFFICE

http://www.sciencemag.org/content/335/6064/26

Preparing to be a faculty candidate

- Your research should have both breadth and depth, and be a platform for future work (e.g., ideas for your own research program)
- Take an independent role in your research
- Get inside your advisor’s head: learn about the pressures and rewards of faculty life, help write proposals, etc.
- Publish, network, communicate; define your community and be active in it
- Get teaching and mentoring experience

Survival Analysis of Faculty Retention in Science and Engineering by Gender

Deborah Kaminski[1]* and Cheryl Geisler[2]

Individual assistant professors (a total of 2966 faculty) hired in science and engineering since 1990 at 14 United States universities were tracked from time of hire to time of departure by using publicly available catalogs and bulletins. Results of survival analysis showed that the chance that any given faculty member will be retained over time is less than 50%; the median time to departure is 10.9 years. Of all those who enter as assistant professors, 64.2% were promoted to associate professor at the same institution. Overall, men and women are retained and promoted at the same rate. In mathematics, however, faculty leave significantly earlier than other disciplines, and women leave significantly sooner than men, 4.45 years compared with 7.33 years.

U.S. universities are concerned about faculty retention in science and engineering (*1–4*). When a faculty member leaves prematurely, they suffer disruptions in teaching and mentoring as well as significant economic losses (*1*). Start-up costs in engineering and natural sciences can range from $110,000 to nearly $1.5 million (*3*), and it may take up to 10 years to recoup this investment (*4*).

Retention rates for faculty in the United States have been consistent. From 1971 through 1989, faculty members were retained at rates of 90 to 92% for associate and full professors and 84 to 86% for assistant professors (*5*). In 1996–1997 and 2001–2002, the retention rates for associate professors were again in the range of 90 to 92% (*6*).

Problems with the retention of women in science and engineering in the United States have been well documented. Like a leaky pipeline, each career stage in engineering and the natural sciences shows the retention of women lower than the stage before it (*3*, *7*). In particular, although women are increasingly represented among those with earned doctorates, they lag behind in representation in the academic faculties (*8*).

The problem appears to lie in differential application rates. Once women apply for or are in consideration for a career move, they are equally likely to succeed, but they are often not in the pool (*3*, *9–11*). Men have been found to be significantly more likely to receive tenure or move to positions outside of academia, whereas women are significantly more likely to be unemployed or to exit the tenure track for adjunct positions (*3*). Women with Ph.D.s in science, technology, engineering, and mathematics (STEM) disciplines have also been found to be less likely than men to be employed full time, although equally likely to succeed if they apply (*11*).

Women have also been shown to have greater intentions to leave the STEM disciplines (*12*), although not academia as a whole (*13*), and to leave for different reasons. Whereas salary is the number one reason for men, women cite more interpersonal and i
in tenure resulting
for women leavi
partment climate i
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Significant dis
retention of wom
In the disciplines

Fig. 1. Nonpara
survival curve for
who entered betwee
and 2002 by gende
interquartile range.

of growth in earned doctorates, the level of representation in the pool of Ph.D.s, and representation in the ranks of assistant professors all showed marked disciplinary differences between men and women (*8*). At research I universities in six of the nine fields included in this study, the mean percentage of those who applied, were interviewed for, and were made offers to was closer to the percentage of women in the relevant doctoral pool for electrical engineering, mathematics, and physics, where their representation was lowest, than in chemistry and biology, where their representation in the pool was highest (*11*).

Women's representation among earned doctorates is particularly high in the biological sciences (*8*). Between 1972 and 1991, representations of women in all levels of academics was highest for life sciences and lowest for engineering, with physical science in between (*9*). The probability of having a tenure-track position 10 years after Ph.D. is significantly smaller for women in the life sciences but about the same for those in physical and engineering sciences (*9*). In the biological and life sciences, where women are most heavily represented, they have an 8 to 9% less chance of getting a tenure-track job, getting tenure, or getting promoted to full professor (*9*). In terms of retention, one study reports that women and minority faculty have higher turnover in-

Fig. 1. Nonparametric survival curve for faculty who entered between 1990 and 2002 by gender. IQR, interquartile range.

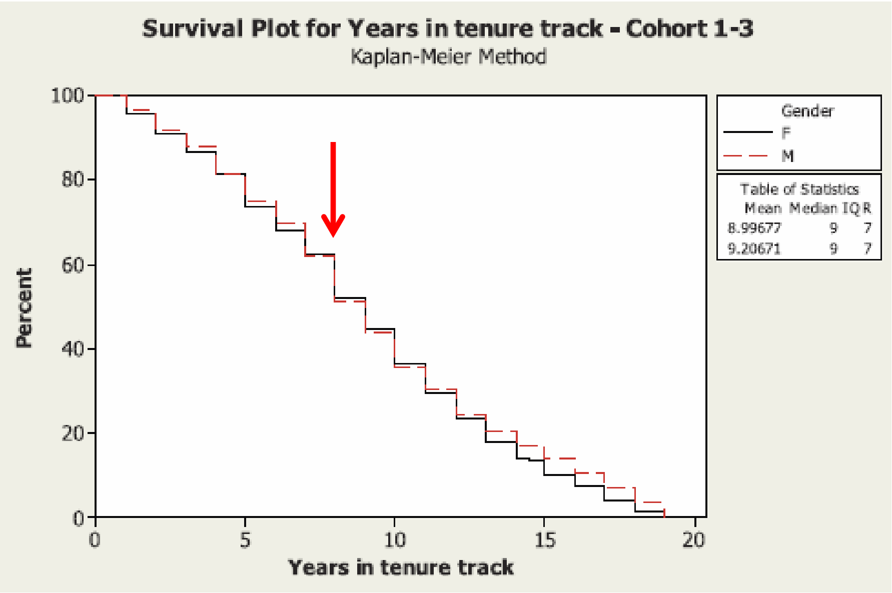

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Table 2. Median times to exit the tenure track by gender and discipline for cohorts 1 to 3. CIs are for medians.

Discipline	Median years men	Lower 95% CI	Upper 95% CI	Median years women	Lower 95% CI	Upper 95% CI	*P* log rank test	*P* Wilcoxon test
Elec Eng	12.92	10.51	15.88	10.68	6.49	17.59	0.641	0.576
Physics	11.14	9.00	13.79	9.41	6.61	13.40	0.118	0.739
Mech Eng	16.19	12.80	20.46	10.41	7.10	15.24	0.109	0.153
Chemistry	12.46	10.07	15.41	10.53	7.57	14.64	0.980	0.847
Math	7.33	6.20	8.68	4.45	3.34	5.93	0.0522	0.0083
Comp Sci	9.32	7.64	11.39	10.25	6.87	15.28	0.5156	0.548
Civil Eng	8.68	7.01	10.76	10.74	7.48	15.43	0.970	0.262
Biology	11.96	9.30	15.37	16.36	9.20	29.10	0.0664	0.197
Chem Eng	11.64	9.00	15.05	9.78	5.95	16.08	0.393	0.687