Gold in the ivory tower: equity rewards of outlicensing

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An analysis of life-science initial public offerings from three time periods reveals that the equity share received by universities and their academic researchers has changed over time.

Since the invention of recombinant DNA techniques, monoclonal antibodies and beyond, biotech companies have relied upon academic discoveries as the foundation of their technology value. University-biotech licensing agreements have become more complex over time, but typically include one or more of these economic elements: an upfront payment to secure the licensing rights or repay patent filing costs, annual license maintenance fees, milestone payments tied to the project reaching various stages en route to commercialization, and a royalty or sublicense percentage of sales that provides the university with a share of the revenues should a commercial product be generated from the licensed technology. We analyzed these economic elements of university-biotech licenses in an earlier publication, which included trend analyses and a comparison of economic benefits obtained by universities and their biotech licensees[1].

Over the past decade, more universities are taking equity as one element of their technology licensing arrangements, particularly in cases in which the technology is licensed to a startup or an early-stage company. The latest Association of University Technology Managers (AUTM) Licensing Survey shows US universities executed 1,433 agreements with equity over the past four years, or 8.6% of all licenses over the period. During the preceding four-year period (fiscal year 1996–1999), these universities signed 786 deals involving equity, or 6.7% of all licenses over the period[2].

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The object of our present study was to examine the financial significance of equity in university-biotech licenses, as seen through the lens of biotech initial public offerings (IPOs) across three discrete time periods. Relying on the extensive IPO disclosure requirements regarding material contracts, related party transactions and principal shareholders, we hoped to capture the portion of university-biotech agreements involving equity that were deemed to be material and disclosable. On the basis of these documents we were then able to evaluate the financial value of the university's equity stake (university equity) on the basis of the IPO pricing and as a function of the aggregate technology value (ATV; **Box 1**) of the group of companies going public in that period.

A careful inspection of the IPO filing documents revealed, however, that university faculty often receives additional equity quite independently from their share of university equity. Stock held by university faculty (faculty equity), as our analysis will highlight, is sometimes of a type or value that it is also disclosed in the IPO filing, and indeed is often much higher than university equity.

The case for equity

Whereas equity remains contentious in some institutions, it is an attractive element in university-biotech license negotiations for several reasons. First, by using equity in lieu of cash to secure the university license, the biotech firm can conserve its cash to focus on increasing the value of the underlying technology—by investing in people and experiments among other things. Second, the university has the potential for a liquidity event well before product royalty streams are realized. The probability of an IPO by a biotech firm is considerably higher than a product incorporating a licensed technology reaching the market.

In addition, if the licensed technology is fundamental to the formation of the biotech company (a 'startup'), issuance of equity may help align university incentives with those of investors, or at least increase the perception of such alignment as the biotech firm attempts to secure financing. For example, the AUTM Licensing Survey noted that in fiscal year 2003, 71.8% of licenses with equity were licenses to startup companies, though startups were only 12.9% of all licenses executed during the year.

Finally, when equity is negotiated as part of a university-biotech license, this element of financial consideration is typically shared (along with upfront payments, milestones and royalties), among various parties within the

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Box 1 Economic barometer

The following terms are commonly used in describing a company's economic position and dealings.

1. Equity share. The percentage of the total value of a company owned by a person or entity, as determined by the number (or value) of shares held relative to the total number (or value) of shares outstanding.
2. Market capitalization. The product of the share price multiplied by the total number of shares outstanding. For private companies, the post-money valuation is the market capitalization until the next financing. For public companies, market capitalization will vary as the share price fluctuates. The post-money valuation equals the market capitalization only in the event that the share price remains at the price of the financing.
3. Pre-money valuation. This value is calculated before a new round of financing and is the worth of the company as determined by the product of the share price at the new round multiplied by the total number of shares outstanding immediately prior to the new round of financing.
4. Post-money valuation. This value is calculated following a new round of financing and is the worth of the company as determined by the sum of the pre-money valuation plus the newly raised capital.
5. Step-ups in valuation. Defined as the difference between the pre-money valuation of a new financing and the post-money valuation of the last prior financing, calculated as a percentage of the last prior post-money valuation.

The Aggregate Technology Value is a term we have developed to express the value of a firm aside from its cumulative capital assets. It is determined by breaking down the overall value of a firm (at the time of IPO) into three component elements—the amount of capital raised during the IPO, the amount of capital raised during prior (private) financing rounds and finally the residual, which we call the 'aggregate technology value.' This is the value other than capital in the company and represents the value of the initial invention(s) together with all the technology 'value-added' that has been accomplished through investment in experimental data, clinical data, animal models and toxicity testing in addition to the implicit value of the management team, board and scientific advisory board to further exploit the potential of the technology.

university. Although the precise percentages vary, these parties include the inventors (faculty and students), the inventors' academic department(s), and the university itself.

Faculty equity includes shares held by academics that appear to have one or more roles within the biotech company, which we have classified as follows.

1. Founder. An academic who is identified in the IPO filing as having founded or cofounded the biotech company.

2. Academic manager. An individual who is identified in the IPO filing as having recently been an academic, but who left academia to join the biotech company as a full-time manager—typically the chief executive or chief scientific officer.

3. Inventor. An academic who is among the inventors of technology and/or compounds licensed to the biotech company, where such license is disclosed in the IPO filing.

4. Director. An academic who is identified in the IPO filing as being on the biotech company's board of directors.

5. Scientific advisory board (SAB) member. An academic who is identified in the IPO filing as being on the biotech company's scientific advisory board.

Recent biotech IPO windows

To analyze the extent of university equity and faculty equity in the context of biotech IPOs, we examined the IPO filing documents of those biotech firms who successfully completed an initial public offering public in one of the three most recent periods of concentrated biotech IPO activity (IPO windows)—namely 2003–2004, 2000–2001 and 1996–1997. These three IPO windows made for an interesting comparison because they represent quite distinctive groups of biotech companies that rely in varying degree on university ideas.

The most recent 2003–2004 IPO window includes mainly "specialty pharma"—biotech companies that had one or more drugs on the market or compounds in human clinical trials at the time of their IPO. Thus, although they might have been founded on the basis of academic inventions, by the time of IPO, these companies were focused largely on commercial and clinical activities— in some cases on molecules that had been brought into the company after the initial funding rounds and any early university licenses. By contrast, the biotech companies that went public in the 2000–2001 IPO window were predominantly 'technology platforms'—attempting to create value through the use of typically university-derived technology that could be applied across multiple therapeutic categories to develop new drug targets and/or lead compounds. Finally, the 1996–1997 IPO window can be characterized as a diverse group of biotech firms, including both technology platform companies (for example, Millennium, Cambridge, MA, USA; Myriad Genetics, Salt Lake City, UT, USA; and Affymetrix, Santa Clara, CA, USA) and specialty pharma (e.g., Aviron, Mountain View, CA, USA; Ilex Oncology, San Antonio, TX,

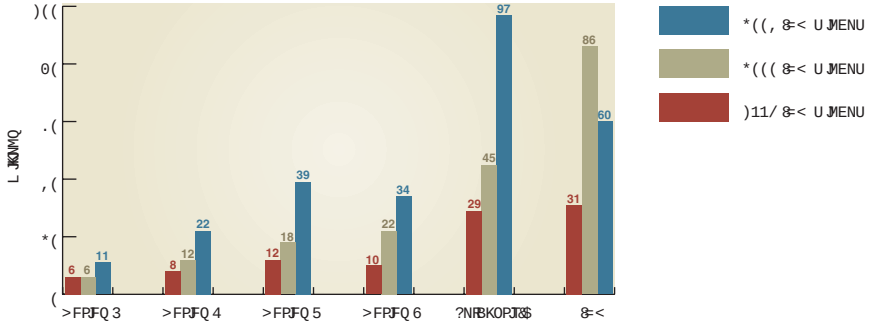

Figure 1 Capital invested in biotech companies. For each IPO period we have analyzed the average amount of capital invested in the biotech firms for each of the various rounds of funding up to and including the IPO funding. These data represent the funding for 34 firms in the 2003–2004 IPO window, 65 for the 2000–2001 window and 53 for the 1996–1997 IPO window.

*Average total capital raised in private rounds does not equal the sum of the series, since not all companies participated in all series.

USA; and Triangle Pharmaceuticals, Durham, NC, USA).

Initially, we examined the typical financing history of these successful biotech IPOs. For each of the three IPO windows, we looked at the amount of capital raised at each financing of the companies that went public in that IPO window, as well as in the IPO itself (**Fig. 1**). For example, in the most recent 2003–2004 IPO window, which started with the IPO of Acusphere in Watertown, Massachusetts, in October 2003 and which, for the purpose of our analysis, we 'close' in December 2004, 52 venture-backed biotech companies filed IPOs, of which 34 were completed. These companies raised an average of $97 million in venture funding over four rounds, plus an additional $60 million at the IPO (**Fig. 1**). This compares to the 2000–2001 IPO window, in which 65 venture-backed biotechs completed IPOs in the US from December 1999 through March 2001. These 65 biotechs raised on average $45 million in venture funding plus $86 million at the IPO. Finally, in the 1996–1997 IPO window, which ran from April 1996 to December 1997, 53 biotech firms completed IPOs. These biotechs raised an average of $29 million in venture funding and $31 million at the IPO itself.

Next we incorporated the average capital invested per round into a composite valuation model for each IPO window. We calculated the average step-ups in valuation from stage to stage for each private financing, as well as the market capitalization based on the share price of each company's IPO (**Fig. 2**). In the 2003–2004 IPO window, these 34 companies had a $257M average market capitalization post-IPO, with round-to-round step-ups ranging from –4% to 65%. This compares to the 2000–2001 IPO window, in which 65 biotechs had an average market capitalization of $365 million post-IPO, with round-to-round step-ups in valuation of 48% to 103%. Finally, in the 1996–1997 IPO window, 53 biotech firms had an average market capitalization of $114 million, with round-to-round step-ups in valuation of 14–71%.

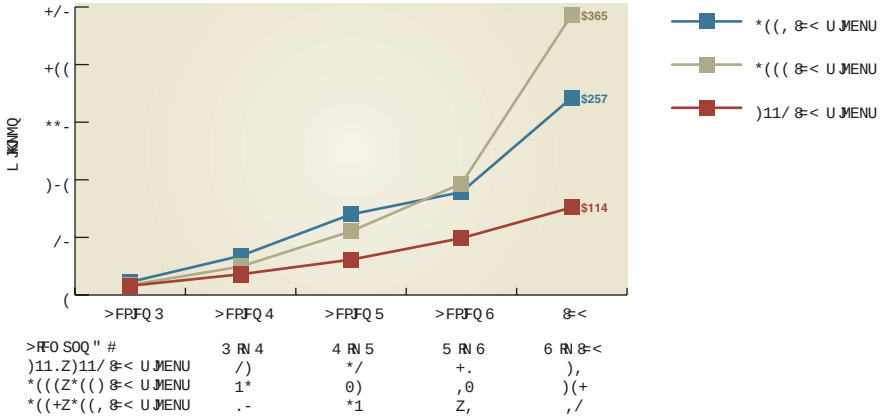

Figure 2 Valuation step-ups by investment round. This figure shows the average step-ups in valuation between financing rounds for firms in the three IPO windows. Step-ups were derived by taking the pre-money valuation of a new round of financing, subtracting from it the post-money valuation of the prior round, and then dividing the difference by the prior round's post-money valuation. For example, if a company had a post-money valuation of $10M after the first round and a $15 million pre-money valuation for its second round of financing, the step-up would be 50% (($15 million–10 million)/$10 million).

The increase in venture funding raised by each class reflects the rising cost of developing robust biotech firms that are attractive in the public markets, particularly the shift toward late-stage molecules as the IPO strategy in the 2004 window. Firms have also varied in their fortunes at the time of IPO, with the buoyant market in 2000 providing an environment in which firms could raise substantial IPO funding at high valuations compared to either 1997 or 2004.

Finally, we calculated the ATV of these companies at the time of the IPO. We did this by subtracting from the overall post-IPO market capitalization the amount of capital raised during the IPO, as well as the aggregate amount of capital raised during all prior financing rounds (**Box 1**). **Figure 3** shows the average ATV for each of the three biotech IPO windows—$100 million for the 2003–2004 IPO window, $234 million for the 2000–2001 IPO window and $54 million for the 1996–1997 IPO window. Conceptually, this is the net value, other than capital cumulatively invested in the company, that represents the current valuation of all contributed or acquired inventions and licenses, together with all other 'value added' that has been accomplished through investment in experimental data, animal models, toxicity testing and so forth, plus the implicit value of the management team and an assessment of the company's commercialization prospects.

In the analysis that follows, we will be looking at both the absolute dollar value of university equity and faculty equity, as well as their relative values as a function of the ATV for each group of companies in an IPO window. The use of ATV allows us to answer the question of what portion of an IPO window's aggregate noncash capitalization belongs to academic institutions and/or their faculty.

University equity holdings

We examined the IPO documentation for the equity holdings by academic institutions (university equity) to determine what dollar

Table 1 University equity in biotechs

	Class of 2004 (14/34) (# with equity/# total IPOs)		Class of 2000 (16/65)		Class of 1997 (16/53)	
	University dollar value (millions)	University percent of total IPO value	University dollar value (millions)	University percent of total IPO value	University dollar value (millions)	University percent of total IPO value
Total	$20	0.2%	$170	0.7%	$88	1.5%
Average	$1.4	0.7%	$10.6	3.4%	$5.5	4.6%
Median	$1.2	0.7%	$4.7	1.3%	$1.7	1.6%
University % of aggregate technology value		0.6%		1.1%		3.1%

This table is derived from the IPOs in which university equity holdings were disclosed, based on information from the IPO prospectuses. Using each company's IPO price, we calculated the aggregate market capitalization of each IPO Class, as well as the total, average and median values (and percentages) of university equity holdings in such companies. We also show the total university equity value as a percentage of the aggregate technology value of each IPO Class.

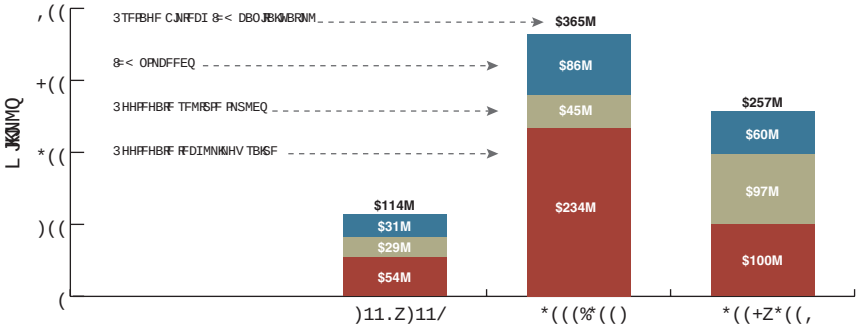

Figure 3 Aggregate technology value of biotech companies. For each Biotech IPO class, we calculated the overall composition of the average post-IPO valuation (the value of the company at the close of business on the day of the IPO, accounting for the potential run-up in value). This valuation has been broken down into three elements: the IPO proceeds (the number of shares sold on the day of the IPO at the issue price), the aggregate private rounds of investment and the ATV, which is the residual post-IPO valuation after all financial rounds have been accounted for (see **Box 1**).

value and share of the ATV each university owns at the time of IPO. We also identified whether one or more universities were responsible for a license to the company. Throughout our analysis we focused on the dollar value of the equity-holding based on the IPO closing price, as well as the percentage value of such equity holdings as a function of the aggregate and average IPO market capitalization (IPO value) and ATV for that IPO window.

The IPO prospectuses of the group of companies that completed IPOs by December 2004 ('Class of 2004'), showed 14 of 34 companies had university equity held by one or more academic institutions (41%). Including those instances in which more than one university held equity in a company and in which an institution held equity in more than one company, a total of 16 academic institutions were identified as holding university equity. In aggregate, this equity amounted to approximately $20 million of value, or 0.2% of the $8.7B in combined post-IPO market capitalization of the Class of 2004 (**Table 1**). The median institution held $1.2 million worth of equity, representing 0.7% of the average biotech post-IPO valuation. The largest holding was of the John Wayne Cancer Institute (Santa Monica, CA), with $3.4 million from the IPO of CancerVax (Carlsbad, CA). Four institutions held equity in more than one of the IPOs in this window—Massachusetts Institute of Technology (MIT, Cambridge, MA) (Momenta and Alnylam, both in Cambridge, MA), University of Texas, Austin, (Immunicon, Huntington Valley, PA, and Myogen, Westminster, CO), Stanford University (Palo Alto, CA), (Corcept, Menlo Park, CA and Corgentech, both in San Francisco) and Brigham & Women's Hospital (Boston) (Corgentech and CoTherix, both in San Francisco).

In terms of ATV, the aggregate technology value for the Class of 2004 was $3.4 billion ($100 million × 34 IPOs). Thus, the $20 million in university equity represented 0.6% of the group's ATV. These data are summarized in **Table 1**.

Because the group of biotechs that went public in the 2000–2001 IPO window ('Class of 2000'), were largely 'technology platforms,' we would expect more widespread academic institutional equity held in greater amounts as compared to the "specialty pharma" of the Class of 2004. Surprisingly only 25% of the Class of 2000 had university equity (16 of 65 IPOs); however the 15 academic institutions that held equity had a total post-IPO valuation of $170 million, or 0.7% of the $23.7 billion in combined post-IPO market capitalization of the Class of 2000. The median dollar value of academic equity holdings was also higher for the Class of 2000 at $4.7 million, but the median equity percentage remained low at about 1.3% (**Table 1**). Several universities dominated the equity holdings of the Class of 2000—with one particularly large holding of $75 million by the University of Florida, (Gainesville, FL), in Regeneration Technologies (Alachua, FL). With this exception, institutional holdings did not exceed University of Texas's holding of $9.6 million in Introgen (Austin, TX). Two institutions held equity in more than one IPO in this Window—Children's Hospital in Boston, MA (Keryx, New York, NY, and OraPharma, Warminster, PA) and the Scripps Research Institute in La Jolla, California (Applied Molecular Evolution, San Diego; Sangamo Biosciences, Richmond, CA).In terms of ATV, the aggregate technology value for the Class of 2000 was $15.2 billion ($234 million × 65 IPOs). Thus, the $170 million in university equity represented 1.1% of the group's ATV.

Finally, for the group of biotechs that went public in the 1996–1997 IPO window ('Class of 1997'), 16 out of 53 IPOs recorded university equity (30%). A total of 17 universities held combined equity positions worth $88 million at IPO, or 1.5% of the $6.0 billion in combined post-IPO market capitalization of the Class of 1997. The median value of the academic equity holdings was $1.7 million, with a median equity percentage of 1.6%. The highest university stake was $33.4 million, held by the Cancer Therapy and Research Foundation of South Texas (affiliated with the University of Texas) in Ilex Oncology (San Antonio, TX).

In terms of ATV, the aggregate technology value for the Class of 1997 was $2.9 billion ($54 million × 53 IPOs). Thus, the $88 million in university equity represented 3.1% of the group's ATV.

Overall, across our three IPO Windows, we observed the reported equity holdings of 152 biotech IPOs, of which 46 recorded university equity at the time of IPO (30%). These holdings were distributed across 37 academic institutions. Of the 37, three were non-US institutions. The academic institution that we most frequently observed as holding university equity in biotech IPOs was the University of Texas with four instances, followed by Stanford and Children's Hospital with three each, and then MIT, Johns Hopkins (Baltimore, Maryland), Cornell University (Ithaca, New York), Emory (Atlanta, Georgia), Virginia Commonwealth (Richmond, Virginia) and the European Molecular Biology Laboratory (EMBL, Heidelberg, Germany), each with two.

The concentration of these university equity holdings is interesting to note, given the much more widespread distribution of patenting and licensing in biotech across many academic institutions. Further, there has also been a marked decline in university equity holdings as a fraction of aggregate technology value (a feature that is at odds with the current debate over the strengthening grip of universities over their intellectual property and their stronger negotiating position with early-stage licensees) from over 3% in the 1997 IPO window to just 0.6% in the 2004 window. This could be reflective of the increased dilution of startup university equity holders as biotech firms need to raise more money and develop more technology before IPO, but may also be indicative of the declining bargaining power of universities.

Faculty equity holdings

Similarly, we examined the IPO documentation for the equity holdings by university faculty (faculty equity) to determine what dollar value and share of the ATV is owned by current or former academics at the time of

IPO. In addition, we identified whether each academic is a founder, an academic manager, an inventor, a director and/or a SAB member (as defined above). Again, throughout our analysis we focused on the dollar value of the equity holding based on the IPO closing price, as well as the percentage value of such equity holdings as a function of the ATV for that IPO window.

Notably, faculty held substantial equity in the biotech companies of the IPO Class of 2004; 50% (17) of the companies reported individual academics with current faculty positions as equity holders and, of these same 17 companies, 7 also had former academics as significant equity owners. For the Class of 2004, 25 current and former faculty members in aggregate held $291 million of value, or 3.3% of the combined post-IPO market capitalization of the Class of 2004. This represents a median faculty holding of $5.6 million, or 2.2% of the average biotech post-IPO valuation. Current (nonmanagement) faculty held $166 million (57%) of this value. Of these, nine were faculty members in departments of basic science or engineering, and ten had positions in academic medical centers, with some patient responsibility. In four instances, current university faculty held significant equity holdings while their university had no reported equity position in the company.

In terms of ATV, the $291 million in faculty equity represented 8.6% of the group's ATV. These data are summarized in **Table 2**.

For the Class of 2000, 38% (25) of the companies have faculty equity, with an aggregate holding of $754 million in value, or 3.2% of the combined post-IPO market capitalization of the Class of 2000. The median faculty equity holding was $8.7 million, or 2.4% of the average biotech's post-IPO valuation. Current faculty held $203 million, or 27%, of this value. In this "technology platform" IPO window, a larger number of the current faculty holding equity were drawn from basic science and engineering departments, as compared to the IPO Class of 2004. In terms of ATV, the $754 million in faculty equity represented 4.9% of the group's ATV.

Finally, faculty equity was held by 43 current and former faculty members in 28 of the 53 companies (53%) in the Class of 1997. These faculty members in aggregate held $140 million of value, or 2.3% of the combined post-IPO market capitalization of the Class of 1997. This represents a median faculty holding of $3.4 million, or 3.0% of the average biotech post-IPO valuation. Current faculty held $79 million (56%) of this value. In terms of ATV, the $140 million in faculty equity represented 4.9% of the group's ATV.

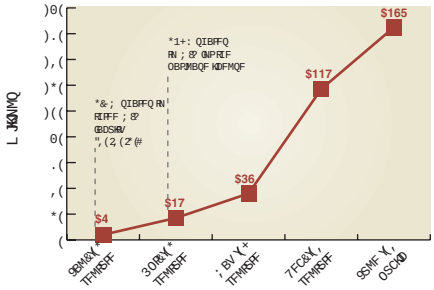

Figure 4 Momenta Pharmaceuticals valuation history.

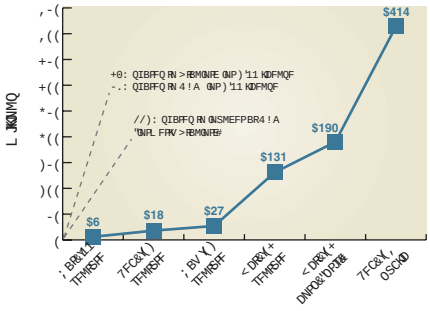

Figure 5 Corgentech valuation history.

Two case studies

Two case studies provide a useful illustrative understanding of the basic structure and distribution of equity holdings among the university and participating faculty. Momenta Pharmaceuticals, which provides a classic example of an 'MIT-style' spinout, was founded in 2001 to build on research from the laboratories of Ram Sasisekharan and Bob Langer in deciphering the structures of complex sugars and manipulating them to improve existing therapies and discover new ones. Between its founding in June 2001 and the June 2004 IPO, Momenta received venture backing totaling $44 million including a first venture financing round (series A) of $1 million in January 2002 rapidly followed by a $4 million round in April 2002. Additional rounds of funding followed in 2003 and 2004 at $19 million and $20.5 million. The three academic founders received 2.5 million shares in Momenta, split 40:40:20, with the larger proportions given to the two faculty founders who remained professors—Langer and Sasisekharan (a former Langer student now an Associate Professor at MIT)—both of whom continue to serve on Momenta's scientific advisory board and board of directors, and the remaining shares to Ganesh Venkataraman, also a former Langer student, who left his position as a research associate in MIT's Biological Engineering division after seven years to join Momenta as vice president, technology. Collectively, these founders' shares were worth $16.7 million at the time of Momenta's IPO.

Momenta received a license from MIT in December 2001 for patents covering heparinase technology. In connection with this license, MIT received a 5% equity interest in Momenta. As of the company's June 2004 IPO, MIT held 293,000 shares worth $1.9 million as one element of its license agreement with Momenta (**Fig. 4**).

In contrast, Corgentech has several ongoing relationships with a number of academic institutions. Founded in 1999, Corgentech focused on the discovery, development and commercialization of a new class of therapeutics called transcription factor decoys, which treat human diseases by regulating gene expression. The founders included two scientists who pioneered the company's core tech-

Table 2 Faculty equity in biotechs

	Class of 2004 (17/34) (# with equity/# total IPOs)		Class of 2000 (25/65)		Class of 1997 (28/53)	
	Dollar value (millions)	Faculty percent of total IPO	Dollar value (millions)	Faculty percent of total IPO	Dollar value (millions)	Faculty percent of total IPO
Total	$291	3.3%	$754	3.2%	$140	2.3%
Average	$17.1	6.6%	$30.2	8.3%	$5.0	4.4%
Median	$5.6	2.2%	$8.7	2.4%	$3.4	3.0 %
Faculty % of aggregate technology value		8.6%		4.9%		4.9%

As with **Table 1**, we examined the extent and value of faculty equity holdings in IPOs based on the closing value of the IPO. We also calculated the value of this equity based on the aggregate technology value of the IPOs.

nology and early clinical investigations: Victor J. Dzau, M.D., currently President and CEO of the Duke University Health System and Michael J. Mann, M.D., Assistant Professor of Surgery in the Division of Cardiothoracic Surgery at the University of California, San Francisco Medical Center. At the time of founding, Dzau was the director of research and chairman of the Department of Medicine of The Brigham and Women's Hospital (BWH), but he had previously been on the faculty at Stanford. Michael Mann had carried out much of the original research upon which the company was based while a student in the Dzau laboratory. Dzau received 771,000 shares as a founder of the Corgentech, a member of the Board of Directors and Chair of the SAB (on a vesting schedule—meaning that the shares are earned over a period years as an individual continues his or her services to the company, with any unearned shares lost if the services were to be stopped) worth $11.7 million at the close of the company's IPO.

Corgentech licensed the technology for transcription factor decoys from Stanford and the BWH in January 1999. In connection with these licenses, each institution received a 3% equity interest in Corgentech, in addition to a series of upfront, milestone, sublicense sharing and royalty payments. The equity held by Stanford and the BGH was worth $1.5 million at the time of Corgentech's IPO. The company paid each of Stanford and BWH an upfront license fee of $50,000. Through December 31, 2003, the company has paid each of Stanford and BWH $1,622,500 in license maintenance fees, milestone payments and sublicense sharing payments in connection with Corgentech's October 2003 agreement with Bristol-Myers Squibb (BMS) for the commercialization of the transcription factor E2F. In addition, the company agreed to pay each of Stanford and BWH an additional $150,000 in the event that the US Food and Drug Administration approved the E2F decoy (plus undisclosed royalties).

Corgentech raised $116 million through five venture financings before going public in February 2004 (**Fig. 5**). At the time of the initial financing, in February 1999, the results of a phase 2 trial initiated in 1997 showed that Corgentech's E2F Decoy was safe and feasible in the treatment of peripheral bypass grafts. Soon after, a phase 2b 200-patient clinical trial investigating the use of Corgentech's E2F decoy in the prevention of graft failures in coronary artery bypass grafts (CABG) was initiated. The trial was carried out at The Heart Center in Siegburg, Germany and also analyzed by Stanford University School of Medicine Core Cardiology Laboratory. The failure of phase 3 trials of E2F to prevent vein graft failure after CABG was announced on March 30, 2005 over a year after the IPO, after a joint trial with Corgentech and BMS on 3,014 patients conducted in collaboration with the Society of Thoracic Surgeons and Duke Clinical Research Institute.

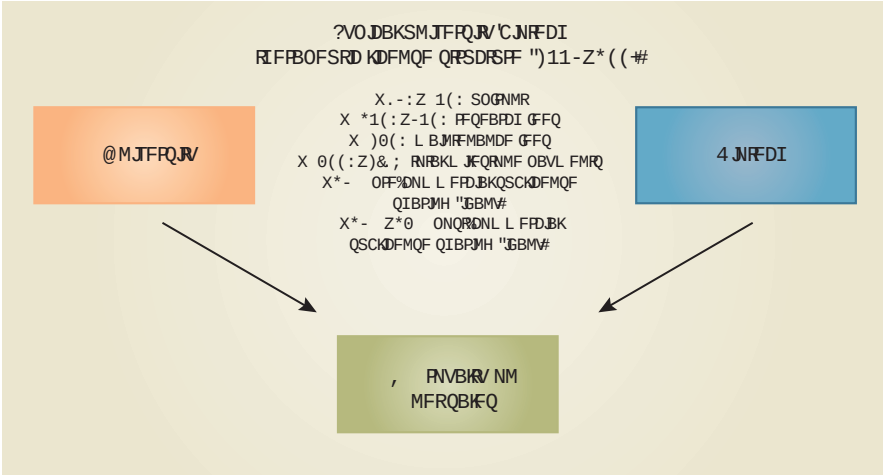

Figure 6 Typical university-biotech license terms. This figure illustrates the typical structure of a university license to a biotech startup based on data from 1995 to 2003 for therapeutic deals (that is, those that include the use of a technology for a particular therapeutic market rather than diagnostic technologies and so forth). The terms include a royalty element, upfront fees, research fees, maintenance fees and a share of any subsequent sublicensing.

Impact of university equity on returns from licensing

For universities, equity represents just one element of a licensing agreement that may be structured between the university and a biotech company. As noted above, equity can be an important element of the license, as it provides the university with some significant upside potential for firms that are constrained in their ability to pay large upfront fees or early milestone payments.

Figure 6 (taken from our earlier publication) shows typical terms for university-biotech licenses signed between 1995 and 2003[1]. Total university licensing payments over a five-year period averaged $245,000 to $270,000, not counting milestone payments or any research fees. If all milestone payments were received and full credit was given for research fees, typical university payments then ranged from $1.3 million to $2.5 million absent any contribution from university equity. By comparison, university equity had a median value of $1.2 million, $4.7 million and $1.7 million for each of the three IPO windows, respectively. Of course, not all university startups will result in a potential liquidity event such as an IPO. One might generalize from the data we have collected that university equity will be roughly 1% of a biotech's post-IPO market capitalization with a value of $2.5 million (depending on market conditions). If one then assumes that one in five venture-backed biotech firms is likely to achieve an IPO (according to the Biotechnology Industry Organization, Washington, D.C., there are approximately 1,450 biotech firms of which over 300 are publicly held, suggesting that as a high estimate, one in five venture-backed biotech startups ultimately achieves an IPO)

Table 3 Comparison of university versus faculty values (ATVs)

	Number of IPOs	Number of IPOs with university equity (%)	Total value of university equity (millions) (% ATV)	Number of IPOs with faculty equity (%)	Total value of faculty equity (millions)
Class of 2004	34	14 (41%)	$20 (0.6%)	17 (50%)	$291 (8.6%)
Class of 2000	65	16 (25%)	$170 (1.1%)	25 (38%)	$754 (4.9%)
Class of 1997	53	16 (30%)	$88 (3.1%)	28 (53%)	$140 (4.9%)

or equivalent liquidity event via a merger or acquisition, then university equity might be thought to have an expected value of $500,000 ($2.5 million / 5). On this basis, therefore, the addition of equity to a university license might well double the expected return from a successful venture ($2.5 million in nonequity and $2.5 million in equity) and similarly double the 'expected' value at the start which might amount to about $500,000 (about $2.5 million / 5 in nonequity-related payments and $2.5 million / 5 in equity payments). Furthermore, this provides a useful benchmark for universities and medical schools in the event that conflict-of-interest requirements prevent them from taking equity.

University versus faculty

If we look at the composition of academic equity across the three IPO windows (**Table 3**), both in terms of number, dollar value and percentage of ATV, we find that in each IPO window there were more firms with faculty equity than with university equity. More startling is the change in relative ownership of aggregate technology value (ATV): whereas in the IPO Class of 1997 the ratio of university to faculty ATV was roughly 1:1.6 (3.1%:4.9%), this grew to a 1:4.5 gap for the Class of 2000, and then exploded to greater than 1:14 for the Class of 2004. In dollar terms, for the IPO Class of 2004, academics (current and former) received $291 million in share value at IPO, versus $20 million received by their university employers. This highlights the dramatic shift in equity holdings (for successful startups) between individual faculty stars and their institutions. It also underscores the growing perception of highly successful faculty as 'star scientists' who themselves are increasingly able to capture a growing fraction of the scientific or commercial value they create, wherever their laboratories are.

The equity of equity

When university startups reach the public markets and have a successful IPO, individual faculty members clearly own a greater equity stake in these companies than their institutions, even though the core technology upon which the companies were founded may have been generated in laboratories supported by substantial institutional infrastructure (and typically a variety of public funds). In a few cases, individual faculty members have made over $10 million at an IPO. Is this division of equity equitable? On the one hand, founding faculty have typically generated the underlying technology in their laboratories, with students they have trained, building on grants received after time-consuming and highly competitive grant writing. For some, at least, their equity stake has accrued as the technology value has grown through multiple rounds of financings and associated step-ups—through SAB service, serving on the board of directors and a vesting schedule designed by investors to maintain the involvement of these important individuals. On the other hand, faculty are not sports stars—they are not free agents, but rather members of the faculty of major institutions whose facilities and reputation contribute to attracting the best students and building a department of intellectually stimulating colleagues.

Perhaps of greater concern is the fact that when a successful IPO does take place, an individual faculty member becomes wealthy to a degree that is substantially distinctive to their colleagues. The concern that this creates a dual society on campus of the 'haves' and 'have nots' has been of concern since the start of the biotech revolution[3]. Policy makers and scholars have worried whether the potential for such substantial financial rewards has a distorting effect on the community of scholars. This effect is difficult to untangle not least because those faculty who engage in building life-science startups (both the successful and unsuccessful) are typically among the most scientifically productive and eminent in the university. There is some evidence, however, that among these faculty entrepreneurs in the life sciences, some faculty are under-represented, particularly female faculty members (Ding, W., Murray, F. & Stuart, T. "An Empirical Study of Gender Differences in Patenting among Academic Life Scientists" working paper, 2006). Furthermore the impact of startup involvement on scientific competition, the behavior of academic scientists and the diffusion of publicly funded science to a wide audience has yet to be fully unraveled.

1. Edwards, M., Murray, F. & Yu, R. *Nat. Biotechnol.* **21**, 618–624 (2003).
2. AUTM licensing survey, fiscal year 2003 (The Association of University Technology Managers, Inc., Northbrook, Illinois, 2000).
3. Kenney, M. *Biotechnology: The University Industrial Complex*. (Yale University Press, New Haven, Connecticut, 1986).