

# BIOTECHNOLOGY ENTREPRENEURSHIP

*From Science to Solutions*

Michael L. Salgaller, PhD



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## CHAPTER 7

# Licensing and Technology Transfer

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### ABSTRACT

Over the past several decades, research conducted at university and federal laboratories has become more recognized as a potent resource for new and established companies. Such research is providing a wide range of benefits—ranging from inventions that are the basis of many new and improved products to access to human capital in terms of students, graduates, and faculty with specialized technical knowledge. Frequently, these new inventions and specialized technical knowledge can be combined with business and capital resources to be the basis of new, paradigm-shifting companies. In any case, the early developmental stage of innovations from these research programs—along with their institutional goals of providing access to the technology by the general public—make these research programs natural allies for bioentrepreneurs seeking new partners and technologies for early developmental stage com-

panies.

## INTRODUCTION TO U.S. BIOMEDICAL RESEARCH

For many years, the United States led the world in government support for non-military research and development (R&D), especially support for work that directly relates to health and human development. A focal point for such investments in biomedical research has been the National Institutes of Health (NIH), along with other federal laboratories and university-based research programs. Base funding (excluding economic stimulus funding) provided by the NIH alone reached \$30.6 billion in fiscal year 2009 with approximately 10% of this funding spent on internal NIH R&D projects (intramural research) utilizing the work of about 6,000 scientists. The balance was used to support the work of 325,000 non-government scientists (extramural research) at 3,000 various colleges, universities and research organizations—such as Georgetown University—throughout the world.<sup>1</sup> Each year, this biomedical research leads to a large variety of novel basic and clinical research discoveries—all of which generally require commercial partners in order to develop them into products for hospital, physician or patient use. Thus, federal laboratories and universities need and actively seek corporate partners or licensees to commercialize its funded research into products in order to help fulfill their fundamental missions in healthcare, medical education and training.

## WHY UNIVERSITIES AND FEDERAL LABS NEED BIOENTREPRENEURS

Licensing and technology transfer programs at non-profit basic research organizations provide a means for getting new inventions to the market for public use and benefit. From a research institution's perspective, this is quite desirable since with this public and commercial use of inventions would typically come with new recognition of the value of basic research programs at the university or organization that originated it. These inventions also serve as a helpful means to attract new R&D resources and partnerships to the laboratory.

Thus, through licensing or other technology transfer means there is also a “return on investment,” whether that is measured in terms of financial, educational or societal parameters, or some combination thereof.

Because a substantial portion of the inventions that occur at basic research programs arise from research that is federally funded, there are also substantial legal requirements to promote commercial development of such new inventions. The Bayh-Dole Act of 1980 (P.L. 96-517) allows such grantees and contractors to seek patent protection on subject inventions made using federal funds, and to license those inventions with the goal of promoting their utilization, commercialization, and public availability. In 1986, federal laboratories were also given a statutory mandate under the Federal Technology Transfer Act (P.L. 99-502) and Executive Order 12591 to ensure that new technologies developed in federal laboratories were transferred to the private sector and commercialized.

Commercialization of inventions from non-profit basic research institutions typically follows a multi-step process, as academic and federal laboratories usually do not provide technology commercialization themselves. Technology commercialization is not a mission of such entities, and the resulting lack of necessary resources equates to much of the entrepreneurship in business arenas both within and outside of the life sciences. To begin the progression of a technology beyond the research institution, a contractual agreement (typically a license) is provided to give permission to use patents, materials, or assets to bring a product concept to market. Financial consideration or other benefits are received by the research institution in exchange through what is often an agreement with a small company who will bring in a large corporate partner later in development.

Since the 1980s, many federal labs and universities have developed a strategic focus for their technology transfer activities and are particularly interested in working with bioentrepreneurs. This is because revenue enhancement from licensing is no longer the sole institutional goal. Instead, these institutions find themselves also looking to increase new company formation based upon academic inventiveness, supporting faculty recruitment and retention, enhancing research funding, creating an entrepreneurial culture, at-

tracting venture investment to their regions, and the like. The economic development aspects of research are being recognized as a fourth mission for such institutions—going along with education, research and public service. It is with this “fourth mission” that bioentrepreneurs can play a key role in establishing or working with companies driven by new research discoveries. At the most enterprising and forward-thinking institutions, accomplishments factoring into the tenure process have expanded to include patents, industry board positions, and commercial activities (within ethical boundaries, of course). No longer are published papers, grant funding, and the number of mentored students the sole or predominant contributors to tenure decisions. Not surprisingly, when scientists and medical researchers are incentivized in entrepreneurial ways, entrepreneurship and company formation is fostered. Regions where such thinking is encouraged and supported are more often than not biotechnology hubs—Boston, San Francisco, etc.

## SOURCES AND CHARACTERISTICS OF TRANSFERABLE TECHNOLOGY

Generally, bioentrepreneurs can directly access research and inventions for product development from three main sources. For research funded by grants and contracts from NIH or other federal agencies (extramural research), the individual university or small business grantees themselves would control commercial rights—with only standard obligations such as reporting and utilization obligations to the federal funding agency. This incentivized approach, which dates from the Bayh-Dole Act of 1980, has been attributed to the annual formation of nearly two new products and more than one new company each day, created through university technology transfer.<sup>2</sup> Biomedical research conducted directly by the federal laboratory (intramural research) is licensed directly through the affiliate technology transfer office.

Each of these institutions owns a robust research program “pipeline” that provides novel, fundamental research discoveries available for commercial applications. NIH, for instance, as both a large-scale provider and consumer, represents a sort of “supermarket” of re-



search products and tools for its commercial partners and suppliers. Additionally, overall product sales of all types by NIH licensees exceed \$5 billion annually. As previously mentioned, most technology transfer activities at NIH and other federal laboratories date from the Federal Technology Transfer Act of 1986. This legislation authorized formal research partnerships with industry. Also, it provided incentives to these programs to license technology by allowing the federal laboratory, for the first time, to keep its license royalties and share them between the individual inventors and their laboratories or institutes.

Research collaborations or assistance by federal laboratories and universities can take several forms. Perhaps the most common is the exchange of research materials through Material Transfer Agreements (MTAs). Recent efforts by the NIH have facilitated the rapid exchanges of such materials to and from NIH funded research programs using Simple Letter Agreements under the published NIH Research Tool Guidelines. Joint research projects are particularly important for bioentrepreneurs for basic research or clinical studies, called Cooperative Research and Development Agreements (CRADAs; at federal laboratories) or Sponsored Research Agreements (at universities) that grant desired license options to new discoveries. Because of their clinical hospitals and centers, as well as other networks and facilities, the NIH and at least some universities are able to take some of their medical discoveries (or those of their partners) into clinical trials through Clinical Trial Agreements. Basic research assistance may also be available to bioentrepreneurs through specialized services such as drug discovery, drug candidate compound screening, or testing services, offered by several programs or scientific training and exchange programs for individual investigators.

## CHANGING LICENSING PRACTICES FAVOR STARTUPS AND SMALL BIOTECHNOLOGY FIRMS

The licensing practices for most non-profit research institutions—including federal institutions and universities—have changed significantly over recent years with respect to biomedical inventions.<sup>3</sup> With their ever-increasing consolidation, large pharmaceutical firms

are typically no longer looking to directly license early-stage technologies for commercialization, and the number of licenses signed with startups as well as small to medium-sized biotechnology companies is on the rise. Unlike 10-15 years ago, when all or most of the high revenue medical products based on licenses from university or federal laboratory research came from large pharmaceutical firms, a majority of the latest success stories tend to be from biotech or other non-pharma companies. Some examples from the NIH licensing program are Kepivance® from Amgen, Velcade® from Millennium, Synagis® from Medimmune, and Taxus Express® from Angiotech. Although these are now all substantive, well-known companies, at the time the underlying technology was licensed to them they were not. The new reality is that commercial partners, especially small, innovative ones, are essential to the goals of biomedical research institutions seeing the results of their research become novel health-care products for the public. Another reason that university licensing offices prefer licenses to a start-up company is because, unlike big companies, survival of the start-up company is dependent upon the development of the technology. Though they may have multiple products under development, most early-stage companies live or die based upon their lead program—for it is that lead program that investors are betting on. Start-up companies are highly motivated to successfully and expeditiously commercialize the licensed technology and expend all their resources toward its development. Most often, this option is better than licensing the technology to a big pharma or biotech company, where several technologies are being developed concomitantly. As a result, it is more likely that the university or federal research institution's technology may get scuttled (“put on the shelf”) or de-emphasized if the risk profile becomes too high relative to other programs. However, the biggest challenge in licensing the technology to a start-up company is its chronically tenuous financial position; i.e., whether or not it can secure future capital to develop the technology in a timely fashion. Therefore, it is important that bioentrepreneurs have the drive and talent to do the right thing in the right way at the right time.

## BASIC LICENSING PRINCIPLES FOR UNIVERSITY AND FEDERAL LABORATORIES

Compared to biomedical licensing from corporations, the federal laboratories and universities have a different focus and perspective when negotiating technology transfer agreements. Because these agreements are used to further overall institutional missions, representatives from such non-profit institutions consider the public consequences of such licenses as their first priority—not the financial terms that may be involved.

For example, compared with their peers in industry, non-profit institutions have the mandate to make technology as broadly available as possible. Thus, a strong preference exists to limit to the scope of a particular license to that needed to develop specific products. Exclusive licenses are quite typical for biomedical products such as vaccines and other medical therapeutics—where the underlying technologies require substantial private risk and investment (and a prior public notice and comment period in the Federal Register, in the case of federal laboratories). In their agreements, federal laboratories and universities also typically expect to retain the right to permit further research use of the technology to be conducted either in the intramural program, in universities, or in companies. Because the commercial rights granted represent institutional (and often public) assets, these agreements have enforceable performance benchmarks to ensure that the public will eventually receive the benefit (through commercialized products) of the research. Regulations governing the license negotiation of federally-owned technologies and their mandated requirements are described in more detail at 37 Code of Federal Regulations (CFR), Part 404, while those for federally-funded technologies can be found at 37 CFR, Part 401.

### TYPES OF LICENSE AGREEMENTS

Universities and federal research institutions negotiate a variety of different types of license agreements for use and development of biomedical technologies. Besides offering exclusive and non-exclusive commercialization agreements for patented technologies, commer-

cialization agreements are negotiated for unpatented biological materials. As a result of an increasingly selective patent strategy, both types of institutions do not try to patent technologies (e.g., research materials or research methodologies) easily transferred for commercial use by biological material license agreements or publication. For patent rights or materials that are not to be sold as commercial products—but useful in internal R&D programs—both federal research institutions and universities typically negotiate non-exclusive, internal-use license agreements. Additionally, companies may obtain evaluation agreements to new technologies as well as specialized agreements relating to interference or other patent dispute settlements. Finally, for bioentrepreneurs interested in a technology that was jointly invented by two or more institutions, an inter-institutional patent/licensing management agreement would be negotiated. As a result, the bioentrepreneur would be able to obtain an exclusive license by dealing with only one party.

## ROYALTIES AND ROYALTY NEGOTIATIONS IN LICENSE AGREEMENTS

Royalty rate negotiations with these institutions are influenced by factors commonly encountered in other negotiations of early-stage biomedical technologies (Table 1). Beyond these, there are negotiating factors unique to federal laboratories and universities, relating to the public health interest regarding the technology being licensed and the products to be developed from it (so-called “white knight clauses”). Examples of this may include: 1) supply back of materials for clinical use, 2) indigent patient access programs in the U.S., 3) commercial benefit sharing for natural product source countries, or 4) incentives for developing world access to the licensed products.

The royalty payments themselves consist of license payments received for execution royalties, minimum annual royalties (received regardless of the amount of product sales), earned royalties (a percentage of product sales), benchmark royalties, and payments for patent costs (Table 2). To date, due to conflict of interest concerns, the NIH has not sought equity payments in licenses or directly participated in company start-ups. Instead of equity, the NIH

**Table 1:** Factors influencing royalty rate negotiations with research Institutions

- Stage of development
- Type of product
- Market value of product
- Uniqueness of biological materials
- Scope of patent coverage
- Research institution “content”
- Public health significance

**Table 2:** Typical types of royalties in licenses agreements with research institutions

- Execution royalty
- Minimum annual royalty (regardless of the amount of net sales)
- Earned royalties (fixed % of net sales)
- Benchmark royalties
- Patent costs
- Equity (varies by institution)

can consider equity-like benchmark royalties that track commercial events at the company. However, many universities do take equity payments in their license agreements as a way to assist a new start-up company—despite the risk inherent in accepting equity in lieu of cash payments. The risk is considerable because such equity is illiquid, and has no present value at the time license is executed.

For several reasons, licensing institutions will often opt to take an equity or equity-like position when available from their licensees. For example, equity would provide for additional revenue in addition to the licensing royalties, especially if the licensed product failed in development but the company itself nevertheless becomes successful. Equity also can be seen as a risk premium for the research institution that provides additional inducement to grant the license to a new startup company verses a more established firm. Importantly (and perhaps most important for bioentrepreneurs), equity allows an licensee who is cash-poor but equity-rich to substitute an ownership position for a cash payment (in full or in part) for an upfront licensing fee and/or a reduced royalty rate. Finally, universities accept this risk to support their mission to assist in commercialization of early-stage technologies which may not be turned into mar-

ketable products otherwise, as well as encourage small business development. However, universities recognize that holding ownership rights in a start-up company creates potential conflict of interest, and so adopt various internal policies that mitigate and/or manage such conflicts.

Unlike their corporate counterparts, inventors at non-profit research institutions do receive a share of the royalties received from the licensing of their inventions. However each institution might have a slightly different revenue-sharing policy with respect to the percentage of licensing revenues provided to inventors. It is not surprising that those institutions offering inventors more lucrative terms are generally more active in licensing and commercialization. More recently, those institutions incentivizing their researchers—*e.g.*, by having patents or patent applications factor in the tenure process—are also vibrant players in the world of bioentrepreneurs.

## CHARACTERISTICS OF TYPICAL LICENSE AGREEMENTS

When licensing from a research institution, it is generally considered good business practices for the organization to standardize license terms to the greatest extent possible. Standardizing non-financial license terms levels the playing field for licensees—an important concept for public institutions—and creates a common understanding of the balance of risks acceptable to a research institution (which may differ markedly from the for-profit sector).

Given this drive for standardization, what might be some of the typical license agreements that a bioentrepreneur would come across in dealings with a non-profit research institution? Typically, federal research institutions and many universities have the types of license agreements shown in Table 3, and described below:<sup>4</sup>

**Commercial evaluation license agreements** are a short-term, non-exclusive license agreement allowing a licensee to conduct feasibility testing—but not sale of products developed from that technology. These typically run no longer than a few months, have a modest cost associated with them and include relevant materials that are supplied by inventor(s). Screening use is not permitted but the agreement has proven to be ideal for feasibility testing of new technologies

**Table 3:** Important types of license agreements involving research institutions

- Commercial evaluation / option license agreement
- Internal commercial use license agreement
- Research products commercialization license agreement
- Vaccine, diagnostic, therapeutic, or medical device product commercialization license agreement
- Inter-institutional agreements

that have a wide-variety of possible useful (but unproven) applications. Screening use implies use of the licensed material in the discovery or development of final end product. For example, a reporter cell that expresses a tumor target can be tested to screen drug candidates that could potentially be effective breast cancer therapeutics. Some universities may also use this type of agreement as a short-term exclusive option agreement for a nascent technology with the hope that a long-term diagnostic, vaccine or therapeutic product commercialization license agreement will later be completed.

**Internal commercial use license agreements** are another non-exclusive license agreement to allow a licensee to use (but not sell) technology in its internal programs. Here materials (either patented or unpatented) are provided, but screening uses are permitted. The financial structure of this agreement can be either a paid-up term license or annual royalty payments each, however, without any “reach through” royalty obligations to other products being used or discovered by the licensee. A paid-up term license would be a license in which the company makes one-time lump sum payment to obtain the rights to use the licensed technology for the duration of the license. On the other hand, “reach through” royalty provisions in a license agreement create royalties to the licensor on the future sales of downstream products that are discovered or developed through the use of licensed technology, even though the final end product may not contain the licensed technology. In other words, reach through royalties are royalties that are due to a licensor even though manufacture, use, sale of the final product does not infringe any patents claiming the licensed technology. Internal commercial use agreements themselves historically have been very popular with larger biomedical firms who are eager to acquire reagents to speed their

internal development programs. Popular research products licensed in this manner include animal models and receptors.

**Research products commercialization license agreements** are also non-exclusive, but permit sales by the licensee to the research products market. Once more, materials (either patented or unpatented) are generally provided, with smaller firms predominating as licensees. For federal laboratories, U.S. manufacturing is required even for non-exclusive product sales in the U.S.—unless a waiver is granted. Such waivers are granted on the basis of lack of manufacturing capacity in the U.S. or economic hardship for the licensee. On the positive side, the financial structure of these licenses generally involves low upfront royalties. On the negative side, there are relatively high earned royalty payments since the materials provided are frequently close or very close to the finished product that is to be sold. Popular research products licensed in this manner include a wide variety of monoclonal/polyclonal antibodies or other research materials in basic studies.

**Vaccine, diagnostic, therapeutic, or medical device product commercialization license agreements** can be exclusive if such is necessary for product development. The exclusivity option is provided due to the capital and risk involved for the licensee. It is important for bioentrepreneurs to be aware that, by law, “small, capable” biomedical firms receive preference from federal laboratories and federally-funded universities as exclusive licensees. At NIH and other federal laboratories, all prospective grantees of exclusive licenses (identifying the licensee and technology by name) are published in the Federal Register for public comment or objections. A detailed development plan with product benchmarks or milestones is expected for licenses in this area. Collaborative research with federal laboratories regarding further pre-clinical or clinical development of the technology is encouraged—but not required—to obtain a license, and is negotiated separately by the individual laboratory. Moreover, these agreements have a requirement for U.S. manufacturing for U.S. product sales, unless a waiver is granted. The federal laboratory can typically grant waivers only when U.S. manufacturing sites are unavailable or manufacturing in the U.S. is economically unfeasible.

The financial structure of these licenses can involve substan-



tial upfront royalties. However, they present much more moderate earned royalties and benchmark payments than those costing the entrepreneur less at the onset, since the technology is typically not as close to a completed, commercialized product. Other provisions to be negotiated include: 1) a share amount of sublicensing proceeds, 2) any of the public health “white knight” provisions described earlier, 3) licensee performance monitoring, and 4) audit requirements.

**Inter-institutional agreements** are often useful for exclusive licensing, as many commercializable technologies will often have inventors from more than one university or federal laboratory due to the collaborative nature of science. If a bioentrepreneur is seeking to obtain an exclusive commercialization license to increase investment interest and decrease risk, it is important to obtain the rights from all of the institutions involved—especially for U.S. patent rights—as all owners have the ability to license separately. Often, the joint owners of a single technology will pool their rights with a single party for patent and licensing purposes through an inter-institutional agreement. Such agreements provide significant convenience and time-saving for bioentrepreneurs, as negotiations with only a single party are necessary to provide the sought-after exclusive license.

## ADVANTAGES OF WORKING WITH FEDERAL LABORATORIES AND UNIVERSITIES

Within these basic licensing structures, there are several advantages bioentrepreneurs can utilize in their product development efforts. Federal laboratories and universities offer favorable treatment to small businesses, and can create an attractive playing field for moving into new areas of product development.

For example, startups can utilize the expertise of the patent law firm hired by the institution to manage the prosecution of licensed technology. This is particularly useful for small firms that may not yet have internal patent counsel or the resources to retain a top—and thus usually expensive—intellectual property (IP) law firm.

Another useful distinction of license agreements with federal laboratories and universities—in contrast with corporate license agreements—is that they do not require bioentrepreneurs to cross-

license existing rights they may own, give up any product marketing rights, nor forsake any downstream developmental rights. Also, research tool licenses negotiated through the NIH and many universities carry no grant-back or reach-through rights. For instance, when a research tool technology is licensed to a company by NIH, the licensee is not required to grant back any usage rights to the improvements that it may develop subsequent to the license agreement. Also, the licensee is not required to share with NIH any future profits that may be made as a result of improvements to the original discovery. In other words, IP derived from new discoveries made with NIH-licensed tools will remain clear and unencumbered.

Another advantage for a bioentrepreneur to license a technology from a non-profit institution is the flexibility in the financial terms. For example, reimbursement of back patent expenses, which the licensee typically pays upon the signing of the license agreement, could be deferred for a certain period of time. Similarly, the license deal could be structured to be heavily back-end loaded and/or equity-based, allowing the bioentrepreneur to apply its cash toward R&D. Unlike many research institutions that take equity in lieu of cash, federal institutions and some universities do not consider equity-based license deals. However, federal laboratories do consider taking equity-like benchmark payments via license deals. This lack of dilution may become an important feature as the bioentrepreneur looks to raise capital through each round of financing.

A bioentrepreneur could also take advantage of the capabilities and technical expertise residing in the licensor's laboratories by collaboration and/or sponsorship of the research needed to expedite the development the technology. While sponsoring research at the inventor's laboratory may raise conflict of interest issues, many institutions are willing to develop a conflict management plan with the engaged parties to help the start up exploit all the resources offered by the licensor. Nonetheless, many research institutions require execution of an agreement, separate from a license agreement, to formalize this arrangement.

## ADDITIONAL CHARACTERISTICS OF AGREEMENTS WITH STARTUPS

Start-ups have the potential to produce significant opportunities for inventors, investors, research institutions, and regional economies. Still, such projects involve more work and are riskier than a traditional license to an existing, well-capitalized company. Although research conducted at federal laboratories and universities is not specifically designed to lead to new company formation, such activities are a way for such institutions to support the economic development aspects of their licensing and technology transfer programs. Successful start-up companies and bioentrepreneurs are highly prized because of the direct benefits to the community, region, state, and country in terms of new employment and tax revenue. Because of this, some research institutions have in-house business development staff dedicated to working with inventors as they consider startup opportunities for their technology. However, many institutions handle entrepreneurial activities of their researchers as part of the regular activities of the technology transfer office. Specialized staff members at the research institution are ideal contact points at institutions for bioentrepreneurs interested in company formation from a spin-out technology. They should be able to provide general assistance provide assistance in a number of activities including:

- Business planning
- Market analysis
- Identification of venture financing or other investments
- Regulatory planning
- Management
- Recruiting
- Miscellaneous business formation activities

A typical protocol for a research institution licensing to a start-up company is to first confirm that there is no other prior claim of rights from a commercial sponsor. Then, execute a letter of intent or other indication of interest, followed quickly with an option agree-

ment to a future exclusive license. If the bioentrepreneur already has substantial resources in place, it may be possible to grant the license directly, in place of an option, when it is merited. Whatever the nature of the agreement, it is generally expected that the negotiation be with an officer of the new venture (or their attorney) rather than with a faculty member who may hope to be involved in the company. Agreements also would contain clear timelines to enforce diligent development of the technology toward commercialization. Deadlines are particularly critical for raising pre-determined levels of initial funding to establish and operate the venture. To avoid conflict of interest problems at the research institution, the new company would operate separately from the faculty inventor's lab—with local incubator or business park space being common options. Further, most research institutions would not allow their faculty inventors to serve as officers for the company without a leave of absence—but would allow these companies to collaborate and/or sponsor ongoing research in the laboratories of inventors subject to conflict of interest review and approval. Generally, a federal laboratory inventor is not able to have an active role in the company without leaving federal employment. The equity shares held by the research institution in these circumstances can vary by type of technology.

The actual equity share held by the research institution is often not that critical. The overall goal for the university or federal laboratory is to develop a robust local or regional corporate research community that closely complements and interacts with ongoing research at the institution. In addition, it is a way to support university or former federal faculty members who themselves are entrepreneurial and willing to commit their time and, often, their own money, to bringing their inventions to the marketplace.

## ASSISTANCE PROGRAMS FROM UNIVERSITY AND FEDERAL LABS FOR STARTUPS AND BIOENTREPRENEURS

At a basic level, the success of a new biotechnology venture depends on five key ingredients: 1) technical expertise, 2) intellectual property assets, 3) business expertise, 4) physical space, and 5) money.<sup>5</sup> Institutional scientists or faculty entrepreneurs can provide the

needed technical expertise (especially if students or post-docs can be hired by the new venture), and the research institutions themselves can license key patent rights to the company. But business expertise, space, and money are often more difficult to come by. Research institutions often try to bridge this gap by providing more than just IP licensing and technical expertise.

To address such needs, many research institutions have set up subsidiary organizations or utilize other academic departments at the university to help provide these types of dedicated services. Such services are often beyond the traditional scope and function of research and research administration at these institutions. For example, many university technology transfer offices also provide business and legal assistance to the start-up by collaborating with business and law schools at the university. Depending on the level of assistance needed and on the specifics of a particular program, the company can provide compensation for such assistance to the university through founder's equity. This equity is held by the university and transferred to business and finance office or investment office at the university which manages such equity until liquidation. In some instances, the assistance can go beyond that offered by in-house university business and law departments. One example is Spinner Technologies, Inc. created by the University of Virginia Patent Foundation in 2000. Spinner provides early-stage business expertise to faculty entrepreneurs and helps them find business partners to provide that expertise over the long run. Spinner also has a limited amount of wet lab space that it leases to faculty startups.<sup>6</sup> Other major universities such as the University of Utah, Columbia University, University of California at San Diego, and others, have been active in setting up such assistance programs, often in conjunction with university research parks, entrepreneurship centers or other affiliated facilities.<sup>7</sup>

Not surprisingly, obtaining seed-stage funding continues to be a significant problem for bioentrepreneurs—whether working with a faculty start-up or other early-stage company. To address this, groups at research institutions look to form a member-managed angel investment group—typically with a regional or alumni-based membership. The concept is for a group of individual angel investors

to contribute to a pooled fund. Subsequently, they work together to evaluate companies affiliated in some manner with research institutions, deciding where and how much to invest. Many larger universities have, or are considering, such programs in conjunction with their technology transfer and university development offices. Some more established programs can be found at University of Florida, Marquette University, George Washington University, Illinois Institute of Technology, and others.<sup>8</sup> It is difficult to predict how well this model will work over time. Still, it is considered a potential means to fund early stage companies commercializing technologies licensed from university and federal labs, prior to their maturing into projects appropriate for investment. This method of support can work in concert with traditional federal funding sources, such as SBIR (Small Business Innovation Research) programs, STTR (Small Business Technology Transfer Research) programs,<sup>9</sup> and various state grants and loan programs

## VALUE OF TECHNOLOGY TRANSFER AND LICENSING FROM UNIVERSITIES AND FEDERAL LABORATORIES

With their leading edge research programs and focus in the health-care market, federal laboratory and university-based research have an exemplary record in providing opportunities for bioentrepreneurs developing high growth companies and high growth medical products. Indeed, a preliminary study from 2007 showed that more than 100 drug and vaccine products approved by the U.S. FDA were based, at least in part, on technologies directly licensed from university and federal laboratories—with nearly 20% provided by federal labs (*e.g.*, NIH).<sup>10</sup> A subsequent study from 2009 showed that: 1) university-licensed products commercialized by industry created more than 279,000 jobs across the U.S. during a 12-year period, and 2) there was an increasing share of the U.S. gross domestic product each year attributable to university-licensed products.<sup>11</sup> This is an indication that the licensing of university and, by extension, federal laboratories, will have an increasingly effective and important impact well into the future.

This commercial success has been a model in demonstrating the

value of technology transfer from federal laboratories, universities, and similar non-profit research institutions, but it is far from the entire story. The final tally must include the full societal value and economic impact of life-saving or enhancing therapeutics, vaccines, devices, diagnostics, and other biomedical products on the market originating from this research. This societal benefit is believed to be the truest measure of the value and importance of licensing and technology transfer from research institutions.

**Case Study:** Licensing of HPV vaccine technology by NIH and Georgetown University

Human papillomavirus (HPV) vaccine is a vaccine that prevents infection with certain species of human papillomavirus associated with the development of cervical cancer, genital warts, and some less common cancers. Although most women infected with genital HPV will not have complications from the virus, worldwide there are an estimated 470,000 new cases of cervical cancer that result in 233,000 deaths per year. About eighty percent of deaths from cervical cancer occur in poor countries.

The research that led to the development of the vaccine began in the 1980s by groups primarily at the University of Rochester, Georgetown University, the German Cancer Center (DKFZ) and the NIH. Medimmune, Inc., then a very small development stage vaccine company based in Gaithersburg, Maryland, licensed the HPV vaccine technology available from all four institutions in the early 1990s. This work, and the work of others, eventually became the basis of Gardasil® (sold by Merck) and Cervarix® (sold by GSK)—blockbuster products in terms of public health and market impacts.

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8. See also conferences and webinars on this topic organized by the National Center for Entrepreneurial Technology Transfer (NCET2) at [www.ncet2.org](http://www.ncet2.org)
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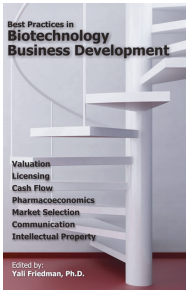


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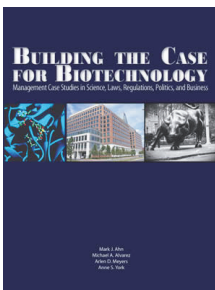
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