

Drexel University

Research Development Report

Reporting Period:

July 1, 2010 - June 30, 2011

Commercial Development of Research

Drexel's Entrepreneurship & Technology Commercialization Office commercializes Drexel intellectual property. The key strategies include 1.) licensing technology to start-up or existing companies, 2.) assisting faculty and other inventors with start-up companies which included mentoring and sharing the dynamics and critical success factors for starting a new company, and 3.) developing relationships with early stage venture capital organizations and with industry to explore mutual opportunities.

Drexel's Entrepreneurship & Technology Commercialization Office actively sought to establish relationships that result in the adoption of Drexel technologies by commercial partners to bring inventions to the marketplace. The overall goal of Technology Commercialization was to set in motion an interactive process that aims to provide significant benefits to the inventors, the university, the business community and the general public.

At Drexel, commercialization activities are university wide, driven by the philosophy that research and the "research enterprise" are integral and essential enhancements to the education that the university provides. Start-up companies provide exciting opportunities for the faculty. This allows bringing discoveries from laboratories to the market. It provides relevant industry experience to the faculty. It also represents a potential for significant economic reward to faculty, university and shareholders. In addition, it creates business and employment opportunities for the local community. However, these are high risk ventures; about one in ten will be successful. These ventures are challenging to finance especially in the last three years. Most investors would not be interested in funding a new venture without professional management. Often complex negotiations are required between different institutions with very diverse expectations and needs. In addition, there are real and perceived individual and institutional conflicts of interest which must be managed effectively.

Research shows that the majority of funding for taking research from laboratory to market comes from three funding sources: corporations, federal government and angel investors. We focused on these organizations for our commercial activities.

In FY 2010-11 the following were the basis for Drexel's plan to cultivate commercial development of research:

- Worked with industry leaders, venture capitalists and university researchers to create new product ideas for commercial development.

- Determined and improved the commercial viability and success potential for new inventions.
- Fostered a team spirit among industry, university researchers and research administration to formulate strategies for success in the commercial marketplace and the medical community.
- Encouraged the development of an environment for creativity, innovation and entrepreneurship.
- Incentivized the research community through shared rewards with business and industry.
- Helped the University, through its technological prowess, to participate in economic development for the well-being of the community, the region and the nation by increased business competitiveness in a global marketplace.

Key strategies were:

- Promoted relationships with industry to foster translation from the academic setting to the commercial sector and to facilitate local economic development.
- Licensed technology to start-up or existing companies.
- Assisted faculty and other inventors to establish start-up companies which included mentoring and sharing the dynamics and critical success factors for starting a new company.
- Developed relationships with early stage venture capital organizations and with industry to explore mutual opportunities.

Drexel's portfolio of patents covers broad technology areas; 35% Health Sciences and Biomedical Engineering, 25% Chemistry and Materials, 15% IT/Electrical and 25% Mechanical Engineering and other Engineering disciplines.

During the period July 1, 2010 through June 30, 2011, Drexel University submitted a total of 100 invention/discovery disclosures.

In today's fast-paced, competitive global markets, with unprecedented opportunities, productive and creative collaborations between the business sector and Drexel University are essential for sustained growth and technological development. At the same time, current economic conditions are making early stage funding of start-ups challenging. Given those realities Drexel University has launched 2 new start-up companies featuring Drexel technology: QLIDA Diagnostics and LifeSplice Pharma, LLC.

Research Licensing Agreements

Drexel University and Drexel University College of Medicine continue to use the research licensing agreements developed by the Research Office. The listed forms and Sample Agreements are available on the Technology Commercialization page on Drexel's website.

IDF

- [Invention Disclosure Form](#) (IDF) [Fillable WordDoc]

- [Instructions for IDF](#)
- [Software Disclosure Form](#)

NDA/CDA

- [Mutual Non-Disclosure - Drexel](#) [Fillable Word Doc]
- [Mutual Non-Disclosure Agreement - DUCOM](#) * [Fillable Word Doc]

MTA

- [Materials Transfer Agreement - Drexel](#) [Fillable Word Doc]
- [Materials Transfer Agreement - DUCOM](#) [Fillable Word Doc]
- [Materials Transfer Agreement \(receiving materials\) - Drexel](#) [Fillable Word Doc]
- [Materials Transfer Agreement \(receiving materials\) - DUCOM](#)

SRA

- [Sponsored Research Agreement - Drexel](#) [Fillable Word Doc]
- [Sponsored Research Agreement - DUCOM](#) [Fillable Word Doc]

Training Students and Health Professionals

Drexel University now claims a leadership role in creating technological solutions to solve societal problems in the 21st Century. This bold statement reflects not only the accomplishments of our faculty and leadership during the recent past, but more importantly, their collective vision going forward. Research is an integral part of Drexel's educational philosophy. Drexel is committed to "use-inspired" research and is poised to respond to novel opportunities for research, scholarship and technological development. The synergies provided by bringing the health sciences of medicine, nursing and public health together with the technological prowess of the engineering units have yielded dramatic successes in translating the questions of clinical care and epidemiology into new answers for our community. Drexel University College of Medicine (DUCOM) is the largest private medical school in the country, with an enrollment of more than 1,000 medical students and 200 in the biomedical graduate student program. Our research training programs span traditional disciplines in Biochemistry, Biology, Molecular Biology and Genetics, Microbiology and Immunology, Neuroscience, Pathology, Pharmacology and Physiology, Biomedical Engineering, Mechanical Engineering, Chemical Engineering, Materials Engineering, & Electrical Engineering and Physics, as well as unique, recently developed programs in Molecular Medicine, Neuroengineering and Physical Cell Biology. Combined, these programs take full advantage of Drexel's strengths in engineering, medicine and biology and are complimented by affiliations with research laboratories. Such a diverse and prolific research environment serves as an exciting backdrop for a multitude of opportunities in undergraduate, and graduate education and research training.

The *Professional Studies in the Health Sciences Program*, with an enrollment of over 650 students offers a variety of Programs that help better position students and professionals for

careers in the health sciences. *Premed Programs* include: Interdepartmental Medical Sciences, Interdisciplinary Health Sciences, Master of Biological Science, Medical Science Preparatory, Drexel Pathway to Medical School, and Evening Post-Baccalaureate Pre-Medical. These programs are structured to prepare students for entry into medical, dental, podiatric, veterinary and other health professional schools, as well as advanced degree programs. *Clinical research programs* include Clinical Research Organization and Management, Certificate Studies in Clinical Research, Clinical Research for Health Professionals. These programs expand the knowledge of standards and management of benchtop research, with a special focus on drug development. *Forensics programs* (Master of Forensic Science and Master of Criminalistic Science) train students in the real-world application of forensic science. *Laboratory technician programs* (Master of Pathologists' Assistant and Master of Histotechnology) train individuals to work alongside pathologists. This may include careers in the allied health sciences, clinical laboratory science, tissue diagnosis and structure.

The Drexel College of Medicine offered several summer research opportunities

Drexel University College of Medicine's Minority Summer Research Training Program provided underrepresented minorities with an opportunity to enhance their understanding of health-related sciences at a nationally recognized, Doctoral/Research - Intensive nonprofit institution. The program's primary objective is to identify and engage underrepresented minorities in the health and research professions through a ten-week summer fellowship at Drexel University. The ten-week research experience is conducted in an academic/research environment consisting of mentors, professional role models, postdoctoral fellows, and high school, undergraduate and graduate students.

Research interns are mentored by Drexel faculty, who work in various disciplines including, but not limited to: Biochemistry, Molecular and Cell Biology and Genetics, Neuroscience, Microbiology and Immunology, Pathobiology, Pharmacology and Physiology, Surgery and Biomedical Engineering. Drexel faculty and members of their laboratory guide students through the planning and practice of daily research experiments and activities. Each student is assigned to work in a specific laboratory for the duration of the program. Under the direction of the laboratory supervisor, the student works on a unique project related to the research goals of that particular laboratory. Students are integrated into the daily laboratory routine, participating in laboratory meetings and gaining exposure to many different facets of the research process.

Summer Undergraduate Research Fellowships (SURF) for undergraduate students interested in a career in biomedical research provide them with an opportunity to greatly enhance their analytical and technical scientific research skills, while earning a stipend to support their participation. Research interns are mentored by Drexel Med faculty, who work in various disciplines including biochemistry, molecular and cell biology, neuroscience, microbiology, immunology, pathobiology, pharmacology and physiology.

Drexel Med faculty and members of their laboratories guide students through the planning and practice of daily research experiments and activities. Each student is assigned to work in a specific laboratory for the duration of the program. SURF students typically work on a unique project related to the research goals of that particular laboratory. Students are integrated into the

daily work of the laboratory, participating in laboratory meetings and gaining exposure to different facets of the laboratory's research. Mentors help students apply their current knowledge and skills and assist them in making the connection between laboratory experiences and their academic studies. Successful applicants are matched with a participating faculty member according to their research interests.

At the end of the summer, students gave a specific, conference-styled presentation describing their research project to an audience of Drexel Med faculty and graduate/medical students. The students met periodically with their mentors to prepare and review the content of their oral presentations. In addition, the students returned on October 15, 2010 to present their research at Discovery 2010, the annual day of research at Drexel Med.

Summer Research Internships (HSSRI) for students from area high schools with an interest in biomedical research provided an opportunity for students to enhance their understanding of current biological/biomedical principles and cultivate their analytical/technical skills in a research environment.

Research interns were mentored by Drexel Med faculty, who work in various disciplines, including biochemistry, molecular and cell biology, neuroscience, microbiology, immunology, pathobiology, pharmacology and physiology. Drexel Med faculty and members of their laboratory guided students through the planning and practice of daily research experiments and activities. Each student was assigned to work in a specific laboratory for the duration of the program. Interns typically worked on a unique project related to the research goals of that particular laboratory. Interns were integrated into the daily work of the laboratory, participating in laboratory meetings and gaining exposure to different facets of the laboratory's research. Mentors helped students apply their current knowledge and skills and assisted them in making the connection between laboratory experiences and their academic studies.

Medical Student Summer Research Program at Drexel University College of Medicine offered ten Summer Research Fellowships for first year medical students. The purpose of this program is to identify opportunities for first year medical students to engage in full time research under the direction of a member of the faculty. Students worked on their projects during the summer. Fellowship recipients were required to submit a summary report of their research experience at the conclusion of the research project and presented their work at the College of Medicine's annual day of research, Discovery Day, held on October 15, 2010.

Drexel Research Experience in Advanced Materials supported undergraduates to work with Drexel faculty members in nanomaterials, biomaterials, and the design and processing of advanced materials. *SENSORS: From Design to Implementation* is a ten-week research program on sensors from science to application for undergraduate students. *Materials Camp*, a weeklong academic camp that features highly interactive, lab-based activity tailored to individual student interest is tailored to high school students in their junior and senior years. The *Summer Engineering Experience at Drexel (SEED)*, gave high school students an opportunity to gain hands-on experience and knowledge about the world of engineering.

Integrative Graduate Education and Research Training (IGERT) Fellowships in Nanoscale

Science and Engineering: The Two-University/One Campus Approach. Dr. Yury Gogotsi (Materials Science & Engineering - MSE) serves as the PI along with co-PIs Drs. Jonathan Spanier (MSE) and Mun Young Choi (Mechanical Engineering & Mechanics - MEM) and Dawn Bonnell and Alan T. Johnson from the University of Pennsylvania (Penn). This grant funds six PhD traineeships at Drexel and Penn each per year. This grant continued an ongoing successful educational collaboration between Drexel and Penn. The IGERT program helps to attract high-quality graduate students to Drexel's College of Engineering.

Drs. Antonios Zavaliangos (PI), Associate Department Head and Professor in the Department of MSE, Surya Kalidindi (Co-PI), Department Head and Professor of MSE, and David Fullwood, Research Professor of MSE, received a Graduate Assistance in Areas of National Need (GAANN) award from the Department of Education. GAANN provided need-based fellowships to PhD students who received exceptional training in research and education in the field of computation. This program is open to students in Mechanical Engineering, Chemical Engineering, Materials Engineering, & Electrical Engineering.

The Drexel Center for Biotechnology and Virology Research (DIBVIR) located in Doylestown, PA shares space and resources with the Hepatitis B Foundation (HBF) and Research Institute in the Pennsylvania Biotechnology Center. Faculty, staff and students of Drexel University carry out biomedical research in a mission-oriented environment. Coursework at DIBVIR was offered in conjunction with the Masters and PhD programs in the Department of Microbiology and Immunology of Drexel University College of Medicine. Courses included Molecular Virology, Experimental Therapeutics, Emerging Infectious Diseases, and Laboratory Techniques in Molecular Biology. Summer research opportunities for undergraduates at DIBVIR were available through a partnership with the HBF, in addition to training fellowships for recent graduates. Teaching and educational programs were offered in the form of courses, workshops and colloquia that expanded the educational opportunities for the biomedical workforce in the northern suburbs of Philadelphia.

Two formal research training programs were offered at the Drexel University College of Medicine: 1) 4th year program in research Association of American Medical Colleges (AAMC) platform: Training of medical students in clinical research; 2) Fundamentals of Medical Research: Training of residents, fellows and faculty in research.

Commercial Research Development Training

Drexel's Office of Technology Commercialization trained faculty and students on a departmental and individual basis. The office also has an internship program in the Office of Technology Commercialization.

In addition, the Drexel University's Laurence A. Baiada Center for Entrepreneurship (LeBow College of Business) bridges education and entrepreneurship by linking research, coursework, experiential learning, and entrepreneurial thinking with practical guidance for budding entrepreneurs. The Center's mission underscored by a deep interdisciplinary nature to develop entrepreneurial leaders and foster the creation of successful technology ventures within the Drexel community distinguishes it as one of the nation's leading entrepreneurship programs.

The Center focused on Entrepreneurship in Action, offered Mentoring Programs, Business Incubation, Student Clubs, and unique opportunities that advanced entrepreneurs, such as New Ventures Projects Online. Students from every academic discipline were encouraged to participate through interactive workshops, entrepreneurial courses, and an annual Business Plan Competition and Entrepreneur Conference. The Baiada Center hosted competitions that provided a process for students to turn great ideas into great businesses. Competitions encourage students to form interdisciplinary teams, to take ideas from the concept phase, through a feasibility study/market analysis to a full business plan, and to build a new venture. These competitions were designed for students across all schools at Drexel, and welcome the participation of students not enrolled in the entrepreneurial or business curriculum. Student teams received extensive feedback and received written comments from several judges. The competitions included the following and were open to current Drexel students: *Global Entrepreneurship Week Pitch Competition*; *Business Concept Paper Competition*; *Business Plan Competition*; and *Baiada Business Incubator Competition* (Opened to current Drexel students and alumni).

Seminars in Entrepreneurial Excellence

Baiada Center's Breakfast Series is Philadelphia's first and only entrepreneurial forum for regional development initiatives that links companies, investors and research institutions with the Drexel community. Panel discussions and guest speakers provide thought leadership in best practices of entrepreneurship for both budding and experienced entrepreneurs. Whether discussing the impact of youth experiences on entrepreneurial success or engaging in a mock buy/sell negotiation, panelists are comprised of established entrepreneurial leaders from throughout the region and the world. Each forum is carefully crafted to provoke thought leadership in entrepreneurship, and to engage the entire audience in a give-and-take dialogue with the panelists about important issues. These content rich events provide an excellent networking opportunity aimed at enhancing and growing the entrepreneurial ecosystem.

Subject Matter Experts (SME) and Mentors

The Baiada Center for Entrepreneurship considers its robust mentoring program as one of the keys to its success. Drawn from diverse business fields, Baiada mentors are experienced and well-qualified professionals with networks in the regional, national and global business world who have volunteered to share their knowledge and expertise with the entrepreneurs and the student community at Drexel.

This team of experts assists entrepreneurs with questions that arise in specific areas including but not limited to: legal issues, best accounting practices, funding options, marketing techniques, and customer relationship management. These experts are available for both face-to-face meetings and virtual consulting via Maestro, the robust interaction portal used as part of the cultivation process for Baiada Center entrepreneurs. Students and entrepreneurs receive daily support from the Baiada Center's in-house staff.

The mentors on call are a group of seasoned professionals whose experience and knowledge is used to guide young entrepreneurs in their fledgling steps toward successful business ownership.

Teams of mentors meet with students or alumni who present their business plans and concepts for evaluation. Consultations are held on a weekly basis and when required, teams are scheduled for follow-up sessions during the term. The mentors on call have an international business perspective and represent a variety of skill sets including financial planning, operations and logistics, marketing, management, communications, and technology.

Outreach to Businesses Regarding Recent Research Developments

Drexel engages with a variety of local groups, including the Chamber of Commerce and Select Greater Philadelphia, to develop regional best practices and approaches to commercializing the fruits of the region's research. This process is actively facilitated and supported by the Commonwealth of Pennsylvania, whose support for local economic development through the Ben Franklin Technology Partners (BFTP) and BioAdvance tangibly support new businesses. In addition, they support innovative programs that focus on developing and commercializing cutting edge technologies.

Drexel continued its participation in Pennsylvania BIO and the Technology Commercialization Group, an initiative of Ben Franklin Technology Partners of Southeastern Pennsylvania. The Group works with companies to develop new products for commercialization. As a partner in the University City Keystone Innovation Zone, Drexel is assisting in commercialization efforts of biotechnology enterprises. University City Science Center (SC) is the largest urban research park in the U.S. whose stakeholders include virtually all of the non-profit research institutions in the region.

The SC developed a program dubbed "QED," that is designed to provide support to research in the region. The QED Proof-of-Concept Program provides business development support for academic researchers developing early-stage life science technologies with high commercial potential. As angel investors, venture capitalists, and established industry increasingly invest in later-stage enterprises, it has become especially difficult to accelerate early-stage innovations in the life sciences. The QED Program launched in early 2009, will continue to participate in its multi-institutional efforts, soliciting life science R&D project proposals from the leading research centers across the Greater Philadelphia region. The key goal is to retire the business risk in these early-stage projects, increasing their attractiveness to follow-on investment by established life science companies and private investors.

Drexel University and Drexel University College of Medicine continued to build strategic relationships and identified mutual research interests for future partnerships.

Drexel University College of Medicine offers the advantage of having a business organization, the Clinical Research Group (CRG), to support the business side of research while investigators focus primarily on the science.

Research Development Collaboration

The Drexel University College of Medicine established Regional Initiatives in Clinical Research with the following institutions and will continue the collaborative efforts with: Fox Chase

Cancer Center, Abington Hospital, Doylestown Hospital, Temple University, Jefferson University, University of Pennsylvania, St Christopher's Hospital for Children and St Peter's Healthcare System.

Drexel University has an ongoing relationship with Good Shepherd Rehabilitation Network (in Allentown) through which Drexel Co-op students are being placed and biomedical devices are being tested in a collaborative venture that gives Drexel access to a large rehab patient population, and gives Good Shepherd access to state-of-the-art developments in Biomedical devices.

Drexel University School of Biomedical Engineering held a workshop "Spirit of Entrepreneurship in Life Saving Solutions." This Entrepreneurship Day event showcases the talent of our students and the 'Life Saving Solutions' that they work on together with our faculty and research staff.

The Center for Integrated Bioinformatics focuses on a system approach to bioinformatics in which information at the gene, protein, cell, tissue, organ, and system level is integrated and interpreted for early detection, accurate diagnosis, and effective treatment of complex diseases such as cancer. The program offers bioinformatics education at both undergraduate and graduate levels and provides advanced bioinformatics training and research support. A broad, educational impact of the Center for Integrated Bioinformatics educational program is to strengthen the system biology and bioinformatics background of life sciences, engineering and computer science students. The program facilitates bioinformatics research in a wide range of topics, including the molecular characterization of tissue heterogeneity, molecular pathways and cellular networks, and the informatics of cultured cells.

In cooperation with the Ben Franklin Technology Center of Southeastern Pennsylvania, DIBVIR continues as a Ben Franklin Innovation Center, providing research and educational resources to both commercial and academic scientists working together to advance partnerships in the areas of medical biotechnology and to promote the development of a highly skilled workforce in the Greater Philadelphia region.

During FY 2010-11, the Translational Medicine and Applied Biotechnology Working Group provided a venue where researchers from various disciplines met to attend evening symposiums. Under the tagline, "promoting bench to bedside research," this symposium series brings together clinicians, basic scientists and engineers at all levels to brainstorm and collaborate on new approaches to specific health topics. At these symposiums, speakers (clinicians, basic scientists and engineers) presented their research. Then the floor opens for a lively discussion for faculty, researchers and students. These workshops increase faculty and researchers' awareness of the resources available across the various Drexel campuses. The poster presentations afford current students, the next generation of researchers, opportunities to learn how to present their research and develop multidisciplinary collaborations. The Working Group organized interdisciplinary scientific workshops including: "*Symposium on Health Informatics*," December 2010; "*Liver Diseases: Advances in Research, Prevention, and Treatment*," May 2011; "*Advances in Human Cognition Enhancement*," May 2011; and "*Interdisciplinary Symposium on Oxygen: From*

Molecular Mechanisms to Real-Time Monitoring,” June 2011. These events offered a great opportunity to coordinate, exchange, and disseminate research information.