

Drexel University

Research Development Report

Reporting Period:

July 1, 2009 - June 30, 2010

Plan for Commercial Development of Research

Drexel's Office of Technology Commercialization mission is to commercialize Drexel intellectual property, to bring benefit to the society and to add value to the university, inventors and the community - in addition, foster entrepreneurial spirit at the University. The key strategies include 1.) licensing technology to start-up or existing companies, 2.) assisting faculty and other inventors with start-up companies which includes 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 University's Office of Technology Commercialization actively seeks to establish relationships that will result in the adoption of Drexel technologies by commercial partners to bring inventions to the marketplace. The overall goal of Technology Commercialization is 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 the majority of funding for taking research from laboratory to market comes from three funding sources: corporations, federal government and angel investors. We focus on these organizations for our commercial activities.

In FY 2009-10 the following goals continued to be the basis for Drexel's plan to cultivate commercial development of research:

- Work with industry leaders, venture capitalists and university researchers to create new product ideas for commercial development.
- Determine and improve the commercial viability and success potential for new inventions.
- Foster a team spirit among industry, university researchers and research administration to formulate strategies for success in the commercial marketplace and the medical community.
- Encourage the development of an environment for creativity, innovation and entrepreneurship.
- Incentivize the research community through shared rewards with business and industry.
- Help 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 continued to be:

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

Drexel portfolio of patents cover broad technology areas: 37% Health Sciences, 21% Biomedical & Biotechnology, 15% Materials, 12% IT/Electrical, 9% Chemistry and 6% Mechanical Engineering.

During the period July 1, 2009 through June 30, 2010, Drexel University submitted a total of one hundred twenty eight (128) 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 3 new start-up companies featuring Drexel technology: Teradyne, Truevision and Advanced Biosensors, Inc.

Forms of Agreement for Licensure

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 Agreement - 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]

Plan for Training Students and Health Professionals

Research is an integral part of Drexel's educational philosophy. 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. Nearly all of our laboratories host undergraduates and involve them in research projects as full members of the research teams. Our research training programs span traditional disciplines in Biochemistry, Molecular Biology and Genetics, Microbiology and Immunology, Neuroscience, Pathology, Pharmacology and Physiology, 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 complemented by affiliations with research laboratories at Allegheny General Hospital, Lankenau Hospital and Fox Chase Cancer Center. Such a diverse and prolific research environment serves as an exciting backdrop for a multitude of opportunities in graduate education and research training.

The *Professional Studies in the Health Sciences Program*, with an enrolment 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 and

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 offers several summer research opportunities:

Drexel University College of Medicine's Minority Summer Research Training Program provides 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, 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 providing 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 give a specific, conference-styled presentation describing their research project to an audience of Drexel Med faculty and graduate/medical students. The students meet periodically with their mentors to prepare and review the content of their oral presentations. In addition, the students may return in October to present their research at Discovery 2009, the annual day of research at Drexel Med.

Summer Research Internships (HSSRI) for students from area high schools with an interest in biomedical research provides 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 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 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. Interns typically work on a unique project related to the research goals of that particular laboratory. Interns 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.

Medical Student Summer Research Program at Drexel University College of Medicine offers ten (10) 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 work on their projects during the summer. Fellowship recipients are required to submit a summary report of their research experience at the conclusion of the research project and present their work at the College of Medicine's annual day of research, Discovery Day, held in October of every year.

Drexel Research Experience in Advanced Materials (DREAM) supports 10 to 15 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)*, which allows high school students an opportunity to gain hands-on experience and knowledge about the world of engineering, holds Materials Mondays for its participants giving them face time with materials students, faculty, and staff to learn more about materials.

IGERT Fellowships in Nanoscale Science and Engineering: The Two-University/One Campus Approach. Dr. Yury Gogotsi (MSE) serves as the PI along with co-PIs Drs. Jonathan Spanier

(MSE) and Mun Young Choi (MEM) and Dawn Bonnell and Alan T. Johnson from the University of Pennsylvania. This grant will fund six Ph.D. traineeships at Drexel and Penn each per year for the next 5 years. This grant continues an ongoing successful educational collaboration between Drexel and University of Pennsylvania. 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, have received a Graduate Assistance in Areas of National Need (GAANN) award from the Department of Education. GAANN provides need-based fellowships to fund Ph.D. students who will receive exceptional training in research and education in the field of computation.

The Drexel Center for Biotechnology and Virology Research (DIBVIR) located in Doylestown, PA shares space and resources with the Hepatitis B Foundation and Research Institute (HBF) in the [Pennsylvania Biotechnology Center](#). Faculty, staff and students of Drexel University carry out biomedical research in a mission-oriented environment.

Coursework at DIBVIR is offered in conjunction with the Masters and Ph.D. programs in the Department of Microbiology and Immunology of Drexel University College of Medicine. Courses include Molecular Virology, Experimental Therapeutics, Emerging Infectious Diseases, and Laboratory Techniques in Molecular Biology.

Summer research opportunities for undergraduates at DIBVIR are available through a partnership with the HBF, in addition to training fellowships for recent graduates. Educational programs are offered in the form of courses, workshops and colloquia that expand the educational opportunities for the biomedical workforce in the area north of Philadelphia.

Drexel University was the host University for the Society of Research Administrators International Delaware Valley Chapter annual meeting. Drexel University was also the host university for AWARE for ALL, an annual program of the Center for Information & Study on Clinical Research Participation (CISCRP).

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

Training Opportunities Related to the Commercial Development of Research

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

Outreach to Businesses Regarding Recent Research Developments

Drexel continued its participation in 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.

Drexel University and Drexel University College of Medicine continue to build strategic relationships and identify 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. The CRG hosts a Pipeline Presentation Series with monthly meetings, including talks from Pfizer, Wyeth, Sanofi Aventis, Pharmatech, Gilead, Novonordisk and Astra Zeneca.

Collaboration for the Development of Research

The Drexel University College of Medicine established Regional Initiatives in Clinical Research with the following institutions: Fox Chase Cancer Center, Doylestown Hospital, Temple University, Jefferson University, University of Pennsylvania, St Christopher's Hospital for Children and St Peter's Healthcare System.

Drexel University School of Biomedical Engineering held a workshop, Spirit of Entrepreneurship in Life Saving Solutions. The Entrepreneurship Day events showcased 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 programs for The Greater Philadelphia Bioinformatics Alliance. The overall objective of the educational program is to train students in system approaches for the development of useful computational models of living systems and novel enabling informatics technologies in life sciences. 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. Tissue heterogeneity is an important property of cancer. Medical, histological, and molecular information addresses the issues of early detection, accurate diagnosis, and individualized treatment. Information integration is also a key ingredient in future advances for the treatment of infectious diseases.

Drexel University continued its activities with the Greater Philadelphia Bioinformatics Alliance that is working to develop a regional "computational orchestra". The term "orchestra" was selected to describe a connected environment where highly specialized yet complimentary disciplines are brought together to create an orchestral whole. The end result is a community

united to catalyze and capture innovation in bioinformatics. In this instance, the Alliance is working to fuse two diverse communities: the region's statistical and computing experts with experts in biological and medical research.

The primary “instruments” of this orchestra continue to be coursework and education. Summer coursework presented focused on the use of a wide variety of statistical, modeling, and computational skills to solve real world biomedical problems. Alliance and University members and affiliates, including biotech companies, were encouraged to participate in the selection of research and development projects. One of the goals of the computational orchestra concept is for collaborations started within courses and seminars, or as a result of other Alliance networking activities, to lead to commercially viable innovations in the life sciences.

In cooperation with the Ben Franklin Technology Center of Southeastern Pennsylvania, DIBVIR continued 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 2009-10, 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 brought together clinicians, basic scientists and engineers at all levels to brainstorm and collaborate on new approaches to specific health topics, (i.e. plasma medicine, breast cancer). At these symposiums, speakers (clinicians, basic scientists and engineers) presented their research. Then the floor opened 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.