



SCHOOL OF BIOMEDICAL ENGINEERING, SCIENCE & HEALTH SYSTEMS DREXEL UNIVERSITY

Bringing Life Saving and Life Changing Solutions to Health Care

Translational Research in Biomedical Technologies Program Overview



On behalf of the students, faculty and staff of the School of Biomedical Engineering, Science and Health Systems of Drexel University, it is my distinct pleasure to provide an overview of our capabilities, accomplishments and action plan in translational research. I am also delighted with this opportunity to announce the formation of our '*strategic commercialization partnership*' with the University City Science Center, Philadelphia. We have recently joined forces to facilitate, enable and accelerate the translation of our discoveries from our laboratories to the clinic and the home.

In recent years, with blessings of Drexel leadership and with support from our alumni and trustees, we have instituted *changes in our academic culture* to recognize, assist and reward our faculty and students engaged in translational research. We took full advantage of Drexel's investment in a modern technology entrepreneurship and commercialization infrastructure. In parallel, we developed solid working relationships with the regional academic and research institutions, economic development agencies as well as the local legal, business and investment communities to sustain our commercialization efforts. As a result, two funded start-ups were launched over the last year and our technology pipeline is filling rapidly.

We are now poised to expand the scope of our biomedical technology commercialization initiative and to rapidly institutionalize our translational research program. The technology commercialization partnerships that we are forming with regional economic development agencies and foundations will infuse the much needed translational research expertise at a most opportune time in the history of our School and while our region is gearing up for prominence in biomedical sciences and technologies. We believe that such partnerships will have a measurable and meaningful impact on our translational research and an amplifier effect on our ability to leverage ample resources that exist in the Greater Philadelphia region. Moreover, our dedication to safe, affordable and broadly deployable biomedical technologies aimed to benefit the quality of health in our global society resonates with the translational mission of our partners. Personal health care technologies that empower the individual to take charge of his/her well-being and to serve the under-privileged populations of the world are high in our priorities.

The entrepreneurial spirit and the enterprising approach that permeate our ranks is a century old legacy of our founder A. J. Drexel. An investment banker, he firmly believed in higher education's critical role in economic development and wealth creation. With its



unique cooperative education and technological focus, Drexel has always viewed itself as an integral part and a driver of the regional economy. As expected, Drexel has responded vigorously to the recent regional mobilization that is transforming Greater Philadelphia into a life sciences hotbed: the School of Biomedical Engineering, Science and Health Systems was established in 1997. This was followed, in 1998, by the historic decision to manage the Allegheny University of Health Sciences which led to our formal merger in 2002 and the creation of our new College of Medicine. In this daring move, our President and our Trustees were guided by the vision of a futuristic technology-driven medical education and the determination to foster and to enable powerful synergies between Drexel scientists and engineers with the new medical faculty. The annual 'Synergy Grant' program which seed-funded teams composed of engineers/scientists and medical/clinical faculty was launched in 1999 and catalyzed the rapid formation of interdisciplinary teams with a growing joint funding portfolio, largely aimed at translational research. Many of our recent start-up activity can be traced to these synergy grants. To stimulate innovations and their eventual commercialization, Drexel has adopted a generous revenue sharing policy. In 2000, the Technology Commercialization Office was reorganized to stimulate and to encourage our faculty and students to explore the commercial potential of their research and to provide guidance and assistance in securing patents, entering in licensing arrangements and launching start-ups. The Baiada Center for Entrepreneurship in Technology was established in 2001 to provide educational opportunities in entrepreneurship and to serve as an incubator for student led start-ups.

We firmly believe that the "marriage of technology with biology and medicine will drive the 21st Century industrial enterprise." This vision inspired the reorganization of our School of Biomedical Engineering, Science and Health Systems in 1997 (formerly Biomedical Engineering and Science Institute founded in 1961.) Consistent with this mission, we strive for clinical and industrial relevance in our academic pursuits. Accordingly, we have updated our annual merit review as well as our tenure and promotion procedures to account for and reward faculty intent on translating their innovations. We established and filled the first Professor of Biomedical Technology position at Drexel. Our laboratories became a breeding ground for the next-generation of entrepreneurial talent. We have also welcomed entrepreneurs into our midst by creating the Biomedical Technology Entrepreneur positions, a concept originally developed by Dr. R. Loring, an alumnus who returned to Drexel in 1999 after creating a successful medical device company based on his doctoral research. He developed and taught our courses in biomedical technology entrepreneurship; he mentored our students to win, year after year, top awards at our University-wide Baiada Business Plan competition. The Loring Award for Biomedical Technology Entrepreneurship has been established under his sponsorship. As our Senior Entrepreneur in Residence, his role is to provide oversight and direct assistance for promising biomedical technologies.

Our School of Biomedical Engineering, Science and Health Systems has experienced remarkable growth over the last five years. We have recruited 10 new tenure-track faculty bringing our ranks to 16. Our enrollment has increased 4 fold, approaching 500 graduate and undergraduate students. Our research portfolio has grown 8 fold to an annual research award level of \$8M with yearly research expenditures close to \$5M. Since our merger in 2002, our collaborative research with our College of Medicine faculty has reached \$18M. Five full-time resident research faculty have joined our ranks to focus primarily on translational research. Together with our 'entrepreneurs in



residence,' they have been crucial in bringing commercialization perspective into our academic culture. One of the competitive advantages of our School is the unique free-standing university-level administrative structure with its own tenure-track faculty lines, budget and space. The Director reports directly to the Provost and works with the College Deans and School Directors. This helps us transcend the traditional organizational boundaries of engineering, sciences and medicine. Our independence allows us to pursue growth and collaborations in various disciplines. Our small size gives us agility to reconfigure and reorganize in response to emerging opportunities; we are proud of the critical role our unit has played in realizing the potential of the recent merger. The University Strategic Plan recognizes our School as "Drexel's prototype of academic integration."

Our strategic thrust directions are: biosensing, bioimaging and drug delivery, with focus on bio-nanotechnologies, biomedical ultrasound and optics; Cellular Tissue Engineering; Neuroengineering and Human Performance; Integrated Bioinformatics. These core competencies are enabling and sustaining our new initiatives in Skin Bioengineering, Pediatric Engineering, Homeland Security Technologies.

Our School is mandated to lead in our academic thrust areas in strategic partnerships with other academic units at Drexel, in particular, the Colleges of Medicine, Arts and Sciences, Engineering, Information Science and Technology, and the LeBow College of Business. In our region, we maintain close working relationships with partner academic and research institutions, in particular, the University of Pennsylvania with which we share a campus in the University City in West Philadelphia. In 2001, we partnered with the University of Pennsylvania and the Ben Franklin Technology Partners to create the Nanotechnology Institute which is committed to rapid commercialization of bio-nanotechnologies. In 2002, again with the University of Pennsylvania and the BioAdvance, we formed the Greater Philadelphia Bioinformatics Alliance. Each of these regional initiatives were sponsored by the State of Pennsylvania at the multi-million dollar level; the faculty at partner institutions were able to multiply these investments several fold by raising substantial federal and corporate funds. Our other key institutional partners include Thomas Jefferson University, Coriell Institute for Medical Research, Wistar Institute, Fox Chase Cancer Center, and St. Peter's University Hospital. We plan to replicate our success in jointly leading major regional initiatives in translational research.

We interact with economic development agencies at all levels. We have formed a 'strategic commercialization partnership' with the Science Center. We work closely with BioAdvance, Ben Franklin Technology Partners and Innovation Philadelphia. We enjoy strong ties with the local legal and business development communities through our alumni, trustees and friends. Our investment partners include individuals, investment groups, angel investor networks, private early and later stage ventures such as BioAdvance Ventures and Quaker BioVentures. Our corporate partners include Exponent and PA Consulting. Johnson & Johnson and Pfizer are our primary corporate mentors. Over the last two years, we have been an active member of the BEACON, the Biomedical Engineering Alliance and Consortium that extends our reach to a network of academic and medical institutions, corporations, and an array of technology and business development and investment resources in the Northeast corridor.



The Coulter Foundation's invitation to submit a full proposal for Translational Research Partnership has already given impetus to our translational research initiative. It rallied our regional partners and attracted the attention of the Commonwealth of Pennsylvania. Thanks to an anonymous gift by one of our trustees, we have formally launched our Translational Research and Development in Biomedical Technologies program in our School. We have since received pledges of additional support and redirected a portion of the earnings of our School's Calhoun endowment to match these gifts. 'Translational research in biomedical technologies' is under consideration as a top priority of the recently announced University-wide Capital Campaign. Based on a proposal that I had presented to our alumni and trustees this past Fall, Mel Baiada, an alumnus trustee and Dr. Donna De Carolis, Department Head of our Management Department, are studying the feasibility of an Alumni and Trustees Angels Club. With the momentum gained, we began to plan for an 'Inventorium,' a design and device prototyping laboratory to serve our students, envisioned as the inventor's basement and located in the proximity of our machine shop.

There is strong evidence that our region is poised to become a 'crucible of biomedical technologies.' In alliance with our partners, stakeholders and benefactors, we are confident that we will be one of the drivers of this transformation: we have the goods, the means and the energy to lay the foundations of a vibrant and thriving biomedical technology enterprise. This overview is our attempt to acquaint the reader with our past, report on our current status, and share our vision as we seize the opportunities before us. Our translational research mission is inspired and guided by our mentor Dr. H. H. Sun who has successfully translated several biomedical technologies to clinical practice. We conclude this overview with the 'impedance cardiography system' that he has innovated with his team.

Last but not least, the credit for the content and the compilation of this overview is owed to our students, faculty and staff who work, with dedication and commitment, to bring life-saving and life-changing solutions to clinical and personal health care. If it fails to do justice to our spirit and our resolve, if it misses to convince the reader that we are meant for this challenge, the blame is solely mine.

Sincerely,

Banu Onaral, Ph.D.
H. H. Sun Professor and Director
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