CHANGING CAMPUS CULTURE OF INNOVATION AND ENTREPRENEURIAL THINKING: RIPPLE EFFECT OF CAMPUS CHANGE-MAKERS

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ABSTRACT

Campus-based innovation and innovative programming happen not only through institutional support, but interdisciplinary interference. The ripple effects of various change agents can create new and exciting opportunities for faculty, students, and administrators. In this paper we discuss how mobilizing key University of Wisconsin-Milwaukee faculty and students across campus toward collaboration, interdisciplinarity, and entrepreneurial thinking can be compared to ripple effects in water. These innovators, like droplets, disturb the calm waters that surround them. Through classwork engagement and extracurricular programs, more students and faculty feel their effect and create their own ripples. With time, these circles expand from the core group around a highly motivated academic community member; ripples interfere with each other, creating interesting patterns and new pathways for collaboration and interaction. We will illustrate these concepts using a case study of one graduate student's biotechnology venture, which has been a product of multiple interferences.

Introduction

Most innovative and entrepreneurial education efforts on campus begin and end with a single faculty champion or a small, highly motivated group. While well-deserved support and resources are often given to these individuals, if they leave campus or move on to another project, their original work can wither. Additionally, the most interesting and productive outcomes from such endeavors are not only those originally intended by their progenitors, but also those created in the spaces of *interference* between two or more working groups. Interesting things happen at the interference points. We believe that academic institutions need to take more advantage of interference. We have learned that if such opportunities are recognized, supported, and encouraged, they can create new champions of change, new projects, and grow the strides made toward sustainable change in innovation and entrepreneurship at the campus level.

In our water metaphor, ripples of change disperse outward, interfere with other ripples, and create interesting patterns of interaction. Interferences such as these can occur with as few as two wave activators—champions or sources—from two different departments. At the University of Wisconsin-Milwaukee (UWM), we've observed how wave activators' points of interaction in the form of new coursework or extra-curricular projects, for example, can go on to inspire new sources. The process builds on itself and can ultimately have far-reaching effects across the campus environment.

The source of these ripples need not be faculty members. In the right environment, student entrepreneurs also become activators. These students directly impact the student teams who participate in their projects or ventures, and also touch a wider circle of students who may be exposed to them through classes and extracurricular activities. We can create environments of change by fostering and amplifying ripples and interference, through programming that exposes students to other change-makers, and gives them opportunities to make a difference. One example of catalyzing in this way is the Epicenter's University Innovation Fellowship (UIF), where champions of change are selected to join a national movement of students transforming engineering education across the country.

The University of Wisconsin-Milwaukee is a public, urban university with a total student population of approximately 28,700, 53% of whom are female and 14% identified as US ethnic minorities. UIF participants come from various colleges and disciplines, not just engineering or business. In addition to our ongoing

participation in this program, UWM is taking further steps to foster an environment of productive interference by developing a network of classes and instructors who support student leaders. Such students act as project sponsors in their classes, where student teams make new prototypes or develop business plans together under their leadership. These classes include the "Product Realization" and "Innovation & Commercialization" courses offered in the College of Engineering and Applied Science and Peck School of the Arts, as well as the "New Ventures" course offered in the Lubar School of Business.

The Product Realization course (instructors: Avdeev and Stern) was initially conceived to offer corporate sponsors a chance to work with student teams to develop a working prototype device over the course of a semester. The class has now been adapted to allow student entrepreneurs the same opportunity with the support of the Student Startup Challenge. The Innovation and Commercialization course (instructor: Thompson) is offered in engineering (but open to other majors), and helps students view technology from a business perspective by introducing concepts that include intellectual property, market assessment, financial modeling, venture finance, and business planning. This class has also been adapted as a tool for student entrepreneurs to help advance their ideas and work with an ever-expanding group of other students.

Similarly, student entrepreneurs from engineering, the arts, and other disciplines have sponsored projects in the New Ventures (business) course, offering a mechanism to partner business expertise with a broader set of entrepreneurial opportunities. Linking student entrepreneurship with the class structure helps sustain the process through which a few students can create ripple effects to impact a broader segment of the student population.

Case Study: Isopoint Technologies, LLC

This case study illustrates the ripple effect. It demonstrates complex patterns of student-faculty-technology interactions, multiple ripple sources, and the creation of new pathways for innovation. The study is centered on a biotechnology venture, Isopoint Technologies, LLC, founded by a graduate mechanical engineering student, Alex Francis, which licenses fundamental technology developed by a UWM professor, Dr. Jorg Woehl.

Origins of the Idea: The Fundamental Technology

Dr. Jorg Woehl, an Associate Professor in UWM's Chemistry and Biochemistry Department, first developed the technology with the help of a Catalyst Grant from the UMW Research Foundation. Dr. Woehl's work includes the development of microscopy tools (Carlson et al. 2010; Carlson and Woehl 2011; Woehl 2011). He proposed building an "electrostatic trap" that could be used to capture and study charged particles under a microscope objective (Figure 1).

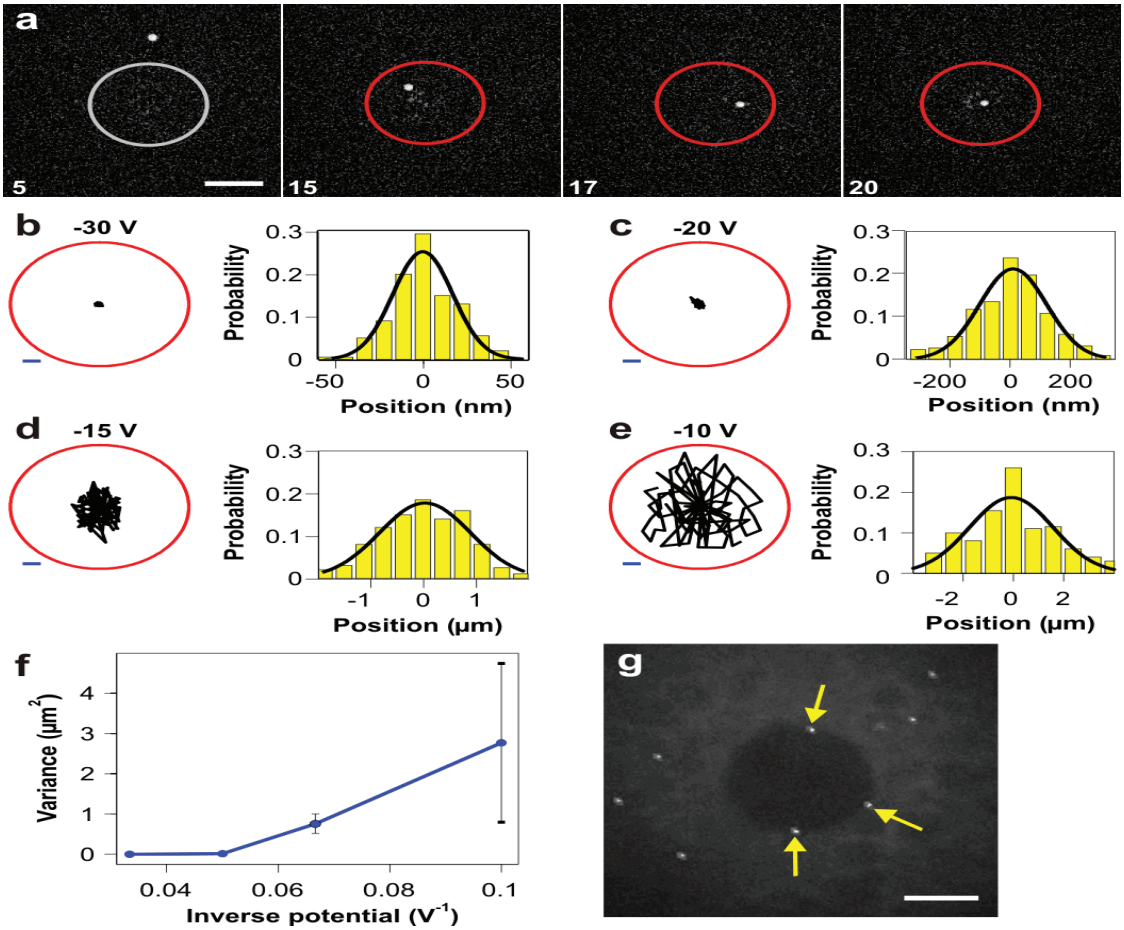

Figure 1. Trapping of a negatively charged, 20 nm nanobead in a 10 μm electrostatic trap (a; red = activated trap) as a function of the applied potential (time trajectories and histograms, b-e)

The Catalyst Grant Program was developed by the UWM Research Foundation to foster ideas that demonstrate both strong science and commercial potential. Woehl was awarded a Catalyst Grant to develop and demonstrate the first working prototype in 2010. This proof of concept formed the basis for a patent filed by the UWM Research Foundation in 2011 and issued in 2013 (US Patent 8,465,967).

The Path to Market

In the university setting, finding the best "path to market" for a technology can be a challenge. The UWM Research Foundation explored licensing the technology directly to an existing company, but as is the case with many early stage technologies, the business case for the technology wasn't fully developed. The Innovation & Commercialization course, offered in the College of Engineering and Applied Science, offered the opportunity to engage students in developing a business case for the technology.

This class brings student teams together to develop business models and plans. In the spring of 2012, students were offered the chance to work on various technologies developed by UWM faculty researchers and managed by the UWM Research Foundation. Alex Francis, an undergraduate engineering student at the time, joined a team working with Dr. Woehl to develop a business case for his technology (Figure 2).

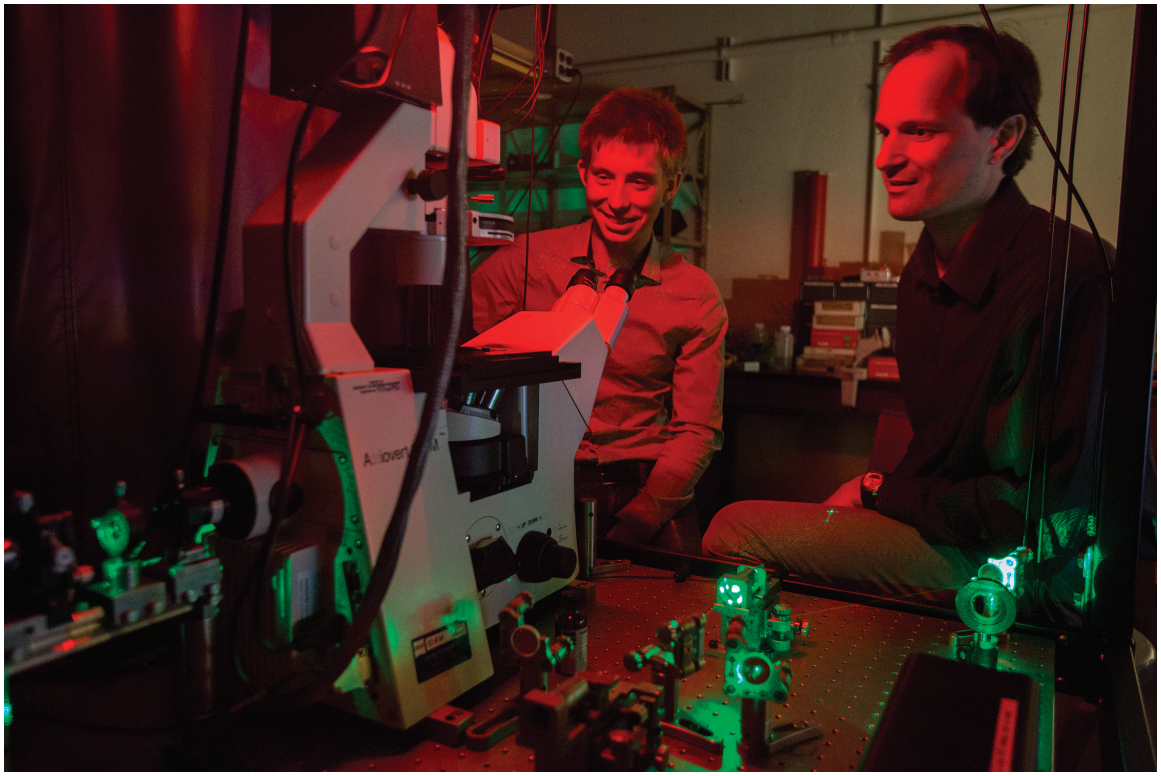

Figure 2. Alex Francis (an entrepreneur) and Dr. Jorg Woehl (an inventor)

Using the structure and the resources of the course, Francis and his teammates got their first look at the particle trapping technology and explored the markets, intellectual property, and development needed to help advance the technology.

The Business Model: From Fundamental Technology to a Product

Isopoint Technologies, LLC, the startup company founded by Francis, is developing a business around a novel hardware platform for trapping a variety of charged micro- and nanoscale particles, as well as single molecules in aqueous solution, using electrostatic fields (Figure 3). The device, E-Trap**,** takes fundamental research on molecular, nanoscale, and microscale objects and applications in fields such as drug discovery, disease control, and biomedical diagnosis/analysis to the next level by not only allowing for the observation, but also direct interaction with the system under investigation. For example, it enables the confinement of a single molecular or biological system in solution over extended periods of time so that a detailed biological, biochemical, or biophysical analysis can be carried out.

The potential market segments for E-Trap include life sciences research, drug discovery, disease control, diagnosis, microelectronics, and advanced material science. BCC Research reported that total microscopy industry is predicted to reach $3.1 billion in 2014, with accessories and supplies predicted to reach $513 million. Emerging applications include personal genomics and clinical diagnostics, which are forecasted to reach $541 million by 2015 compared to $15.5 million in 2010, with markets for DNA sequencing products growing to more than $3.3 billion by 2015 (BCC Research 2013).

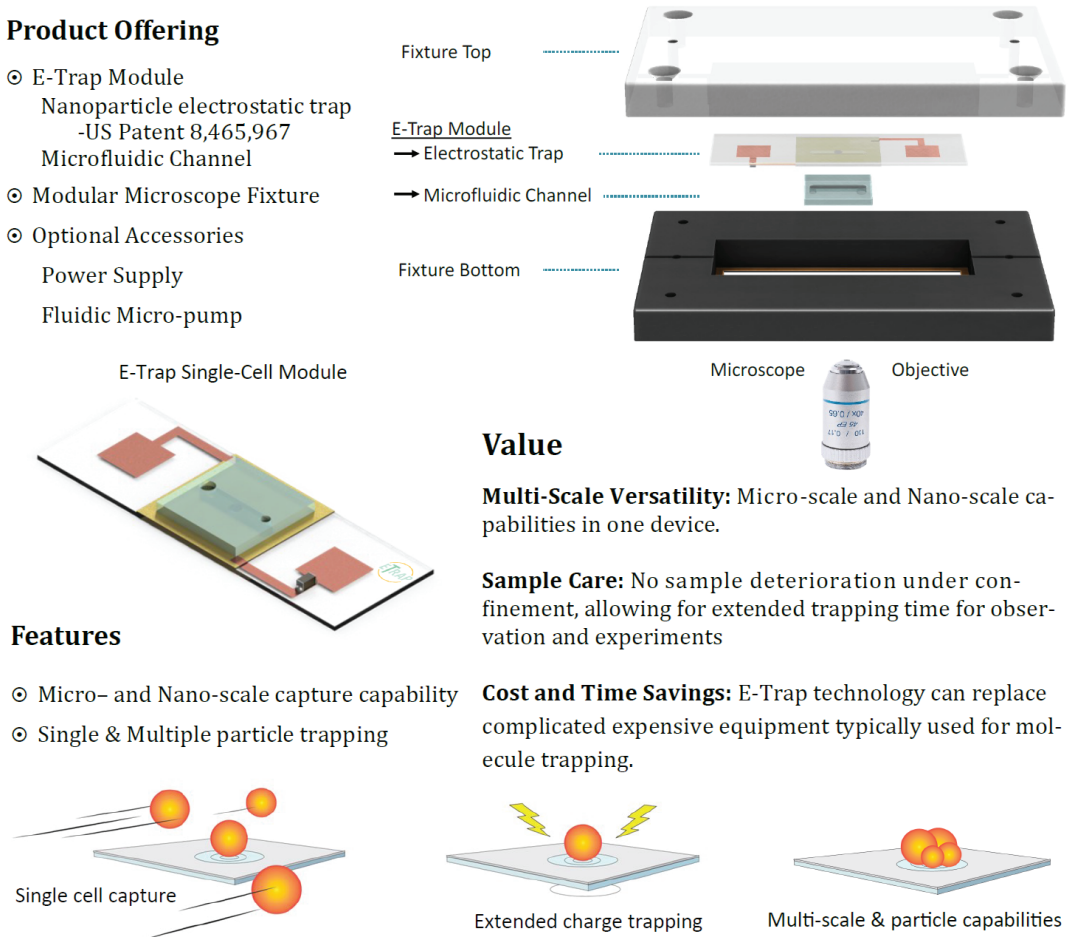

Figure 3. Schematics of the E-Trap prototype and key product features

There were essentially three ripple sources at play: (1) Dr. Woehl's research lab generating new ideas and scientific knowledge that can be used for platform development, (2) the UWM Research Foundation Catalyst Grant Program supporting risky research, and (3) the Innovation & Commercialization course that prepared engineering students to deal with research commercialization tasks (Figure 4). The interferences between these three sources produced two important outcomes: the E-Trap invention (intellectual property) and a new entrepreneur (Alex Francis) who eventually became the CEO of a new company and a new source of ripples.

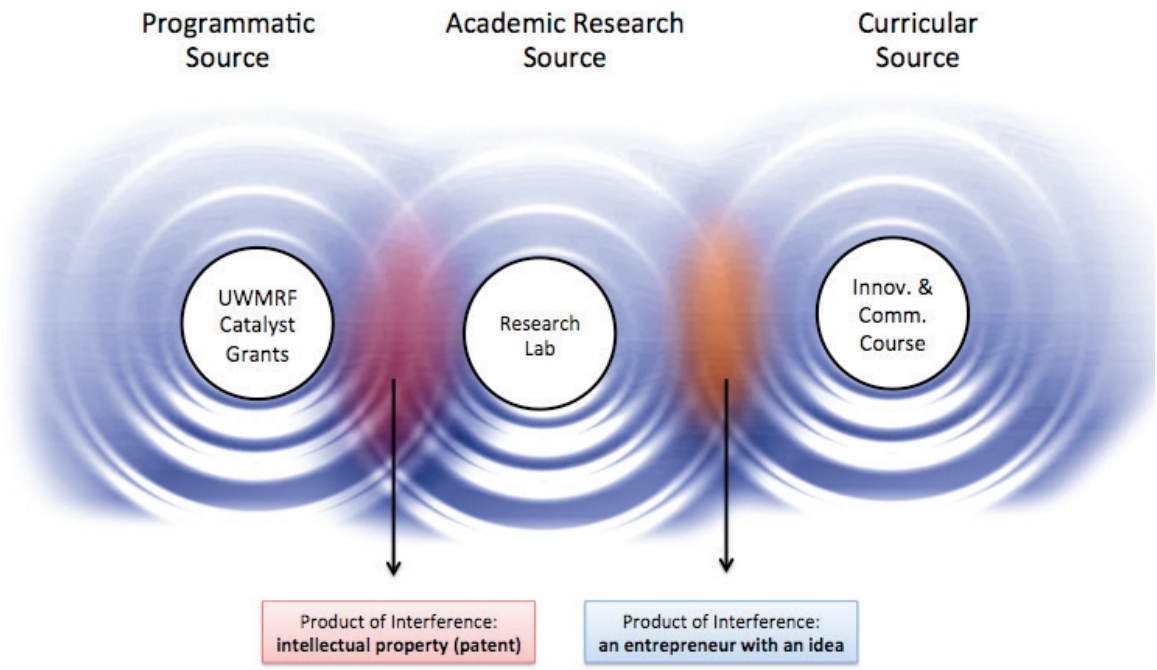

Figure 4. Sources of ripples (programmatic, research, and curricular) and interferences of I&E activities that lead to creation of new ideas and new ripple sources

Project Evolution

Alex Francis remained intrigued with the technology, and as the Innovation & Commercialization Class wrapped up, he saw an opportunity to move it forward. Francis entered the UWM Student Startup Challenge, a co-curricular program that pairs student-entrepreneurs with teams in other classes to help them develop prototype devices and business models. In the summer of 2013, Francis was selected along with seven other student teams to participate in the second year of the Student Startup Challenge. The program creates a cohort of student entrepreneurs who participate in boot camps and booster events to develop and refine their business plans. The program also paired Francis with a team of engineers and art students in a second engineering class, the Product Realization course.

With Francis acting as sponsor, the student team developed a concept device that used Woehl's electrostatic trap invention in a consumer-friendly format that combined a "docking station" to provide control of the trap with disposable microscope slides containing the trap. The idea was in keeping with Francis' business model for the technology based on the "razor and razor blade" model, where the primary revenue for the business would be based on recurring sales of the disposable microscope slides. In addition, a team of business students from the New Ventures course at the Lubar School of Business started developing a marketing and business plan around the technology. The ripples created by these four strong sources of innovation and entrepreneurship activity interfered and produced a new biotechnology venture. Francis went on to form a company (Isopoint Technologies, LLC) and completed an option agreement with the UMW Research Foundation (Figure 5).

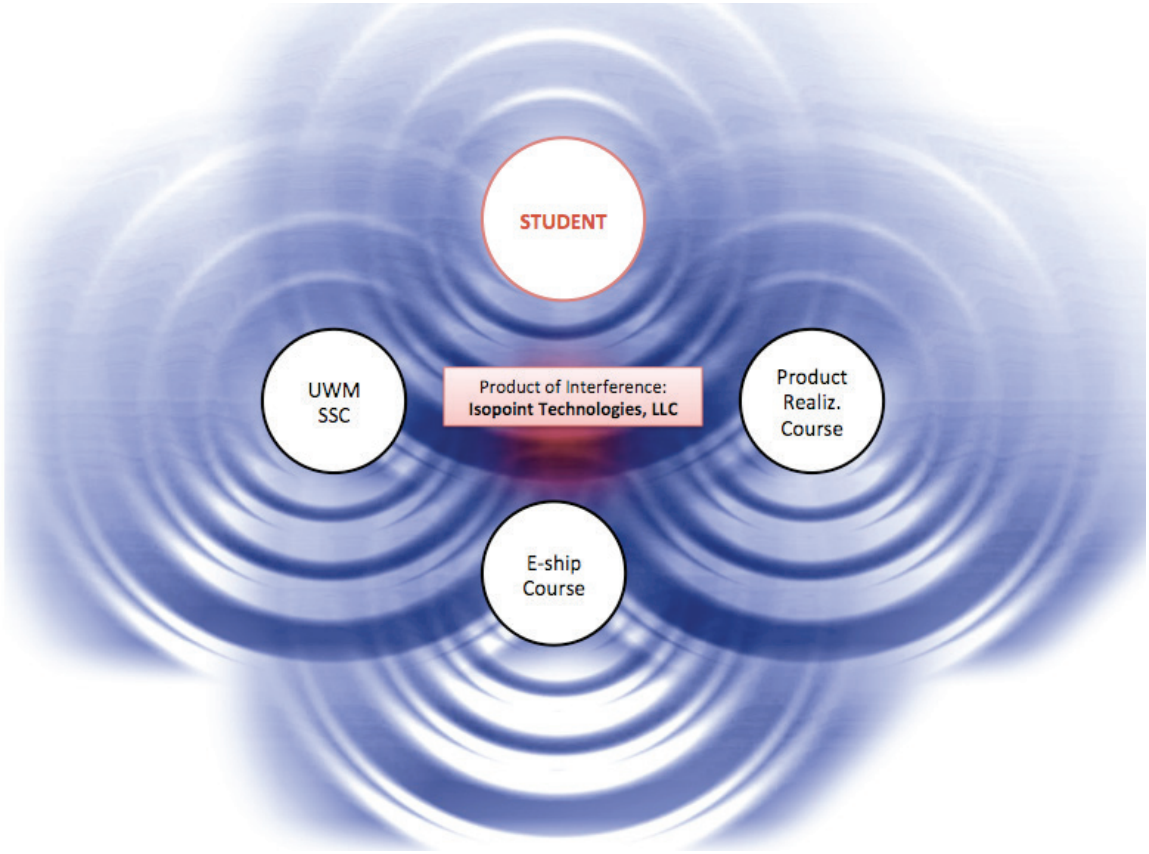

Figure 5. A new transient source of ripples

Alex Francis generated new waves of activity: he applied for and won grand prize of the UWM Student Startup Challenge (SSC) and he became an external sponsor for the Product Realization and Entrepreneurship course student team projects. The interference created a new value: Isopoint Technologies, LLC

Engaging Students

Francis's new venture hasn't just impacted his career path. The project has directly involved dozens of students enrolled in the classes that were using E-Trap as a project for development of a technology and business plan. The process also offered Francis a direction that he might not have considered when he first enrolled as an undergraduate engineering student at the university.

Francis has gone on to become a leader in student entrepreneurship, helping expose hundreds of students to new technologies, entrepreneurship, and a variety of other resources and activities at UWM. He was selected in 2013 to be one of the UWM's University Innovation Fellows (UIF), sponsored by the National Science Foundation and administered through Stanford's Epicenter. He has also gone on the lead UWM's Collegiate Entrepreneurs Organization (CEO), a student organization typically led by someone in UWM's business school, and is helping to bridge gaps between engineering students and business students. Francis's academic career trajectory was a product of inference that became a kind of transient source of ripples, and an amplifier of other sources and interferences (Figure 6).

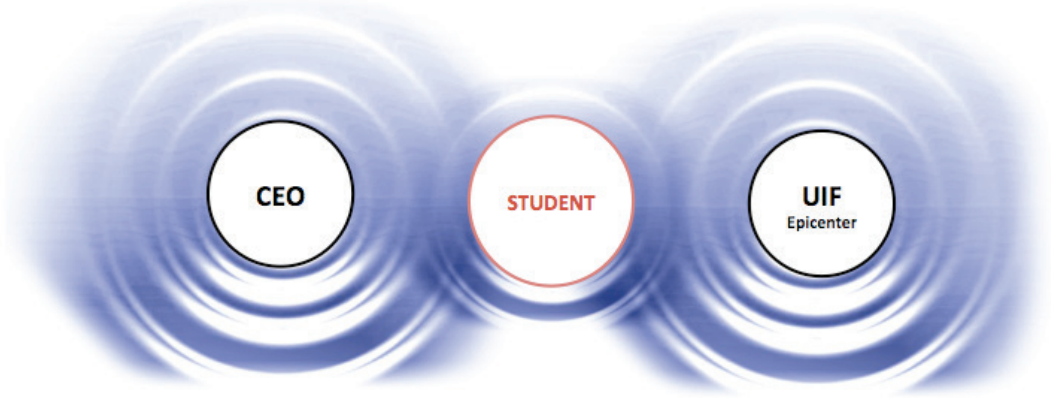

Figure 6. Amplifying impact of other sources at UWM through new connections

Engaging Faculty

Francis didn't stop there. Working with the technology's inventor, Dr. Woehl, his master's thesis advisor, Dr. Ilya Avdeev (mechanical engineering faculty), and another engineering professor, Dr. Woo-Jin Chang, Francis applied for another catalyst grant offered through the chemistry department. The team was awarded the grant to continue development of the device and bring it to market (Figure 7).

In parallel with the development of the technology, Francis has continued to explore the market. In 2014, he was awarded an Ideadvance grant through the UW System Extension, which provides a structure and support for Francis to continue the customer discovery process. Expanding on the contacts developed through the Startup Challenge, Francis has reached out to dozens of potential customers to help understand future applications for the technology.

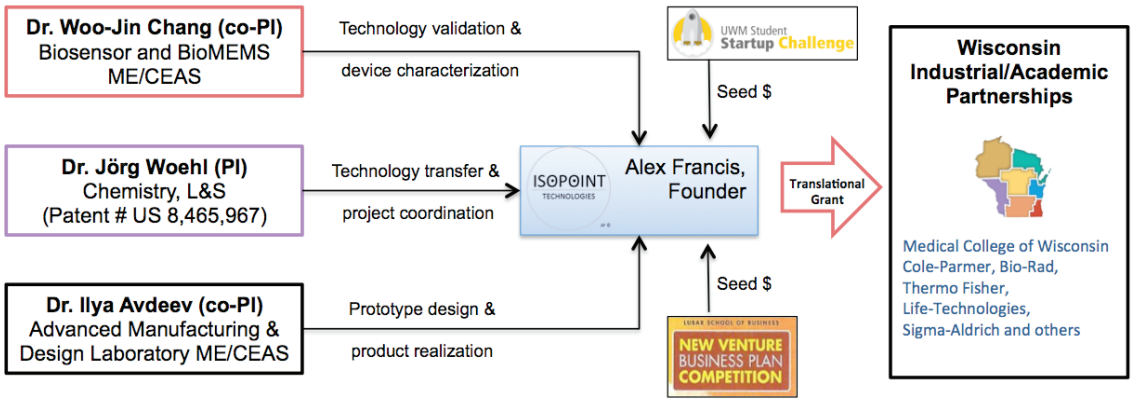

Figure 7. Chemistry catalyst grant: faculty collaboration structure

Future Outlook

The community of practice that formed around Alex and his new venture, Isopoint Technologies, LLC, continues to evolve. The team of collaborating faculty members is working on advancing the technology and preparing SBIR and I-Corps grant applications. Alex is focusing on customer discovery process and developing an MVP (Minimum Viable Product). He is using the network that formed in the last two years to move forward, as well as to create new connections.

Conclusion

Universities are complex organizations, and creating sustainable change can be a significant challenge. We have observed the ripple effect in action at the University of Wisconsin-Milwaukee, where we are working to create lasting change in entrepreneurship on campus by identifying patterns of interference, developing new sources at those centers of activities, and amplifying existing sources of change.

In this example, interactions between faculty researchers and students led to the creation of a new venture and a new student entrepreneur. That student went on to be a champion for entrepreneurship with the support of a national network of other students. Putting student entrepreneurs in the position of sponsors in classes helped them create ripples that touched more students.

At UWM, we continue to work to identify and foster promising points of "interference" where interesting things begin to happen. We amplify the results, and believe this useful perspective can help other universities create their own "ripple effects" in education and entrepreneurship.

Acknowledgments

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