

SCIENCE ENTREPRENEURSHIP PROGRAMS

A relatively recent trend in entrepreneurial education is programs directed at science students. Case Western has been a pioneer of Science Entrepreneurship programs, launching with its Physics Entrepreneurship program, with first graduates in May, 2002. They subsequently launched a program in Statistics Entrepreneurship in Fall, 2002 and additional programs in Biology, Chemistry, and Mathematics are starting in Fall, 2003. Georgia Tech launched a Science Entrepreneurship program in 2002. A longer-standing program exists Carthage College, launched in 1995 with the impetus provided by an alumnus and donor with a Science-based entrepreneurship background.

Overview

- *Programs are small.* Universities need to be prepared that a program in Science Entrepreneurship will likely be small-scale and specialized, and that it might not break even initially. For example, CWRU launched its Physics Entrepreneurship program with five students; the Statistics Entrepreneurship program launched with four. They expect to grow to 85 students entering by the year 2008 across the five science entrepreneurship programs, so approximately 17 students per program on average. Georgia Tech's program launched with 25 students. Carthage College's senior project involving a detailed business plan enrolls 5-12 students per year.
- *Undergraduate, Masters, and PhD. level programs.* There is variety across programs with regard to their educational level. CWRU's program is aimed at the Master's level; Georgia Tech has a PhD focus. USF's program at the Institute for Excellence in Life Sciences Entrepreneurship is at the undergraduate, graduate, and post-graduate levels. Carthage College is aimed solely at undergraduates.
- *Flexible course content in technical discipline.* Programs aimed at graduate and post-graduate students attempt to be flexible in the technical discipline content of the programs to tailor to the specific interests of the student. CWRU created a couple new physics and biology courses for the Entrepreneurship program that combined science and entrepreneurship. While flexibility is useful to achieve the goals of the students, it also creates resource demands on the university.
- *Projects are a critical component.* Intensive projects with technical content in an entrepreneurial context are often core to these programs. For example, CWRU students earn 9 credits out of a required 27 for a master's thesis for the project. Carthage College students with an entrepreneurship minor have a major thesis involving a business plan, conducted by students individually.
- *Science Entrepreneurship projects appear to be successful.* CWRU found that two of the three finalists in the 2002 Business Plan competition in the Business School were from the Physics Entrepreneurship program. One of these projects resulted in a medical device start-up that has so far received \$700,000 in initial funding.
- *Technology Transfer Linkages.* These programs often develop strong relationships with their technology transfer office. One of the key goals of USF's Institute for Excellence in Life Sciences Entrepreneurship, for example, is enhancing technology transfer from the University to the private sector. CWRU is developing linkages with its university's emerging technology transfer function.
- *Pre-seed and Seed Venture Funds linkages.* Universities should think about a proactive approach to providing investment capital to start-ups arising from these programs. CWRU, for example, helped launch a pre-seed fund called Fast Start and has other linkages with local venture capital firms.

- *Linkages with incubator-based and other start-ups.* Hands-on experience working with high tech companies is often an important component. Tulsa University's program, for example, has linkages with the Oklahoma Technology Commercialization Center (OTCC) The University of South Florida works closely with the USF Technology Incubator. Carthage College's entrepreneurial science students are working with the CATI incubator program start-ups. Current involvement is on business planning; plans to expand the program to internships in the students' junior year are underway. Similarly, CWRU is expanding its program relationships with the University's Enterprise Development incubator, with a NASA incubator, and an emerging incubator involving Cleveland Clinic.
- *Business School integration and cross-fertilization.* Science Entrepreneurship students frequently take entrepreneurship courses with MBA students for cross-fertilization of knowledge within project teams. Business school faculty members also serve as advisors on projects. USF's Institute for Excellence in Life Sciences Entrepreneurship, for example, is a partnership with its Center for Entrepreneurship in the Business School. CWRU would not have launched its program without the solid support of its Business School.
- *Foundation funding available.* Given the small size of these programs, external funding is particularly important. Funding was provided to CWRU by the Sloan Foundation and the Coleman Foundation/U.S. Association of Small Business and Entrepreneurship (USASBE). USF's Institute for Excellence in Life Sciences Entrepreneurship is partially funded by the Kauffman Foundation. Georgia Tech's TI:GER program was funded by a \$2.9 million National Science Foundation's Integrative Graduate Education in Research Training (NSF-IGERT) grant. Program funding has also been received through the NCIIA Advanced E-Team grants by CWRU and the University of Tennessee at Martin.
- *Endowment funding available.* As is true for entrepreneurship programs in general, Science entrepreneurship programs are attractive for endowment funding. For example, CWRU has raised \$1.6 million in endowment funding for the ongoing support of the Physics Entrepreneurship program, in addition to Foundation funding.
- *Boot Camps.* To familiarize science students with business, some programs are developing a business curriculum conducted in boot camps during the summer prior to their program start. Offered by CWRU, Georgia Tech, University of Maryland, and others.
- *Networks.* Linking students with the larger entrepreneurial community is another key feature of these programs. CWRU, for example, has regular seminar series featuring local entrepreneurs, venture capitalists, angels, scientists, and other service providers.
- *Alumni Interest.* Science graduates become entrepreneurs with some frequency, depending on the University's location and technology expertise and reputation. Such alumni tend to be very supportive of Science Entrepreneurship programs, and are frequently involved as mentors, internship providers, board members and donors. For example, both CWRU and Carthage College launched their programs at the suggestion of and donation from a science entrepreneur alumnus.

Benchmarks

Carthage College

- *ScienceWorks Technology Entrepreneurship Program, and Entrepreneurial Studies in the Natural Sciences (ESNS).* ScienceWorks students are majors in biology, chemistry, physics, mathematics or computer science. Their business preparation includes a variety

of business and entrepreneurship courses. Students also have the option to become involved in hands-on projects in the Center for Advanced Technology and Innovation (CATI), an innovative incubator program.

- *Entrepreneurial Studies in the Natural Sciences (ESNS) Program.* ESNS is a unique offering. It provides the opportunity to develop skills and opportunities in the business and professional world and is a complement to liberal arts studies. The ESNS Program is based on a one-year course sequence normally taken during the junior year, covering all of the aspects of technology business. The summer following the junior year is devoted to a hands-on internship experience, while the senior year includes a detailed technology business project. This mixture of project work, hands-on experience, and preparatory course work provides the best preparation before entering a career, and results in a product that the student can use to show his/her capabilities. The course work emphasizes integration of important skills, such as written and oral communication, graphics and artwork, business accounting, management, and marketing, with the important aspects of legal issues, regulation, and intellectual property. In addition the course covers the characteristics of all types of technology businesses. The courses are taught by many different Carthage faculty, and include outside speakers from many specialty areas, including local and national business leaders.
<http://www2.carthage.edu/departments/esns/>

Case Western Reserve University

- *Science Entrepreneurship Program.* The Masters Programs in Science Entrepreneurship at Case Western Reserve University afford more than top-level academic instruction. They connect students with the business executives and leaders, experts, and venture capitalists who are crucial to success in start-up and growing ventures. The programs provide training and real-world experience to students who have a background in science and a vision for new and growing ventures. The goal: scientists who are empowered as entrepreneurs, and who have the skills to start new high-tech businesses and grow them successfully. The two-year Science Entrepreneurship Programs include a masters thesis and courses in one of the departments and courses in the Weatherhead School of Management at CWRU. Each student is paired with a mentor from one of the participating science departments who acts as an academic advisor as well as a long-term scientific resource. A member of the Weatherhead faculty likewise serves each student as a business management resource. The scheduling of courses is flexible. Programs available in the following departments
 - Biology
 - Chemistry
 - Mathematics
 - Physics
 - Statistics
 - <http://sep.cwru.edu/> http://weatherhead.cwru.edu/ENTP/program/sci_entp.htm

Georgia Institute of Technology (in affiliation with Emory University)

- *Technological Innovation: Generating Economic Results (TI:GER).* A new program at the Georgia Institute of Technology and Emory University brings Ph.D. students in Science and Engineering together with Georgia Tech MBA students and Emory law students to participate in a curriculum on the technical, legal, and business issues involved with moving fundamental research to the marketplace. The program is designed to address two critical components of the technology commercialization process: 1) the development of a professional workforce with the skills and capabilities necessary to facilitate innovation, and 2) the development of a body of knowledge unique to the innovation and

commercialization process. The overriding goal of the program is the development of technically proficient students with the skills necessary for success as academics, entrepreneurs in small companies, or intrapreneurs in the corporate world. The program is multidisciplinary, drawing students and faculty from the **sciences, management, law, and economics**. The science and engineering disciplines currently involved include: Biomedical Engineering, Tissue Engineering, Microelectronics, Packaging, and Microelectromagnetic Systems. Training occurs in multidisciplinary teams. Central to the program, are team projects in which students consider potential market applications of the Ph.D. students' research. The teams are formed at the beginning of the MBA students' program, and teams are required by the end of the MBA to have completed a detailed commercialization plan that is the focus of the science and engineering students' research. <http://www.dupree.gatech.edu/entrectr/index.shtml>

Interdisciplinary Center Herzliya (IDC) (Israel)

- *The Efi Arazi School of Computer Science*. Students begin their education with a series of introductory mathematics and computer science courses, with special emphasis on the Java programming language. Second year courses focus on the core of the field: algorithms, digital architectures, operating systems, software engineering, database management, communications and networks. During this year, the students develop programming skills in C++, Visual Basic, and Scheme. The third and final year of studies focuses on advanced courses in such areas as computational models and distributed systems. In addition, the students form project teams that develop industrial-strength systems, under the academic supervision of our faculty and the sponsorship of some 50 Israeli high technology companies. Furthermore, the program features a minor in business administration, consisting of courses in economics, finance, marketing, accounting, communications skills, and entrepreneurship. As our program's structure reflects, our goal is not limited to preparing programmers and software developers; our graduates are prepared to take the fast track and grow quickly into product management and technology leadership positions. <http://www.idc.ac.il/eng/content/csprog.asp>

NOAA Educational Partnership Program with Minority Serving Institutions (U.S. Department of Education)

- *The Environmental Entrepreneurship Program (EEP)*. EEP provides funding to eligible Minority Serving Institutions (MSIs) to attract under represented students to pursue advanced academic study and entrepreneurship opportunities in the NOAA-related environmental fields. The program will train, mentor, and retain students in the atmospheric, oceanic, and environmental sciences. Funds are disbursed on an annual basis through a competitive process. The program facilitates partnerships between MSIs, NOAA, and the Department of Commerce. Relationships are formed with academic, research, government, and non-governmental organizations (NGOs) aimed at preparing students with the necessary knowledge, skills, tools, and technology to foster environmentally sustainable and economically viable local communities and careers. <http://epp.noaa.gov/programs/?ID=3>

Syracuse University

- *Program in Entrepreneurship and Emerging Enterprises* at the School of Management. Minor in Entrepreneurship is aimed at students, particularly those in majors outside the

School of Management, for a nice complement to their major area. The minor is intended to help students bring an entrepreneurial perspective to their major field of study, ranging from the arts and sciences, engineering, and education, to the health professions, communications, and the visual and performing arts. Students pursuing the Entrepreneur Minor must complete Introduction to Entrepreneurship, three elective courses in entrepreneurship, Introduction to Financial Accounting, and Finance for Non-business Students. This program has a continuing relationship with the *Center for Advanced Technology in Computer Applications and Software Engineering (CASE)*. The objective of the program, led by Gary Lim, is to develop within students the business savvy to carry ideas and dreams as high and as far as the students wish to take them. Students develop the knowledge needed to transform ideas and emerging organizations into prospering enterprises, the astuteness to anticipate opportunity and minimize risk, and the wherewithal to maintain a clear vision. The vision of Syracuse University's Program in Entrepreneurship and Emerging Enterprises is to forge a synergy between educational excellence and entrepreneurial ingenuity. Students gain the knowledge and skills to nurture a startup, manage a family business, revitalize an established business, or shepherd hybrid economic organizations-alliances, joint ventures, partnerships, or "virtual corporations." (<http://sominfo.syr.edu/entrepcorner>).

Tulsa University

- *Tulsa University Innovation Institute (TUI2) Certificate Program in Innovation and Product Development.* The TU Innovation Institute (TUI2) provides a unique interdisciplinary forum where **engineering, business, arts and sciences**, and **law** students come together to study and develop comprehensive plans for marketable technology-based products. Students also collaborate with the Oklahoma Technology Commercialization Center (OTCC) to analyze actual business plans submitted by aspiring entrepreneurs. <http://www.utulsa.edu/fyi/index.pl?group=2&bullet=2>

University of South Florida

- The **Center for Entrepreneurship** is a multi-disciplinary, campus-wide center focusing on entrepreneurial education, training and research. The vision of the USF Center for Entrepreneurship is to create an internationally recognized Center of Excellence for educating and training entrepreneurial leaders using innovative, interdisciplinary approaches. The Center seeks to create unique learning opportunities through partnerships among students, faculty and community entrepreneurial leaders. These partnerships leverage the strengths of all participants to create a nationally recognized program which enables students, faculty and entrepreneurial leaders to develop the critical skills necessary to (1) identify new opportunities (2) accelerate the commercialization of new technologies and (3) create and grow successful new business ventures. <http://www.entrepreneurship.usf.edu/>
- The **Institute for Excellence in Life Sciences Entrepreneurship** is a partnership between the University of South Florida's Center for Entrepreneurship and the Ewing Marion Kauffman Foundation (<http://www.emkf.org/>). The Institute maintains an active research program which explores the underlying success factors which drive the creation, growth and failures of the Life Sciences Industry. http://www.entrepreneurship.usf.edu/ce_InstExcellenceLifeScience.html

University of Tennessee at Martin

- *The Entrepreneurship Program.* The College of Business and Public Affairs offers a multidisciplinary program for students who wish to study entrepreneurship. Courses emphasize innovation and invention, and the integration of students from other schools

offers realism and technical knowledge from the other disciplines. Students from any major who is sincerely interested working on a project to bring a product or service to market are potential students. Each major in the University has technical knowledge to add to the general knowledge base of the class, whether this knowledge be in education, electronics, science, nursing, agriculture or any other discipline. The current curriculum consists of:

- a concentration in entrepreneurship within the management major
- a certificate of entrepreneurship, primarily for technical majors such as engineering or
- a minor in entrepreneurship, offered for arts and science majors

The courses in this curriculum utilize team based class assignments to encourage students to develop their innovative and creative capabilities. These teams work on projects of their own choosing. Faculty from various schools are involved in teaching and advising students. Each project is developed by a team that includes non-business and business students. These teams develop around a team concept referred to as an E-Team. The "E" is for "Excellence and Entrepreneurship." The overall objectives of the program for student teams are to:

- educate university students from business and non-business in innovation and invention within existing businesses and in startup business situations,
- develop entrepreneurial and intrapreneurial (entrepreneurial efforts within existing organizations) skills and techniques necessary to recognize problems, and develop and carry out realistic solutions to those problems, and
- discover and understand what does and does not work in today's global competitive marketplace.

This program is a two-year study beginning in the students' junior year. There are no course prerequisites, but junior standing is strongly suggested. The program would ideally have equal numbers of non-business and business students.

<http://www.utm.edu/departments/soba/mmps/mmps.html>

This concept was championed by the National Collegiate Inventors and Innovators Alliance (<http://hamp.hampshire.edu/~nciia/#NCIIA>) which is based at Hampshire College (<http://www.hampshire.edu/>) in Amherst, MA. Considerable advice and knowledge is drawn from this Hampshire College and the Entrepreneurship Program (<http://www.usc.edu/dept/buad/entrepreneur/info/courses.html>) at the University of Southern California.