

The Physics Entrepreneurship Program at Case Western Reserve University

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Introduction and Overview

The Department of Physics at Case Western Reserve University (CWRU), in cooperation with the Entrepreneurship Division of the Weatherhead School of Management, has launched a new Master's level Program in Physics Entrepreneurship.¹ The first class entered in the fall of 2000. Though we are only midway through the second year of the program, there are already significant early indicators of success.

The purpose of the Physics Entrepreneurship Programs is to provide training and real-world experiences to students who have a scientific background and a vision for new and growing ventures. The goal: physicists who are empowered as entrepreneurs, and who have the skills to start new high-tech businesses and grow them successfully.

Overview of the Program

The two-year Master's program has several components:

- a core of courses taught by the Department of Physics including a new two-semester sequence on *Modern Physics and Innovation* specifically designed for this program;
- a core of courses taught by the Weatherhead School of Management, including *New Venture Creation* and a new course on *Technology Entrepreneurship*;
- a physics master's thesis involving an entrepreneurially oriented project. This will typically arise from an entrepreneurially oriented internship in a sponsor company, or from a student-designed research project that will be the basis for launching a new venture;
- options for elective courses tailored to the needs of each student;
- an active seminar program provides continual exposure to scientists, technologists and entrepreneurs who are actively engaged in forming new high-tech ventures.

It is perhaps worth emphasizing several aspects of this program.

First, the detailed course content has been developed to meet the specific needs that our physicist/entrepreneur advisors identified as being crucial, while preserving a degree of flexibility permitting students to target areas of individual interest.

Second, the internship/Master's thesis insures that the students will have real-world experience of technical innovation in an entrepreneurial environment.

Third, the mingling of business graduate students with the students from this program in the courses on New Venture Creation and Technological Entrepreneurship results in significant synergies. The mixing of these two groups of students in a setting focused on common entrepreneurial goals is very exciting, and is already yielding results in the form multi-person teams dedicated to developing new ventures.

Historical Background

In 1993, the Department of Physics at CWRU inaugurated a new period of growth and development by recruiting Lawrence Krauss, a noted physicist and author of several science best-sellers, as Chair of the Department. Since then, the Department has seen a major renovation of the Rockefeller Physics Building, as well as the hiring of some 8 new faculty members. This growth is continuing.

Perhaps more importantly, the Department also began a major review and renovation of its degree programs. In the undergraduate arena, significant changes were made in the entire curriculum. New undergraduate programs in Engineering Physics and in Mathematics and Physics were launched, while the program leading to a B. A. degree (as opposed to the B.S.) was restructured to appeal to a wider spectrum of students. As a result, the number of students declaring physics majors has almost tripled.

The idea for the Physics Entrepreneurship Program arose from similar consideration of our graduate program, and explicitly resulted from two outreach activities launched by the Physics Department. First, in order to help address the question as to what we should do to improve our graduate programs, we turned to our alumni. Here the feedback quickly identified physics entrepreneurship – a program preparing physicists for entrepreneurial careers – as a major national need, and a target of opportunity for the CWRU Physics Department. A second thrust was to similarly query industrial leaders. This identified a desire on the part of high-tech industry to improve connections with the university, and in particular suggested long-term and intensive student internships as an approach with both significant pedagogical value while providing a new mechanism for funding graduate students.

Having identified a potential opportunity, there remained the question of how to create a program that would address the need. Indeed, it was unclear to us initially whether the program should be housed in the Physics Department or the Weatherhead School of Management, whether it should be an undergraduate program or a graduate program, and if so, whether it should be at the Master's or Ph.D. level.

To help us address this question, one of our alumni, Robert Stieglitz, provided funding for the “Stieglitz Physics Entrepreneurship Lecture Series”. As part of this series, we brought a series of physicists-turned-entrepreneurs to campus as part of the regular colloquium series, scheduled intensive meetings with both faculty and students, and solicited their advice as to how to structure an academic program in Physics Entrepreneurship.

As a result of these discussions, it soon became clear that the program should be at the Master’s level (an undergraduate degree does not appear to provide sufficient disciplinary base, while a PhD has very long time scale compared to typical entrepreneurial activity) and housed in the Physics Department (thus insuring the integrity of the technical component of the program). A corollary to these considerations was a strong recommendation that the course requirements for the program be lean and flexible, and that the program as a whole be grounded in significant real-world experience.

It is extremely important to note that Robert Hisrich, head of the Entrepreneurship Division of CWRU’s Weatherhead School of Management, was an integral participant in these discussions, and strongly supported the recommendations that we received. The Entrepreneurship Division, consistently ranked among the top entrepreneurship programs in the world, provides the core instruction on the business side, as well as providing significant advising to the students in the Physics Entrepreneurship Program. The Physics Entrepreneurship Program is thus a close partnership with the Entrepreneurship Division, a relationship formally reflected by the Physics Department appointing Prof. Hisrich as Associate Director of the Physics Entrepreneurship Program. This close cooperation is absolutely essential for the success of the program.

When the outlines of the program fell into place in the fall of 1999, we decided to implement the program as quickly as possible. Several factors allowed us to move very rapidly. First, since the Physics Department was already authorized to grant a Master of Science in Physics, we only needed approval for a new track for this existing degree. This was obtained in February 2000. Second, Robert Stieglitz, who had been instrumental both in helping to identify the opportunity and in providing the resources the Physics Department needed in order to figure out how to exploit the opportunity, died as the outlines of the program were coming together. He very generously left the Department an endowment, the interest on which has been used to help launch the program. Together with grants from the Coleman Foundation² and the National Collegiate Inventors and Innovators Alliance (NCIIA)³, we were able to recruit a class of five superb students, who entered the program in the fall of 2000.

Seminar Series

As part of the Physics Entrepreneurship Program, the CWRU Physics Department inaugurated a new seminar series in the 2000-2001 academic year, complementing the existing series in condensed matter physics and particle/astrophysics. Speakers have ranged from the President of a 4-person startup intent on growing his company without resorting to venture capital to the former Chief Financial Officer of WebVan.

The seminar series play several important functions. First, it provides continuous exposure of the students and faculty to people actively involved in all aspects of the new venture creation process. This goes beyond just the formal seminar: speakers have been extraordinarily generous in volunteering to assist the students as challenges arise in the various student projects. Speakers have also been very generous in seeking other ways that they can assist the program.

Conversely, the seminar series provides an important entry point to the university for entrepreneurs outside the academic community. One measure of this is that many speakers frequently attend future seminars – and invite other entrepreneurs they think will benefit. As a result, the series is becoming an important networking event, for members of the Northeast Ohio high-tech community as well as for students in the program.

Advisory Board

The external advisory board provides guidance and oversight for the program. The Board is chaired by Frank Mosier, Former President, Standard Oil Company and Former President, BP America. Other members include Christopher Coburn (Executive Director, CCF Innovations & COO, NovaMedics), Joseph Keithley (Chairman, President and CEO of Keithley Instruments, Inc.), Richard Stieglitz, (President of RGS Associates, Inc.) and Juris Sulcs (CTO, Advanced Lighting Technologies, Inc.).

Early indicators of success

The real test of any program seeking to empower people as entrepreneurs is the number of successful companies created. Creating and growing new companies takes time, but there are already clear indications that some of our students are on the road to success, even though the program is only a year and a half old.

Thus we were delighted when it was reported in early December 2001 that the Governor of Ohio had announced “state assistance for NeoMed Technologies” in the form of “a 60 percent, six-year tax credit.”⁴ Marc Umeno, the founder and President of NeoMed Technologies, was attracted to Cleveland to become a student in the first class of the Physics Entrepreneurship Program. NeoMed⁵ had secured seed funding earlier this year, allowing it to begin the FDA approval process and begin early clinical trials for their novel screening test for coronary artery disease. NeoMed had also earlier won both the Weatherhead Business Plan Competition and the Case-Weatherhead Business Launch Competition. It had also secured an Advanced E-Team grant from the NCIIA.

Outcome Assessment and Quality Control

Quality control is essential for all aspects of the program. This is particularly critical because of the difference in cultures of academia and industry. Management of these

issues is of great importance, and largely dictates the rate at which we hope to grow the program, as well as the final size of the program.

Metrics for assessing the program are thus essential. We have identified a variety of metrics which are conveniently categorized down by the various communities of stakeholders in the new Professional Master's Programs in Science Entrepreneurship, and involve a mixture of short-term metrics (such as seminar attendance) as well as long term metrics (number of IPO's resulting from student launched ventures). Specific communities of stakeholders for which metrics have been identified include: students, the University, partner firms, new ventures, and the broader community.

Future Plans for the Physics Entrepreneurship Program

The Physics Entrepreneurship Program had five students enter the two-year program as full-time students in the Fall of 2000. A similar number entered in the fall of 2001, representing a doubling in the total number of full-time students in the program. After that, our goals are 10 full-time students entering in the fall of 2002, 15 in the fall of 2003 and 20 in the fall of 2004. This number, corresponding to about 40 full-time students in the program, represents the maximum number that the Physics Department believes that it can properly supervise with its present faculty size. (It corresponds to about one entering student per faculty member per year). At this point, the number of Physics Entrepreneurship students will also be comparable to the regular, PhD-track, graduate program.

Next Steps: Science Entrepreneurship at CWRU

In the summer of 2001, the Professional Master's Program⁶ of the Alfred P. Sloan Foundation invited us to submit a proposal for planning and implementation of an extension of the model of the Physics Entrepreneurship Program to other Sciences at CWRU. This proposal was funded in December 2001, and new programs in Biology Entrepreneurship, Chemistry Entrepreneurship, Mathematics Entrepreneurship and Statistics Entrepreneurship will be launched, beginning in 2002. Additional funding for this initiative has been provided by a Dec. 2001 Coleman Foundation-USASBE Entrepreneurship Awareness and Education Grant.⁷

Bibliography

1. For further information, see the Program's web site at <http://pep.cwru.edu>
2. The Coleman Foundation's web site is <http://www.colemanfoundation.org/>
3. The web site of the National Collegiate Inventors and Innovators Alliance is <http://www.nciia.org/>
4. **Central Ohio Source**, 5 December 2001, <http://www.sourcenews.com/news/Action.lasso?-database=news&-layout=web&-response=story.lasso&-recordID=12595698&-search>

5. For more information about NeoMed Technologies, see the companies web site at <http://www.neomedtechnologies.com>
6. The web site for the Professional Master's Program of the Alfred P. Sloan Foundation is <http://www.sciencemasters.com/>
7. The web site for the Coleman Foundation-USASBE Entrepreneurship Awareness and Education Grant Program is <http://www.usasbe.org/>

Biographical Information

CYRUS TAYLOR is Professor of Physics and Director of the Physics Entrepreneurship Program at Case Western Reserve University. He has been a John Simon Guggenheim Fellow, a Lilly Foundation Teaching, and a Harry S. Truman Fellow. A particle theorist, he also served as co-spokesman for MiniMax (T-864), an experiment at the Fermilab Tevatron Collider.

