UNIVERSITY OF OREGON

INQUIRY

Information from the frontiers of knowledge

A magazine highlighting research at the University of Oregon

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A Message About Research

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Dialog Box

Rich Linton
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There is no greater concern within Oregon than the pressing need for new strategies for sustainable economic development. The UO, as the eighteenth largest employer in the state, makes enormous contributions to the Oregon economy of more than $700 million annually. The corresponding return on investment is ten times that of the funds provided to the UO through direct state appropriations. In addition, the university is increasingly successful in translating its basic research discoveries into commercial products and spin-off companies. The research centers and institutes, funded largely through competitively awarded federal grants to faculty members, are the major source of the UO innovations driving its technology transfer efforts.

This issue of *Inquiry* provides three exciting examples of UO centers and their associated spin-off companies that transform academic research into applications directly benefitting society. These efforts are found in diverse fields including software to improve the efficiency of manufacturing processes, new medical imaging devices and associated bioinformatics systems, and second language learning and assessment tools. The Riverfront Research Park and the UO Office of Technology Transfer, by providing an exceptional infrastructure to support the UO's research and technology transfer efforts, help to assure that the entrepreneurial efforts of UO researchers will benefit the state's economy.

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Crossing the Valley of Death: The Road from Research to Profit

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They call it the Valley of Death. No, it's not a biblical Armageddon or that place you've got to walk all by yourself. As seen through the eyes of the University of Oregon's Office of Technology Transfer, it's the long walk between years of research and a final payoff on the entrepreneurial side.

Don Gerhart, Director for the Office of Technology Transfer

Since 1992, the office has taken on a series of growing responsibilities, all aimed at facilitating the development of commercial products based on innovations that arise through UO research. A number of such products are now sold. In addition, the university's efforts have led to the creation of several start-up companies that are currently operating out of the UO's Riverfront Research Park, a one-million square foot development, where knowledge-based businesses and organizations can start and grow in close proximity to and collaborative association with the research capabilities of the university.

Tenants at the park work in the fields of optics, neuroscience, biotechnology, artificial intelligence, internet-based multimedia, software, web design, behavioral research, teaching, networking productions and solutions, and customer relations management. They include three UO spinoff companies featured in this issue of Inquiry: On Time Systems Inc., Language Learning Systems, and Electrical Geodesics Inc. Getting to the point where they become profitable ventures with worthwhile returns on investment is the real challenge.

"When you take a close look at this, you begin to appreciate how challenging it is to cross the Valley of Death—to move from research to a product that can become a commercial success," says Don Gerhart, director for the Office of Technology Transfer. "It's a tough nut to crack for anyone."

Yet, crossing that valley is what the office's efforts are all about.

At the UO's Monoclonal Antibody Facility (MAF), the first steps are being taken to join those fortunate few that succeed. In research that produces antibodies used in studies of molecular structure, subcellular activities, and cellular differentiation, the antibodies have been marketed successfully through corporate partners such as Molecular Probes, a biotechnology company specializing in the area of fluorescence technology. Fluorescence technology is used for research in various areas of biology, with a practical focus on medical diagnostic practice.

The initial research, explains Rod Capaldi, Knight Professor of Liberal Arts and Sciences at the UO and researcher in UO's Institute of Molecular Biology, showed that antibodies that were developed for other purposes were capable of identifying molecules related to certain genetic diseases whose existence could otherwise only be inferred.

"It's absolutely wonderful," Capaldi says. "After twenty years of being highly focused on basic research with an interest in human disease, seeing an application in human health is incredibly rewarding."

"With this enterprise, as with any, you need proof that it will work in the real marketplace, that it addresses unmet needs," Gerhart says.

That proof is often hard to reach. He sites Taxol, a byproduct of the Pacific yew tree, as one cancer fighting drug developed from as many as 140,000 sample extracts. The process began in 1958 when the U. S. National Cancer Institute (NCI) initiated a program to screen plant species for anticancer activity. Through this program and other efforts, medicinal chemists Monroe Wall and M.C. Wani eventually described the structure in 1971. Yet this compound's journey through the Valley of Death was not completed until Taxol was approved for use in the treatment of metastatic carcinoma of the ovary in 1992.

"It takes long-range work and determination," Gerhart says.

This year, that work and determination has resulted in more than $1 million in licensing revenue to the UO during fiscal years 2001 and 2002, a 93 percent increase over the preceding biennium. Despite the economic recession that has gripped the U.S., the University of Oregon anticipates exceeding $1 million in licensing revenue for fiscal year 2003, the first time that the UO has surpassed this milestone.

"The University of Oregon's Office of Technology Transfer has grown dramatically over the last decade," says Gerhart. "As the program has matured, the UO's performance has joined the top quartile of United States universities in licensing revenue per sponsored research dollar. This is a real testament to the innovation and creativity of the UO's faculty and staff, and I'm proud that OTT has risen to that level of performance and service to the institution."

The UO is also rated in the top quartile for the number of successful startup companies generated in relation to research funding.

"Our hope," Gerhart says, "is that we will sustain that performance—even improve on it. We have a rich growing base of research activity here at UO, and our staff is working hard to make sure that we are the most effective portal possible to the world outside this institution."

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On Time Systems—from Infinite Possibilities to Million Dollar Savings

David Etherington of the UO's Computational Intelligence Research Laboratory

On Monday David Etherington can sit before a screen and build an aircraft carrier. On Tuesday he can construct a passenger plane. Wednesday he helps rush hour drivers in Los Angeles find the quickest way home. Thursday he routes aircraft so they save on fuel expenses. And he still has Friday left.

Etherington isn't alone in these and other efforts being made through the University of Oregon's Computational Intelligence Research Laboratory (CIRL). Located in the UO's Riverfront Research Park, CIRL is a university research center loosely affiliated with the Department of Computer and Information Science.

With four faculty members and the assistance of two graduate students and nearly a dozen alumni, CIRL is developing sophisticated artificial intelligence to solve such complex problems as finding the most cost-effective allocation of tasks and workers for construction of naval ships, or determining the quickest approach to building a passenger jet—or even helping one driver make it through L.A.'s notorious rush-hour traffic.

Of course, the ship "building" is on a computer, and actually represents the culmination of a search for the most timely or cost-effective solution to these and other extremely complex problems. It's not a simple task.

"For any interesting problem," Etherington says, "there can be more possibilities than there are atoms in the universe."

In such cases, Etherington explains, many of the bad solutions have to be eliminated before the good

ones can be explored. Through this process, CIRL team members have developed algorithms—step-by-step problem solving procedures capable of narrowing that universe of possibilities. Out of that research has emerged solutions—and On Time Systems.

Since CIRL is a research laboratory, it doesn't undertake development projects per se. However, On Time Systems Inc. (OTS) is a start-up company spun out of CIRL and housed in adjacent offices at the Riverfront Research Park. OTS develops the practical applications of CIRL's technology.

On Time Systems brings this state of the art search-based optimization technology—the process of seeking one solution out of trillions of possibilities--to bear on industrial problems. In recent years, search-based techniques have surpassed the effectiveness of the long-dominant operations research techniques for solving a large variety of optimization problems.

Matthew Ginsberg, CEO of On Time Systems

OTS's three main products to date are ARGOS, the ship production scheduling system; the Worldwide Aeronautical Route Planner (WARP), a system that finds the most fuel-efficient routes for aircraft flights; and TrafficDodger, a route-planning system for drivers in high traffic density cities.

OTS's solutions to real-world problems faced by military and industrial clients are resulting in, among other things, an expected 10 to 15 percent reduction in labor costs for ship construction and an estimated 2 percent reduction in fuel costs for U.S. Air Force cargo aircraft, projected to be nearly $15 million a year in savings.

"It's fun," Etherington says, "to be holding technology that is so much better than anything else out there. You know you can make a difference, change the way things can be done for the better."

"It's also nice," adds Matthew Ginsberg, CEO of On Time Systems, "to know that twenty million gallons less of fuel are being burned in the upper atmosphere."

While ARGOS and WARP have been sold to the government, TrafficDodger is being offered free to drivers in Los Angeles. Using the same basic search principles developed by CIRL, it gives an up-to-the-second analysis of the route between the driver's point of origin and destination, taking into account real-time traffic data.

Long term goals for On Time Systems are ambitious.

"We'd like to see all the shipyards in the world using ARGOS in five years," Ginsberg says. "In five

years we want everyone using WARP to select their flight routes."

Ginsberg thinks TrafficDodger could turn into a subscription service, noting that those who have started to use it have stayed with it.

"It must be adding value," he says, "or they wouldn't be bothering."

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A Better Way to Learn Language Moves from Classroom to World

Carl Falsgraf, left, and Kyle Ennis, Managing Director of Language Learning Systems

Learning a language in the twenty-first century is more than memorization of verbs, nouns, and vocabulary—more than knowing the twenty basic phrases to get by as a tourist. Today it incorporates learning all aspects of another culture and society, and offers students the challenge and opportunity to communicate on complex levels for business, science, governmental needs--or just out of interest in another culture.

"If you don't know the language, you don't know the culture," says Carl Falsgraf, director of the University of Oregon's Center for Applied Second Language Studies (CASLS). "Language classes are not just drill sessions any more," he adds, "they are international learning centers that incorporate culture, society, and art as expressed through another language."

Falsgraf and others at the center are working to help educators and students accomplish those goals. In the process, CASLS has created a spinoff business, Language Learning Systems (LLS), under which a wide range of cutting edge language testing and learning tools can be marketed to educational institutions around the country. The center and its spinoff venture are housed in the UO's Riverfront Research Park.

"I feel strongly that we have to give teachers the resources so we set kids up for success, not failure," Falsgraf says.

Last August, CASLS received a $1.3 million federal education grant designed to help students in the Pacific Northwest master foreign languages and cultures. As a recipient of this grant, CASLS becomes one of fourteen National Foreign Language Centers established by the U.S. Department of Education.

As such, CASLS will work with teachers in programs that range from kindergarten through university, with a focus on advanced language skills achieved through carefully developed lesson guidelines and sophisticated but easy-to-use testing.

Language skills, Falsgraf points out, used to be for what some would consider the wealthy or elite. No longer, he says, noting that in Oregon many rural areas are experiencing the impact of Spanish-speaking workers.

"It's a huge cultural clash," he says. "If people can speak the language, there is the potential for understanding, instead of a cultural war. It's important for educators, law enforcement people, medical professionals—anyone dealing with the public."

At the heart of the tools CASLS has developed is an assessment program that combines computerized testing according to set standards, with materials that teachers can download and customize for their specific needs. This testing is sophisticated enough to evaluate writing skill levels as well as simpler vocabulary and grammar understanding. When combined with a focus on the culture and people who speak the language, it offers what Falsgraf calls a "better way to learn."

As a spinoff of CASLS, Language Learning Systems is licensed through the UO, and markets to a wide range of educational institutions with the same focus on the kind of standards-based teaching that saves time and money.

"This licensing agreement will benefit CASLS, the university, and the language teaching community by allowing distribution of the excellent products that CASLS has developed to a much wider audience than would otherwise be possible," says Don Gerhart, UO director of technology transfer.

While technology transfer traditionally takes place in the sciences, Language Learning Systems is the first offshoot business on the UO campus to be based in the social sciences and education.

"We may be one of the few spinoffs from the Oregon University System not to come out of the sciences or engineering," Falsgraf notes. "It's a whole new way of looking at technology transfer."

In addition, it is a new way of looking at avenues for educational products, especially the teaching of foreign languages. With three districts in Oregon on contract and interest shown in Japan, Falsgraf and his associates have their eyes set on the business world.

Dow Jones, he says, is interested in a program that would combine teaching English with reading the Wall Street Journal.

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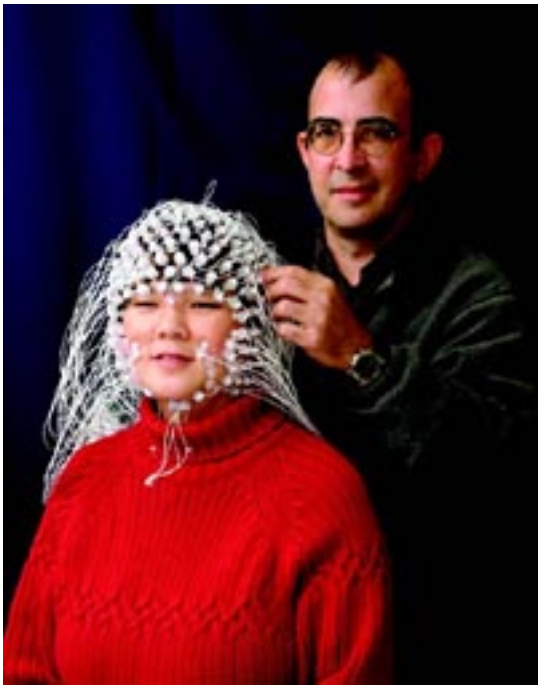
The New Frontier of the Brain Combines Business and Research



Don Tucker and Terri Schrantz modeling a dense array EEG

In a scene reflective of something from the next science fiction movie you see, a woman sits calmly with 256 electronic wires attached to her head. But this isn't science fiction. It's science—science as being developed at an office in the University of Oregon's Riverfront Research Park by Don Tucker and other researchers at Electrical Geodesics Inc. (EGI). And in this science, the brain is the new frontier.

The woman is modeling a dense-array EEG designed by Tucker and others at EGI. It contains twice as many contacts as an earlier model, allowing for more accurate measurement of brain activity, and thus a better understanding of what the brain is actually doing.

This and other work being done in this new frontier has practical applications in both research and the medical field, in particular in treating strokes, presurgery planning, neonatal monitoring, epilepsy treatment, and other neurological procedures.

Electrical Geodesics Inc., which recently received FDA approval to sell its neuroimaging equipment and software for medical use, is a direct spinoff from research undertaken at the UO psychology department's Brain Electrophysiology Laboratory. It also has close ties to the university's Brain, Biology, Machine Initiative, bringing together the UO's top scientists in the fields of cognitive neuroscience, molecular biology, genomics, and computational science.

The company licenses technology from the UO, designing, producing, and selling electrophysical neuroimaging equipment and related software. Employing twenty-eight undergraduates, graduate students, and postdoctoral fellows, it also serves as a training ground in the field of cognitive neuroscience.

"In 2002," EGI Director Don Tucker says, "sales reached $4.5 million, an increase over 2001's $4

million. We see plenty of opportunity for more growth."

You can pretty much bet that wherever any type of advanced scientific research is involved, so is a computer. EGI is no exception. It relies on advanced computer work courtesy of the Neuroinformatics Center (NIC), also located in the UO's Riverfront Research Park.

"It's fortunate the University of Oregon has its experts in parallel computing, as it is essential to what we are doing here," says Tucker.

Parallel computing, according to NIC Director Allen Malony, is the use of multiple computer processing units (CPUs) in the execution of an application program for purposes of improving its performance. By executing the calculations involved in the application "in parallel"—i.e., simultaneously on the multiple processors--the total time to execute the program can be substantially reduced. If good parallelism is achieved, it is possible to increase the number of CPUs to further achieve performance improvements.

NIC is working now to create a high-resolution model of human head tissues, which will be used in the analysis of brain function by integrating information from EEG and MRI sources. This will enable researchers and doctors to see a far greater range of brain function taking place over a longer period of time—which is one of the computational challenges.

"This is a computational problem that is difficult to solve," says Malony.

When neuroimaging measurement data are merged from two sources, Malony explains, not only is the amount of the data quite large for average experiments, the complexity of data associations increases.

"You're suddenly dealing with large amounts of data," he says.

The goal is to be able to connect the phenomena being observed with the sources in the brain of that activity, and then observe it over time.

"We want to be able to develop a computer environment able to do 3-D brain modeling in a manner capable of producing high resolution spacial representation of the brain," Malony says.

"What we're doing here is on the border between basic research and business," Tucker says. "It's exciting."