Speed of Light

St. Olaf's interdisciplinary approach to mathematics and the sciences is a sign of the swiftly changing times

By Scott A. Briggs '88

St. Olaf biology major Erica Savage '05 spent much of last summer focused on *Mycobacterium marinum,* a disease-causing agent in fish that has the potential to spark new insights about tuberculosis. Savage's research project required that she pore through vast online databases to identify resources that would prove valuable to her work. She had one problem, however.

"I'm not a computer science person," Savage concedes, pointing out that basic Windows-based software on a desktop PC wasn't going to cut it for the task at hand. "Just to get the computer to run, I needed to learn some basic commands and how to maneuver around the system." Fortunately, she teamed with computer science major Michael Olson '04. "If I had something that I wanted the computer to do," Savage explains, "Mike would write a program for me."

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David Van Wylen '80

This 10-week partnership generated a better understanding of the marinum genome that Savage and Olson studied. It also produced the Current Comparative Table, a freely available software product that now enables scientists to select a specific genome and easily access updated data about it as soon as any new findings emerge. "The biologist understood the DNA side," says Rob Rutherford, the St. Olaf assistant professor of biology who advised the two students, "and the computer scientist understood the tools that help you study 4,000 genes across 1,000 conditions, through time, while all that data is changing."

Each student gleaned knowledge about the other's area of expertise. Olson learned a lot about biology by developing programs to address project needs and watching Savage test his work to verify its usefulness to biologists. Olson's success, in turn, opened Savage's eyes to the impacts of technology upon her field. "I never realized the power of computer science and how much it can help you achieve your goals," she says.

Only a few decades ago, young future biologists would hole up in dedicated classrooms and labs to conduct research and solve scientific problems — independent of their colleagues in physics, chemistry and math. Many colleges housed these departments in separate buildings.

Today, the study of science has evolved into an intricate discovery process that calls upon the theories, tools and techniques of multiple academic disciplines.

At St. Olaf, scientific programs with an inherently interdisciplinary nature are increasingly emphasized. An environmental studies program introduced in 1989 allows students to blend coursework in the natural sciences with economics, politics, statistics and humanities. "You take political science classes to get a feel for how our political system functions," explains environmental studies major Jeff Jasperson '04. "It's difficult for just a straight-up ecologist to know how to apply what he finds to the systems that get things done."

In 2002, the college hired Assistant Professor of Psychology Shelly Dickinson to bolster offerings in neuroscience, a field now

The I's Have It

By fall 2008, St. Olaf College hopes to have a state-of-the-art natural sciences and mathematics complex that is designed to attract students in all disciplines — as well as faculty, staff and even townspeople — to the structure, on the site of the current Flaten Hall. The building itself will be a tool for teaching, in seven important ways.

According to Associate Dean for the Natural Sciences and Mathematics David Van Wylen '80, the science complex will be:

Interdisciplinary

To remain at the cutting edge of modern science, St. Olaf must promote interdisciplinary teaching and research. This means keeping students and faculty of the natural sciences and mathematics departments in close proximity to one another.

Investigative

To sustain St. Olaf's nationally recognized undergraduate research program, the complex must contain classroom and lab spaces that promote student exploration. These spaces must be designed to foster an investigative approach to science and mathematics.

Interactive

Scientific advances occur when teams of experts combine their various perspectives. St. Olaf's science complex must provide space for student-student, student-faculty and faculty-faculty interaction.

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A rendering for the proposed complex to house the natural sciences and mathematics at St. Olaf, which will sit on the Flaten Hall site.

poised for remarkable rates of achievement in clinical depression, Alzheimer's and Parkinson's disease. In the past, "the psychologist talked about behavior and the biologist tried to understand what nerve cells look like," says David Van Wylen '80, St. Olaf professor of biology and associate dean for the natural sciences and mathematics. Now, neuroscience dictates that biology and psychology be inexorably intertwined. "The only way to understand how behavior occurs is to understand how the brain works," Dickinson says.

Michael Bongard '04 isn't fazed by the overlap of scientific fields. This St. Olaf triple major — math, physics and computer science — is developing a data analysis computer program to help researchers better understand the geometry of the nuclei of atoms. "The relationship between physics and mathematics has always been an intimate one," he says. "Sometimes theoretical mathematics will spur physics, and sometimes it's the other way around. And computer science has been driven by both."

Nowadays, computers push progress in all of the sciences. Recent revelations about human genetics, for example, have generated unprecedented amounts of new information. To take advantage of this, scientists must sift through many sources, filter out irrelevant material and pinpoint what applies to their particular topics of focus.

"Biologists have finally gotten so good at creating data that they need the tools of computer science to really understand it," Rutherford says, "and the tools of statistics to figure out what they can trust." Those needs have spawned a new field called bioinformatics, dedicated to the analysis and management of scientific data. St. Olaf will debut an Interim class on that subject this January, team-taught by Rutherford, St. Olaf Professor of Computer Science and Mathematics Richard Allen and Dr. Laurent Trilling, a visiting bioinformaticist from the Université Joseph Fourier in Grenoble, France. Similarly, an environmental studies course on geographic information systems teaches students how to tap new technological tools that help researchers track and analyze data regarding land and water quality throughout the world.

"We can't do science anymore without being interdisciplinary," Van Wylen says. "That's how students need to go through scientific thinking."

[The I's Have It]

Innovative

Tools used in the study of science and math will continue to evolve and shape the way these subjects are taught. St. Olaf's new facility must be flexible enough to adapt to emerging innovations in technology and education techniques.

Interconnected

To reflect St. Olaf's diversely talented community and its foundation in the liberal arts, a new building must include spaces that interconnect mathematics and the natural sciences with the college's recognized strengths in the fine arts, international studies, humanities and social/applied sciences.

Inviting

To be a busy and vibrant place, the science complex must include intriguing spaces that invite and inspire many users — from scientists and mathematicians to other students, faculty members and campus visitors.

Integrity

To reflect the integrity of St. Olaf's mission, the new building must be designed, built and used in ways that honor the environment. The facility must also help stimulate students' critical thinking and moral development.

For more information about the proposed science complex, visit the web site: *www.stolaf.edu/sciencecomplex.*

Setting It in Stone

St. Olaf will demonstrate its embrace of modern methodology — one covered in limestone, copper and glass — when the college builds a new science complex. First discussed a decade ago, the project is now a top priority of the college's strategic plan as outlined by St. Olaf President Christopher Thomforde.

Fewer than 2,000 people were enrolled at the college when the current science facility opened in 1967; today, the student population is close to 3,000, with nearly 40 percent pursuing a major in science or math. General education math and science requirements have increased, too — from one course in each subject to one math class and two science classes — so even non-science majors spend more time in the building than ever before.

Meanwhile, the building is plain outdated. Individual departments are segregated from one another — the norm for the late 1960s — and labs feature tables and chairs permanently secured to the floor.

"When you took students to the lab, you'd put a little equipment in front of them and hand them a lab manual to follow," Van Wylen explains. "Now we teach with investigative projects. We put students together in teams, working on novel research in some cases, using all kinds of different equipment. People constantly move around, interacting with each other. So the style of the current lab is no longer consistent with the way we teach."

Preliminary drawings of a new science complex depict twice the square footage for research, flexible layouts for labs and lecture halls, and faculty offices and classrooms grouped to foster interaction among departments.

"Right now, departments come together and create opportunities. St. Olaf has been doing this really well for quite a while," says Rutherford. "The new building would facilitate more of this."

Among the nation's baccalaureate liberal arts colleges, St. Olaf boasts the highest number of graduates who earn mathematics and statistics Ph.D.s, and ranks in the top 10 for several other scientific disciplines.

"I have an advantage over people who have studied pure physics or pure math," says Bongard, who expects to attend graduate school in nuclear physics. "When it comes to real-world problems, there is a benefit to having the wider perspective."

Today's high-profile scientific accomplishments often occur when work within several fields intersects. "The most exciting things are happening at the margins of the disciplines," says Rutherford. "We need to train students who are comfortable working in that world, because that's where tomorrow's discoveries are going to come from."

"When it comes to solving real-world problems, there is a benefit to having the wider, global perspective."

Rob Rutherford

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