UMaine Today
CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE JANUARY/FEBRUARY 2005

The art of genomics

Learning about the inner workings of life's building blocks

From the President

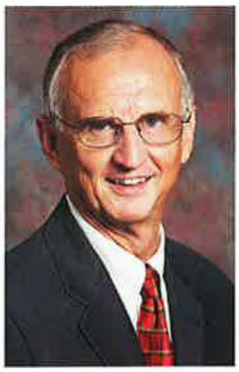


Photo by Kathy Rice

WE OFTEN TALK ABOUT UMAINE as a "21st-century university," meaning that we constantly work to position ourselves on the cutting edge of teaching, research and other activities. It is, of course, critical that we maintain that focus if we are to properly serve the people of Maine, in keeping with the basic and treasured tenets of our land-grant tradition.

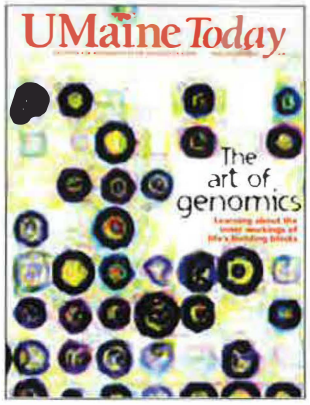
One event this past fall caused me to think about the 21st century more literally. It so happens that I arrived at UMaine in the summer of 2000, as we crossed into the third millennium. In the four years since, we have seen remarkable progress with regard to UMaine's research infrastructure. Last Oct. 22, as I attended the grand opening for UMaine's Engineering and Science Research Building, I was struck by how far we have come in a short time. We are truly in the midst of a remarkable upgrade in our research infrastructure with recent updates to Aubert Hall, Hitchner Hall and the Advanced Engineered Wood Composites Center, and construction of the new home of the Advanced Manufacturing Center on campus and a business incubator building at our aquaculture research center in Franklin.

We owe this progress in large part to the people of Maine, who have listened to our arguments about the role of university research in statewide economic development. Through elected representatives and statewide referenda, they have spoken clearly and told us that they believe that UMaine is a key to the future. We are becoming increasingly more competitive for research grants, for faculty members and for top students. This progress is largely due to UMaine's improving infrastructure.

The new Engineering and Science Research Building, which is connected to Barrows Hall, has literally paid immediate dividends. Professors Rosemary Smith, Scott Collins and David Kotecki have received a prestigious National Institutes of Health RO1 grant. If not for the availability of equipment in the new building, that $855,047 three-year grant would have gone somewhere else.

When I spoke at the Oct. 22 opening, I said that it was a "great day" for science and engineering in Maine. Certainly it was a watershed day for UMaine, but the importance of facilities like this one goes far beyond that. It is an important step as we work to live up to our responsibility as one of the primary forces that will determine Maine's future.

Robert A. Kennedy
Interim President



ON THE COVER: A highly stylized image of a microarray pattern revealed using lasers, a special microscope and a camera. DNA microarray technology offers a close-up look at the building blocks of life. A microarray — up to half a million tiny spots of DNA on a half-inch-square glass slide, silicon chip or nylon membrane — is a scientific tool with which scientists can simultaneously analyze the expression or "on switch" of essentially all the genes found in a genome. Determining how specific genes function will help scientists better understand their role in disease development. This technology is used by researchers in the Functional Genomics Ph.D. Program, profiled in a story that begins on page 12.

Photo courtesy of The Jackson Laboratory

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1865 THE UNIVERSITY OF MAINE

Located in Orono, Maine, the University of Maine is the state's land-grant and sea-grant institution. UMaine serves its home state through its explicit statewide teaching, research, and public service outreach mission. Offering 88 bachelor's, 64 master's and 25 doctoral degree programs, UMaine provides the most varied and advanced selection of programs available in Maine. The Carnegie Foundation for the Advancement of Teaching classifies UMaine as a Doctoral Research Extensive University, the highest classification.

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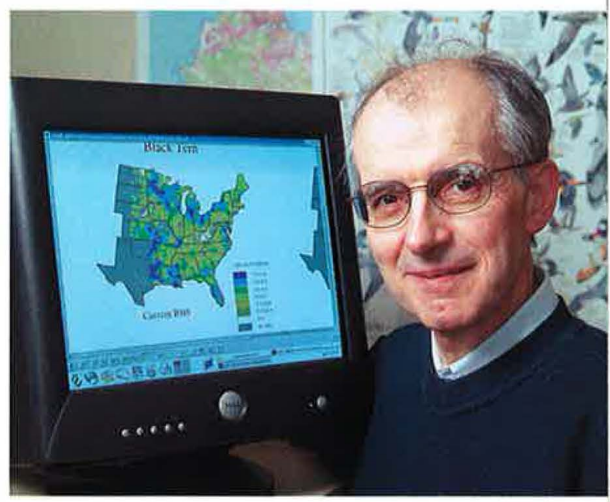

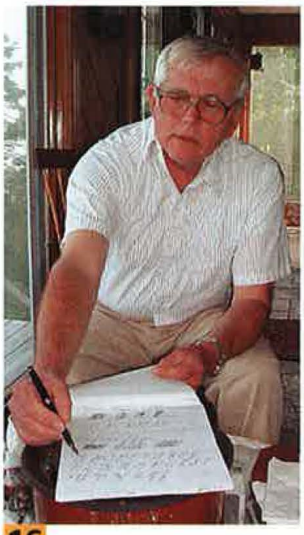

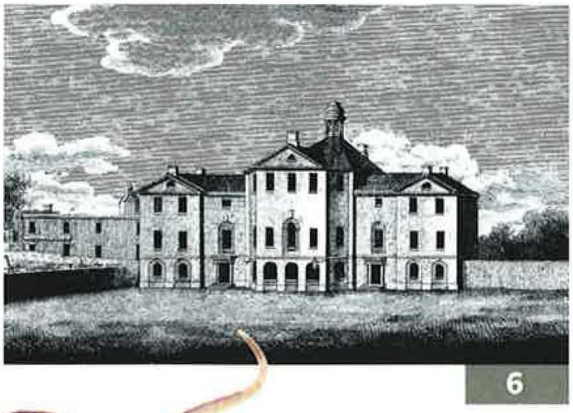

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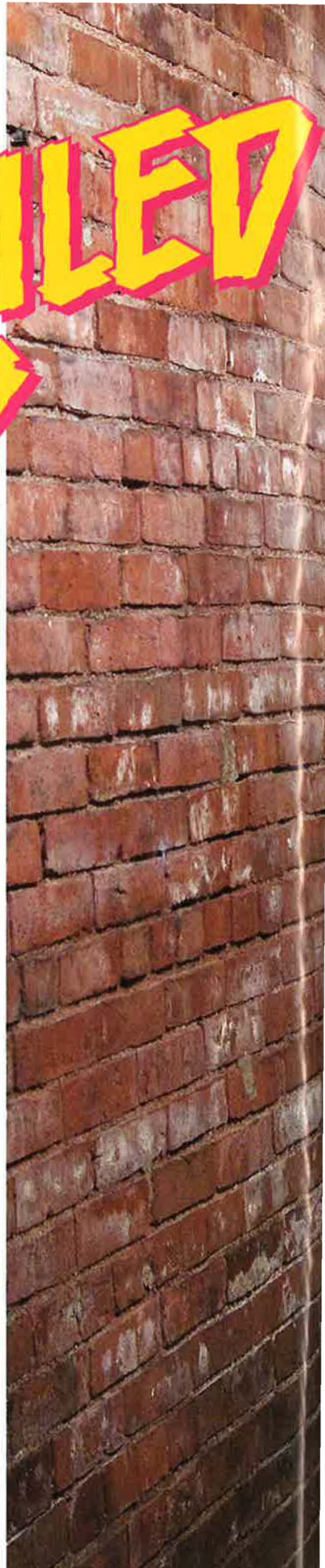
HARD-BOILED PULP

UMaine professor makes a case for the detective novel



There is one thing that is most important, in all the dark mystery of tonight, and that is how that ugly little auburn-haired red-eyed man, with his torn ear and his sharp dog-pointed teeth, with his twisted corkscrew legs and his truncated height, and all the other extraordinary details about him, could have got away and vanished so completely from the face of the countryside after killing Inis St. Erme.

From *The Red Right Hand,* by Joel Townsley Rogers

By Christopher Smith

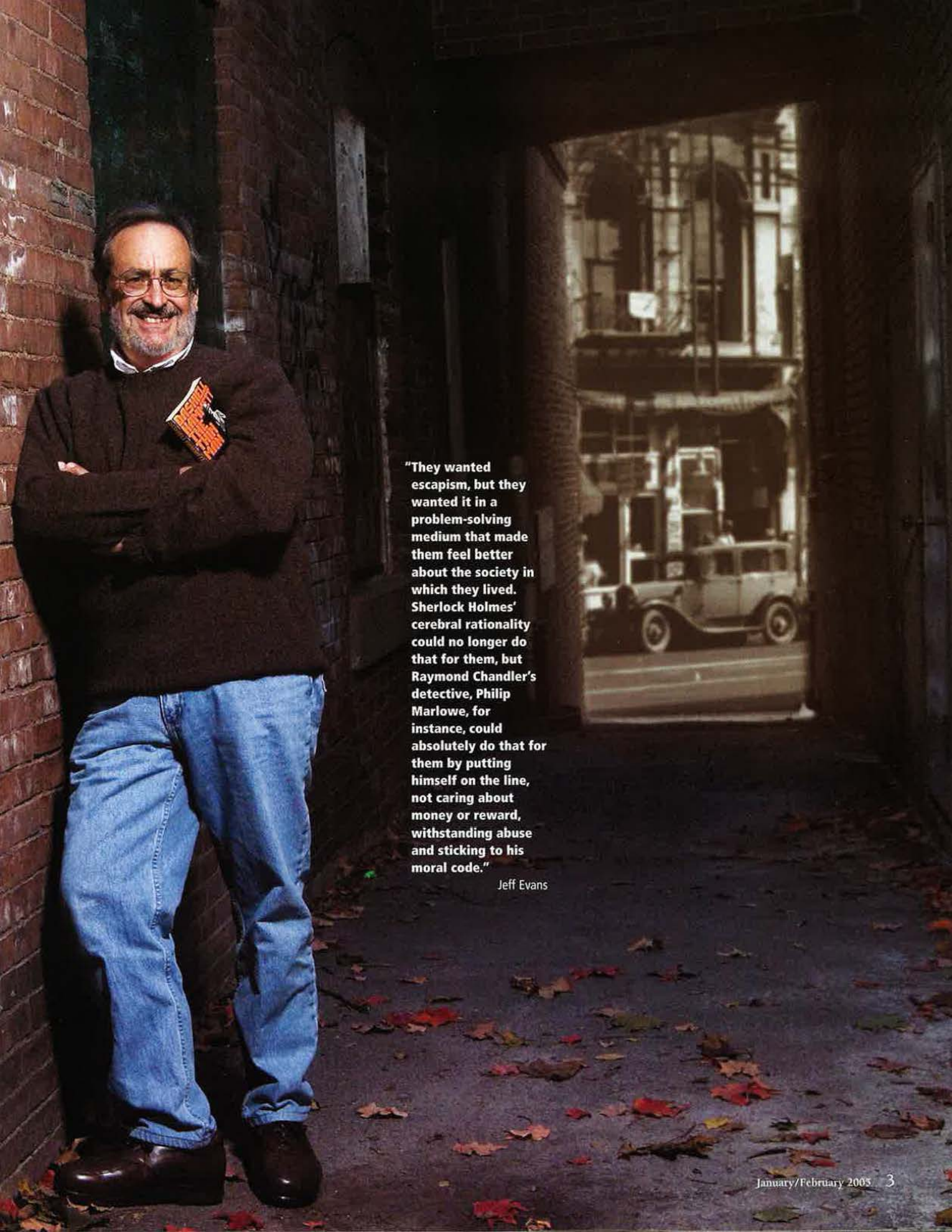
During its heyday, from 1920–50, the hard-boiled detective novel dominated American pop culture. In its grit, it rivaled the outlaw toughness of the Western, which influenced it. In its darkness, it echoed the Gothic, which deepened it.

Like jazz, it was distinctly American, an exciting, fresh style of writing that reflected the brash rhythms of a new frontier — the city. It was urban and racy, the dialogue snapped, sex underscored the sleaze, blood soaked the pavements.

It was everywhere — on best-seller lists and magazine racks, on radio shows and at the movies. It influenced the noir movement of the 1940s and '50s, such as with John Huston's *The Maltese Falcon* and Alfred Hitchcock's *Shadow of a Doubt,* and it found some pulp magazine writers each pounding out more than 1.5 million words a year just to keep up with the demand.

Its invention was a necessity. With Prohibition killing a national high, crime on the rise and people out of work due to the Depression, the American dream essentially went belly up. Those who had been on a binge in the '20s were faced with the bleak reality that they were broke and might not become rich after all. That knowledge led to a

Photo illustration by Bill Drake and Michael Mardosa



"They wanted escapism, but they wanted it in a problem-solving medium that made them feel better about the society in which they lived. Sherlock Holmes' cerebral rationality could no longer do that for them, but Raymond Chandler's detective, Philip Marlowe, for instance, could absolutely do that for them by putting himself on the line, not caring about money or reward, withstanding abuse and sticking to his moral code."

Jeff Evans

Library of Congress, Prints and Photographs Division, Historic American Buildings Survey, HABS, CAL, 19-LOSAN, 4-1

HARD-BOILED PULP

The edge of the frontier was California and the detective needed to confront the city. What he found was a mask, a veneer of society and civilization that concealed great complication. Politics, wealth and social status all came to bear on the problems he had to solve.

national gloom that proved the perfect caldron for the invention of a new artform, one that would allow people to escape their frustration through urban fantasy.

What they wanted was complex. Those who were suddenly out of work resented the big-time crooks of the day who were becoming wealthy and powerful through crime; they wanted them dead for it.

At the same time, Bonnie and Clyde, Pretty Boy Floyd and John Dillinger — all small-time crooks compared to Al Capone — had become national folk heroes. It was a time of such upheaval, readers could no longer identify with the quaint, respectable British detective fiction that featured such mannered sleuths as Sherlock Holmes, Miss Marple and Hercule Poirot.

What they wanted was someone unmannered and tough, an honest hero who would physically take to the streets and get rid of these bums with their fists and their brains. They wanted action and they wanted heat, not crimes being solved cerebrally in the comfort of a drawing room.

So who was such a person?

According to University of Maine Associate Professor of English Jeff Evans, an expert in the hard-boiled genre, this new detective was "a lone wolf gunslinger with a sense of justice who enforced the law himself. He was a rebel, the person who turned against established society and tried to articulate a whole new set of freedoms. He was an outsider. In him are characteristics we wanted to see in the culture."

Never respected as literature until such writers as Dashiell Hammett, Raymond Chandler and Ross Macdonald pushed it into prominence with their unique style and worldview, the genre was born in the wealth of pulp fiction magazines of the day, including such entertaining rags as *Black Mask, Dime Detective, Detective Fiction Weekly* and *Clues.*

It was considered a cheaper style of writing because of its daring content and fringe characters, and because of the quality of the paper on which it was printed. Whereas the respected magazines of the day — *Smart Set, Scribner's, Saturday Evening Post* — were printed on high-end, glossy stock, this new brand of detective fiction was published on low-end pulp. Still, it is vital and important. It offers a window into the past, and its influence resonates even today in the works of such popular writers as Elmore Leonard, Sara Paretsky, Patricia Cornwell, Michael Connelly and John Sandford.

According to Evans, the genre connected with readers of the day because of its mistrust in the institutions that failed to serve us, such as government and law, and because it recognized there no longer was a frontier. This was, after all, an era in which Dodge City had become a city, not just an outpost, and the American landscape was forever changed.

"The country was all used up," Evans says. "The edge of the frontier was California and the detective needed to confront the city. What he found was a mask, a veneer of society and civilization that concealed great complication. Politics, wealth and social status all came to bear on the problems he had to solve."

With the pressures of the Depression, Prohibition and World War II weighing down the population, people were thrown out of their ordinary sets of beliefs and faiths.

"They wanted escapism," Evans says, "but they wanted it in a problem-solving medium that made them feel better about the society in which they lived. Sherlock Holmes' cerebral rationality could no longer do that for them, but Raymond Chandler's detective, Philip Marlowe, for instance, could absolutely do that for them by putting himself on the line, not caring about money or reward, withstanding abuse and sticking to his moral code."

American society viewed evil as an ongoing reality, uncoiling just beneath the surface, and the real reason our country and its systems no longer worked.

For the hard-boiled detective, solving a case is parallel to a kind of knightly ordeal, Evans says, a gauntlet of tortures. "If there is nothing else to believe in, you believe in the profession and you try to advance that," he says. "It's what I like about the genre. Beneath the professionalism is a moral code these detectives stick to. That might be what endeared people to the reading. There is a clear sense of direction and action these characters take."

The direction the genre took went beyond magazines and books. It rippled across popular mediums, connecting with radio audiences in the detective serials of the day, and especially in Hollywood with the gangster films of the '30s and '40s.

One of the most influential films of the genre is the 1946 Howard Hawks' classic, *The Big Sleep,* a baffling yet entertaining movie based on Raymond Chandler's 1939 novel of the same name.

The movie stars Humphrey Bogart as Chandler's great hero, Philip Marlowe, a private dick who is on the side of justice, even though he doesn't see much justice around him. The film is crafted in the noir style, a direct descendant of the hard-boiled genre that gets to its base elements of mistrust, such as in its cynical examination of women and romantic love.

"The treatment of women in the genre isn't very good, as you would suspect," says Evans. "They are portrayed as temptresses and seductresses, or they are the good woman, the housekeeper, the home crafter, someone playing a subservient role who needed to be rescued. When they behaved as men, they would either be seen as comic, evil or immoral."

However, Evans says, as the genre evolved — and as the male protagonist, such as Jack Nicholson's character in *Chinatown,* became more problematized — the female character often broke out of stereotypes and became more complex and capable, such as the character Susan Silverman in Robert B. Parker's novels.

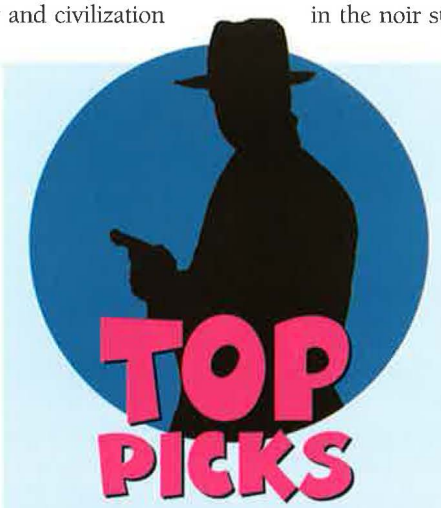
In his classes, Evans teaches the literary canon, but he presses against it by complementing it with other books. He joins other scholars in believing that the canon should be broadened to reflect the genres it ignores, such as this brand of fiction.

"What I've done is to insinuate Chandler into the traditional American novel," he says. "For instance, Chandler's novel, *The Long Goodbye,* is essentially a version of *The Great Gatsby.* It's fascinating to teach them together."

This semester, he will teach an advanced topics in film course that will juxtapose American noir fiction with its counterpart in film. He also teaches Hammett in a graduate-level course on 20th-century American literature.

"Hammett was writing during the same time as Hemingway," Evans says, "but he hasn't enjoyed the same critical acclaim. You can teach him for his style and vision. He was one of the first writers who melded a style with a modern worldview, which shaped a whole generation of popular writers.

"That kind of influence can't go ignored." ▮



WHEN ASKED to create his top 10 picks for the best hard-boiled detective novels, UMaine Associate Professor of English Jeff Evans went one better and offered 11. The following are his must-reads from the genre.

- **Dashiell Hammett,** Red Harvest
- **Philip Garlington,** Aces and Eights
- **Kenneth Fearing,** The Big Clock
- **Joe Gores,** Interface
- **Raymond Chandler,** The Long Goodbye
- **James Ellroy,** The Big Nowhere
- **Robert Ferrigno,** Flinch
- **Kent Anderson,** Sympathy for the Devil
- **James Crumley,** The Wrong Case
- **Don Winslow,** California Fire and Life
- **Stephen Greenleaf,** Grave Error

Temples of Justice

The history of courthouses offers insight into the rise of the legal profession

By Margaret Nagle

IN A 1786 TRIAL HELD IN A MASSACHUSETTS TAVERN, a transient basketmaker named Isaac Combs was convicted in the murder of his wife. But before reaching the verdict that sent Combs to the gallows, jury members first mingled among the tavern patrons and discussed at length the merits of the case.

Such an informal judicial setting and process were typical in New England until the early 1800s. When English colonists first dispensed justice, courthouses as we know them — function-specific buildings primarily used for legal proceedings — didn't exist. Instead, prior to the late 18th century, judges held court in meetinghouses, town houses or taverns located in a community's commercial center. When courthouses did begin to appear, their construction had little to do with concerns over justice and everything to do with the desires of lawyers and architects to be perceived as trained specialists with the public interest in mind, according to Martha McNamara, who specializes in American cultural history and New England history.

The halls of justice came to represent a new vision for the organization and use of civic space — a redefinition that has stood the test of time.

"Certainly justice was meted out during the 17th and 18th centuries without courthouses," says McNamara, associate professor of history at the University of Maine and author of the newly released book, *From Tavern to Courthouse: Architecture and Ritual in American Law, 1658–1860*. "But the development of courthouses as highly specialized, ritualized buildings occurred at the same time that the legal profession began to gain power and exclusive control in legal proceedings. In addition, changes to the

building trades during this period also were producing the first professional architects."

Law and architecture are good examples of how two specific occupational groups, both with similar agendas, shaped the landscape of 19th-century New England towns.

"Understanding the various elements of a particular landscape — its architectural form, its geographical arrangement and its social construction — illuminates the links between physical space and abstract ideas," says McNamara, whose research focuses on public buildings and how they are vested with political and cultural authority.

"Buildings can be used to understand the culture that produced them," she says. "They have great stories to tell, not just about wealthy and powerful people, but also about everyday life and how people thought about things like law and justice."

In particular, McNamara finds that the architecture of Massachusetts courthouses dating from 1750–1850 holds clues to how lawyers and architects succeeded in professionalizing their fields. Indeed, the halls of justice found in one of the country's oldest colonial settlements contain the roots of the modern legal profession.

"We have a tendency to see our physical environment as reflecting a common sense notion of the way things should be, but that's not always the case," McNamara says. "There's a relationship between physical space and concepts like professionalization. I look at how space and ideas might work together to favor a specific group of people."

IN THE 17TH AND EARLY 18TH CENTURIES, colonial town houses, meetinghouses, and taverns were the most common venues for court sessions. In taverns, people found lodging, entertainment, business transactions and the latest news. The rooms for court proceedings were usually on the second floor and often equipped with temporary furnishings to accommodate the court, such as platforms to elevate the justices above the crowd.

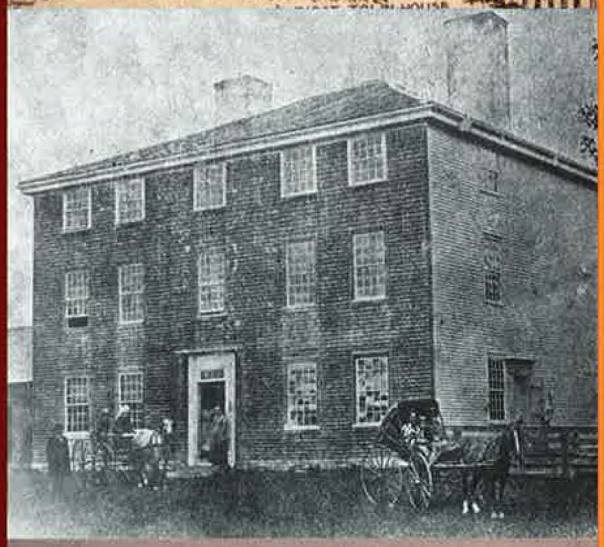
The major changes in the judicial landscape came at the end of the 18th century, when courthouses began to proliferate, says McNamara. Over the course of the 1700s, trained lawyers began to appear more frequently in Massachusetts courtrooms. They did so at the risk of alienating the public, which, since the earliest period of English settlement, had looked askance at what appeared to be the lawyers' self-interested practices.

The perception was that lawyers diluted the court's emphasis on truth telling and profited from the misfortune of others, McNamara says. Nevertheless, between 1765 and 1840, the number of trained lawyers in Massachusetts alone rose from about 50 to more than 600. The first bar association created during this period set educational standards to keep untrained lawyers out of courtrooms and away from potential clients.

The fledgling legal profession needed to establish itself as legitimate in the eyes of the public, and did so effectively by claiming a unique expertise. To give that legitimacy physical expression, the legal profession advocated for the construction of specialized buildings for court proceedings, severing long-standing ties with commerce by seeking new locations for the courts. The new courthouses moved court sessions away from the commercial activities taking place in taverns and town houses.

The James Brown Marston Painting *State Street, 1801* (left) shows the 1747 Boston Town House at the center of the city's commercial district. The cupola of the 1769 Suffolk County Courthouse, built away from the civic center, is visible to the right.

The 1658 Boston Town House was the most important civic structure in New England. Above the first-floor merchants' exchange were rooms for court and town government.
Charles A. Lawrence conjectural drawing. Courtesy of the Bostonian Society/ Old State House



The 1761 Pownalborough Court House stands today as one of the only remaining pre-Revolutionary War judicial buildings in Maine.
Courtesy of the Library of Congress, Prints and Photographs Division, Historic American Buildings Survey, HABS, ME, 8-CEGRO, 1-1

The 1824 courthouse In Wiscasset, Maine, is the oldest in continuous use in the state.
Library of Congress, Prints and Photographs Division, Historic American Buildings Survey, HABS, ME, 8-WISC,11-3

Ironically, as the commercial economy grew, merchants increasingly needed lawyers to wade through complicated transactions and settle debts. It was all the more reason for the legal system to "create the illusion of distance from mercantile activity in order to shore up their professional claims," McNamara says. Distinguishing legal and commercial venues also removed law from the everyday and made it a little more mysterious.

The first function-specific courthouse was built in Boston in 1769. Unlike its multi-purpose town house predecessors, this new home for the courts was designed exclusively to serve the needs of the legal system. By the early 1800s, courthouses contained specialized spaces for clerks, justices and juries, and offices of probate and deeds.

Newly professionalized lawyers also reshaped court rituals in order to lend legitimacy to their legal authority, says McNamara. Rather than emphasizing public displays of authority and justice, court proceedings became performances designed to highlight the professional demeanor and legal acumen of the leading characters — lawyers on the bench and at the bar.

For instance, justices now entered the courtroom through a door behind the elevated bench, rather than coming into court through the same doors the public used and walking between the rows of seats. Courtroom features such as the bar behind the lawyer's bench also served to separate the public from the proceedings.

BETWEEN 1780 AND 1830, every county in Massachusetts, including the District of Maine, acquired a new courthouse. The goal was not only to reshape civic space but to mold it in monumental proportions. To design these spaces, lawyers turned to architects, who were eager to define themselves as professionals, different from members of the building trades, by designing courthouses and other public buildings.

"Professionalization is promoted when you can convince a client that you have special skills or qualities that enable you to conduct business," says McNamara. "An element that helps make that argument is a special kind of building."

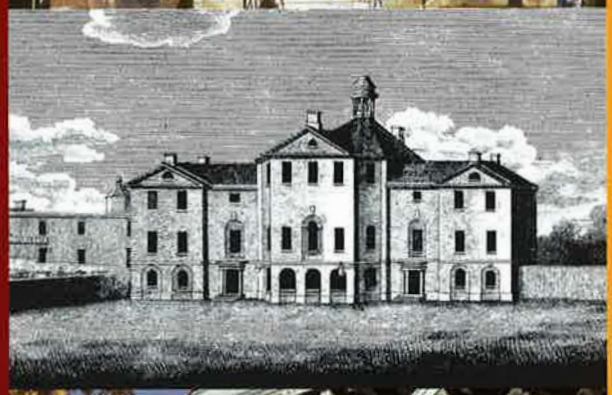
Brick became a popular building material for courthouses because of concerns about fire. Good examples surviving in Maine include the Lincoln County Courthouse (1820s) in Wiscasset and Oxford County Courthouse (ca. 1805) in Paris.

In the first decades of the 19th century, granite also was used; it was a new Suffolk County Courthouse built in Boston in 1810 that led the way. Granite became a popular building material with both lawyers and architects because it conveyed austerity, permanence and endurance. The opening of major quarries in Maine provided granite for monumental civic buildings throughout New England and beyond.

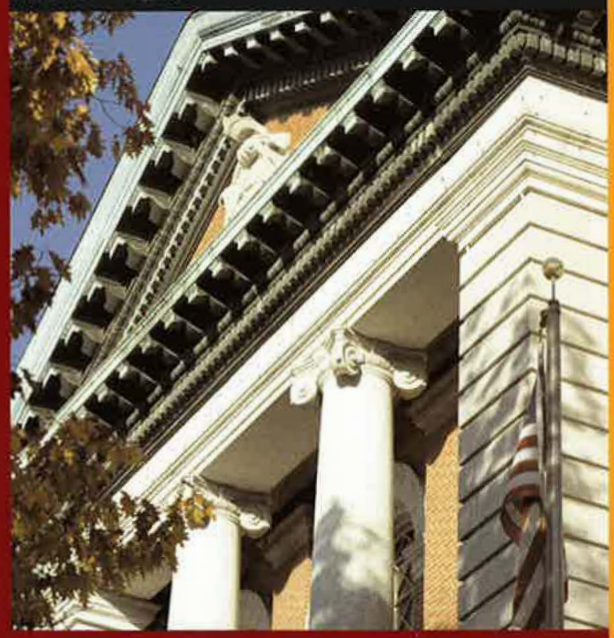
By the 1830s, Massachusetts courthouses had truly become "temples of justice," McNamara says. Courthouses, often coupled with jails in a park-like or fenced area, created a "landscape of justice," helping to symbolize the power of the legal profession.

"These landscapes defined and represented a professional ideal," says McNamara. "The new buildings, their design, their location, and their role as settings for court rituals physically articulated and supported the professionalization of both law and architecture in the early republic." ∎

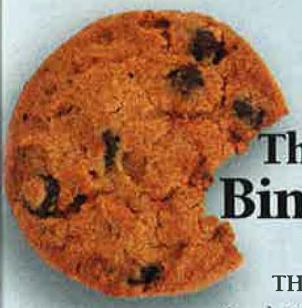
Built in 1815, Massachusetts' Berkshire County Courthouse replaced a square, two-story wooden structure constructed in the 1780s.
Photo courtesy of Martha McNamara



Massachusetts' 1810 Suffolk County Courthouse represented further specialization and was the first built of granite.
From *A History of Boston* by Caleb Snow, 1825



Classic styles of architecture for courthouses, like Maine's 1902 Penobscot County Courthouse, and other civic buildings continued into the 20th century.
Photo by Bill Drake



The Stress of Binge Eating

THE ROLE OF STRESS in stimulating and sustaining binge eating is the focus of research by University of Maine Provost Fellow and Ph.D. student Stephanie LaMattina.

LaMattina is a member of a four-student team working with Sandy Sigmon, UMaine professor and director of clinical training in the Department of Psychology, on a study of binge eating. Eating a large amount of food in a short time qualifies as binge eating behavior. To date, most studies have focused on the link between binge eating and obesity.

"Stress can make lots of problems worse," says LaMattina, of Malden, Mass., who received one of 10 Provost Fellowships in 2003, competitive awards presented annually to incoming graduate students who are among the most highly recruited in their academic programs. "You can be biologically vulnerable to a health problem, but with stress, symptoms tend to show up more."

LaMattina hopes her findings will contribute to better psychological treatments for binge eaters, including prevention of the behavior before it starts. She and other students are interviewing volunteers who have been clinically diagnosed with binge eating disorder. Key to their work is determining how people respond to stressful situations and understanding how episodes of binge eating affect emotions.

The team also is focusing on cognitive-behavioral treatments, such as keeping diaries and modifying eating patterns. "We encourage individuals to eat smaller amounts of food six times a day, every two to three hours or so," says LaMattina. "A regular pattern can help people avoid becoming really hungry and then eating a lot."

Feelings of distress and loss of self-control are hallmarks of anxiety disorders, says Sigmon. Those emotions may reinforce a consumption pattern that contributes to obesity and a negative self-image. Sigmon specializes in anxiety disorders such as panic disorder and seasonal affective disorder (SAD).

An essential ingredient: Mentoring

KELLY GUTHRIE graduated from high school knowing she wanted to study science at the University of Maine. She just didn't know which science.

That summer before she enrolled, she took a part-time job in the research laboratory of food scientist Rod Bushway. It's now five years later, and she's never left.

"I remember how intimidating it was walking into the lab, getting thrown into research unlike anything I'd ever done in high school," says Guthrie, now a grad student working toward a Ph.D. in food and nutrition sciences. "It also was exciting to use sophisticated equipment people my age didn't get a chance to see, let alone work with."

In the lab throughout her undergraduate years, working alongside Bushway and research chemist Brian Perkins, Guthrie was involved in the development of methodology to analyze and detect pesticides, vitamins and natural toxins in food, water and soil.

Her first project involved quantifying capsaicinoids (the "hot" compounds in hot peppers) in oleoresins (concentrated extracts from hot pepper fruit) using High Performance Liquid Chromatography (HPLC), and correlating those values with others obtained by analysis with Enzyme Immunoassay (EIA). She cooperated in research analyzing pesticides on blueberries and in groundwater. In a particularly large project, Guthrie helped in an analysis of the levels of naturally occurring toxins in potato varieties.

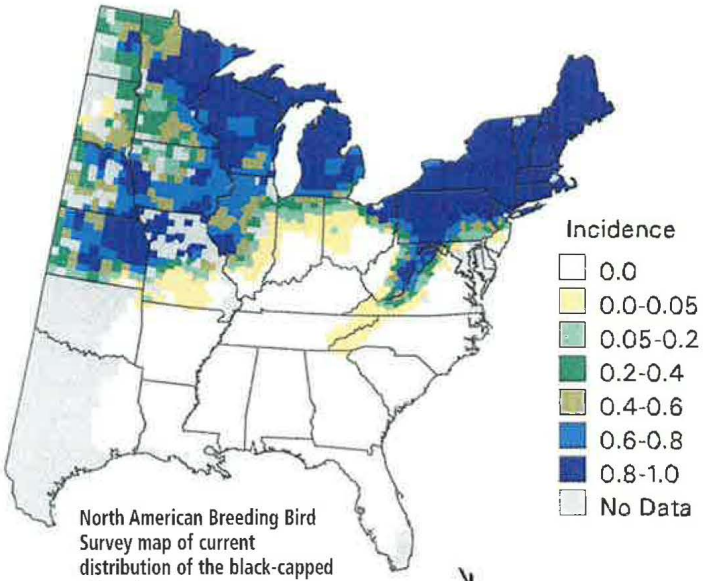
"I was pleased to find food science fit so well with what I wanted to do. It involves a lot of chemistry, some biology — a good mix of sciences," she says.

Guthrie is not the first high school student to find her way into basic scientific research via the laboratories of the UMaine Department of Food Science and Human Nutrition, the only university program in Maine that offers both bachelor's and graduate education in food science, human nutrition and dietetics. Both Bushway and Perkins have worked with secondary school students through the years on projects that have led to winning entries in state and regional science fair competitions, and co-authored articles in peer-reviewed journals. The budding scientists come from local communities like Bangor and Hermon (Guthrie's hometown), and from as far away as Cumberland in southern Maine.

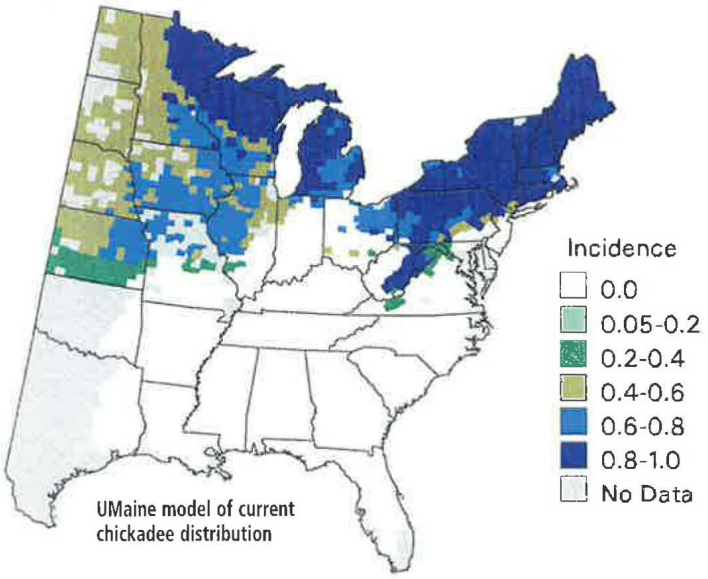
"Twenty years of doing cutting-edge research and fulfilling a love for teaching have convinced me that one-on-one mentoring is an essential ingredient for the personal growth of most students," says Perkins, who manages the lab.

With HPLC skills, Guthrie says she'll have several career options working in the food industry or in pharmaceuticals. "But I'm also interested in being a high school science teacher," she says. "Having practical lab experience will make a difference in how I teach."

Photo by Kathy Rice



North American Breeding Bird Survey map of current distribution of the black-capped chickadee



UMaine model of current chickadee distribution

A bird's-eye view of climate change

Computer modeling predicts dramatic shifts in species' ranges

By Nick Houtman

CHICKADEES, SONG SPARROWS, robins and other common bird species are among the familiar sights and sounds of Maine and much of the eastern United States, but in a world affected by a changing climate, they may not always be around.

"Both climate and landscape are important to birds," says Steve Matthews, who, for his master's degree in wildlife ecology at the University of Maine, studied how bird species might respond to a warmer world.

Matthews worked with UMaine Professor Raymond O'Connor on a computer model using current information about climate and the eastern U.S. landscape to show where bird species occur. Bird density is hard to measure directly; the researchers used incidence, a measure of how reliably a species can be found at a location.

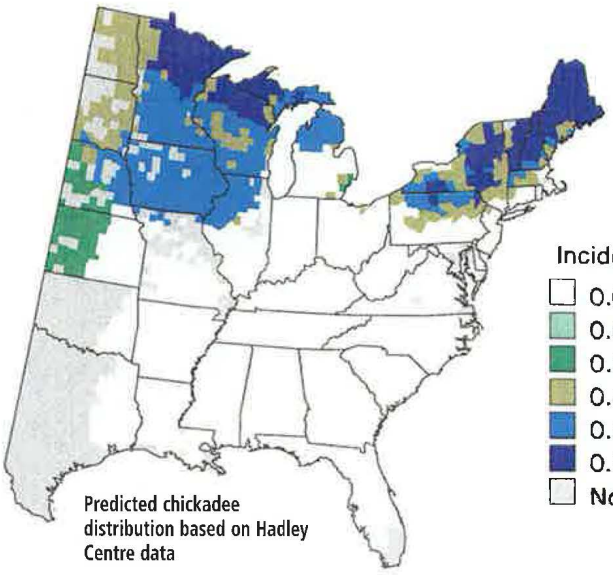
O'Connor's research focuses on the consequences of changing landscapes and agricultural practices on birds and other wildlife in Great Britain and North America.

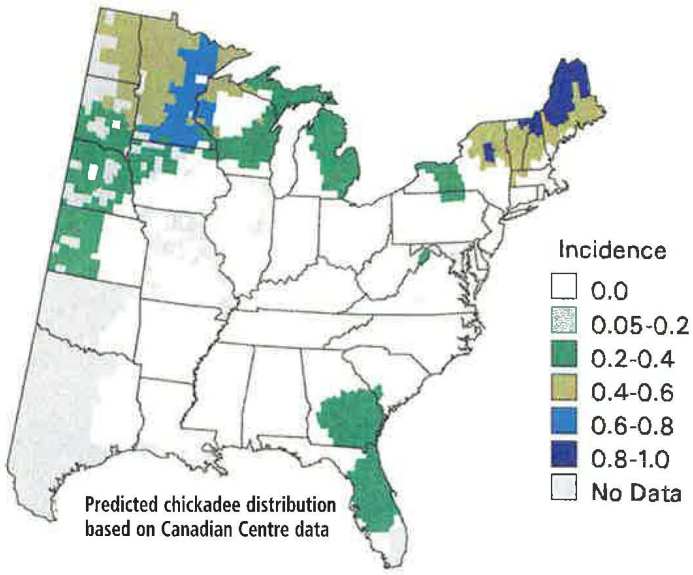
Using current data about climate, vegetation and elevation, the researchers found that their model faithfully reproduced the known ranges of 150 bird species. But the model wasn't perfect, says Matthews, a native of Charlottesville, Va. For most of 36 other species, the model did a poor job of reflecting current knowledge. Nevertheless, success with a large number of species meant the computer model had accurately captured factors critical to those species.

Matthews and O'Connor then turned to the future. One of the aces in their hand was a recent study of how eastern forests might change in a world made warmer by increasing greenhouse gases in the atmosphere. That work by two U.S. Forest Service scientists, Louis Iverson and Anantha Prasad of the Northeastern Research Station, paved the way for Matthews and O'Connor to look at the consequences for birds.

Using the 150 bird species for which they had reliable information, the UMaine scientists built the forest data into their own models. They also used two climate change scenarios, one from the Hadley Centre for Climate Prediction and Research in England, and one from the Canadian Centre for Climate Modelling and Analysis (CCCma). When they ran their model for each of the 150 species, the results surprised Matthews, who had worked on ornithology research projects in the mid-Atlantic states and the South before he came to New England.

"More than half the species were projected to lose at least 25 percent of their current abundance in the eastern U.S. That's a lot; a big surprise. It doesn't mean that they would go extinct. Many would probably increase their range in Canada, but we'll lose them in large parts of the U.S.," Matthews says.





The computer model developed by University of Maine Professor of Wildlife Ecology Raymond O'Connor and former graduate student Steve Matthews successfully used climate and landscape data to reproduce distribution maps for 150 species of birds, including the black-capped chickadee (above). The scientists then used data on climate change and its impact on eastern forests to predict the future ranges of these species. Based on predictions from the Hadley Centre for Climate Prediction and Research in England, and the Canadian Centre for Climate Modelling and Analysis, the UMaine model found the distribution of the chickadee greatly diminished.

The most significant changes occurred in the southern portions of birds' ranges. In some cases, the model suggested that certain birds would disappear altogether from that portion of their current range. In other cases, a species might change from being abundant in an area to being rare. The results also showed that a small number of species would increase their ranges.

"Many bird species are limited in their distribution by climatic constraints and by their habitat, such as where a particular type of forest is located," says O'Connor. "We were able to work out where and in what numbers each bird species would survive for the eastern U.S. — a first in climate change studies. Previous work considered only the climate envelope, not the joint effects of shifting habitat (forest) and shifting climate."

Among the species projected to become less abundant across the East are Maine's state bird, the black-capped chickadee (Parus atricapillus), the song sparrow (Melospiza melodia) and the American robin (Turdus migratorius). In Maine itself, the model estimates that black-capped chickadees and robins are likely to see little change, while song sparrows could decline significantly.

"More than half of the species were projected to lose at least 25 percent of their current abundance in the eastern U.S."

Steve Matthews

Predicting the future, even with the most up-to-date information, is always tricky. Whether bird species actually shift their ranges in the future as the UMaine model suggests depends on climate and biology. If climate changes as the Hadley and Canadian climate models suggest, and if the birds maintain their present relationship to climate and habitat, then the UMaine model results may come to pass.

"The uncertainty is about the exact pattern of climate change (Hadley and CCCma are extremes) and whether the birds might adapt to change in ways they do not now display, such as by changing their temperature tolerances or by turning to other new (habitat) types in which to nest," says O'Connor.

The Forest Service has published the research on trees by Iverson and Prasad and posted it on the Web (www.fs.fed.us/ne/delaware/atlas/index.html). In October, the Forest Service also published UMaine's bird species maps in *Atlas of Climate Change Effects on Common Birds in the Eastern United States*. Funding for the atlas included support from UMaine's Office of the Vice President for Research and the College of Natural Sciences, Forestry, and Agriculture.

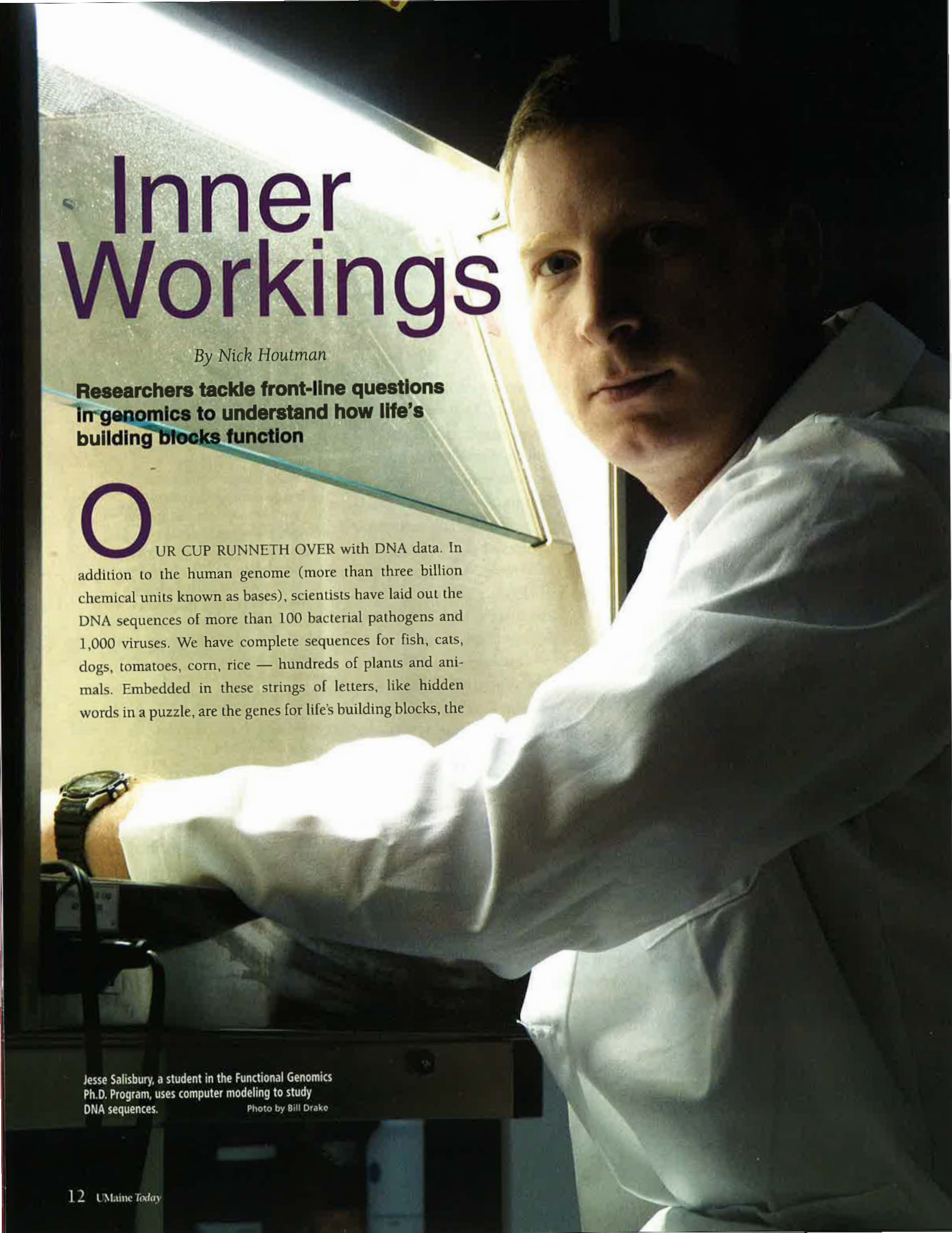
Matthews' research received financial support from the Forest Service and the Department of Wildlife Ecology at UMaine. He is now a Ph.D. student at Ohio State University studying the ecology of migration in birds. ▮

Inner Workings

By Nick Houtman

Researchers tackle front-line questions in genomics to understand how life's building blocks function

OUR CUP RUNNETH OVER with DNA data. In addition to the human genome (more than three billion chemical units known as bases), scientists have laid out the DNA sequences of more than 100 bacterial pathogens and 1,000 viruses. We have complete sequences for fish, cats, dogs, tomatoes, corn, rice — hundreds of plants and animals. Embedded in these strings of letters, like hidden words in a puzzle, are the genes for life's building blocks, the



Jesse Salisbury, a student in the Functional Genomics Ph.D. Program, uses computer modeling to study DNA sequences. Photo by Bill Drake

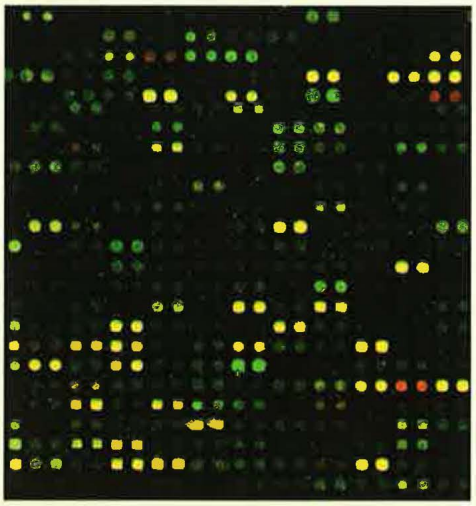
The program's goal is to give students opportunities to explore the inner workings of the cell's command center — the DNA, proteins and other chemicals that control development.

proteins that make up everything from spleen to sinew.

Publicly funded repositories, such as GenBank of the National Institutes of Health, store those sequences and make them available for study. A new academic discipline has arisen — "functional genomics," the science of how genomes work. Scientists in functional genomics programs are carving out niches in everything from new research methods to the gene-related mechanisms of single species.

In Maine, three research institutions – UMaine, the Maine Medical Center Research Institute and The Jackson Laboratory — have combined efforts to offer a new Functional Genomics Ph.D. Program for students in this growing field. The National Science Foundation has jump-started the program with a $2.6 million IGERT (Integrative Graduate Education and Research Traineeship) grant. For a glimpse at functional genomics in Maine, consider recent advances at each institution:

- Last fall, researchers at Jackson Laboratory in Bar Harbor reported finding evidence that some of the so-called junk DNA in a cell's nucleus might play an important role in development. A team lead by Barbara Knowles, a developmental biologist at the lab, discovered that long-repeated DNA sequences thought to have no function actually turn genes off and on during the earliest stages of growth.
- Stem cells offer great promise in treating diseases ranging from diabetes to Alzheimer's. However, before such possibilities can be realized, scientists must uncover the mechanisms that control how stem cells copy themselves (self-renew) or develop into specific tissues such as muscle, nerve and bone. At the Maine Medical Center Research Institute in Scarborough, a research team led by Joe Verdi, director of MMCRI's Center for Regenerative Medicine, has identified the signaling pathways and genes that drive stem cells to self-renew and differentiate into various tissue-specific cell types. They have found that adult stem cells have greater potential to develop into a wider range of tissues than originally believed.
- At UMaine, scientists are studying gene function in a variety of organisms, including zebrafish, fruit flies, microorganisms and plants. They have confirmed that zebrafish have a gene for producing interferon, a critical part of the animal immune system. They also have identified genes that affect heart rate, muscle function and biochemical processes in microbes. Their research has led to new technology that monitors farm-raised fish for disease and to the identification of new species of animals and microorganisms.



University of Maine Ph.D. student researcher Karen Fancher is using a mouse model of human breast cancer to investigate genetic changes in mammary gland cells destined to progress into a tumor. Shown here is a microarray image of her research revealing patterns of gene expression. Each dot is associated with a particular gene; each color represents either healthy or diseased tissue. In this microarray, red represents genes apparently expressed or "turned on" in pre-tumor cells; green represents genes expressed only in normal cells; yellow shows those genes expressed equally in both tissues.

Photo courtesy of The Jackson Laboratory

THE COMBINED EXPERTISE at these institutions was just what Jennifer Rochira was looking for. Before coming to UMaine last fall, the Rhode Island native had worked in the electronics industry. She had gotten her undergraduate degree in industrial engineering from the University of Rhode Island and then went to work in industry designing wire harnesses, cable assemblies and medical lasers. The possibility of combining her expertise with biology led her to consider a career change, and the new Maine program offered diversity and depth.

"I wanted a program that focuses at the molecular level. It's innovative, and it gives me background in DNA and genetics," says Rochira.

Students in the program must work in a laboratory at each institution, a process known as doing rotations. Last fall, Rochira did research with Jackson Laboratory staff scientist Susan Ackerman, where she learned about the development of nerve cells in the brain. In 2005, she intends to focus on laser microscopy with UMaine Assistant Professor of Physics Sam Hess. She also hopes to conduct research with UMaine's Rosemary Smith and Scott Collins using scanning tunneling microscopy, a

Inner Workings

Partners

THE JACKSON LABORATORY (www.jax.org) is the world's largest mammalian genetics research facility. In addition to supplying universities, government research centers and other laboratories with genetically pure mouse strains, the lab conducts research that is critical to understanding genetic factors related to human health.

RESEARCHERS AT MAINE MEDICAL CENTER RESEARCH INSTITUTE (www.mmcri.org) focus on molecular processes that underlie the cardiovascular system, the skeleton and cancer. Chemical signals affecting stem cells is a major area of work. MMCRI conducts both basic and clinical studies oriented toward improving patient care.

AT THE UNIVERSITY OF MAINE, faculty members participating in the functional genomics program bring expertise in chemistry, spatial information science, electrical engineering, computer science and biology, in addition to biochemistry.

technology to identify nanopore gene sequencing with tunneling current detection; and learn about stem cells at MMCRI's Center for Regenerative Medicine.

The program's goal is to give students opportunities to explore the inner workings of the cell's command center — the DNA, proteins and other chemicals that control development. Such knowledge is at the heart of research centers and businesses working in healthcare, the environment and the biotechnology industry.

UMaine Professor of Biochemistry and Molecular Biology Keith Hutchison administers the program with Barbara Knowles, vice president for training, education and external scientific collaboration at The Jackson Laboratory. It is the collaboration among scientists in disciplines across these research organizations, says Hutchison, that gives students an advantage in tackling front-line questions in genomics.

Program concentrations include the application of computational techniques to questions in genome architecture, and the interactions among genes and proteins that make the difference between health and disease. Physical processes in this molecular world also are a focus for the new Institute for Molecular Biophysics that links the three Maine institutions in collaborative research.

An unusual feature of the Functional Genomics Ph.D. Program, says Hutchison, is an arrangement known as "twinning." Instead of working under the guidance of a single scientist, students work closely with two mentors in different scientific disciplines. Students apply expertise from both disciplines in solving questions related to gene function. Thus, they can consider neurological cell growth and development, for example, from the perspectives of mathematical models, biochemistry and new sensor technologies. They can consider how mechanisms work in two major model organisms, the mouse and the zebrafish, leading to better understanding of how processes might occur in humans.

More than ever, says Hutchison, addressing how genomes work requires interactions among the biological, physical and computational sciences.

SARAH VINCENT GREW UP in Montoursville, Pa., and got her start in the field of molecular biology as a UMaine undergraduate in Hutchison's lab. In a six-month rotation, she is studying with Lindsay Shopland, a cell biologist at Jackson Lab, and Peggy Agouris, an engineer in UMaine's Department of Spatial Information Science and Engineering.

Vincent uses image analysis techniques to look inside the nuclei of mouse cells to study the structure and shape of chromatin, which is comprised of DNA and associated proteins. She expects to use her degree in an academic setting or research center.

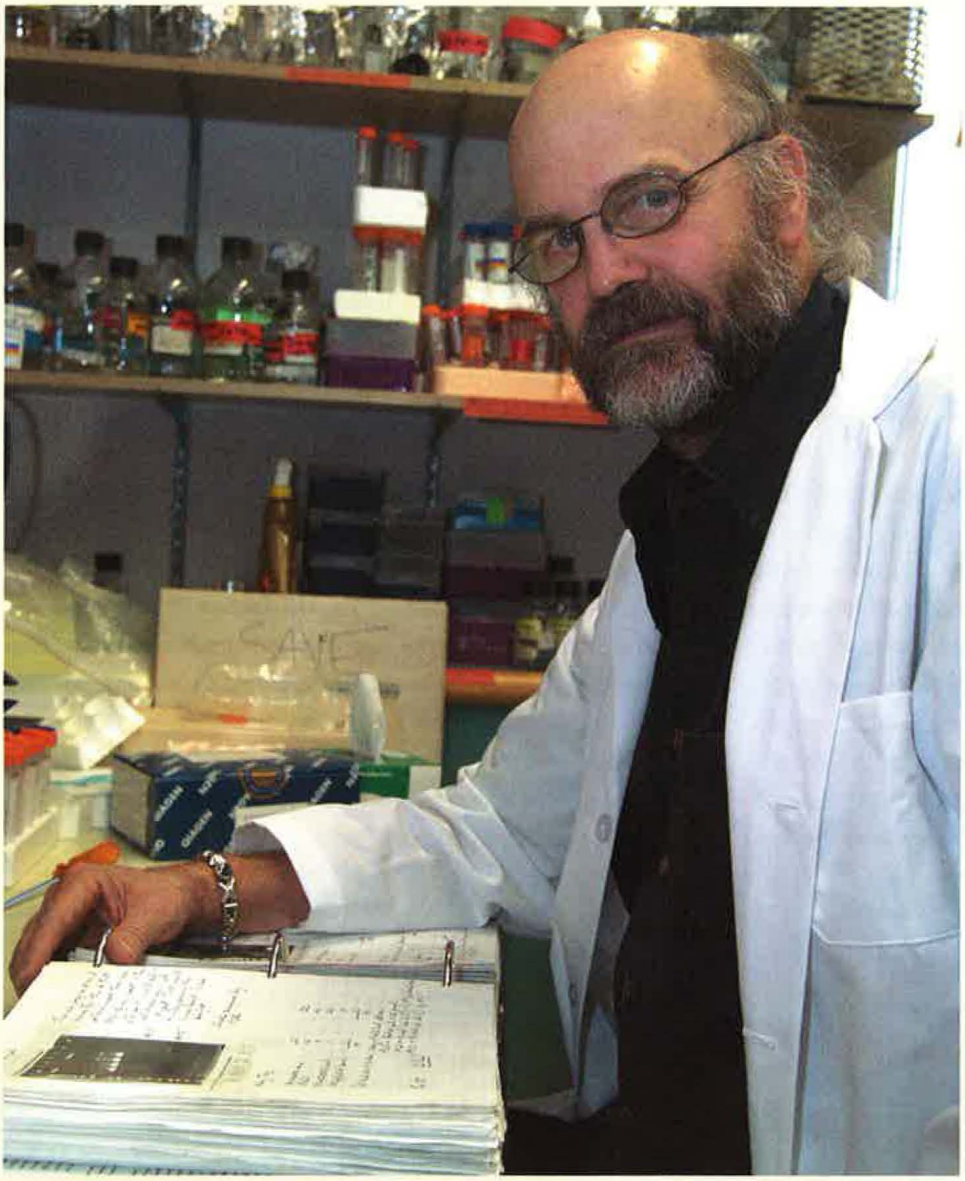
"Getting a Ph.D. is a lofty goal that requires a whole lot of dedication and hard work. I love what I do, and I love to learn and keep busy, so this field suits me well. This is a personal goal of mine, and along the way I hope that I can contribute to the body of knowledge that society knows as science," she says.

A NATIVE OF PLYMOUTH, Maine, Karen Fancher received her bachelor's degree in biochemistry from Hartwick College in Oneonta, N.Y., in 1995. She worked as a research assistant at Jackson Lab before deciding to advance her career by enrolling in the Functional Genomics Ph.D. Program.

"The program is beneficial because it bridges the gaps between disciplines. In my work, I have advisors in molecular genetics, and statistics and computer science," she says.

In her research, Fancher is using a mouse model of human breast cancer to investigate early genetic changes in normal mammary glands containing atypia or ductal carcinoma in situ.

Her focus is on mechanisms of early detection. They include microarrays that provide information about statistically



UMaine Professor of Biochemistry and Molecular Biology Keith Hutchison administers the Functional Genomics Ph.D. Program with Barbara Knowles, vice president for training, education and external scientific collaboration at The Jackson Laboratory. An unusual feature of the Functional Genomics Ph.D. Program is an arrangement known as "twinning," in which students work closely with two mentors in different scientific disciplines. They then apply expertise from both disciplines in solving questions related to gene function. Photo by Bill Drake

significant changes in genes, and fluorescence techniques that can reveal the presence of cancer cells in the earliest stages of tumor development. Her advisors are Barbara Knowles and Gary Churchill at Jackson Lab.

Eventually, the research could lead to earlier detection of breast cancer in humans. "Using a mouse model of human breast cancer allows us to do things you can't do in humans," says Fancher. "We're looking at ways to detect cancer in the earliest stages, before you would see or feel any lump."

LEARNING TO BE AN ELECTRICIAN, an airplane mechanic and an Air National Guard pilot apparently wasn't enough for Jesse Salisbury. The native of Pittsfield and graduate of Maine Central Institute also has degrees from the University of Maine at Machias in biology and the University of Southern Maine in immunology.

He is now working on the mechanics of DNA regulation, focusing on a DNA region that controls how the information encoded in genes is turned into proteins. The focus of Salisbury's work with Joel Graber at Jackson Lab and with Hutchison at UMaine is a short sequence on the DNA strand that trails behind the gene itself. This region, which does not directly contribute to the chemical structure of a new protein, nevertheless appears to affect the process in which proteins are made from genes.

The output from DNA sequencing labs has outpaced the ability of molecular biologists to identify genes. Using computational techniques, biologists can begin to make sense of the DNA sequences, taking advantage of knowledge of how genes and proteins interact. "If you can write a (computer) program to model where the genes are, you can get a rough idea of what's going on in that organism within a few hours," Salisbury says.

KATE THORNTON FROM Milford, Maine, received her bachelor's degree in microbiology from UMaine. As a Ph.D. student, she has studied with UMaine Professor Carol Kim, looking at the effects of alcohol on the innate immune system. She uses zebrafish as a model organism.

At Jackson Lab, she also has worked with Lindsay Shopland on nuclear organization and how it may relate to gene function. To investigate that question further, she is pursuing a third avenue of research with Carol Bult at Jackson Lab, working with the same chromosomal region that she investigated with Shopland.

She is using bioinformatics, the application of computational techniques to biology, to identify specific DNA sequences that may be involved in creating or maintaining the patterns of organization that she identified in her earlier work. ▮

More information on UMaine's Functional Genomics Ph.D. Program is on the Web **www.umaine.edu/genomics/**

In her laboratory, Judy Walker measures the acoustic features of prosody, such as increased syllable duration — components of speech that can be altered by stroke damage. Photos by Bill Drake

Deleted Words

Research into how the brain processes communication helping stroke survivors recover lost language skills

By George Manlove

Bob Lundstrom had just finished speaking on the phone with a lawyer and with the head of his company in Sweden when a strange feeling came over him. It was as if his brain "was going down."

Unaware of what was happening or of the severity of his condition, the Georgetown, Maine, resident tried to continue his normal morning routine. He stopped at the local post office, but left abruptly when he was unable to communicate with the postmaster. Although Lundstrom was unaware of it, his speech was incomprehensible, something of a "word salad."

Lundstrom, a physicist and founder of his own wire-making company, then drove to Bath to meet his wife for lunch — driving, he recalls, "as though I was drunk," the road appearing to him as though he was looking backward through binoculars. By the time he arrived, it was clear something was wrong, but Lundstrom could not articulate what he was experiencing.

Such a sudden inability to communicate is one of the symptoms of stroke, the nation's third leading cause of death. Those who survive strokes often are unable to read, write or talk. Others like Lundstrom, who had a stroke in 1996, may only be able to express part of their message, without the appropriate or logical arrangement of words.

Their inability to process or produce language because of brain damage is known as aphasia, which affects more than a million people in the United States, according to the National Aphasia Association. People with aphasia lose the ability to process and produce language in the part of the brain that is damaged by stroke, says Judy Perkins Walker, a University of Maine researcher and associate professor of communication sciences and disorders.

Walker, who would eventually meet Lundstrom at a stroke survivors' support group meeting, understands what happens when a stroke or brain injury causes aphasia. She has spent 20 years work-

ing in hospitals with patients who have brain damage and researching the complex effects of such trauma. Patients who volunteer to cooperate with Walker in her research are struggling to understand stroke damage and its effects. Lundstrom agreed to participate in Walker's research and served as a test subject.

Walker's research is contributing to new understanding of how the brain processes certain aspects of language. Her work blends scientific and medical theory with research results and communication performance by survivors.

Walker is an internationally recognized authority on an area of neurolinguistics concerning prosodic deficits in brain-damaged subjects, and has published numerous articles in scientific journals on her research. She speaks on the topic throughout Maine, nationally and internationally. With response-time experiments and acoustic analyses of speech production, Walker currently is focusing on how language is processed and produced by people who have had strokes.

Specifically, Walker studies prosody, or the melody of speech that helps us understand language through more than mere words. She concentrates on injuries to the left hemisphere of the brain, the area that controls our ability to understand and produce language, including intonation and accenting on specific words or syllables to assist in recognizing nouns and verbs.

Patients with right hemisphere damage also are part of Walker's research. The right hemisphere is responsible for spatial and perceptual functioning, including a person's ability to decipher emotion and non-verbal communications that may be conveyed through prosody.

Walker's research expands on existing theory that explains how the left and right hemispheres work together to process the overall meaning of sentences. The left hemisphere processes prosody that conveys linguistic meaning; the right hemisphere processes aspects of prosody that convey emotional information.

To understand the linguistic distinctions that Walker asks her research subjects to make, consider words like "suspect," "convict" or "permit" that carry multiple meanings as nouns or verbs, depending on which syllables are stressed. Aphasic subjects may hear the tonal distinction, but may be unable to understand it when the message reaches the damaged left hemisphere of the brain.

functions is critical to

In a similar example, consider the parsing, or grammatical interpretation of a sentence like, "The man who hunts, ducks out in winter." Aphasic subjects may overlook the comma or not register the pause, parsing the sentence incorrectly: "The man who hunts ducks, out in winter."

Linguistically, people tend to associate words that naturally go together, like "hunts ducks," according to Walker. But prosodic cues can direct a listener to parse the sentence differently.

Perhaps more troubling for an aphasic subject is the inability to understand whether a question is being asked or statement being made by the rise or drop in tone at the end of a sentence. They hear the change in intonation, but they do not process what it means.

Conversely, a subject with right hemisphere damage may have trouble distinguishing emotional meaning in a sentence that is conveyed through varying intonation.

Research by Judy Walker, UMaine associate professor of communication sciences and disorders, focuses on cognitive and linguistic impairment following central nervous system damage. In particular, she focuses on injured areas of the brain — the left hemisphere that controls our ability to understand and produce language, including intonation, and word or syllable accenting; and the right hemisphere, responsible for spatial and perceptual functioning, including the ability to decipher emotion and non-verbal communication that may be conveyed through prosody. Her research expands on existing theory that explains how the left and right hemispheres work together to process the overall meaning of sentences.

In her work with people who have brain damage, Walker measures response times and accuracy as they decipher words and sentences. With the latest acoustic equipment in her laboratory, Walker also can measure the features of prosody, such as increased syllable duration — components of speech that can be altered by stroke damage.

The complexity of language processing and production often is taken for granted, Walker says, but it is important in determining what communication functions have been compromised by the damage and what therapy will be most effective in treatment. That's why she and other researchers are trying to establish the degree to which prosody affects understanding and production of meaningful sentences in people with brain damage.

Using her findings, she hopes to help develop more effective therapies so people with aphasia can recover communication skills or at least compensate for them sooner.

Students in the Department of Communication Sciences and Disorders find Walker's research and classes particularly insightful and memorable. Research assistants under her supervision often work with aphasic subjects. Recent UMaine graduate student Rebecca Pelletier, now a speech pathologist working at a rehabilitation center and a hospital in Bangor, studied under Walker in courses and as a research assistant. She says Walker's anecdotal teaching methods introduce students to the realities of patients' symptoms and struggles. They also learn about the importance of family support in a stroke survivor's recovery, she says.

Before joining the University of Maine faculty in 1997, Walker spent many years as a clinician and researcher working with patients with neurological disorders in such settings as the Veteran's Administration Hospital in Houston, Massachusetts General Hospital and Spaulding Rehabilitation Hospital in Boston, and Dartmouth-Hitchcock Medical Center.

"My focus is really to teach students to become future speech-language clinicians who will work in medical settings, helping patients get back on their feet and start living a life as normal as possible after a stroke."

Bob Lundstrom's stroke wiped out an entire vocabulary in English and German languages, and his grasp of Morse code.

"It was a powerful thing for me in the hospital for a long time," Lundstrom says. "I couldn't (verbalize that) I wanted a glass of water. You can't imagine the frustration a patient has. I couldn't read, write or spell. I couldn't understand what they were saying on TV."

In the months of therapy designed to get him to use other parts of his brain, Lundstrom began memorizing words again. He practiced them one by one, with his speech therapist and his wife — all part of the support team Walker says is important for recovery.

"Someone's got to look you in the eye and say 'You can do it,'" says Lundstrom, 67, who now speaks about his experiences in Walker's classes. "It's going to be somebody like Dr. Walker or someone she's taught."

After his stroke, even Lundstrom's then 4-year-old grandson was part of the therapy. He told his grandfather: "Papa, you taught me the names of the trees. Now I'll teach them back to you." ▮

Reengineering the Past

UMaine students use digital modeling to virtually rebuild 18th-century plantation ruins

By Nick Houtman

IT SOUNDS LIKE the perfect spring break. Last March, eight University of Maine students joined two engineering faculty members for a trip to the U.S. Virgin Islands. The students camped on tent platforms under warm skies, a far cry from the snow and cold back home. Each morning, they hiked along the beach, soaking up the tropical sunshine and taking in the sights.

At least that's the way it might have looked from afar. In truth, these students spent much of their time grubbing out vines, shrubs and trees from the ruins of old buildings. They had to keep an eye out for scorpions and tarantulas. And in addition to their swimsuits and beach towels, they brought along the tools of academic research — laptop computers, global positioning system (GPS) receivers and surveying instruments.

The purpose of their trip was to apply the latest information technologies to a thorny problem in archaeology: how to preserve history in the face of deteriorating physical evidence. The Virgin Islands National Park on St. John, it turns out, is an ideal place — and one with a remarkable history — to apply computer-aided design (CAD) and geographic information system (GIS) software to the needs of historical preservation.

Scratch the surface of this tropical paradise and you'll find a history of colonial shipping and piracy, slave labor to work the sugarcane fields and European power struggles. On St. John, the third largest of the 68 islands within the U.S. territory, evidence of those times is still visible in the remains of more than 500 buildings, most within the national park.

Many of these buildings date from the 18th century, and some go back to the 1680s, when Spain, Britain, France and Holland vied for economic and military power in the region. The stone structures include well houses, sugarcane mills, storehouses, slave huts, and large homes for plantation managers and owners. Preserving those cultural resources is part of the park's mission, but physical renovation is costly, and many buildings are falling prey to time and the stranglehold of vines and trees.

"These buildings are being destroyed to the point that in a few years, there won't be anything left but piles of stones," says Univer-

The engineering team involved in digitally restoring the historical Leinster sugar plantation included eight students and two faculty members from UMaine's class in CAD Modeling of Archaeological Sites. Overseeing the project was archaeologist Ken Wild with the National Park Service (center).

sity of Maine engineer Connie Holden. "They can't begin to stabilize what they have." And as buildings fall to ruin, historical clues can be lost forever.

HOLDEN IS AN INSTRUCTOR in the Department of Spatial Information Science and Engineering. She and Karen Horton, associate professor of mechanical engineering technology, led the eight UMaine undergraduates to St. John to document the precise location, landscape features and structural details of an 18th-century sugar plantation.

"We'll probably never have the money to rebuild them," says Ken Wild, National Park Service archaeologist who initiated the project with Horton. Wild has worked in national parks throughout the southeastern U.S. and first came to St. John in 1984.

"Some of the buildings have fallen down since I've been here. The technology that Karen and Connie are using will give us a three-dimensional (computer) model that allows us to visualize how these structures were built. Even if one does fall down, you'll still be able to walk through it (on the computer)."

The technology will enable future park visitors to see ruins that, by then, may have deteriorated completely. Moreover, archaeologists and historians will have a thorough and precise record to use for studies of the island's history and culture. And if reconstruction money should become available, the 3-D models can be used to visualize how to rebuild, says Wild.

"Engineers use this technology to design new buildings. Why not use it in reverse to bring these buildings back?" he says.

A photograph provides just one perspective, says Holden. "A 3-D model gives you everything. We're including in the database things like specific measurements, thickness of the walls, places where an arch is holding the building up, how that arch was constructed. These details do not exist in a photograph."

GIS, says Holden, allows historians and archaeologists to create maps that show the relationships among the landscape and building features. For example, understanding how sugar plantations varied with respect to elevation, soils, proximity to the sea and structures can help historians recreate events such as the slave revolt that occurred in 1733.

Also important for historians is information about how data were collected. By knowing how accurate the data are, they can evaluate interpretations of the past as new facts come to light.

"The interest in the enslaved people, from their perspective, is an important aspect of history," says Horton. "Historians would be thrilled to have the ability to visualize where a slave revolt physically began. What are the differences in each of the plantations? Which of the plantations had places where people could be on higher ground, for example? What was the physical relationship between where the slaves were at the time that the revolt started compared to where the people who were enslaving them were located?

History in the Sun

PIRACY AND AN ECONOMY based on slavery mark the history of the U.S. Virgin Islands, located at the shoulder of the West Indies just east of Puerto Rico. Named by Christopher Columbus, the islands had been under Spanish, French and Danish influence before being purchased by the United States from Denmark in 1917 for $25 million. Today, the 68 islands have U.S. territorial status. Residents are U.S. citizens and elect a non-voting representative to Congress, but they cannot vote for president.

The 14,689-acre Virgin Islands National Park on St. John preserves cultural artifacts that include petroglyphs and other evidence of pre-Columbian native peoples. Starting in the early 18th century under Danish rule, sugar plantations fueled an economy based on African slave labor. For more than a century, the system generated wealth for owners, but slaves rebelled in 1733, 1818, 1840 and 1848, the year that Denmark abolished slavery.

Sugar plantations continued to operate after abolition. In 1867, a combination of devastating earthquakes and a severe hurricane caused extensive damage to the island's plantations, include the one at Leinster Bay. Sugar operations ceased, and during much of the 20th century, the area was used as a cattle farm.

Today, about 760,000 people visit the park annually, part of a tourism industry that accounts for the majority of the territory's annual revenues.

Students focused much of their efforts on this well house made of stone, brick and coral, located on the Leinster Bay sugar plantation that is part of the more than 14,500-acre national park on St. John. In addition to the cane fields, the 18th-century plantation included the windmill-powered well, a horse-driven sugar cane mill, slave huts and a large hilltop house for the owners. At the well house, students cleared vegetation, measured walls, took photographs and downloaded data into a laptop computer to generate digital designs of the building. Their renderings (right) preserve details about the structure for future historical analysis and restoration. Leinster plantation, built in 1721, operated for a century before the Caribbean sugar industry collapsed.

Photos and images courtesy of Karen Horton

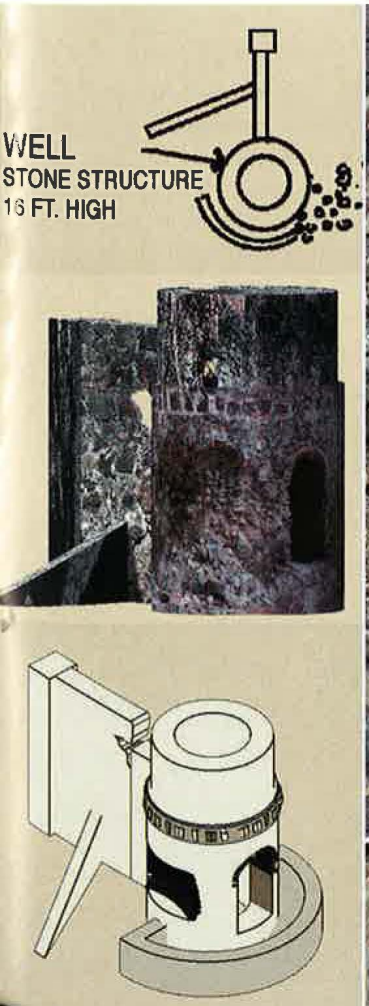
"(The GIS) allows an historical analysis. The information for that analysis isn't currently tied together in any way. There's a huge historical record on this (St. John sugar plantations), but the records are scattered."

Students participating in the trip last spring came with backgrounds in engineering, art and even theater. They focused their attention on the old Leinster Bay sugar plantation, which operated with slaves from 1721–1867. During the day, the students cleared trees and other vegetation, took photographs and measurements, and established survey points. They collected GPS data for the site, although the island's steep topography sometimes blocked their access to the satellites on which the system is based.

The engineering students used MicroStation, CAD software that generated precise 3-D images of the ruins. Once on St. John, they downloaded their photographs and measurements to the CAD program, refining the data and photographic images as they worked. Their goal was to take back all the raw data needed to produce an accurate rendering of one of the buildings and to integrate the rendering into a full GIS package of the site.

Upon returning to Orono, the students worked with Horton and Holden to produce a report for the National Park Service. Eventually, the GIS and CAD renderings will be posted online for public use.

Support for the project came from University of Maine faculty research funds, the Friends of the Virgin Islands National Park and the National Park Service. ▮



Pioneers in paradise

University of Maine art major Amy Crosby talks about her engineering fieldwork.

FOR ME, THE TRIP to the Virgin Islands was an eye-opening experience.

Taken from subzero weather to a tropical paradise in the matter of a day was a dream come true. The history, nightlife, overwhelming beauty, heart-stopping taxi rides, local people, wildlife, and the experiences with my classmates and people we worked with are all part of experiences I will never forget.

But most important, we had come to do a job — an endeavor bigger than any of us anticipated. I wasn't prepared for the difficulties of measuring ruins that, from the photographs, seemed such a simple task back in Maine. Little did I know we were pioneers.

There were no textbooks or directions telling us what to do, what to measure, where to store our information or how to analyze it. As an art major, I particularly came to appreciate the photography aspect of the project. Everyone had a different task to do in order to gain the information we needed to create our model.

It took a week alone to tackle the jungle with machetes just so we could wrap a tape measure around a wall, all the while being careful not to tumble the crumbling structure.

Knowing the history they carried, it was disheartening to see the ruins in such disrepair. It also was an awesome responsibility, knowing that we are the best hope for preserving these ruins — if not structurally, at least digitally.

The greatest part of this project: knowing we're making a difference. The press hiked all the way into our site to see what was going on; tourists were full of questions about how they could help. Everyone we met was genuinely grateful for our efforts to preserve a piece of the island's history.

SPANISH AS A FIRST LANGUAGE

UNIVERSITY OF MAINE Spanish Professor Kathleen March and five current or former students have embarked on a cooperative pilot project tutoring Spanish-speaking migrant workers Down East. But instead of helping Spanish-speaking families with English as a second language, the tutors are bringing them up to speed on their own language, Spanish, before tackling English.

March is working with Candace Austin, the founder of Mano en Mano, a Milbridge, Maine-based nonprofit social service organization. Austin tutors Hispanic families in English through the public library and schools in Milbridge, a community where 12 percent of the population, mostly berry pickers, wreath makers and fish factory workers, speak Spanish.

Austin found that many of the migrant family adults were unable to read and write beyond third- or fourth-grade levels in their own language, and were unable to transition from Spanish to English.

The recent suspension of the state Migrant Education Program brought enough new people to her door, Austin says, that she called upon March to help put together a Literacy Volunteers certification workshop and find 10 bilingual people willing to travel to Milbridge to tutor families. Half of the tutors are from the Milbridge area; half are from the university community.

The year-long tutoring project is partially funded by a $25,000 grant from the Barbara Bush Foundation for Family Literacy. If successful, the program could be a national model.

Moving Earth

Human activity reshaping the planet at alarming rates

THINK OF LARGE earth-moving projects: highway interchanges, coal mines or Boston's Big Dig. According to Roger Hooke, a University of Maine scientist, such activities have propelled humans into becoming arguably the most potent force in shaping the planet, surpassing natural phenomena like rivers and wind. He finds this troubling, and other scientists are taking note.

"I come at this from an environmental point of view. We've been at it for a century at this level. I wonder how much longer we can continue making a mess of the planet."

Roger Hooke

As a research professor in the Department of Earth Sciences and with the Climate Change Institute, Hooke studies glaciated landscapes. He has worked in Maine, the Canadian Arctic and Sweden on the forces that molded ice sculpted hills, built gravel ridges and left large landforms such as Cape Cod and Long Island.

In the early 1990s, a newspaper report on the annual number of housing starts in the United States led Hooke to wonder just how much earth was being displaced by human activity. He gathered data on residential subdivisions, road construction and mining. His goal was to estimate the amount of soil and rock that humans move from one location to another through activities akin to the forces of nature that he also studied.

In 1994, Hooke published the results in a paper in *GSA Today*, a journal of the Geological Society of America. He estimated that on a worldwide basis, humans move more of the planet around, about 45 gigatons (billion tons) annually, than do rivers, glaciers, oceans or wind. For comparison, he estimated that meandering rivers may move about 39 gigatons of sediment a year. Others have estimated that rivers deliver about 24 gigatons of sediment to the oceans annually. Even that enormous figure can be partly attributed to people. Soil erosion from farm fields, construction sites and other sources contributes significantly to river sediment.

Continuing his research, Hooke has put human earth moving into historical context. After all, people moved rock to build monuments such as Stonehenge in England, and pyramids in Egypt and the Americas. In the journal *Geology* in 2000, Hooke estimated that in the last 5,000 years of human history, the total amount of soil and rock moved by people would be enough to build a mountain range about 13,000 feet high, 25 miles wide and 62 miles long.

In the last century, powerful technologies have enabled people to accelerate this process. At current rates, the size of that metaphorical mountain range could double in the next 100 years, he wrote.

"One might ask how long such rates of increase can be sustained and whether it will be rational behavior or catastrophe that brings them to an end."

A new $16 million Engineering and Science Research Building on campus is now the home of the University of Maine Department of Electrical and Computer Engineering, and the Laboratory for Surface Science and Technology. A highlight of the facility is a 3,500-square-foot clean room for research and development in the areas of nanotechnology, microfabrication, sensors and biotechnology. It is the only such facility in northern New England and one of approximately 25 university-based clean rooms of its kind in the U.S.

PULP TO POLYMERS

WOOD PULP used in the paper industry has untapped potential, according to University of Maine professor Adriaan van Heiningen, who is researching ways to squeeze more energy and new products from the renewable resource.

"The basic concept is not new, but we're developing new technologies that will make it economical, and keep our pulp and paper industry competitive."
Adriaan van Heiningen

With a three-year, $1 million grant from the U.S. Department of Energy and a contract with International Paper, van Heiningen, who holds the J. Larcom Ober Chair in Chemical Engineering, is focusing on a portion of pulp known as hemicelluloses. In a pulp mill, most of the hemicelluloses end up in the spent pulping liquor and are burned. However, hemicelluloses contain a considerable amount of oxygen and do not generate much heat when burned in industry boilers. Van Heiningen wants to increase the value of hemicelluloses for the paper industry by using them for new value-added products, ranging from ethanol to car fenders and tabletops.

The U.S. paper industry needs new sources of revenue to compete internationally and the country needs alternative fuels to reduce its dependence on fossil fuel, says van Heiningen. The process he's researching could use more of the biomass in trees and create more products at competitive prices.

Van Heiningen has more than 20 years of experience in pulp and paper research. He works with professors Douglas Gardner and Joseph Genco, research engineer Haixuan Zou, and graduate students on new uses of hemicelluloses extracted from wood chips prior to pulping.

In UMaine's Pulp and Paper Process Development Center, wood chips are chemically extracted at varying temperatures and pressures. The trick, says van Heiningen, is to extract hemicelluloses in a way that preserves the quality of chips used in the standard Kraft chemical pulp process. The extracted hemicelluloses can then be fermented into fuel ethanol and/or further converted into other chemicals to form industrial polymers.

Hemicellulose-based polymers will be used in the Advanced Engineered Wood Composite Center to make new products.

Flu-fighting food

DIDN'T GET A FLU SHOT? You may want to stock up on some flu-fighting foods recommended by University of Maine food scientist Mary Ellen Camire, a spokesperson for the national Institute of Food Technologists.

Chicken soup is a traditional treatment for colds and flu. The hot liquid helps soothe the throat and unclog nasal passages. Hot beverages, non-creamy soups and pungent spices have similar effects. Try Chinese hot and sour or Thai tom yum soup.

Cranberry juice contains compounds that prevent certain types of bacteria from sticking to tissues in our bodies. Although little is know about cranberries' benefits against viral infections, drinking cranberry juice could help prevent streptococcal throat infections.

If you eat **yogurt** with active bacterial cultures, you are consuming probiotics. These "good" bacteria survive for short periods in our intestines, stimulating the immune system to fight infections. Regular consumption is essential for deriving health benefits, so add yogurt daily during flu season.

Regular consumption of **vitamin C** (about 60 milligrams, easily provided by a glass of orange juice) should help ward off infections. Despite the popular myth that vitamin C prevents colds, an evaluation of 29 research studies involving more than 11,000 people concluded that large doses don't offer protection for most people.

UMaine Surfing

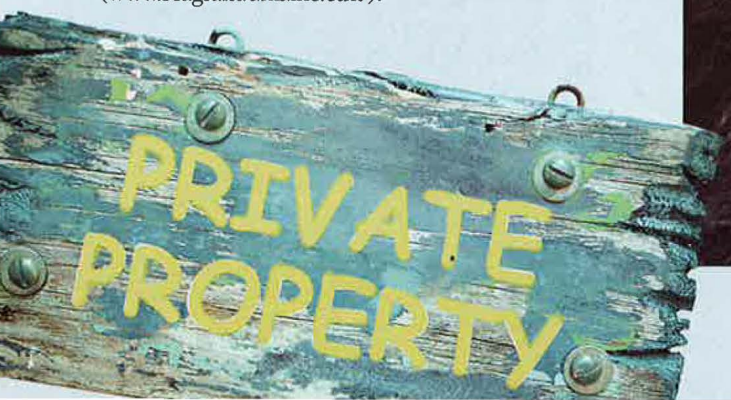
EARLY THIS YEAR, the University of Maine will launch its new top-level Web site, redesigned by the Department of Public Affairs and Marketing. The site offers a new virtual tour of campus, as well as a day-in-the-life feature with student Melissa Armes and two videos: "UMaine in a Day" by new media major Christina Seeber, and "Green Bike Tour of Campus," providing a cyclist's perspective. The site is intuitive and informative, with daily university news and a spotlight section highlighting upcoming campus events. Current and prospective students, parents, family, alumni and retirees will find links catering specifically to their needs.

Yours? Mine? Ours?

ASK A MAINER who owns the beach, and you're likely to get several answers: The beach is private property; it's owned by the town; or it is public land.

Maine has thousands of miles of coastline, yet only a small percentage of it is publicly owned. However, the public has certain traditional rights to the land between high and low tides, even where that land is privately held. Understanding those rights can be tricky.

To help people navigate the legal issues and technicalities of public access to the Maine coast, a new publication has been produced by John Duff of the Marine Law Institute, University of Maine School of Law, and Maine Sea Grant. *Public Shoreline Access in Maine, A Citizen's Guide to Ocean and Coastal Law* reviews existing access laws, describes several landmark court cases establishing public and private rights to coastal land, and discusses options for communities seeking to secure public access to the coast. Copies of the publication are available from Maine Sea Grant at the University of Maine or online (www.seagrant.umaine.edu/).



From the Ashes

VOLCANIC ACTIVITY regularly creates new landforms from deposits of tephra, ash and lava. These initially sterile, pristine deposits undergo a range of physical, chemical and biological transformations that lead in some cases to diverse, complex ecosystems such as Hawaiian rainforests.

With an $886,000, five-year grant from the National Science Foundation, Gary King of the University of Maine Department of Biochemistry, Microbiology and Molecular Biology has established the Kilauea Volcano Microbial Observatory to study microorganisms that colonize lava deposits. He will focus on carbon monoxide-oxidizing bacteria colonizing two deposits that are 45 and 55 years old.

The bacteria are important because they contribute to budgets of carbon monoxide in the atmosphere and participate in major biogeochemical cycles. Preliminary results indicate that many new species can be anticipated, including symbiotic microbes that affect plant development.

In addition to its research efforts, the Kilauea Volcano Microbial Observatory will support an educational outreach program involving grade 5–8 students at South Bristol Elementary School in Maine, and the Volcano School for Arts and Sciences in Hawaii.

Photo courtesy of the U.S. Department of Interior, U.S. Geological Survey

James Bartlett, the first permanent staff member of Maine's experiment station, was a UMaine research chemist for half a century.
Photo courtesy of University of Maine Special Collections, Fogler Library

THE MAINE AGRICULTURAL AND FOREST EXPERIMENT STATION got its start 120 years ago at the University of Maine. It was created by the state legislature two years before passage of the national Hatch Act in 1887, which made federal experiment stations possible in every state.

One of the initial mandates of Maine's experiment station was to inspect and control the quality of manufactured agricultural fertilizer. In addition, early experiments were conducted to find the best cattle feeds and seeds, increase dairy production, and identify and control agricultural pests. Publication of the scientists' research findings gave farmers access to the latest scientific knowledge that revolutionized farming and improved people's lives.

Today, the experiment station tradition of cutting-edge research, technological training and information dissemination continues. In Maine, more than 100 scientists participate in research designed to apply techniques of modern science to the needs of the state. This commitment to relevance is seen in both applied and basic research in agriculture, forestry, wildlife, human nutrition, food technology, biotechnology, fisheries and aquaculture, community economic development, resource economics and policy, and plant and animal biology. Information about UMaine experiment station research programs and publications is on the Web (www.umaine.edu/mafes).

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Photo by Bill Drake

Pride of Place

THE UNIVERSITY OF MAINE'S sense of place is based on its history and leadership in the state, its responsibility in higher education and its commitment to people.

The Robert D. Buchanan '44 Alumni House is the epitome of that sense of place.

Buchanan Alumni House opened in May 2002 as the official front door — the architectural gateway — to the UMaine campus. The $7.3 million facility was planned by alumni, who refer to it as "a place to call home." The UMaine community knows Buchanan Alumni House as a premier facility showcasing the state's largest university.

Since it opened, more than 28,000 visitors have toured or met in Alumni House. Each year, an average of 500 meetings, seminars, receptions and dinners have been held, attended by 13,500 members of campus and community groups. As a preferred campus location, Buchanan Alumni House has set a standard of excellence in the UMaine landscape.

UMaine's two independent associations — the University of Maine Foundation and the University of Maine Alumni Association — operate the 32,000-square-foot signature building, constructed exclusively with private monies. The two groups now are building an endowment for the facility to ensure its future. The $4 million Pride of Place capital campaign is in its final stages, with $800,000 remaining to be raised.

"More than any other facility on campus, Buchanan Alumni House exemplifies the achievements, excellence and aspirations of Maine's land-grant and sea-grant institution," says Amos Orcutt, president/CEO of the University of Maine Foundation. "A substantial endowment will ensure Buchanan Alumni House is an inspiration for generations of Maine people."

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