Gerald Davison is an avuncular man with an easy laugh. He is chair of psychology and not above bragging about his department. He sums it up in one word: interdisciplinary.

“Psychology is interdisciplinary because it straddles so many knowledge domains,” he says. “It’s a natural reach across the sciences of biology and chemistry into sociology and philosophy. It crosses so many boundaries. Besides, who isn’t interested in human behavior?”

Davison was head of the psychology department from 1984 to 1990 and came back as chair in 2001. He says one of his biggest contributions to the department was to strengthen ties to neuroscience researchers in the mid-1980s, linking psychologists with brain researchers and other scientists in an interdisciplinary neuroscience program in USC College.

“The upshot for our department was an increase in faculty and doctoral students interested in the complexities of mind-brain interactions,” says Davison. “I saw it as an important direction for our department to go.”

The department’s 32 behavioral scientists study a wide range of subjects, from learning and memory to aging and disease. Researchers are examining criminal behavior and substance abuse, happiness and sadness. In short, most of life itself.

Richard Thompson, the William M. Keck Professor of Psychology, uses psychological and genetic approaches to track the minute changes that take place in the brain as learning occurs and memories are coded, stored and retrieved. Irving Biederman, the Harold W. Dornsife Professor of Neuroscience, theorizes on the brain’s pleasure cells.

Technology is revealing new frontiers yet to be explored. A new Cognitive Neuroscience Imaging Center will help scientists like Adrian Raine, the Robert Grandford Wright Professor, Biederman and Professor of Psychology Frank Manis probe deeper into the mysteries of the human brain and foster collaborative research across disciplines.
A MESSAGE FROM THE DEAN

Making a Difference

As we have said in these pages many times, USC College is on a roll. We are upward bound and we have momentum. We are doing well because we have an innovative plan and we are determined to succeed. We are also fortunate to have many alumni, friends and faculty who can support our efforts to transform the College.

Our faculty hiring initiative is bringing star professors and "rising star" associate professors. We are also now competing for outstanding junior faculty—and we are succeeding because of the unique opportunities available at USC and in southern California. Our program to attract even better graduate students is having an impact. And our bedrock undergraduate education program is bringing in the best freshmen in the land. They are performing well and garnering more honors.

Our drive to be the best has taken added importance in light of the California state budget retrenchment and cutbacks in public education. Our flourishing teaching and research

BOARD OF COUNCILORS’ CORNER

Meet Dr. Alicia Smotherman

When Dr. Alicia Smotherman joined the College Board of Councilors nearly a year ago, she saw many parallels between her own career and the research of College biologists.

In casual conversation, she calls herself a "a huge admirer of Norm and Mike," referring to Norman Amheim and Michael Waterman. And she, the Ester Dornsife Chair in Biological Sciences, is the pioneering molecular biologist who helped develop a revolutionary method for studying genetics in a single cell. Waterman, a University Professor and holder of the USC Associates Chair in Natural Sciences, is widely recognized for his work in pioneering mathematical and computational approaches to molecular biology and human genetics.

"I love being surrounded by people who have original ideas," Smotherman says.

Smotherman, too, is an original thinker—best known for her study and treatment of hemochromatosis. This potentially fatal genetic disorder causes the body to absorb and store too much iron. The extra iron builds up in organs and damages them.

As a physician, her work has been groundbreaking. But her original ideas have also inspired her to write. In her book "The Neighborhood Doctor: True to Its Name," Smotherman tells the story of her family's business, The Neighborhood Doctors, a successful health care business launched by her husband, Thad Alan Smotherman, to bring health care to people who have original ideas, for example, Todd Sandler, the Robert R. and Katheryn A. Dockson Chair in Economics and International Relations, is acknowledged as one of the leading authorities on political fundamentalism and terrorism. These are topics that unfortunately have occupied much of our recent history, and his work is having an impact.

Our drive to greatness has taken us out of the ivory tower forever. I firmly believe that the creative intellectual resources of USC College will play an increasingly important role in the region, the nation, and the world—one that will benefit generations to come.

And that will make a difference.
When Clifford Johnson talks about the formation of crystals, he refers to it as “beautiful math.” He reminisces about an earlier “flattening” with theoretical condensed matter physics. But his real passion ignites when he is discussing his current research: string theory, matrix models, D-branes and black holes.

Johnson, a professor in the College’s physics department, came to USC College in the fall of 2003 as part of the Senor Faculty Hiring Initiative. This advancement effort strives to hire outstanding senior faculty and well-established associate professor candidates.

“Cliff is a leading expert on the most recent developments in the theory of superstrings … and a skilled lecturer,” says Gene Bickers, chair of the department of physics and astronomy.

Johnson has been studying string theory since the late 1980s. String theory is a revolutionary field in contemporary physics as it attempts to unify gravity, electromagnetism, the strong nuclear force and the weak nuclear force—the four forces of nature—within a single mathematical framework.

Born in London and raised for ten years on the Caribbean island of Montserrat, Johnson “always wanted to be a scientist.” He decided when he was nine that he would specialize in physics and become a professor (he looked it up in the dictionary) and claims that he’s been “boringly single-minded” ever since. He got his bachelor’s in physics from Imperial College at London University, and was straight away obtained his Ph.D. at Southampton University. In graduate school, he worked with a small group doing cutting-edge work in Conformal Field Theory and in a formulation of string theory called Matrix Models.

Up until 1989, studies of string theory were largely perturbative, meaning the strings were interacting weakly, if at all. Matrix Models were very exciting at the time because they gave the tools to understand non-perturbative string theory. "We would really like to understand when strings are interacting with each other strongly," Johnson explains. "Because we’re trying to understand how black holes work and how Hawking radiation works … how the universe itself works." (Hawking radiation is the idea that black holes glow when a particle from a virtual particle pair escapes after its anti-particle is absorbed).

But Johnson found himself outcast at The Institute for Advanced Study—"the Mexa of Physics." By the time he arrived there to do his first postdoc, Matrix Models had lost their allure; it was thought that the aspects of physics they produced were inconsistent. Despite the fact that Johnson and his colleagues in Southampton showed that the models’ non-perturbative physics were fully consistent, with a definition as natural as the mainstream models, the rest of the physics world wasn’t listening. “It gave quite wonderful physics but it was never used for anything and it’s remained always at the back of my mind,” says Johnson.

This fall his ideas were vindicated when the Princeton physics establishment wrote a paper, connecting Johnson’s thesis work on Matrix Models from 12 years ago to many modern ideas in string theory. He has since written a follow-up paper. “It’s all of a sudden become relevant,” he says.

At Princeton, he studied string theory under renowned physicist Ed Witten. He also found his physics voice working with Joe Polchinski at the Institute for Theoretical Physics at UC Santa Barbara. There, he became widely recognized for his work on D-branes—higher dimensional membrane-like structures.

His eloquence found a purpose in teaching. Johnson started lecturing at Princeton, and later became an assistant professor at the University of Kentucky and a professor at the University of Durham in England.

**Superstring Theorist with Physical Ambitions**

A fresh take on what ‘everyone encounters everyday’

**Fundamental Science in Africa**

His enthusiasm for teaching parallels his intellectual appetite. Johnson referred to his childhood in the Caribbean, as a time when he was always running into a “limit to what you could find in the library.” Likewise while lecturing in South Africa, he was struck by the pervasive post-apartheid problems in education, where he felt students were simply missing opportunities. So he developed a scientific education program called ASTI—The African Summer Theory Institute—for students, high school teachers and researchers to converse and discuss scientific ideas.

This pilot program in Cape Town, sponsored in 2004 by the Flora Family Foundation, the Perimeter Institute of Theoretical Physics and the South African National Astrophysics and Space Science program, will allow aspiring African scientists to explore topics in science. Through lectures, master classes and colloquia, it will expand their knowledge of resources and career prospects.

It is the first forum for such groups to meet together in the same place. In early 2004 Johnson plans to oversee the inaugural ASTI program. In the spring, he will teach an undergraduate physics course on “what everyone encounters everyday.” Boiling water as thermodynamics, turning on a light switch as electromagnetism—he has seen that a lot of people want to know how such simple phenomena work. “And it’s great,” he says happily, “to be the first person to show them.”

—Katherine Youngner Kim

**Viterbi continued from page 1**

Monday and Tuesday as the topics switched from overviews to the specifics of a field heavy on math, computation and genetics. There was a distinct feeling, expressed freely, of being in on the beginning of something important, but what is to emerge can’t yet be described.

Viterbi was in regular attendance and at a small speakers dinner hosted by College Dean Joseph Aoun, said that he was pleased to be a catalyst for this event. Viterbi’s academic roots are at MIT, where he received bachelor and master degrees, and USC, where he received a Ph.D. And as an Italian Jew whose family fled the Fascists in 1939, he has an abiding interest in Israel.

His career is built around the “Viterbi Algorithm,” which is central to digital and wireless communications. In recent years he found commonality of interest and intent in computational genomics, fostering and financing scholars in the field.

The group expressed the intent to meet again next year at MIT.

—Alfred Kodaw
Inside Psychology

At the Heart of Family Conflict
Psychologist studies children’s vulnerability to negative emotions

In Gayla Margolin’s lab, a pre-adolescent boy sits alone in a room wearing headphones. From an audiotape, sounds of imaginary scenarios echo in his ear. In one, parents loudly argue. In another, a suitcase slams closed. In the most violent, glass shatters. The recording asks the boy how he would respond to each imaginary scenario if he overheard his parents arguing that way.

Speaking into a microphone, the boy says he would stand between his parents and try to break up the fight. It’s these coping responses that intrigue Margolin, a psychology professor who studies how children respond to different dimensions of marital conflict.

“Our lab tries to understand why some children blame themselves and intercede when their parents fight while others just go outside and play with the dog,” she says.

The answer may depend on whether in the past the family’s marital conflicts have turned aggressive and violent. Margolin’s research shows that once violence has occurred in a family, future conflicts elicit heightened apprehensions in family members.

For instance, boys who come from families even with low levels of aggressive marital behaviors (such as pushing and shoving) tell Margolin they would physically try to break up a fight between their parents. These same boys also are more likely to exhibit anxiety, depression and social problems.

“Most parents really don’t understand the impact that low-level violence can have on their children, even when it’s not done directly in front of them. The door may be closed during a fight, but most children hear more than their parents think, or wish, they heard,” says Margolin.

Trained as a clinical psychologist, she got her start as a marital researcher and later became interested in the effects of marital conflict and violence on children.

“Adults have a choice about whether to stay in relationships, but children don’t have a choice about the families in which they grow up,” says Margolin.

To gather data, she turns to Los Angeles families. As volunteers, the families provide information about their lives, including actual family discussions and daily journal entries. (Of the families she studied, 50 percent report episodes of husband-to-wife aggression in the past year.)

With funding from the David and Lucile Packard Foundation, Margolin follows the volunteers over three years to understand the cumulative effects of violence on children.

Margolin has found that families with financial and parenting stress have high potential for child abuse if husband-to-wife aggression also exists in the home.

“What I want to understand are ways that violence exposure affects the subtle, everyday dynamics of family interactions,” says Margolin. “We are learning, for example, that children’s violence exposure is related to erosions in parental support. Children who may need the most parental support actually appear to receive less empathy and more irritability from their parents.”

These are small but pervasive patterns of daily life that can impact how a child copes, particularly through the transition into adolescence, she says.

Often children’s coping strategies mimic their parents’ behavior. Taking a family’s response in the wake of a natural disaster, for example.

Prior to the Northridge earthquake that shook southern California in 1994, Margolin was working with numerous families, monitoring their behaviors and conducting research. Several months after the earthquake struck, she sent out a series of questionnaires to this same group of families.

“Surprisingly, we found that most families did not experience high levels of conflict after the disaster. Instead, families seemed to rally and pull together,” she says, “with the exception of one group.”

Those families that reported both high levels of marital conflict and parental symptoms of depression or anxiety before the earthquake reported increased marital conflict after the earthquake. Moreover, children’s reactions after the earthquake were not just related to the natural disaster. The children’s distress was closely related to family problems before the earthquake occurred—and their parents’ distress after the earthquake.

“But for the most part, families pulled together, even those families where conflict was part of a normal routine,” she says. “That was good news.”

—N.S.
Understanding Alzheimer’s

Suppose you enter a room, an entirely dark space save for a dim lamp that allows you to see several objects. When the light is turned off, you have a picture in your mind of what was in the room—courtesy of your iconic memory.

Associate Professor of Psychology Zhong-Lin Lu studies cognitive deficits in observers at-risk for Alzheimer’s disease. With a team of researchers, he has just completed a study that shows at-risk patients have deficiencies in observers at-risk for Alzheimer’s. With a team of researchers, he has just completed a study that shows at-risk patients have deficiencies in perceiving and remembering images when the light is turned off. This is a major predictor of your mind of what was in the room—courtesy of your iconic memory.

Lu explains, “We are saying that we also find signs to the sensory cortex,” Lu explains. “Alzheimer’s disease starts from higher order in a family of dementias, affecting four-and-a-half million Americans. Primarily a specialist in perception, perceptual learning, attention and brain imaging, Lu says this is his first study on Alzheimer’s. But he joins two stalwarts in the psychology department in examining the etiology of this debilitation brain disease.

Controlled Genetics

Psychology Professor Margaret Gatz determined that cognitive stimulation plays an important role in positive aging. In a study of 143 pairs of Swedish twins who were discordant for dementia, low education was shown to be a possible factor in developing Alzheimer’s disease. The sibling not exhibiting signs of dementia was described as “having read more books” and “being less likely to get lost.” Gatz refers to the demented twin as “less intellectually engaged.”

As we age, our “cognitive reserve”—our brain’s cognitive functions, such as learning and problem solving—is assuaged. While chemicals, injuries and stress have proven to be risk factors, it may also be possible to bolster cognitive reserve through cognitive stimulation and good nutritional habits during one’s earlier years.

The Real Culprit

An unmistakable characteristic of Alzheimer’s is plaque deposits that form lesions in the brain. This plaque, found to appear in the presence of amyloid beta molecules, has been targeted as the culprit behind early dementia and has been the subject of research for the past two decades. But some healthy patients show the same brain lesions without showing any signs of dementia. In 2001, Caleb Finch, University Professor, ARCO/William F. Keichnick Chair in the Neurobiology of Aging, and professor of gerontology, biological sciences and psychology, pinpointed a molecule that is needed, “to give older people the whole story.”

As a result of her research, Daley hopes to play a role in public health policy and the prevention of depression. “We’re never going to have enough funds to offer prevention for every kid,” she admits. “But I hope that my work identifies traits in teenagers that put them at risk for depression. There are many young people who should be receiving intervention.”

Daley has also worked with graduate students at the Human Relations Center (HRC) to help low-income residents of Los Angeles deal with psychological problems and relationship difficulties. —Theresa Haganov
Nature and Nurture

Schizophrenia researchers search for roots of a devastating disorder

When schizophrenia strikes, the brain disorder can leave its victims haunted by delusions and auditory hallucinations and isolated in a world they perceive to have gone mad. Early theories linked the disease to environmental stresses, such as growing up in a dysfunctional family. Then, researchers focused their studies on the brain chemical dopamine, genetics and the brain's frontal lobe.

Schizophrenia, says USC College of Letters, Arts & Sciences College vision researcher Bosco Tjan holds up his cell phone and asks “What is this?”

This is Tjan’s way of paying ode to the human visual system, from the pupil and retina to the visual processing areas in the cortex of the brain. “The best computer vision system can’t do what we do instantaneously and without effort,” says Tjan, an assistant professor of psychology.

“If we can understand what happens in your mind’s eye when we see what’s around us, we can understand the whole brain,” says Tjan. He studies the initial steps of seeing and how adding specially designed visual “noise” to an image impacts its recognizability.

This could lead to new insights into the brain and help people who rely on peripheral vision, where these effects are most pronounced.

A Leaping Tiger

“Detecting the motion of prey or predators is critical for survival of all animals,” says Zhong-Lin Lu, associate professor of psychology, who studies how we sense motion. “If you see a tiger, the brain can tell if it is moving by comparing the luminosity, texture and color of the tiger to the background.”

“The brain breaks motion down in these three parts, analyzes the information by three different pathways, and then puts it all back together. We see the sum—one tiger moving,” says Lu. He will use the College’s new brain imaging center to pinpoint where in the brain these processes take place.

Pleasure of Perception

An expert on eye and brain, Irving Biederman, the Harold W. Dornsife Professor of Neuroscience, delights in the vagaries of vision—especially those that reveal seeing as a product of the mind as much as that of the eye.

When you move your eyes the mind suppresses vision temporarily, so that you can never look at things while your eyes roam. “The mind fills in the blanks,” says Biederman.

Recently, he started investigating the connections between visual perception, cognition and pleasure to understand why we choose to pay attention to certain things in our surroundings over others. “The pay-off is pleasure,” he thinks. In the cerebral cortex of the brain, scientists have found cells that release endorphins—natural opiates considered the neurochemical basis of pleasure. These cells are found at all levels of the higher visual system, but are most dense in brain areas where faces, objects and voices are perceived and linked to memories.

At the imaging center, Biederman plans to test his theory, and continue to study object recognition. “Somewhere between 50 to 65 percent of the brain’s cortex is involved in visual perception,” Biederman says. "We’re a very visual species."
New vistas of the brain will advance studies of behavior and experience

In his quest to understand both the biological and psychological bases of crime, violence and mental illness, USC College Professor Adrian Raine has peered into the brains of murderers, thieves, schizophrenics and people “just a bit odd”—those with personality disorders.

Over the last 15 years, Raine has taken advantage of an array of brain imaging techniques, from EEG to fMRI, to offer scientists the most detailed view of where activity is taking place. IMRI, or functional magnetic resonance imaging, is today’s most cutting-edge brain scanner. Using powerful magnets, fMRI scanners offer scientists the most detailed view yet of both the brain’s activity and the precise location of that activity.

Raine’s own brain imaging studies have revealed links between abnormalities in the physical structure and activity of the brain and behavioral problems, discoveries helping to move scientists closer to understanding both brain and mind.

Yet even Raine, the Robert T. Wright Professor of Psychology, has been taken off guard by the increasing pace of new discoveries made using fMRI and related brain imaging techniques over the past few years.

“There’s been an exponential gain in our knowledge about the brain,” says Raine. “I’ve seen a dramatic change in the quantity and quality of work in this field. Brain imaging studies, and their implications, are generating enormous excitement, beyond academic circles, in the general public.”

Imaging: Emotion

At the new center, Adrian Raine plans to study the neural processes underlying the emotion of anger. Understanding how normal people process anger, he says, will help shed light on the altered brain processes that lead to the extreme pathological anger of violent criminals such as murderers.

Raine will also work with Laura Baker, professor of psychology, on a study of a variety of emotions in identical and fraternal twins that will integrate fMRI, MRI and related brain imaging techniques over the past few years.

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Imaging: Dyslexia

Frank Manis’ ongoing fMRI studies of dyslexia point to regions of the brain crucial to reading, and hint at what goes wrong in the brains of dyslexics. At the new center, Manis hopes to build a library of fMRI brain scans of normal readers at various ages. Comparing these with scans of dyslexics matched to develop normal reading skills. What he finds may help him design early identification methods for sub-types of dyslexia and lead to different instructional approaches for the sub-types.
Bullies and the Bullied
Genetics may influence playground fights and criminal behavior

Nearly 60 percent of boys who researchers classified as bullies in grades six through nine were convicted of at least one crime by the age of 24; 40 percent of them had three or more convictions by 24, the report said.

College Psychology Professor David Schwartz, who has studied bullying for 35 years, has found that in 90 percent of the cases, the targets of aggressive behavior are submissive or passive children, many of whom come from an overprotective or controlling environment.

About 20 percent are described as angry kids. “Sometimes it’s the kids who overreact and get angry who get picked on, but in most cases it’s the passive ones who are the biggest targets,” he says.

His studies have also found that having a close friend helps children who are chronically bullied. “Kids who are at risk seem to do OK if they have a friend,” he adds. “It serves as protection.”

While the link between bullies and criminals has been established, the future of the chronically bullied has been less examined, according to Schwartz. He says both the bully and the bullied generally have problems later in life.

“Aggression early on indicates problems for the targets of bullies,” says Schwartz. “It’s predictive of all kinds of future social problems.”

While it’s unclear how much, scientists agree both genes and the environment play significant roles in developing character and behavior.

“Genes should probably be viewed as risk factors rather than predictors of antisocial behavior,” says Baker. “The more we know about each and how it influences behavior, the more we can help mediate the problem.” —K.X.T.

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D e bullies learn to push and shove their way through life? Or are they hard wired from birth? Those first few kicks may be the first step toward antisocial behavior.

Psychology Professor Laura Baker has been puzzling over the nature/nurture question her whole life. As a child, she wondered if aggressive kids were conceived or created that way.

To find out, she is studying a large group of twins from southern California. With fellow psychologist Adrian Raine, they have gathered more than 300 sets of twins (both identical and fraternal) from public schools throughout the area.

To better understand how genes and environment influence behavior, the scientists are researching the siblings’ learning and behavior problems, including antisocial activities and attention deficit disorder.

“We’d like to be able to predict and prevent problem behavior,” says Baker. “But you can’t prevent something unless you understand the biological and social roots of the problem.”

The study, funded by the National Institute of Mental Health, still track the twins in waves, beginning at ages nine and 10 and analyzing them every two years through age 21. So far, the researchers have completed two waves; the twins are now aged 11 and 12.

Why twins? They provide a natural laboratory because they share the same genetic code. Fraternal twins share about half the same genes.

Antisocial behavior is a complicated subject to study, Baker says. “Aggression takes many forms, from pushing, to manipulation, to breaking rules,” says Baker. “The complexity of violence and aggression makes it a difficult and fascinating area of study.

Just as there are many forms of aggression, there are probably many causes for aggressive behavior.”

The Criminal Mind
When nature and nurture join forces to shape an individual’s personality, the likelihood of criminal behavior more than doubles, according to studies by Raine, the Robert G. Wright Professor of Psychology.

“Certain people have only biological and psychosocial risk factors. As a group, these ‘biological’ individuals account for about 70 percent of all crime.”

A 1996 study by Raine and his colleagues examined Danish males born in the years 1959 through 1961. The youths with the highest crime rate were found to be those who had experienced both biological and psychosocial risks. One third of this biological group had committed at least one crime by age 22.

By comparison, the crime rate was 17.9 percent for the obstetrics group, which experienced only the biological risks of obstetrical complications and slow motor development. The group exposed only to the psychosocial risk of poverty (the poverty group) had the lowest rate of all, 15.7 percent.

The biosocial group also had significantly more academic and behavior problems than the obstetrics group and more behavior problems than the poverty group.

Raine’s brain imaging studies have led to significant discoveries about the minds of criminals, in particular the fact that violent offenders have poor functioning in the brain’s prefrontal cortex. This section of the brain houses the mental machinery that controls impulsive behavior, social sensitivity and feelings of remorse, says Raine.

In a study of men diagnosed with Antisocial Personality Disorder, Raine and his co-researchers measured tissue volume in the prefrontal cortex and found that the antisocial men had 11 to 14 percent less volume of nerve cells in this area compared to normal males.

From Bullies to Criminals
Researchers have found that many individuals graduate to criminal activity from lessons learned in the playground. In a report by Fight Crime: Invest in Kids, a children’s advocacy group, nearly one in six children in grades six through 10 were victims of bullying each year and 3.7 percent were bullies.

“We’d like to be able to predict and prevent problem behavior,” says Baker. “But you can’t prevent something unless you understand the biological and social roots of the problem.”

Genetic influences may also play a part in preventing and controlling antisocial behavior. With the help of Baker, Raine, and their research colleagues in southern California, the twins are helping scientists bring into focus the genetics of criminal behavior.

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Beyond Botox

(A how-to on aging gracefully)

A sk University Professor Caleb Finch what his ultimate career goal is and he won't hesitate to respond: “It’s to understand the mechanisms behind the human life span,” says Finch, holder of the ARCO/William F. Kieschnick Chair in the Neurobiology of Aging and professor of biological sciences in the College. Besides Finch, other researchers in the College are looking at ways to make life better, and maybe even longer. Here is a sampling:

Start early to stay young

The best time to adopt healthful diet and exercise habits is very early in life. A new paper by Biologist Michel Baudry lends support to the idea that cognitive declines begin in early middle age. Prenatal and postnatal nutrition is especially important to healthy brain development, says Margaret Gatz, psychology professor in the College.

Use your mind and socialize

Stimulating your mind throughout your life span, through crossword puzzles for example, might help ward off Alzheimer’s. “While we have not proved the adage ‘use it or lose it’, it certainly makes sense that keeping an active mind contributes to positive aging,” says psychology doctoral student Michael Crowe. Going to museums and socializing with friends during middle and senior years has been shown to be related to lower risk of developing dementia, says Gatz.

Eat less, but more of the right things

A growing body of research shows that eating less can lead to a longer life and postpone, or prevent, many diseases—at least in worms, flies and mice. Finch has shown that low-calorie diets also can slow brain aging in rodents.

Regular exercise helps lower blood pressure, reduces the risk of falls and resultant serious injuries (such as hip or wrist fractures) and slows the body’s loss of muscle and bone mass. A healthy dose of sweat also works as a mood elevator, promotes better sleep and is hypothesized to reduce the risk of Alzheimer’s disease, says Gatz.

Tobacco cuts deep in many ways

Steering clear of toxic substances such as tobacco will likely leave you looking—and remembering—better at 70. Finch and collaborators have discovered a new form of soluble toxic proteins in the brain—called Aβ101 amyloid beta—may be a culprit behind Alzheimer’s.

Hope for good ancestors (and good luck)

Ultimately, much of the aging process is left to chance, says Finch. Genotypes may only explain 20 to 30 percent of our longevity, he says. “The life-span of our cells is programmed into our genetics to a point, but not as much as people might think,” says Finch, whose book on chance, development and aging emphasizes the fundamentally random nature of cell processes that affect aging.

Relax and reflect to remember

Individual personality traits may affect how well you age. For instance, people who live a high stress lifestyle over a long period of time alter neurotransmitter levels, and thus the brain area where memory is encoded, says Gatz.

Think about where you are headed

Eileen Crimmins, Edna M. Jones Chair in Gerontology and professor of gerontology and sociology, is studying the possible link between longevity, education and income levels. She also studies how demanding work environments affect the aging process. This line of research asks whether more money and more college degrees lead to longer lives, and whether high stress jobs make one live longer—or shorter.

And if happiness leads to longer life...

“People make decisions assuming that more income and positional goods will make them happier, failing to recognize that hedonic adaptation and social comparison will come into play and raise their aspirations to about the same extent as their actual economic gains,” writes Richard Easterlin, a professor of economics in USC College. “As a result, they spend a disproportionate amount of time working at the expense of family life and health, domains in which aspirations remain fairly constant as actual family circumstances change, and where the attainment of one’s goals consequently has a more lasting impact on happiness.”

The take home message:

Relax, do crossword puzzles at home with family, visit friends, eat healthy small meals, don’t smoke, exercise and stay active.

—N.S.
Skin Color Stressors

Graduate student takes a new look at racism

Graduate student Jennifer Best is turning the study of racial prejudice on its head. Scholars have long studied the environmental and social factors that lead to racially biased thinking and behaviors. “What hasn’t been as widely researched is how victims of racial prejudice cope with discrimination-related stress,” says Best, who studies clinical psychology in USC College.

Figure out the psychological and social wellness of people of color is not an easy task. But that didn’t stop this Staten Island native who, as an undergraduate, studied psychology and biology at Harvard.

As part of her masters’ project (which has since become the basis for her dissertation), Best recruited 64 African American women to participate in a research study. She used psychology professor and research supervisor Gerald Davison’s Articulated Thoughts in Simulated Situations method as the foundation for her research.

Through audio recordings, she simulated three imaginary scenarios. The first features the participant imagining being given poor service at a mall that has predominantly white customers. The second depicts a hate crime in which the participant’s car is vandalized with racial slurs. “This scenario provoked the most intense emotions of fear and anger,” she says. “Most of the women coped with the hate crime situation in a problem-focused way, meaning they would ask for help rather than shouting back.

But the most unique aspect of Best’s research is the third scenario which asks: How does a woman react when people of her own race judge her along racial lines?

To find out, Best made a third audiotape.

“The participant imagines herself about to sign up for a predominantly black student organization, while two other African American women look on disapprovingly. Later the two girls pull the new club member aside and ask, ‘Why don’t you sign up for the white club on campus, you’re not black enough [for our club].’”

Best found this final scenario provoked an intense sense of sadness in several of the volunteers.

“The subject of intra-group prejudice has barely been examined scientifically, but it is a very real issue—especially for ethnic minority students trying to adjust to a multicultural college environment,” she says. “Intra-group prejudice is something that is almost taboo to talk about,” she says. “There are certain said or unsaid codes about what it means to be an African American female.”

Best’s unusual approach to the study of prejudice was so well received she is asking a related question in her dissertation: How do racial identity and trait hostility influence the perception of and ways of coping with racial discrimination?

To answer this, she’s analyzing how ethnic groups, including African Americans, Mexican Americans, Asians and Europeans deal with everyday slights.

“Things like bad customer service, for example, may or may not be attributed to prejudice. But how do people react psychologically when they’re not sure.”

It’s an burgeoning field that fits well with Best’s “break the mold” attitude.

—Y.S.

Strength in Numbers

A stronger economics department models the practical

Curious what World Cup soccer, procrastination and frequent flyer miles have in common?

Ask a USC College economist.

While some scholars wait decades to see their work find practical application, College economists’ research is applied with tangible results.

On a routine day, economists combine theory and data to predict stock prices, structure compensation contracts, and pinpoint why and how incentives motivate people.

“In the past few years, this department has really gained momentum. Most of what we research relates to issues that are going on in the real world,” says Robert Dekle, associate professor of economics and chair of the department.

Dekle attributes much of this vigor to the College’s senior faculty recruitment effort. Since 2000, five senior professors and a cadre of rising associate professors have joined the department, with others moving along the recruitment pipeline.

Together they’re propelling the department to new heights, steadily breaking ground in macroeconomics, contact theory and industrial organization. The department is partnering with scholars in the Marshall School of Business to supplement existing strengths in macroeconomics.

A World View

In September 2003, Professors Hashem Pesaran and Guofu Tan joined the department. Scarcity of economic formulas adorn their white boards. Complex to be sure, but a look past the surface reveals practical applications.

Pesaran provides insights about the economics of oil in the Middle East, energy demand in Asian countries and the monetary and foreign exchange policy in Iran. A former consultant to the World Bank and United Nations, he develops econometric models that governments and businesses can use when they need to make economic and financial decisions on the fly.

“I am hoping I will be able to continue my work in this area and build the foundation of what might one day be called Real Time Econometrics,” says Pesaran, who joined the College from the University of Cambridge.

Fellow newcomer Tan brings international expertise with respect to Asia and the Chinese economy.

Organizing Industry

Tan and Jean-Jacques Laffont, the John Elliott Chair in Economics, anchor the department’s work in industrial organization. In a series of articles, Tan explains some of the unpredicted consequences of the deregulation of the U.S. airline industry in 1979. His economic models analyze the hub-spoke network, frequent flyer programs and failure of new entrants and mergers.

Meanwhile, Laffont’s work has been tapped by the Federal Communication Commission, forming the backbone for policies that regulate pricing in the telecommunications industry.

Two rising stars, Associate Professor Juan Carrillo and Assistant Professor Isabelle Brousse, add muscle to the department’s growing expertise in industrial organization and behavioral economics. They research original topics such as rush and procrastination under interdependent activities and the psychology of economic decisions as it pertains to information and self-control.

Carrillo, formerly a faculty member at Columbia Business School, is blazing new ground in his study of job assignments as a screening device.

Sometimes economics can be found in the most unexpected places.

Professor Richard Easterlin, a member of the National Academy of...
Homing in on Hormones

At first glance, sex and aging don’t seem to go together. In the laboratory of Psychology Professor Kathleen Chambers, however, they have a lot in common. She studies sex hormones to understand the process of aging.

“I’m interested not only in the basic function of hormones, but the changes that take place with aging and how hormones modulate learning and regulate sexual activity,” says Chambers. “We’ve learned that hormones play different roles in males and females. We’ve also learned that although there is a great deal of similarity in the effects of hormones across animal species, what works for rodents doesn’t always work for monkeys and humans.”

Chambers began her career studying how animals learn to avoid certain foods that have made them ill.

Research on the relationship between learned food aversions and aging developed later.

As a scientist at the Oregon Regional Primate Research Center, she learned that imprisoned male sexual offenders were being given testosterone, progesterone, based on research that had shown that rats dosed with progesterone exhibited a decrease in sexual activity.

“The prisoner program was a disaster,” Chambers says. “Progesterone doesn’t work that way in primates, although it does inhibit behavior in rodents. One of the participants left the prison and repeated his crimes. And the program shut down.” But it stimulated her interest in the relationships between sex and behavior.

“I’d always been intrigued by the problem of sexual offenders and wondered what could be done about sexual violence,” she says. She thought if she could understand how and why male sexual activity diminishes with age, she might be able to find a successful way to treat sexual offenders.

When Chambers explored the relationship between a decrease in testosterone and the decline of sexual activity in aging males she found that adding more testosterone had little effect. Some of her research with rats suggests a reduction in the brain’s receptors that control behavior.

But for females, the situation is different. They appear to retain interest in sex as they get older, Chambers says. “With female rats and rhesus monkeys, we have found that even past the equivalent of menopause, if you give them hormones, their behavior will come back. This is not true for males.”

Chambers says one biological explanation might be so-called “affiliative behavior.” In a monkey, for example, sexual behavior can be a way of “affiliating,” with a male who might offer her protection or something else that would be beneficial in an evolutionary sense.

Her work on learned food aversions also has important implications for aging. “There has been a great deal of press on the memory enhancing abilities of estrogen,” Chambers says. “In fact, our research shows that estrogen can have both facilitating and detrimental effects on memory. Which effect it has depends on when it is present during the learning and memory retrieval processes. Clearly, the idea that one hormone or drug can enhance all memory processes is looking to be quite simplistic.”

“These two systems, learned food aversion and sex, can shed light on our survival.”

Contracting Minds

Laffont and Economics Professor Bentley McLeod are advancing the study of contract theory.

McLeod has found that understanding the complexities of an environment has all kinds of implications for contracts and employment relationships. He is currently studying such issues at the Industrial Relations Center at Princeton University. His research has found it is very common for contract parties to describe certain behaviors as “unfair.”

For instance, if an employee feels that she is being unfairly treated, then she might respond to this by decreasing output. An implication is that an employer’s beliefs as to what an employee can do can have dramatic effects on performance.

“But motivating people is not an issue in our department,” laughs Dekle. “The energy seems to be contagious.”

---K.N.Y.
Golden Chemistry
Barrios studies how metals work in the body

At age nine, Amy Barrios liked chemistry. Her parents bought her a biology kit. It wasn’t until she received her Ph.D. that she got the chemistry set she always wanted, says Barrios, the newest member of the USC College chemistry department.

Perhaps her parents knew something. Barrios combines interests in the chemical world of atoms and the biological world of cells in her research on the chemistry of metals within the body.

Metals are critical in many of the body’s proteins. Iron ions, for example, are a key ingredient in hemoglobin, which carries oxygen in blood. The anti-cancer drug cisplatin, which helped cyclist Lance Armstrong beat testicular cancer, contains platinum.

One of her three research projects focuses on gold, a main ingredient in a last resort drug used for rheumatoid arthritis (RA) patients who fail other treatments. Although effective, gold has unwanted side effects. Auranofin, the gold-containing drug, targets the body’s joints, slowing the disease process. Barrios speculates that auranofin interferes with enzymes called cathespins thought to play a role in RA and osteoporosis. Cathespins cut up and clear away proteins no longer needed in the cell. Gone away, the enzymes may damage healthy proteins such as the collagen in joints.

“We’re trying to figure out if gold inhibits these enzymes,” says Barrios, the Gabilan Assistant Professor of Chemistry. Understanding the drug’s mechanism could lead to a drug that’s more efficient and has fewer side effects. “That’s a big undertaking—not something I expect to accomplish anytime soon.”

In another investigation, Barrios researches the dramatic differences in zinc levels found in healthy and malignant prostate cells. She aims to create a zinc-sensitive molecule to use with magnetic resonance imaging technology to better diagnose prostate cancer.

In a third project, Barrios hopes to characterize enzymes called protein tyrosine phosphatases, important in cellular signaling pathways such as the one that controls insulin levels.

Genomic studies reveal 120 genes encoding for these enzymes, but how they differ isn’t known. By figuring out how, Barrios hopes to reveal new ways to battle diabetes mellitus, which some link to overactive phosphatases. Inhibiting the enzymes could lead to new treatments.

Barrios is a welcome addition to the department, says chemistry chair and professor Hanna Reisler. “She’s bringing us new expertise in the field of pharmaceutical chemistry.”

Under the Microscope

Is it sweet, bitter — or umami?
College research lights up taste

Put a caramel in your mouth and your taste buds detect the sugary substance and instantly send a message to the brain, which interprets the signal—sweet! Trying to figure out what happens in the split-second between eating something and recognizing its sweet or bitter flavor, or more precisely, between the initial detection of a taste and a signal reaching the brain, led neuroscientist Emily Liman to take a closer look inside the cells in the taste buds.

What she found reveals new details about how the sense of taste works. The research by Liman, an assistant professor of biological sciences in USC College, and graduate student Dan Liu indicates that calcium plays a key role in the detection of tastes by taste cells in the tongue.

Published in December in the Proceedings of the National Academy of Sciences, the paper also offers a molecular model of how taste cells reset so they are ready to detect new tastes. Until recently, scientists have known little about how taste works on a cellular or molecular level. Just four years ago scientists officially added a unique taste, called umami, to the list of better known ones: sweet, bitter, salty and sour. Umami receptors are sensitive to the amino acid glutamate, which most think serve as a marker for protein-rich foods. Glutamate is also the main ingredient in the commonly used flavor additive MSG (monosodium glutamate), which may explain the additive’s appeal.

Taste research has attracted the attention of basic researchers like Liman interested in unraveling how cellular signaling works. Food and drug industry scientists are also very interested in understanding the molecular details of taste, especially bitter and sweet, Liman says.

“It’s important to know how taste works and to identify the molecules involved. These molecules can be targets for designing chemicals that activate taste—for example, a better artificial sweetener—or that block taste, such as an additive that could be used to block bitter tastes,” she says.

—E.E.
Recruitment Strides
New hires bring more women to science

The College’s strategic plan identifies increasing faculty diversity as one of its key goals. Expanding the life sciences is another.

The new women scientists, added to the recent appointments of three new men faculty in biology, help fulfill both aims, says Beth Meyersowitz, dean of faculty and professor of psychology in the College, who oversaw this year’s successful hiring of new College faculty, 12 of these women.

In biology, the new hires bring the number of tenure-track women faculty from six to 10, with women now making up 21 percent of the biology faculty. In chemistry, a department with only two women faculty last year, the jump was smaller (from seven percent to more than 10 percent this year), but qualitatively significant—chemists Anna Krylov and Hanna Reisler can now use the plural in describing their female colleagues. Reisler chairs the department.

In addition, the administration reports a 25 percent rise in the number of tenure-track and tenured minority faculty members since the strategic plan’s debut.

Recognizing that major work lies ahead, College Dean Joseph Aoun has the gains made so far.

“Increasing the number of women on our faculty is one aspect of our goal to diversify our faculty,” says Aoun. “Minority hiring is up over the last three years, and we are mindful of intellectual diversity as well. In seeking new faculty who are leaders in emerging fields, and whose research crosses the usual disciplinary boundaries, we are building a lively faculty with many interesting perspectives. “But this year, we are very proud that we have been able to attract such outstanding women faculty.”

A National Problem
USC College is if anything getting ahead of the curve on the issue of how to increase the number of women academics in science. According to a 1999 report from the National Science Foundation, progress has been slow and uneven across science fields (with biology attracting more women than physics) at colleges and universities across the nation.

Aoun points to the pivotal role of the WiSE program in this year’s successful recruitment. WiSE has gotten the word out that USC is committed to building an environment that will support and help develop the careers of young women scientists. And applicants are responding.

It made a difference to Amy Barrios, who joined the College in 2003 as the Gabilan Assistant Professor of Chemistry, one of three Gabilan chairs designed to assist junior faculty in launching their scientific careers. “It is an impressive statement for a school to make publicly,” she says. “It told me that there was a support system already in place, and that was important to me.”

WiSE Support
When WiSE was established three years ago under the leadership of USC Provost Llloyd Armstrong, Jr., its primary goal was to double the number of tenured and tenure-track women scientists and engineers within five years.

Generously funded by an anonymous gift of $20 million, WiSE contributes the majority of its annual budget to recruitment. The College’s new women scientists received substantial research start-up funds from WiSE on top of that offered by the College, says Jean Morrison, WiSE director and associate professor of earth sciences.

WiSE exposes a second, harder-to-measure aim: to create a scientific community that fosters the development of young faculty, both women and men. “It starts with recruitment. But it’s critical to build a culture that helps people thrive and grow,” says Morrison.

Signs of Success
Barrios, who studies the chemistry of metals in biological molecules and systems, was attracted to USC for a number of reasons, she says, including a chance to help guide the development of a growing biochemistry emphasis. But her interactions with Reisler and others involved in WiSE, as well as the generous start-up funds, made the College her top choice.

New faculty member Michelle Arbetman, who joined the molecular and computational biology program this fall, echoes Barrios’ sentiment.

“The funds WiSE has given me will help me do my research more efficiently. And their support, in terms of advice and networking, has been important,” says Arbetman, the Gabilan Assistant Professor of Biology.

Her research focuses on the molecular and genetic processes that determine the sex of a developing fruit fly and generate sex-specific behaviors in adults, such as male courtship.

In addition to Barrios and Arbetman, the College welcomes the following assistant professors to the biological sciences department:

• Xianghong “Jasmine” Zhou, a computational biologist who works to develop new computational methods that will allow greater understanding of how and when cells turn on and off genes.

• Samantha Butler, a developmental neurobiologist, studies how developing nerve cells hook up with other neurons to form the brain’s communications network.

USC Sponsors Regional Biology Calendar

Life science scholarship is thriving in Los Angeles. As a result, USC’s regional online calendar of the life sciences, BiologyWest, in its second full year, is finding high readership for its listings of lectures, conferences and symposia in and around L.A.

The site can be viewed at www.usc.edu/biowest/. Readers are invited to log on to find out what’s happening in molecular and computational biology, cancer research, and countless other topics.

USC, UC Irvine, UCLA, Caltech and other institutions sponsor numerous symposia, talks and lecture series that are open to the public, and post them on the BiologyWest Web site.

Sponsoring institutions can submit events at the Web site simply by clicking on “submit an event” and entering the details.

Further information is available by e-mail at bwest@usc.edu.
**Gifts and Grants**

**Surfing for Science**

Quiksilver supports Wrigley Institute and college programs

A unique ocean-based program designed to improve science education in southern California schools was announced in October by USC College, the USC Wrigley Institute and Quiksilver, a Huntington Beach-based company that designs and sells surf and sun clothing.

With more than $1 million from the Quiksilver Foundation, the partnership will support a variety of new programs that build on current Wrigley offerings. The goal is to make science more approachable, relevant and fun for children ranging from kindergarten to 12th grade.

“There is a critical shortage of scientists in the nation,” says Joseph Aoun, dean of the USC College. “Science plays an important role as an agent of economic growth and sustainability and promotes the well-being of citizens.”

“It’s incumbent upon us to reach out to students during their formative years (K-12) and use their love of the ocean to make them appreciate science,” Aoun says. “We are grateful to USC alumnus Bob McKnight for his passion and commitment to the environment and to education.”

The project will also sponsor “QuikScience Challenge,” a competition encouraging seventh- and eighth-graders in five southern California counties to find innovative ways to work with their teachers and schools to adopt and improve the Wrigley Institute curriculum.

Students will compete for the opportunity to spend a week in the Caribbean Sea studying aboard the Indian Trader, a 72-foot ocean research vessel sponsored by Quiksilver, or a weekend research trip to the USC marine lab on Catalina Island.

Bob McKnight, Quiksilver’s chief executive officer, says his company is committed to the environment as well as to children.

“As surfers, we have a deep appreciation for the ocean’s beauty and its power, but also its fragility,” he says. “We have a responsibility to give back and support the communities in which we operate, and we believe education is one of the best ways to give back.”

Quiksilver, which produces a number of brands under names such as Roxy, Renos and Quiksilver, also will support the Ocean Leadership Awards, which recognizes teachers who excel in teaching science in unique ways. Eight area teachers were presented with awards in October.

Professor Anthony Michaels, director of USC’s Wrigley Institute, says the goal of the Wrigley Institute “is to extend our knowledge base outside the university. One of the most important things we do is to work with students—the idea makers of tomorrow.”

—Gilien Silsby, USC News
Mellon Foundation Supports Early Modern Studies

The trustees of the Andrew W. Mellon Foundation have awarded a $628,000 grant to USC College, for a collaboration with the Henry E. Huntington Library & Art Gallery.

The gift will help boost the USC Huntington Institute for Early Modern Studies, bringing together researchers to share discoveries and scholarship on human societies between 1492 and 1800—a period richly captured by the Huntington’s vast collection of rare books, manuscripts and newspapers.

The money will be used over the next three years to support research and graduate training in studies of the early modern world.

“One of the unique features of the institute is that there are no comparable institutions on the West Coast,” says Peter Mancall, director of the Institute and a history professor in the College. “That gives us something of an advantage in terms of integrating scholarship on the Pacific Rim with scholarship on the Atlantic world.”

Unlike existing centers that focus on particular regions, the emphasis will be global, both in scope of research topics and in the recruitment of fellows, seminars and conference participants.

The College Connection

Associates program kicks off in spring

Alumni, parents and friends who support USC College will receive customized courtesies when the new Associates Program launches in spring 2004.

A sampling includes free on-campus parking, private seminars with leading authors and art historians, receptions at the Faculty Center restaurant, accessibility to the USC library system and pre-football game picnics to cheer on the Trojans.

The program’s intent is to increase philanthropic support and awareness of the College by working in conjunction with the USC Associates, the University’s premier group. Gifts raised through the new program are designated specifically to USC College.

“Among the most rewarding advantages of joining the USC College Associates is the opportunity to connect with alumni and faculty who are recognized leaders in their profession and community,” says Tamara Baringer, the development officer who directs the program for the College.

Most importantly, membership in the program presents an unparalleled opportunity to support the intellectual heart of the University. Disciplines honored within College corridors are central to all of the University’s professional schools—from gerontology to law—from communication to business. Today, every USC undergraduate takes classes in the College, with top professors teaching many of these undergraduate courses.

Whether your intellectual passion is letters, arts or sciences, or the burgeoning intersection of all three, membership provides the opportunity to directly support specific programs and disciplinary fields. Support can also target the College’s priority areas, such as graduate programs, life sciences, the senior faculty hiring initiative and undergraduate education.

A specialized division of the program called the International Associates will offer special benefits such as admittance to assist with course selection and invitations to events in the U.S. and abroad. The Parents Associates program will offer similar customized courtesies.

Membership, at various levels, is open to anyone who wants to support the College:

• Presidential level (5 year pledge) $100,000
• Senior level (5 year pledge) $50,000
• Junior level (age 35 and under) $25,000
• Membership level (5 year pledge) $2,500 annually
• President’s level (5 year pledge) $100,000

For more information contact Tamara Baringer, (213) 740-4990, or e-mail baringr@usc.edu.

Supporting Brain Research

David and Dana Dornsife recently gave an $8 million gift to establish a Cognitive Neuroscience Imaging Center headquartered at USC College (see page 7). Pictured at the celebratory dinner (from left to right) is USC President Steven B. Sample, Dana Dornsife, USC Trustee David Dornsife, Chairman of the USC Board of Trustees, Stanley R. Gold, and College Dean Joseph Aoun.
Putting USC on the Global Map

Cartier wants to bring international perspectives to the fore

in an effort to bring greater focus on international research to USC.

Carolyn Cartier is helping to create a new certificate in urban and global studies.

The long-term vision calls for a center for Urban and Global Studies that would be an umbrella institute for the social science graduate curriculum and faculty research in the College.

“Putting USC on the Global Map...”

Cartier says the College’s social sciences should have a broader international focus and she hopes new faculty will bring expertise in global issues. “We need to take the strengths of USC’s urban and regional research to the global arena; we need to have active research on a spectrum of issues in diverse world cities and regions,” she says.

The College has a strong basis in urban studies, but Cartier says there is a need to press further on comparative studies of L.A. in relation to other U.S. and international cities, as well as urban issues globally, especially in areas such as Asia and Latin America, where the College has been developing research strengths. She says that a dominant focus on L.A. keeps the College marginalized from some major funding agencies that tend to target global issues. The program is part of a University wide effort to strengthen urban and global studies.

“A university of this stature should have a more integrated international perspective,” Cartier says. “It is a reality that the future is about ties among places, including critical questions about transnational relations, urban sustainability and the global economy.”
A Public Service Announcement

Cunningham '77 is appointed President of L.A.P.D. board

David Cunningham III was 16 years old when his father ran for state senator. He was asked to walk precincts for the campaign, and it was the experience of “meeting people and debating public issues” that triggered his interest in public service.

Still fulfilling that commitment, Cunningham was unanimously elected president of the Board of Commissioners for the Los Angeles Police Department in July 2003. He had previously served on the five-member commission for two years.

Cunningham, who graduated summa cum laude and Phi Beta Kappa from USC College in 1977, attributes his public service involvement to his undergraduate years. As president of Omega Psi Phi, he fundraised for sickle cell anemia. He volunteered at a halfway house and learned to navigate the criminal justice system. As an intern in the U.S. Court of Appeals for the District of Columbia Circuit, he met and discussed public service and the role of law in society with Supreme Court Justice Thurgood Marshall—an encounter that further cemented his ambition.

“USC rewards me every day,” Cunningham says. “Not just because of my contacts, but because of the chances I had and the goals that it helped me set. USC offered it, and still continues to offer it.”

As commissioner, Cunningham wants to increase the 9,308-strong police force to 10,000. He cites the diversification of police recruitment and departmental reform as two of his personal priorities in 2004, calling for 21st century policing that is mindful of constitutional rights.

“We have a lot of work to do on that one,” he admits. But he highlights L.A.P.D. success in crime reduction—a 24.6% decrease for homicides in 2003—and hails Los Angeles Mayor James Hahn’s goal of “making L.A. the safest city in America.”

Cunningham also has an extensive private sector background as a development attorney—part of a distinguished legal career that is steeped in civil rights. He graduated from New York University’s School of Law and later counseled in the Voting Rights Section of the Civil Rights Division in the Department of Justice. He also had a judicial clerkship before moving onto civil litigation.

Currently, Cunningham builds economic bases in low-income urban areas by cleaning contaminated industrial sites and upgrading them into housing and retail components. The NoHo Commons project is an upcoming arts and entertainment district in North Hollywood, in South Central Los Angeles. Commissioner Cunningham is collaborating with the NoHo Redevelopment Agency to turn a number of properties with heavy soil and vapor contamination into one major retail site.

“Brownfields”—as the project is called—will ideally create employment in an economically blighted area.

Striving to meld his dedication to community involvement with Los Angeles’ police affairs, Cunningham is pushing to enhance the partnership between the police and the community, and he sees multiple town meetings as a means of accomplishing this task.

Much like his start canvassing from house to house, the commissioner says this aspect of his vision and goal for the LAPD is to “reach as much of the population as possible.”

—K.Y.K.

and pieces to provide good readings for his students.

“I thought it was getting tiresome pulling these texts together, and often there was nothing adequate,” he says. “So I thought to myself, ‘why don’t I write the whole damn thing?’”

“I tested the chapters on my students throughout the 1980s, so that by the early 1990s I had written the whole book. And to my considerable surprise it was accepted. So I dedicated the book to my students at USC.”

“Mountain of Fame: Portraits in Chinese History” was published by Princeton University Press in 1994. Wills says the book is an example of how publishing and teaching efforts can support each other.


Shortly after he leaves USC, Wills will travel to China and Vietnam. He plans to lecture, research and write during retirement.

He sums it up this way: “I plan to do the exact same things I’m doing now—except grade papers.”

—A.O.T.

Building the Future, Beam by Beam

Much progress has been made since groundbreaking for the new Molecular and Computational Biology Building took place in spring 2003. As one of the most ambitious projects in the College’s history, the more than 100,000-square-foot building heralds an important step for USC College and a new era for life science research at the University.

With state-of-the-art computing facilities and laboratory space for basic biological research, it will be configured to promote collaboration among some of the College’s most creative scientists. The new building will house up to 28 faculty researchers. It features eight state-of-the-art molecular biology labs, eight new computational biology laboratories, and four “hybrid” labs that have both wet lab and computing areas.

To view building construction in “real-time” visit http://www.usc.edu/schools/college/ and click on “New Biology Building Webcam.”
O
n December 20, 2003, pre-
cisely a year from its
publication in the American
journal Science, a paper from
a young postdoc in the Molecular
and Computational Biology group in USC
College was chosen as the most impor-
tant biomedical research paper in the
year for 2003.

The Lancet, England’s prestigious
medical journal, bestowed the honor
on Noah A. Rosenberg, who, working
with colleagues in many fields, from
many institutions, published a paper
titled “Genetic Structure of Human
Populations.”

“In working on this project, we
were very fortunate to have had access
to an excellent collection of genetic
samples from around the world,” says
Rosenberg.

“Our work is only an initial step
toward understanding the relationship
between population ancestry and
genetic disease,” he says. “We hope
that future collaborations can link
anthropology and genetics to make
advances in medicine.”

Rosenberg expanded on his
honored paper in a presentation to the
Yiterbi Symposium (see page one) Dec.
36 entitled “Inference of indi-
vidual ancestry from
variable markers in the
human
genome.”

In choosing the
paper, the Lancet
commented:

“The paper by Rosenberg et al has
two messages of utmost importance:
one general biological, even humanis-
tic, and one methodological.

“The general biological lesson is
that the overwhelming source of
human genetic variation is between
individuals and not between ethnic
groups. In the paper this becomes
even clearer by the finding that there are
no absolute genetic differences
between ethnic groups: the differ-
ences that exist are in relative
frequencies only.

“The methodological lesson is that for genetic
risk assessment it fol-
lows that investigators can use standard epi-
demiological study designs, provided self-
reported ethnic background is taken into
account: for such risk assessment one should
dont worry about ‘genetic admixture.’

“The most enlighten-
aspect of the paper, however, is
the insight that it givesos in the ‘genetic
structure of human populations’—
the very title of the paper.”

The paper also illustrates the
changing, interdisciplinary, interna-
tional nature of science. Rosenberg's
co-authors were from the Department
of Human Genetics, University of
Chicago; the Center for Medical
Genetics, Marshfield Medical
Research Foundation, Wisconsin; the
Foundation Jean Dausset-Centre
d’Étude du Polymorphisme Humain
(CEPH), Paris; the Department of
Genetics, Yale University School of
Medicine; the Vavilov Institute of
General Genetics, Russian Academy
of Sciences, Moscow; and the
Department of Biological Sciences,
Stanford University.

Other nominated papers included
the identification of the SARS coron-
virus, a vaccine trial of the human
papilloma virus and the Million
Women Study highlighting the
increased risk of breast cancer from
combination hormone replacement
therapy.

Lancet editor Richard Horton said,
“…There is a fatal flaw in, for exam-
ple, the Nobel Prize awards. With
this prize, we aim to salute truly first-
class advances in thinking or practice
which would otherwise go unnoticed
by the contemporary establishment
of science.”

—A.K.

Responding to Kids’ Need to Read

JEPS asks ‘Spend lunch over a book—Read to a child!’

S
aying responsive to the com-
unity, both on and off the
USC campus, has been a pow-
erpful force in keeping the Joint
Educational Project and its various
service learning programs alive and
thriving for more than 30 years at
USC College.

So a few years ago, when local edu-
cators and principals asked JEP
Executive Director Tamara
Anderson and Tina Koneazny, director
of JEP’s USC ReadersPLUS program,
for additional reading tutors, the team
went into action. First they added a
student volunteer component to the
main USC ReadersPLUS program,
which employs about 100 work-study
students as reading and math tutors to
their message out. They even have
coordinated efforts and found new ways to get
their message out. They even have
considered using a slogan: “Spend
lunch over a good book—Read to a
child.”

“Our community schools have been
happy to host our students, whose lit-
eracy assistance truly makes a
difference in the children’s reading
abilities,” Koneazny says. The special
attention brings results. According to
an assessment done in 2002, 63 per-
cent of children working with USC
readers showed substantial improve-
ments in reading accuracy.

Recognizing the difficulty for peo-
ple who work full-time or have busy
schedules, the Literacy Project asks
for only one to two hours a week of
volunteers’ time.

Nguyen’s work has already started
to pay off, with more than 20 people
signed up for the spring training to
learn the basics about working one-on-
one with a struggling reader.

ReadersPLUS is one of the three

Noah A. Rosenberg

College Commons

All in the Family

Study establishing the similarity of human populations named ‘best paper’

Last year, Koneazny and her team
began rebuilding the program, recruit-
ing 15 graduate student volunteers.
This year, in an effort spearheaded by
Sherry Nguyen, the student central
coordinator of USC ReadersPLUS,
they have increased recruitment
efforts and found new ways to get
their message out. They even have
considered using a slogan: “Spend
lunch over a good book—Read to a
child.”

“...But it’s a vital force in keeping the Joint
Educational Project and its various
service learning programs alive and
thriving for more than 30 years at
USC College.”

Champions of service learning: JEP Executive Director Tammy Anderson sits between Sherry
Nguyen (left) and Tina Koneazny (right) of USC ReadersPLUS and the recently re-launched
USC Literacy Project, on the porch of the JEP House.

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Chemist George Olah Decorated by Japan

Nobel laureate receives high honor

In December, the Grand Cordon of the Order of the Rising Sun was presented to USC Distinguished Professor George Olah as a tribute to the valuable role he has played in the development of science and technology in Japan over the last 40 years.

Olah, holder of the Donald F. and Katherine B. Loker Chair in Organic Chemistry and director of the Loker Hydrocarbon Research Institute, received the decoration during a ceremony held at the Los Angeles residence of the Consul General of Japan.

Olah is one of 38 non-Japanese citizens honored with an Imperial Decoration this year, and one of only three to receive the Grand Cordon decoration, the highest award possible. He is the first foreign scientist to ever receive the honor.

One of the world’s preeminent scholars of hydrocarbon chemistry, Olah won the 1994 Nobel Prize in chemistry for his groundbreaking work on superacids and carbocations—a fleeting chemical species long theorized to exist but never confirmed.

Olah devised a way to keep the transient carbocations around long enough to study their properties. What he found revolutionized organic chemistry, leading to new discoveries, new fields of research and countless applications.

The representative of the Japanese Minister of Education, Culture, Sport, Science and Technology, Hideyuki Tsumota, thanked Olah for his efforts to promote chemistry in Japan, beginning in the 1960s. Olah trained and mentored more than 30 young Japanese chemists, who worked in his U.S. lab and many of whom subsequently became leaders in academia and industry.

In 1974, Olah was elected a Fellow of the Society for the Promotion of Science in Japan and in 2002 an Honorary Member of the Chemical Society of Japan.

USC College Dean Joseph Aoun proposed a champagne toast to Olah, while his family, colleagues and other guests, including Katherine Loker, a longtime USC philanthropist, looked on. Loker has been an unwavering supporter of Olah, providing the endowment for his chair and crucial funds for the Loker Hydrocarbon Institute.

Olah’s career began in his native Hungary, where he earned his doctorate from the Technical University of Budapest. He came to the United States in 1957, working first for Dow Chemical Co. and, from 1965 to 1977, at Case Western Reserve University in Ohio. In 1977, he joined USC College, moving his entire lab from Cleveland to Los Angeles.

Olah has made significant research contributions to the practical development of improved lead-free gasoline, cleaner high-octane gas and other promising nonpolluting fuels, as well as many processes now used worldwide in pharmaceutical and industrial chemistry. His research has also led to the development of a direct methanol, using fuel cell—a highly efficient and convenient source of electricity.

His recent research centers on conversion of two greenhouse gases, carbon dioxide and methane, into useful fuels and products, and is motivated by his long-standing interest in energy and environmental issues. To deal with the problems of diminishing oil reserves and rising levels of greenhouse gases, Olah envisions a new era of producing fuels based on methanol.

This fall, Olah publicly outlined this vision in a guest editorial—called The Methanol Economy—featured on the cover of Chemical & Engineering News, a magazine produced by the American Chemical Society.

An elected member of the National Academy of Sciences among many other honors, Olah has authored more than 1,200 scientific papers and more than a dozen monographs and books. He holds more than 120 patents.

---E.E.
Faculty News

National Book Award Nominations

Two English professors were finalists for the 2003 National Book Awards. T. C. Boyle and Carol Muske-Dukas were nominated in fiction and poetry, respectively, for "Drop City" and "Sparrow." USC College was the only institution to boast two nominees. Boyle is the author of eight previous novels and six collections of stories. "Drop City," Boyle's ninth novel, centers on the travails of a hippie commune in the early 1970's. Set in Sonoma County, it follows a group of open-minded free-lovers and drug abusers. But beneath the characters' non-chalant veneer lurk the same selfish impulses against which they set out to define themselves.

Muske-Dukas, who recently received the Chautauqua Award for Poetry from the Columbia University School of the Arts, sees the poems in "Sparrow" as a real departure from her usual style and subject matter. Written in the wake of personal tragedy from the death of her husband, "Sparrow" grapples with the contrast between love and grief, finding the image of a flitting sparrow as the most fitting metaphor.

Saint Vincent Honors Ragan

James Ragan, director of the master of professional writing program, was named to the advisory board for the Fred M. Rogers Center for Early Learning and Children's Media at Saint Vincent College in Latrobe, Pennsylvania. Ragan also received the school's presidential medal of honor and delivered the May 2003 commencement address.

Publications on the Brain

Assistant Professor of Neurobiology Judith Hirsch published an article about how inhibitory circuits in the cortex process visual information. It appeared in the journal Nature Neuroscience on Nov. 16. Two neuroscientists were published in the Oct. 30 edition of Neuron. Professor of Neurobiology Chen-Ping Ko's group wrote about the role the glia cells play in maintaining synaptic function. In a separate article, Associate Professor of Molecular Biology Michael Quick analyzed the function of serotonin transporters, which are major targets for a variety of therapeutic interventions.

MLA President

English Professor Marjorie Perillo was recently elected president of the Modern Language Association. Perillo returns to USC College from Stanford in fall 2004.

Alumni News

International Council Honor

Carl T. Terzian (B.A., '73), public relations consultant and past president of the Los Angeles Fire Commission, was honored as the International Citizens of the Year by the International Visitors Council of Los Angeles. The award recognizes him as an emerging international leader. Terzian graduated magna cum laude from USC College and was a student body president. He was a State Department Goodwill Ambassador for President Eisenhower and a former dean and professor of government for Woodrow Wilson University. Terzian has been recognized for civic, philanthropic and professional leadership by the U.S. Congress and the Queen of England.

Street Smart Ethics


Published Post

Emmy Perez (B.A. '93) published her first collection of poetry, "Silence" with Swan Scythe Press in 2003. After teaching for Columbia's University's master of fine arts program, she received poetry fellowships from the New York Foundation for the Arts and the Fine Arts Work Center in Provinceton. Her work has appeared in "Prize Stories" (North American Review), "New York Quarterly" and other publications.

Teacher of the Year

Alan Lawrence Stonmer (Ph.D. '89) was named 2003 Teacher of the Year by the California Literacy program. He is a Woodward High School English teacher, who also writes for the Walt Disney Company.

Aerial Photographs

Judson Perk Bradner, Jr. (B.A. '37) became a world-renowned aerial photographer after leaving USC. Before his death in an F-16 crash in 2001, he shot a number of aviation Week cover photos, and his work had been published in Aviation Week & Times and U.S. News. His video and aerials are used on the Discovery Channel, the Weather Channel, CNN, and PBS's NOVA. A new book celebrating his work, "Breaking Free," has just been published and is available at www.thinairpublishing.com

On the Ballot

When USC College professors Ann Cigler (B.A., ‘72) and Edward McCaffrey began compiling a book on the politics and prospects of American election reform, they used the 2000 presidential race as a starting point. Little did they know that three years later, California's controversial recall election would offer an interesting parallel. The dozen essays included in "Rethinking the Vote: The Politics and Prospects of American Election Reform" (University Of Oxford Press, 2004) are attempts to learn from the past and offer possible solutions for the future.

Some 22 scholars-including USC College political scientist Jeb Barnes and law professors Erin Chemerinsky and Susan Estrich, who both have joint appointments in
Top-Notch Teachers
Raubenheimer recognizes teaching, research and service

Annually, USC College presents the Raubenheimer Award to outstanding faculty members who have excelled in each of the College’s three disciplinary spheres of teaching, research and service to the University. This is the College’s highest honor.

This year’s recipients include:

Moshe Lazar, Humanities
Moshe Lazar’s colleagues call him an unrecognized jewel. This professor of drama and comparative literature has a range of expertise in European cultural traditions. Lazar came to USC in 1977 on a visiting appointment from Tel Aviv University, where he founded the School of Visual and Performing Arts. At USC, Lazar founded the first comparative literature program, which has since become a College department.

He has produced scholarly work on medieval literature in Old French, Spanish, and Provençal. He also writes about and for the contemporary theatre, particularly in French, and translates modern European plays into Hebrew for the Israeli stage. Since 1960, he has written and edited more than 40 books.

“As a teacher, Moshe is equally tireless,” says Peggy Kamuf, chair of the comparative literature department. “His courses sparkle with wit and knowledge that draw students to his classrooms and office.”

Philippa Levine, Social Sciences

“Philippa Levine has infectious enthusiasm,” says Steven Ross, chair of the history department. “She has been an important innovator, scholar and teacher.”

In the College, Levine is taking a new look at imperial history. Her project opens up a once very rigidly defined field to include subjects such as race, sexuality and the body. She examines issues from the perspectives of the colonized as well as the colonizer. These interests are brought together in her new book, “Prostitution, Race and Politics: Policing Venereal Disease in the British Empire, 1860-1961.”

She also teaches a variety of courses in British history, methods and theory. Never reluctant to learn new things, Levine underwent a multimedia training that exposed her to the way the candidates are listed on the ballot.

“The (California) recall election showed the promise and potential of the vote—it showed people’s hunger for truly meaningful participation in the process,” says Crigler.

“But our past—recent and distant—shows how fragile that hope can be. We need to keep thinking and rethinking the proper means of and roles for popular voting in democracy.”

—Gordon Saylor, USC News

Curt Wittig, Natural Sciences and Mathematics

Curt Wittig has been credited with creating the Physical Chemistry section at USC College.

He holds the Paul A. Miller Chair in Letters, Arts and Sciences and is a Professor of Chemistry. A leading researcher in the field of molecular dynamics, he pioneered the use of weakly bonded clusters as a new medium for the study of chemical reactions.

Wittig directs the Center for the Studies of Fast Transient Processes. Today, the group is one of the major U.S. centers of molecular dynamics, free radical chemistry and surface science. “All of this has originated either in Wittig’s lab, through collaborations with Wittig, or from colleagues attracted to USC by the tireless efforts of Curt as a recruiter, mentor and collaborator,” says Chemistry Professor Hanna Reisler.

Wittig’s work restructuring the chemistry department’s graduate student recruitment program resulted in an increase in both the number and quality of graduate students. And he teaches the most difficult, and feared, core course for graduate students: Math Methods for Chemistry and Physics. His love for teaching is obvious. Coffee is ready in morning classes and one-on-one tutorials are always available.

Jefferey Sellers, Political Science

Jefferey Sellers, winner of the Junior Faculty Award, loves to teach. Student evaluations praise him as a “treasure at USC.” Part of that reason stems from the international perspective he brings to the studies of cities and countries.

Sellers is the mastermind behind a new subfield called Urban Politics and Development in Global Society. The field was recently introduced in the Political Science / International Relations joint Ph.D. program to develop scholarship relevant to Los Angeles and to the international relations of global cities in the U.S. and abroad.

He also coordinates The Pacific Rim Urban Environmental Governance Study and collaborates with researchers from five Pacific Rim countries to study urban environmental governance.

“He command of data and analysis from cities across the globe place him at the forefront of scholars from numerous disciplines who are now focusing on innovative governance,” says Mark Kann, USC Associates Endowed Professor of Political Science and Social Science. “He is a great academic role model for our younger assistant professors.”

—N.S.

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Student Excellence Times Two
Two from USC College named Marshall Scholars

Kenneth Basin, a junior at USC College who majors in international relations, successfully stumped Harvard and Yale in a nationally televised episode of “Jeopardy” in November.

The budding internationalist, who participated in two shows, scoring 16,800 points in the first round, which earned him the first-place take home prize of $5,000.

“I signed up for the past two years but didn’t get a call back until this year,” he says. But this time, luck and smarts were on his side.

After being randomly selected from a Web site registration last summer, Basin passed a challenging written test which qualified him for a spot on the show. Then, to test his entertainment value, he participated in a mock show with casting people. “They had a sample interview section to see if we could batten with Alex,” Basin laughs. “This is still television.”

So what was the easiest category much doomed me for the rest of the game.”

In the second round, Basin lost to a contestant from Middlebury College (although he beat Wake Forest).

Letters to the Editor

Beyond Skin Color and Gender
I was stunned by the reader who suffered “shock and sadness” because you put “four white males” on the front of your Summer 2003 issue. It is unfortunate that this reader could not get beyond the skin color and gender of the people depicted and instead appreciate their accomplishments. I am surprised that you would devote valuable print space to such a blatantly racist and sexist letter.

—Scott F. Marsch
Marsch earned an A.B. in International Relations from USC College in 1976.

Look to History
I am intrigued by the piece, “American Culture Permeates Foreign Policy,” in which Professor Ronald Steel relates the resemblance between U.S. foreign policy and the film, “High Noon.” There is the suggestion that instead of dealing head on with terrorism it can be “managed similar to a disease like arthritis and AIDS.”

A study of history reveals that in the fifth century Rome was routinely sacked by the Vandals, and the Romans, rather than dealing with them as Gary Cooper might have, decided to “manage” the situation. Is it necessary to remind Professor Steel what happened in 476 A.D.?

—Emil M. Murad
Huntington Beach, CA
Anton Burg, 99;
Took USC chemistry from ‘alchemy’ to excellence

Anton Burg, 99, once the world’s leading expert on boron and the father of chemistry at USC, died Nov. 18 at his home near the USC campus in Los Angeles. No cause of death was given.

USC had a minuscule and undistinguished chemistry department when Burg joined the staff in 1939—"only one step ahead of alchemy," in the words of one official. The emphasis was solely on teaching and no research had been performed there for years.

Within a year, the young assistant professor had become chairman of the department and embarked on a hiring program that, within a decade, made the department one of the nation’s best. "By the early 1950s, we were third in the United States in funding per faculty member and fifth in publications," said chemist Sidney Benson, one of Burg’s hires.

Chemist Arthur Adamson, another of Burg’s hires who died on July 22, 2003 at the age of 83, recalled that the university’s president was surprised by the changes in the department. "He was used to very subservient chairs. But Burg would not jump, and he wouldn’t hesitate to stand up for what he thought had to be done," Adamson said.

But Burg’s passion was the study of boron. In 1927, Burg heard a lecture by chemist Gilbert Newton Lewis, who "said that nobody understood the chemistry of boron hydrides," Burg recently recalled. He made it his business to do so.

First at the University of Chicago, and later at USC, Burg synthesized a host of boron compounds that subsequently came to have wide use in organic chemistry as tools for making more complex molecules. None of his creations became household names, but along the way he was one of the first people to see polyethylene and other more complex molecules. None of his research had been published, he said that if he had published, they would have shared the Nobel.

Anton Behme Burg was born Oct. 18, 1904, in Dallas City, Ill., the grandson of a German immigrant who made a fortune building carriages. He attended the University of Chicago, excelling as both a student and an athlete. His specialty was the high jump, and he was nationally ranked.

In 1926, the 5-feet-11 Burg cleared 6 feet 6 1/4 inches. The winning jump in the 1924 Olympics was 6 feet 6 inches. Burg barely missed qualifying for the 1928 team.

His athletic interests later turned to bicycling. Although he lived in Los Angeles for 64 years, he never owned an automobile, preferring to bicycle everywhere. His ability to get around startled others.

"After we moved to Palos Verdes in 1950," Adamson said, "my wife and I would have annual Christmas parties for the faculty and other friends. Antxon bicycled all 20 miles to get there."

In 1994, Burg noted that he had gone through eight bicycles so far. "Of course, three of them were stolen," he added.

Benson recalled how Burg prevented fire marshals from condemn- ing an old Army barracks that USC was using as a chemistry lab in 1946. The marshals were concerned because there was only one exit from the second story. Burg jumped out a second-story window, landing easily and yelling out, "See, that’s all there is to it," Benson recalled. "The Fire Department approved the lab for use…. We ended up using it for another 20 years."

Burg retired in 1974, but kept coming to his lab to continue his research. Following the 1994 Northridge earthquake, Benson recalled, his colleagues searched all over for Burg to inform him that his building had been condemned and he couldn’t enter. When they finally located him, he was in the lab making repairs.

Burg never married.
Tracking Earth’s Most Ancient Animals
Fossil hunter looks back to animal origins

Life originated in the water of nameless, ancient oceans. Most of these oceans have since shifted or dried up. But not without a trace: Much of what is known about life’s early history has emerged from studies of the fossils left in rocks once covered by these forgotten seas.

That’s why USC College paleobiologist and fossil hunter David Bottjer looks to ancient seabeds—from Texas to China—in his search for clues, long turned to stone, about the planet’s first animals.

“You could say I’m a marine biologist,” says Bottjer, a professor of earth sciences and biology and a member of the College’s growing geobiology program. “But I study ancient oceans and all of the evidence I’m interested in is locked up in rocks.”

Fortunately, Bottjer’s fluent in the language of rocks and life. He studies marine fossils to shed light on some of evolution’s toughest questions. Where did animals first appear on Earth? What did they look like? How have animals changed over time?

Answers have come slowly, partly because the earliest animals’ soft, boneless bodies rarely fossilized. Until recently, the best fossil evidence dated the emergence of animals at about 560 million years ago, despite theoretical and molecular studies suggesting a far earlier origin.

New fossils, now under study by Bottjer and an international, multidisciplinary team of scientists, show that most multicellular animals were around 600 million years ago.

“These fossils are the closest we get toward the origin of animals on Earth,” Bottjer says.

Signs of Early Animals
Although most think of fossils as the bones or shells of once living animals, fossils are all rock. As geologic forces turn loose sediments to rock, any animal remains buried in the sediments also turn to stone. Over tens to hundreds of thousands of years, minerals gradually replace entombed bones, shells or, much more rarely, soft tissues, and preserve the animal’s entire form.

The ancient sea animals that most fascinate Bottjer have no shells or bones, which led him to become an expert in the study of Lagerstätten, the truly rare fossils that preserve soft bodies and whole animals in wonderful detail.

In the late 1990s, paleontologist Jun-Yuan Chen and biologist Chia-Wei Lu unearthed extremely small, but exceptionally detailed Lagerstätten fossils of multi-cellular animals from the 600-million-year-old Doushantu fossils.

“The collection of microscopic fossils contains many species never seen before. Most are less than a millimeter in size—a little smaller than a pinhead—and include the eggs, embryos and some adults of species that most closely resemble modern sea sponges and cnidarians—a group that includes jellyfish, sea anemones and corals.”

“We’re looking back at the very roots of animal evolution,” Bottjer says. “These are very primitive creatures.”

Surprising Finds
The fossils have brought surprises. One was finding them at all: identifying the microfossils hidden deep in rock is a bit like searching every piece of straw in a haystack for the elusive needle. “But we found a bunch of needles.” Bottjer says, noting that the team cut and examined more than 6,000 thin sections of rock under the microscope.

The diversity of animals revealed in the rocks was another unexpected find. The number of species present 600 million years ago leads the team to speculate that animals probably emerged even earlier in the planet’s past, given the time required for the evolution of new species from a common ancestor.

This past fall, Bottjer presented the team’s latest results at the 2003 Geological Society of America meeting. Most exciting, he shared “tantalizing evidence” that a bilaterian, a lineage of animals distinct from sponges and corals, may be among the Doushantuo fossils. Bilaterians are important because they gave rise to the majority of animal species alive today, including humans and all land animals, from beetles to zebras.

“The big catch will be finding definitive evidence for bilaterians, which people have said evolved much later,” he says. The team, funded by NASA and led by Caltech developmental molecular biologist Eric Davidson, continues to carefully scrutinize the putative bilaterian microfossils and hopes to publish their results this year.

Enthusiasm as well as an air of healthy skepticism met the presentation, says Bottjer, who serves as the president-elect of the Paleontological Society. In a field with so many missing pieces of evidence, that’s only natural.

“Understanding how life formed and evolved is the best mystery I know,” says Bottjer. “Sometimes it’s a bit like a Sherlock Holmes novel. I’ve got some evidence and a lot of questions, and I have to try to deduce as much as I can from the little I’ve got.”

—Eva Emerson

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