

Washington

FALL 1991

WASHINGTON • UNIVERSITY • MAGAZINE

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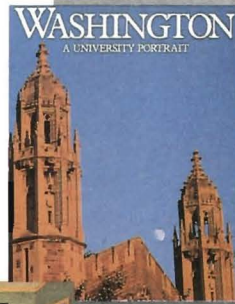
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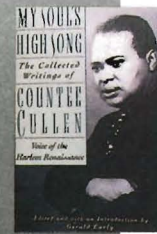
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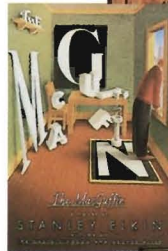
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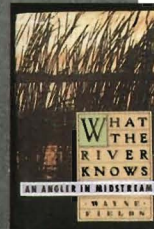
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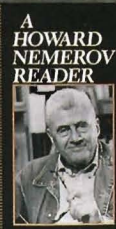
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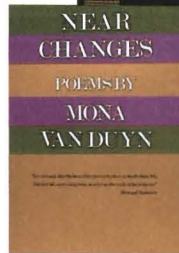
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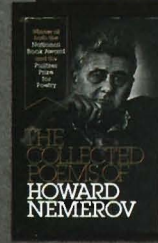
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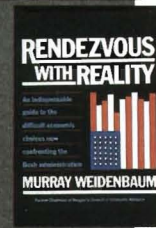
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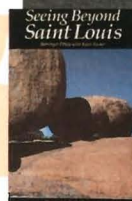
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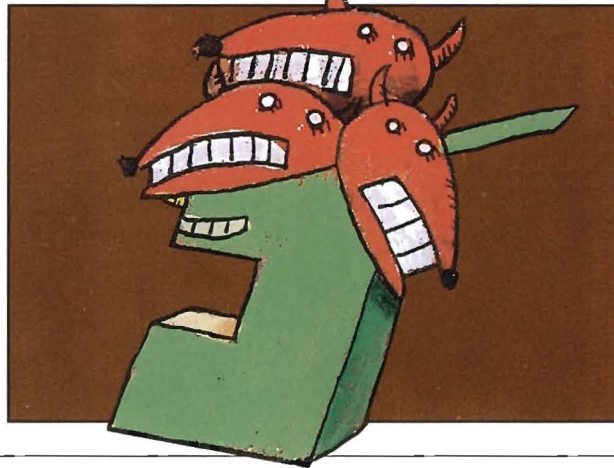
Washington

WASHINGTON • UNIVERSITY • MAGAZINE

ST. LOUIS

Vol. 61, No. 3 • Fall 1991

Cover: *The blink takes us into the deepest recesses of the mind, revealing much more than meets the eye. Illustration by R. J. Shay. See story on page 10.*



James Yang

Shady operators: *Bacteria can elude circulating antibodies in the human body by burying themselves inside a host cell. Turn to page 20 for more on the strategic workings of pathogens on the immune system.*

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A legacy of distinguished work prevails.

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Operating through elaborate mechanisms essential to their survival, pathogens have evolved into wily tricksters of the human immune system.

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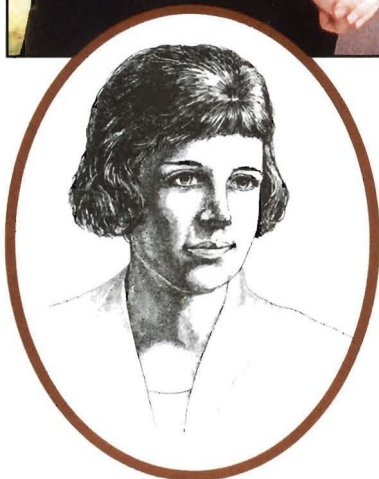
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Helen Ette Park's Challenging Commitment



A drawing after Helen Ette's photo in the 1919 Hatchet.

Helen Ette Park House was dedicated in honor of Mrs. Park on April 24, 1991. Participating in the ceremony were (left to right) Gary N. Babick, Mrs. Park's representative; Chancellor William H. Danforth; Park House resident Marianne Wanek; and Gregory R. Janes, speaker, Congress of the South 40.

Many years of travel and life abroad gave Mrs. Helen Ette Park a special appreciation for the quality of education offered by Washington University. After settling in California, the St. Louis native and 1919 graduate of Washington became a generous supporter of many organizations, the University prominent among them. Over the years, Mrs. Park has created many life income gifts to benefit numerous programs at Washington University and to encourage its outreach to a global community. In grateful appreciation, the University has named Helen Ette Park House in her honor.

In November 1990, Mrs. Park created the \$500,000 Helen Ette Park Challenge Fund for life income gifts, the first such challenge at Washington University. Her efforts encouraged many alumni and friends to establish gift plans to benefit the University, while providing donors and their beneficiaries with attractive income and tax benefits. Because of the tremendous response to Mrs. Park's challenge, the fund was completed 18 months ahead of schedule.

Washington University is deeply grateful to Mrs. Park for her vision, commitment, and generous support.

For more information about life income gifts, establishing challenge funds for such giving arrangements, and any other planned giving options, please call 935-5848 or (800) 835-3503, or write: Office of Planned Giving, Washington University, Campus Box 1193D, One Brookings Drive, St. Louis, Missouri 63130-4899.

FRONT RUNNERS

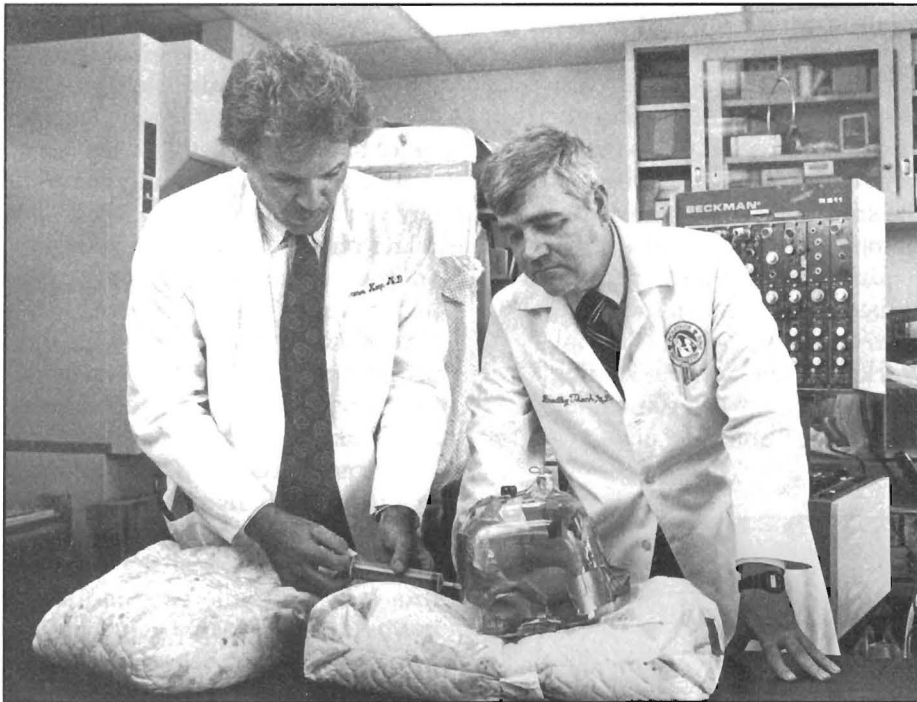


Photo: Wehrman

Investigating infant airways: Doctors James S. Kemp, left, and Bradley T. Thach

Pitch the Polystyrene-filled Pillows

Parents still using polystyrene-filled cushions, banned last year by the Consumer Product Safety Commission, are endangering their babies' lives.

University medical researchers James S. Kemp and Bradley T. Thach warn that cushions may cause accidental death by limiting infants' ability to move their heads, thus preventing them from obtaining fresh air.

Kemp, an instructor in pediatrics, and Thach, professor of pediatrics, studied the deaths of 25 infants, most of whom died face down on polystyrene bead-filled cushions. In 19 of 23 infants, the death was attributed to Sudden Infant Death Syndrome (SIDS). The researchers, however, concluded that the majority of the deaths were due instead to rebreathing, a form of accidental suffocation. The infants had drawn

in what they exhaled: stale air low in oxygen.

"These deaths from rebreathing appear to have occurred in a manner not previously reported in infants," the pair wrote in the June 27 issue of the *New England Journal of Medicine*. "Our findings challenge the basic assumptions used to distinguish SIDS from accidental suffocation and emphasize the need for new safety regulations for infant bedding."

New Center a First to Integrate Business, Law, and Economics

A new Center for Business, Law, and Economics, the first of its kind in the nation, was established in May at the John M. Olin School of Business. The center provides a forum for the study of how business concerns interact with larger societal issues and trends.

"We are examining how law and economics affect accounting, mar-

keting, finance, and other operations within a firm," says Don Coursey, Vernon W. and Marion K. Piper Professor of Business Economics and the center's director. "We are also looking at the impact of management-level decisions on much larger issues, such as politics, medical research, and environmental policy."

During the first year, the center is focusing on the environment as a theme for teaching and research activities. "No other current topic has the potential to elicit as much campus-wide interest right now as does the topic of the environment," Coursey claims. For this reason, he predicts that in the near future, a rise in similar programs will become a national trend.

Lateral Career Moves

Employees are finding that their only hope for future advancement may be, at present, a lateral move. When a slow economy triggers reductions in staff and middle-manager positions, moving sideways to a similar job and salary, with different duties, may be the only route to a promotion.

According to David F. Gillespie, an organization theorist and professor of social work, lateral movement is the result of corporate downsizing over the past 10 years due to "the large influx of the Baby Boom bulge into middle management at the same time as a recessionary period."

Gillespie, however, does not view this trend negatively. "Employers have to keep people interested, sharp, and involved. If you can't grow outward by being promoted, then you can grow outward by accomplishing capabilities in new areas. And a lateral move to another organization has the potential of an upward move after that."

A Surgical Cure for Atrial Fibrillation

When President George Bush developed an abnormal heart beat, the American public got a front-page education on atrial fibrillation. An estimated one million Americans suffer from the disorder, which causes nearly 150,000 strokes per year. Typically, as in the President's case, physicians treat the ailment with various drugs. Yet, "unfortunately, 50 to 75 percent of patients on drug therapy will resume atrial fibrillation within 12 months," says James Cox, chief of cardiothoracic surgery at the University's School of Medicine.

Cox and a team of physicians from the medical school developed a surgical technique, called the Maze procedure, to cure atrial fibrillation. The open-heart procedure involves making a series of incisions across the atria, the chambers composing the top half of the patient's heart, to block the abnormal impulses that cause fibrillation. Regular impulses continue to sustain a normal heart beat.

Cox has performed 22 of the operations, with a cure rate of better than 90 percent. Until recently, he was the only surgeon in the world to perform the complicated, one-hour operation. But dozens of surgeons from the United States and abroad now attend his yearly classes to learn the technique.

Despite the encouraging cure rate, Cox does not recommend surgery for everyone with the disorder, due to the complexity and nature of the operation. "If this could be done with a catheter," he says, "we would probably do this on virtually all atrial fibrillation patients. But this is an open-heart operation, and you don't subject somebody to that lightly."

Stemming the Spread of AIDS in Inner-City Youth

Despite vigorous AIDS education programs targeted toward inner-city youths, behaviors inherent to the spread of the disease are not changing. According to a study conducted by Arlene R. Stiffman, assistant professor in the George Warren Brown School of Social Work, the stress characterizing inner-city life, when compounded with alcohol and drug abuse,



Address the stress: Arlene R. Stiffman advocates mental health programs in the fight against AIDS.

depression, and hopelessness, makes the youths more likely to engage in the behavior the programs are attempting to stop.

Stiffman and coinvestigators Renee Cunningham and Peter Dore, both graduate students from Washington University, and Felton Earls, from the Harvard School of Public Health and Harvard Medical School, tracked the actions and

behavioral attitudes of 602 youths from cities across the nation. The investigators recorded changes their subjects experienced from adolescence to adulthood.

"Young people, especially inner-city youths, often initiate AIDS-related high-risk behaviors during adolescence—when they feel invulnerable," says Stiffman. "Preventive programs must focus on providing mental health services and services that help to ameliorate stressful life events."

Stiffman presented her findings in a paper, "Change in AIDS Risk Behaviors From Adolescence to Adulthood," in June at the VII International Conference on AIDS in Florence, Italy. Her paper was one of the top four selected from the 4,800 that were presented at the conference.

Study of Society Takes New Direction

Washington University is offering a new, multidisciplinary program in the social sciences. Called Social Thought and Analysis, the program stresses the integration of social theory with the empirical study of society, the importance of cross-cultural and historical studies, and the examination of contemporary issues in the United States.

In launching the teaching and research program, the Committee on Social Thought and Analysis has brought together faculty from the Arts and Sciences departments of anthropology, economics, education, history, political science, and psychology, as well as from the schools of engineering, law, medicine and social work. Chaired by John R. Bowen, associate professor of anthropology, the committee is developing an undergraduate major in Social Thought and Analysis and

will bring new social science faculty to the University.

A core set of courses in Social Thought and Analysis is offered to students this fall. By fall 1992, says Bowen, an integrated program will be in place.

"We are benefiting from a much closer relationship among departments and across the various schools," Bowen says. "The social work faculty, for example, will teach courses designed specifically for undergraduates in the Arts and Sciences—that's new." The committee also plans to pursue new directions in multidisciplinary social science research and graduate training.

The impetus for the new program came from the closing of the sociology department, announced in 1989, and the formation of a task force to arrive at a new social science program.

"The curriculum will allow questions and issues to be studied from different points of view," offers Martin Israel, dean of the Faculty of Arts and Sciences. "It will tie together the social sciences."

East Meets West in Mathematics Program

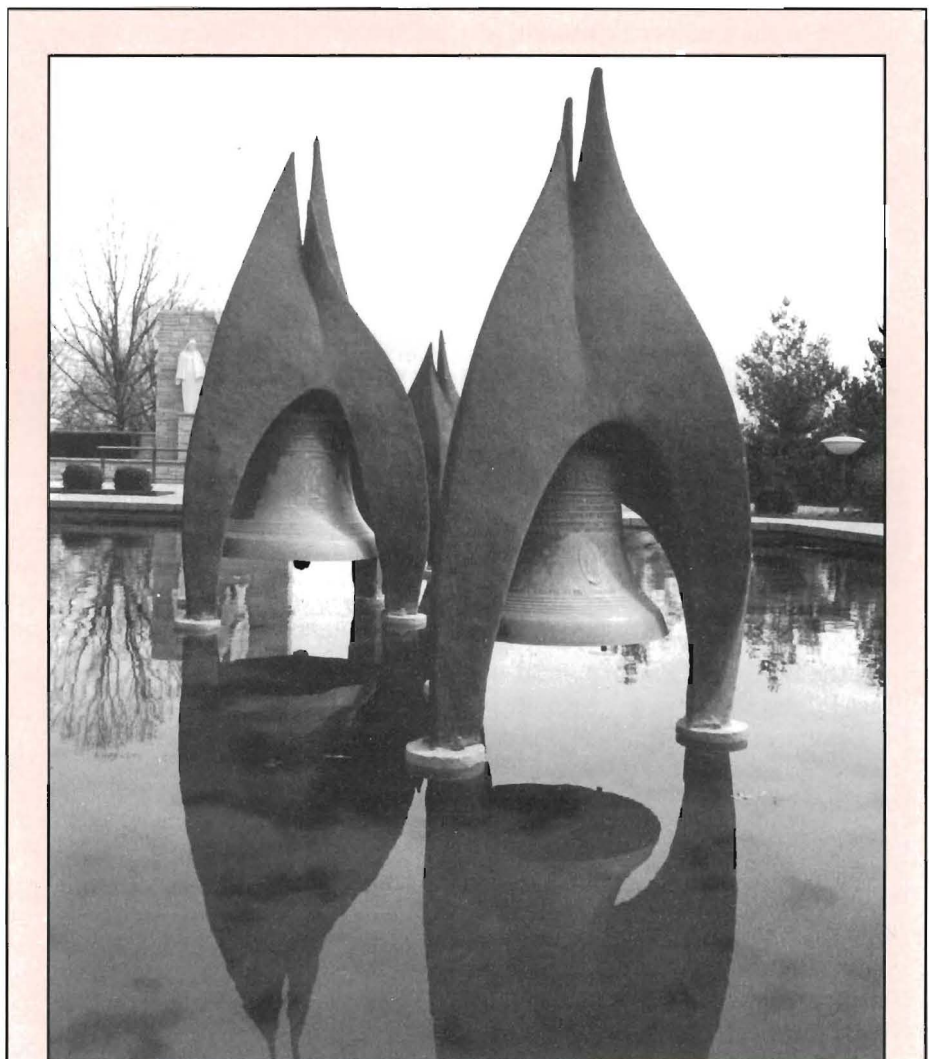
The Kumon Institute of Education of Japan and the Osaka Gas Information System awarded Washington a five-year \$1.3 million grant to computerize its highly successful mathematics education concept, the Kumon method.

The Japanese institutions will send three researchers to the University for four years to cooperate in developing a pen-based, notebook computer system that will automate the labor-intensive Kumon mathematics method and integrate the ideas of Kumon

mathematics with traditional Western concept-learning. Seven University scientists headed by T. D. (Dan) Kimura, associate professor of computer science, will work with the Kumon scientists.

Used by 1.5 million students worldwide, the Kumon method was developed 35 years ago in Japan by

Toru Kumon to improve the math skills of his sons. It stresses repetition, speed, accuracy, individual pace, and goal orientation. Enthusiasts claim students increase their math skills, attention spans, and self-image using the Kumon method.



They toll for thee: The hooded bells at the Shrine of Our Lady of the Snows in Belleville, Illinois, appear in *Seeing Beyond Saint Louis* (Books & Books, 1991), a tour guide to the outlying landscapes and regional wealth of the St. Louis area. Written by Barringer Fifield and Keith Recker, with photography by Herb Weitman, B.S.B.A.'50, director of the University's photographic services and associate editor of *Washington University Magazine*, the book succeeds *Seeing Saint Louis*, published in 1987.

Washington People in the News

William A. Anders, chairman and chief executive officer, General Dynamics Corporation; **Stephen F. Brauer**, president, Hunter Engineering Company; and **Mary Ann Krey**, owner and president, Krey Distributing Company, were elected to the University's Board of Trustees in May. They join three reappointed trustees: **Charles Lipton**, chairman of the board of Ruder-Finn, Inc., in New York; **William P. Stirtz**, chairman and chief executive officer of Ralston Purina Company; and **Raymond H. Wittcoff**, president, Transurban Corporation.

Anders, one of the first astronauts to participate in lunar flight in 1968 and a former ambassador to Norway, is a retired major general in the Air Force Reserve. He serves on the board of Exxon Corporation, is a trustee of the Battelle Memorial Institute, and holds memberships in both the National Academy of Engineering and the Society of Experimental Test Pilots.

Brauer is on the board of directors of Boatmen's Trust Company and is a trustee for the Missouri Botanical Garden, the Saint Louis Art Museum, and St. Louis Country Day High School. He is also vice-consul of Belgium for the St. Louis area and serves on the national council for the University's School of Engineering.

Mary Ann Krey sits on many civic boards and participates in numerous educational, business, and charitable activities. An active Washington University alumna, she serves on the board of directors of the Women's Society.

Carolyn M. Baum, assistant professor and Elias Michael Director of the Program in Occupational Therapy at the School of Medicine, began serving on the advisory board of the newly established National Center for Medical Rehabilitation Research (NCMRR) in July. The board advises the directors of the National Institutes of Health, the National Institute of Child Health and Human Development, and the NCMRR on the center's medical rehabilitation research and training programs.

Baum is director of clinical services at the medical school's Irene Walter Johnson Institute of Rehabilitation and president of the American Occupational Therapy Certification Board.

Mary Ellen Benson was promoted to senior director of publications in December. She oversees a program that produces more than 1,000 publications a year. She also serves as executive editor of *Alumni News* and *Washington University Magazine*.

Benson, who began working at the University in 1983 as a publications editor, most recently served as director of publications. She holds a bachelor's degree in English from Vassar College.

William E. Buhro, assistant professor in the chemistry department, was named a 1991 Presidential Young Investigator in June. The National Science Foundation grants this award annually to more than 200 of the nation's most outstanding and promising young science and engineering faculty.

Buhro, a synthetic inorganic chemist, will continue to develop new precursors and strategies for the processing of superconductors and semiconductors.

In 1990, Buhro received a Faculty Award from the University Council of Students of Arts and Sciences for his excellence in teaching and genuine concern for the welfare of students.

Stuart A. Kornfeld, professor of medicine and biochemistry and molecular biophysics at the School of Medicine, is one of two recipients of the 1991 Passano Foundation Award. Kornfeld was honored for his discoveries in the areas of cell biology and human disease.

The award is given annually to one or two researchers who have made an outstanding contribution to the advancement of medical science and whose associated work was done in the United States. Each recipient is presented a \$20,000 honorarium.

Paul E. Lacy, Robert L. Kroc Professor of Pathology at the School of Medicine, was elected a fellow of the American Academy of Arts and Sciences, which recognizes leaders in science, scholarship, the arts, and public affairs.

One of 195 new fellows elected to the academy, Lacy is known worldwide as a leader in the study of insulin-dependent diabetes mellitus. One of his most significant contributions is the transplantation of islets—cells in the pancreas that produce insulin—for the treatment of diabetes.

Lacy joined the medical school faculty in 1956 and served as Edward Mallinckrodt Professor and head of the Department of Pathology for more than 20 years. He also served as pathologist-in-chief at Barnes, Jewish, and Children's hospitals, all sponsoring institutions of Washington University Medical Center.



Heidi Weisman

Cosmic cultivation: Sophomore Lynn Klein's experiment involving microgravity effects on germinating tomato seeds is scheduled for lift-off in early 1992.

Student Experiments Out of This World

What began as a summer camp project for sophomore Lynn Klein has literally taken flight. A few summers ago in Huntsville, Alabama, Klein attended the National Aeronautics and Space Administration (NASA) Space Academy for high school students. With three fellow students, she developed a proposal to study the effects of microgravity on the germination of plant seeds. NASA accepted the proposal and scheduled Klein's experiment for an early 1992 shuttle mission.

A mechanical engineering major, Klein spent her 1990-91 semester break working on project details under the direction of renowned rocket scientist Konrad K. Dannenberg at the Alabama Space and Rocket Center. After selecting the seeds and determining optimal

temperatures and parameters for growth, she must next design the container for her experiment. Klein says that the project has combined her interests in the plant sciences and mechanical engineering. Fine-tuning the experiment required her to think big and to think ahead.

"In the future, astronauts may be living in space for long periods of time," Klein states, "so growing food in space would be practical to feed crews on a journey to Mars or a 90-day term on a space station. This project might grow into a process where astronauts could make their own food supply on the space station, reducing the cost of transporting food from earth to space."

As exciting as the news from NASA was for Klein, it is unlikely to compare with the excitement of lift-off day. "I've watched the space program since I was really little," she says. "When our shuttle goes up, my feeling will be indescribable."

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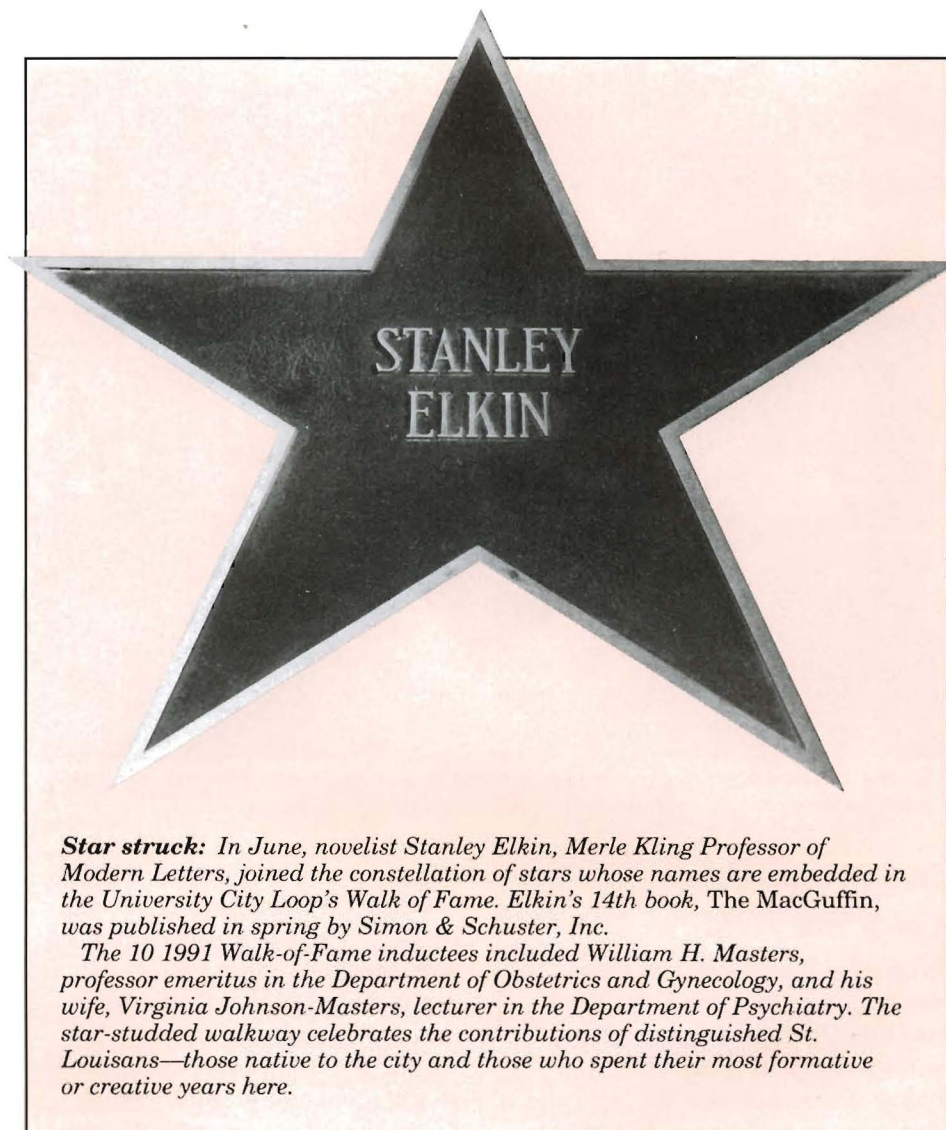
Gustav Schonfeld, William B. Kountz Professor of Medicine and director of the Atherosclerosis and Lipid Research Center, and Keith Mankowitz, a research fellow in Schonfeld's laboratory, studied a group of eight runners who ran an average of 35-40 miles per week. When the volunteers stopped training for 16-22 days, the researchers found that the level of lipoproteins, fat-ferrying proteins that are inherent in the development of coronary artery disease, rose significantly.

Maintaining exercise on a steady basis is integral, says Schonfeld, who discovered that people who abandon their training program may fall back into the risk category in less than three weeks.

A second study conducted by Mankowitz revealed that exercise greatly reduces the levels of chylomicron, small packets of fat released into the blood stream immediately after a meal, and chylomicron remnant levels in the blood stream. Many doctors believe that chylomicrons may be an independent risk factor for coronary artery disease, Mankowitz says.



Burton Morris



Star struck: In June, novelist Stanley Elkin, Merle Kling Professor of Modern Letters, joined the constellation of stars whose names are embedded in the University City Loop's Walk of Fame. Elkin's 14th book, *The MacGuffin*, was published in spring by Simon & Schuster, Inc.

The 10 1991 Walk-of-Fame inductees included William H. Masters, professor emeritus in the Department of Obstetrics and Gynecology, and his wife, Virginia Johnson-Masters, lecturer in the Department of Psychiatry. The star-studded walkway celebrates the contributions of distinguished St. Louisans—those native to the city and those who spent their most formative or creative years here.

Curtiss Awarded Grant for Infectious Disease Research

Roy Curtiss III, chair of the Department of Biology, received a five-year, \$500,000 unrestricted grant from Bristol-Myers Squibb Company in recognition of his pioneering work in infectious disease research.

Curtiss, George William and Irene Koechig Freiberg Professor of Biology, and his research group have directed their efforts toward defining the biochemical bases and genetic controls by which bacterial pathogens cause tooth decay, gastroenteritis, typhoid fever, leprosy, pneumonia,

and septicemia (blood-poisoning).

Bristol-Myers Squibb will provide additional financial support for convening an international symposium, to be held at the University, on a topic of Curtiss' choice.

Scientists from the University of Chicago, Dana-Farber Cancer Institute, Mount Sinai School of Medicine, and Stanford University received similar grants for research in infectious diseases. ■

Contributors: Angela Davis, Gerry Everding, Tony Fitzpatrick, Jim Keeley, Paul Nagle.

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COMMUNICATING
IN THE
BLINK
OF AN EYE

BY MARK BAUTZ

JOHN STERN WANTS YOU TO KNOW: There's more to blinking than meets the eye. And what he is learning may one day save your life.

For some 12 years now, in a small, instrument-strewn laboratory in the basement of Eads Hall, Stern, professor and chair of the psychology department, has been studying the human visual system. A psychophysicist, he uses microscopic physiological measures to probe the workings of the human mind — specifically eye blinks, eye jerks (saccades), pupil dilation, and head movements.

What he's found may surprise you.

"We don't blink at random," Stern says. "We blink at times that are psychologically important. Blinks are punctuation marks. Their tim-

Mark Bautz's work has appeared in the Los Angeles Herald-Examiner and the Washington Times. He received an M.F.A. in creative writing from Washington University in 1991. This article was based on a story written by St. Louis writer Regina Engelken.



ing is tied to what is going on in your brain.”

While mere eye-rinsing requires a blink no more frequently than once a minute, most people blink about 15 times a minute. According to Stern, there is a direct relationship between this spontaneous blinking and the way the mind works. His research shows that the frequency and duration of blinks vary according to whether a person is alert, bored, anxious, or closely concentrating.

opportune,” Stern adds. “Apparently, when the brain judges incoming information to be less than compelling, it allows itself to rest, and blinks last longer.”

So, people blink more when they’re bored. When for the umpteenth time your tennis partner blames his racket for weak shots into the net, you’re likely to find your eyelids more frequently squeezing shut and staying shut longer. In studies that required

Testing one, two:
By fitting volunteers with electrodes to measure eye blinks and bicycle helmets instrumented to record head movements, Stern acquires data that allow him to relate eye and head movements to aspects of thinking. Pictured is senior Michael Prstojevič.



Herb Weisman

When alert, people blink less. Cruising along a deserted rural interstate, a driver may blink quite frequently, but put that same driver on a city street crowded with pedestrians, bicyclists, and honking taxi cabs, and his blink rate will drop substantially, as will the duration of his blinks.

Similarly, while anticipating a green traffic light, a driver inhibits blinking or, if necessary, blinks with a short closure duration. Stern says, “When information acquisition is important, you actively inhibit blinking.” This explains why a driver may blink several times while making a routine check of the speedometer but doesn’t blink when using the rear view mirror to change lanes or to study a fast approaching police car.

“We blink at points in time that are most

people to listen to a 30-minute series of tones, says Stern, the average duration of their blinks increased by more than 30 percent, reflecting their increasing boredom.

Anxiety also causes people to blink more. According to Stern, novice helicopter pilots blink more often than their instructors, and witnesses under cross-examination blink more frequently than those facing friendly lawyers. When a person answering a question has to face another person rather than an inanimate object, such as a telephone, blinking increases.

Precisely this connection between anxiety and increased blink rates first attracted Stern to his present research. While watching the Watergate hearings, he became fascinated by President Nixon’s testimony.

“His blink rate markedly increased when

asked a question he was not prepared to answer," Stern says. "His speech was well controlled, and he didn't manifest other symptoms of anxiety, but you could see it in his eyes. Most politicians have learned to disguise feelings except in ways they can't inhibit."

Stern cites the work of Joseph Tecce, a Boston University neuropsychologist who studied blink rates during the 1988 presidential debates and concluded that both Dukakis and Bush showed greater increases in blink rate when required to deal with a question spontaneously than when allowed to present a well-rehearsed response to an expected question. Thus, for Bush, blink rate was higher when asked to briefly summarize the major points he made in debate than when he justified his choice of running mate. But as to why anxiety and tension increase blink rates, Stern says neither physiologists nor psychologists can offer a definitive answer.

There is a clearer connection between blinking and memorization. When given a series of letters to memorize, a test subject is most likely to blink shortly after taking them all in. The more letters one is asked to memorize, the more time elapses until the first blink: The brain needs longer to store six characters than it does two.

"It seems likely," says Stern, "that the blink indicates the moment at which a rudimentary memory of the information forms and the brain anticipates no additional material."

Stern believes that when solving problems, a subject is likely to blink at the completion of each stage of the process: first, after taking in information, then after beginning to think about it. When reading, a person will most likely blink as gaze shifts from one page to the next, at the end of a line, or, failing to understand it, blink when going back to reread the last three or four words.

"The brain seems to need to pause between significant sensory episodes," he explains. "The blink serves as a kind of mental punctuation mark—an interruption that allows the brain to store or mull over information."



"Up until now," says Stern, "safety studies have paid more attention to the equipment itself than to the person operating it. We're interested in the human part of the equation . . . to assess deteriorating operator performance before it's too late."

Sounds peaceful, right? Not to Stern. It is this seemingly innocuous image of a human brain at rest behind rapidly blinking eyes that most troubles him these days. His current studies, supported by the Federal Aviation Administration and the U.S. Air Force, focus attention on the vigilance (and lack thereof) of human operators of sophisticated electronic equipment, such as pilots, air-traffic controllers, and atomic-energy-plant workers.

Stern says, "The question we're trying to answer is: Can we predict when such a person will be momentarily inattentive and miss crucial, split-second danger signals?"

The answer could save lives.

Stern points out that technological advancements have changed the tasks people perform in many jobs. Pilots, for example, have become on-board managers of elaborate, computer-driven operating systems. Rather than fly with their hands on the controls as they once did, pilots now passively monitor data screens while computers fly the planes. Although there are many advantages to such systems (a reduction in fuel consumption, to name one), there is one big disadvantage—namely, increased pilot inattention.

"Humans do a poor job of maintaining vigilance when they are not asked to do much for long periods of time," Stern says. "When staring at a computer screen for hours, boredom tends to set in; the mind starts to wander. Of course, the implications of this letdown in vigilance are obvious and potentially disastrous if an unexpected event occurs."

Imagine a common scenario. You're driving peacefully along the interstate with the cruise control button set to 65 miles per hour, admiring the scenery, your foot absently tapping to the beat of the radio, when from out of nowhere a car shoots past, its horn blowing. Suddenly, you realize you've drifted part way into the adjoining lane. And where did that car come from anyway? The last time you checked the mirror, the road behind you was deserted.

According to Stern, you probably drifted into something called micro sleep, an attention lapse caused by boredom. Your

eyes remained closed longer than they would for an average blink. He says, "There are times when you suddenly wonder, 'How did I get here?' That's most likely micro sleep. Accidents occur when unexpected events concur with periods of micro sleep."

Unexpected events, like the rapid blip on a radar screen indicating that another plane is flying directly at you or that a ship is on a collision course with your vessel. Or the

major role. Stern has monitored the blink patterns of pilots in flight simulators to detect signs of decreased performance due to fatigue. Now the Air Force is testing pilots in live flights.

James C. Miller, a research physiologist formerly at the Flight Test Center at Edwards Air Force Base in California, calls Stern a pioneer in blink research. "We used his research with success," Miller says. "The

Air Force is interested in blinking as one of the signals to be used to monitor the alertness of pilots and flight controllers."

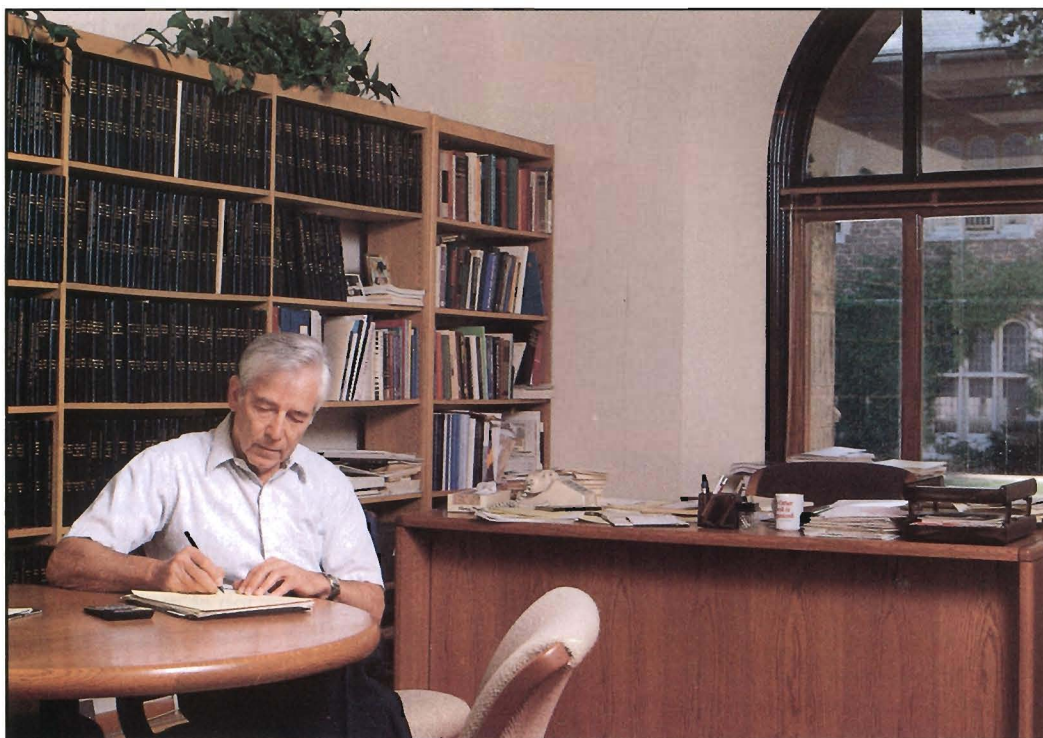
In one study conducted for a dissertation at the Air Force School of Aerospace Medicine, pilots were awakened in the middle of the night and kept awake to fly a four-and-a-half-hour simulation 12 hours later. Using measurements of blinking and eye movement, the researchers found a high correlation between blink data and errors in flight performance.

"Essentially, as you get more tired, your blink gets less crisp," Miller says.

By monitoring blinks, Stern can determine if a pilot's work load is too heavy for his current physiological state. "We know that when a pilot is either overtaxed or bored, he is likely to miss important events," he says. "We want to know what we can do to reduce the likelihood of pilots, air-traffic controllers, and automobile and truck drivers missing these sometimes life-threatening events."

One idea Stern would like to see tried is an on-board monitoring system that would assess an operator's alertness by means of infrared lights directed at the eyes. During a lid closure, less light is reflected.

Stern also believes that some type of information-looping system could be imple-



Herb Weisman

Behind the blink:

"Most 18th- and 19th-century scientists merely observed blinking as naturalists might, offering no theory for its purpose or its timing," says Professor John Stern, seated in his Eads Hall office. "The first important insights came in 1895, when it was suggested that blinking is related to fatigue caused by reading."

yellow flash of light warning you that a radioactive core is overheating.

"Up until now," says Stern, "safety studies have paid more attention to making the equipment more reliable. Little attention has been paid to the person operating it. We are interested in the human part of the equation. We're looking for ways to assess deteriorating operator performance before it's too late to do something about it."

For example, a pilot whose vigilance has dropped could be replaced by a co-pilot. Or a computer could momentarily take over for an inattentive pilot or atomic-energy-plant worker.

Of course, boredom isn't the only factor that reduces one's vigilance. Fatigue plays a



“The brain seems to need to pause between significant sensory episodes. The blink serves as a kind of mental punctuation—an interruption that allows the brain to store or mull over information.”

John Stern

mented to replay important events on a delayed basis, which would give a pilot or air-traffic controller a second opportunity to catch a signal missed due to inattention.

Stern’s research even has implications for hiring practices. Since each individual has a different attention threshold, a pre-employment test could be used to screen out poor candidates. “As far as pilot selection goes,” says Stern, “it would be possible to hire only those who show low levels of dropout [inattention].”

While Stern is primarily interested in these types of vigilance research, he is also branching out into other areas. One current dissertation study by Douglas Dunham, a graduate student in psychology, is measuring the relationship between problem solving and eye and head movements.

In his laboratory, Stern and his collaborators collect data for the study by attaching electrodes strategically around the eyes of a research subject (to measure eye blinks and saccades), fitting the volunteer with a common bicycle helmet instrumented to measure head movement, and then administering a battery of visual tests.

In one task, letters of the alphabet are flashed at different peripheral points on a black screen, and the subject is asked to decide immediately if the new letters belong to a group of letters presented previously. If yes, the volunteer presses one button on the panel before him; if no, the other.

During the 20- to 30-minute test, the subject’s electronic signals are etched on strip charts, recorded on analog tape, and fed into a computer data base acquisition system. The computer program then allows Stern to study patterns in the data—eye blink rate and amplitude, say, or head movements.

“The advantage of this system,” says Stern, “is that it’s inexpensive and accurate.” One preliminary finding of the current study indicates that as cognitive difficulty increases, so do head movements. This finding may allow researchers to make inferences about a subject’s cognitive abilities.

Other researchers are using Stern’s methods to study a variety of subjects. In her doctoral dissertation done at Washington University, Susan Lindsay found some surprising connections between blinking and hypnosis. Expecting that hypnosis would improve subject vigilance, Lindsay saw no such relationship. Equally unanticipated was the finding that good hypnotic subjects blink less frequently than poor subjects, whether hypnotized or not.

Psychopathological researchers are studying schizophrenics, who blink more frequently than non-schizophrenics. The data suggest that this condition may relate to high dopamine levels in the schizophrenic brain. Preliminary studies on Parkinsonism show a connection between low blink rates and low dopamine levels.

Often, Stern travels the country and overseas to present his findings to universities and research groups. Last year, he was in Warsaw, Poland, addressing a conference on anxiety and physiological measurement. Recently, he spoke at a Washington, D.C., conference, at Wright State and Howard universities, and at an Air Force seminar on psychophysiology of attention.

In spite of the worldwide attention his research has been getting, Stern remains humble about his efforts. He says, “Even with all we’ve learned so far, we can account for only 30 to 40 percent of the blinks people make. The other 60 percent remains a mystery.”

And he cautions those who would make large, unfounded assertions about his microscopic data—like media people looking for a story.

“During the Persian Gulf War I got a lot of calls about Saddam Hussein’s incessant blinking,” Stern says. “Reporters wanted to know, ‘What does all this blinking mean? Is it a sign of Hussein’s incipient psychosis, or what?’”

Stern blinks twice and then laughs. “I didn’t have the heart to tell them what was probably the simple truth: Hussein was always on the move, keeping irregular hours, probably not getting much sleep. The man was tired. We blink more when we are tired.” ■

Dental School Bows After 125 Years

A legacy of distinguished work prevails.

by Steven J. Givens

One hundred and twenty-five years ago, 25 students gathered in St. Louis to become educated at the first dental school west of the Mississippi. The cost of this education, including matriculation and graduation fees, totaled \$45.

From those beginnings until its closing in May, Washington University's School of Dental Medicine trained more than 3,000 dentists, many of whom built influential careers and advanced the profession in operative technique, scientific research, and clinical education. Among them was G. V. Black, an 1878 graduate, who became known as the father of modern dentistry.

"It was Black who originated a way to fill teeth efficiently and effectively," says Jack Gilster, D.D.M.'44, who joined the faculty in 1950 and served 37 years before retiring in 1987. "The G. V. Black cavity preparation still stands today as the standard for cleaning out tooth decay and making the restoration strong and serviceable."

Other notables associated with the School include the following:

- Thomas L. Gilmer, class of 1882, founded and became the first dean of Northwestern University's dental school.
- Robert Gorlin, class of 1947, is

recognized as the world's foremost authority on genetic syndromes of the head and neck.

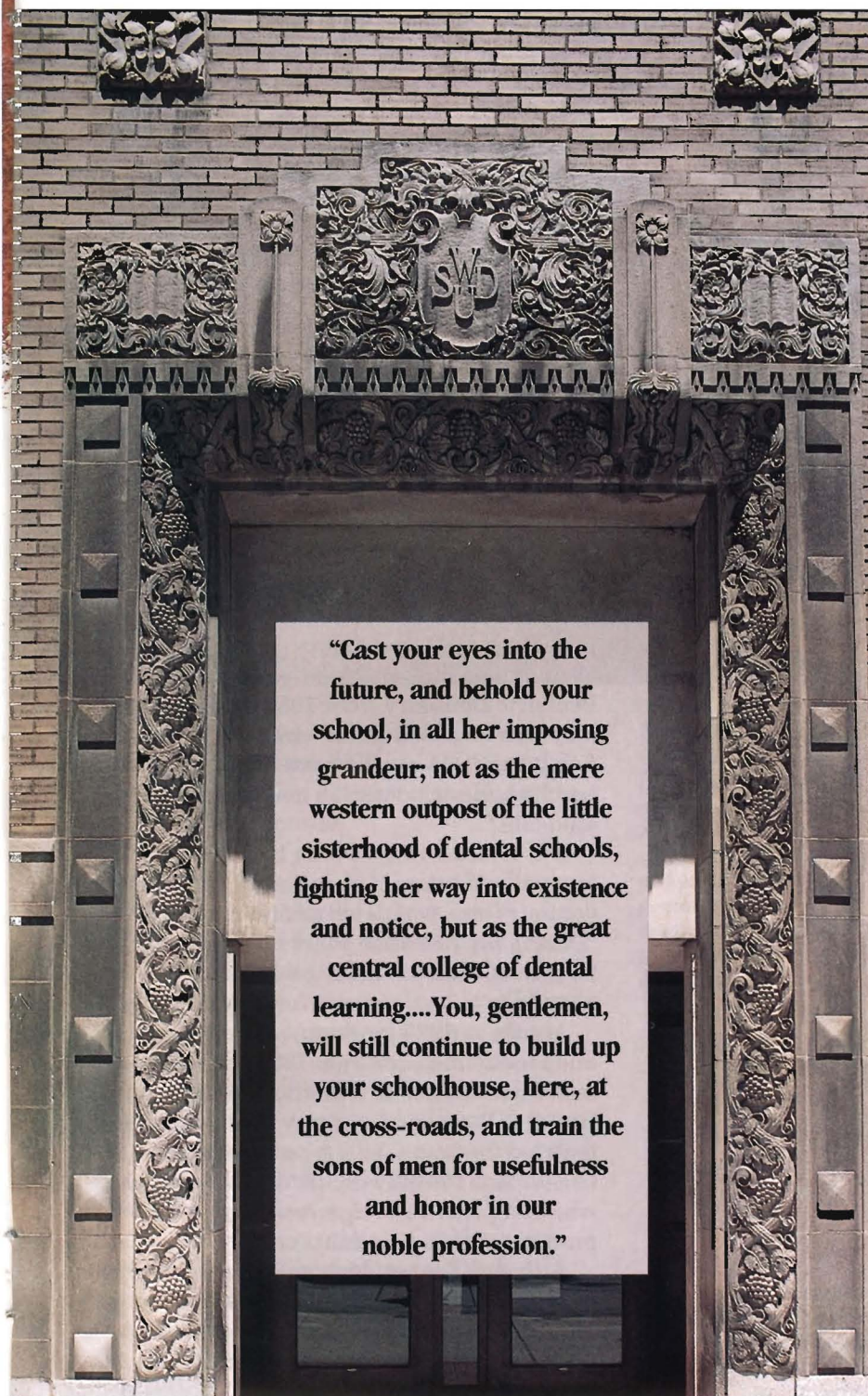
- T. M. Graber, class of 1940, author of more than 15 books and 750 articles, is considered one of the world's most widely published orthodontists. He has written standard textbooks for both graduate and undergraduate training.

- H. J. B. McKellops was one of the principal founders of the School and president of the American Dental Association from 1878 to 1879. His renowned library is now housed in the rare books collection at the University's Medical Library and Biomedical Communications Center.

- Earl Shepard, class of 1931, chaired the School's orthodontics department from 1952 to 1975 and served as executive director from 1977 until 1986. He was elected to the American Board of Orthodontics in 1970, served a seven-year term as a director, and was author of two widely used textbooks on orthodontics. Up until his death in May 1991, Shepard was assistant editor of *The American Journal of Orthodontics*.

- Clarence O. Simpson, the father of

Steven J. Givens is a writer and editor living in St. Louis.



DEAN KIRBY

“Cast your eyes into the future, and behold your school, in all her imposing grandeur; not as the mere western outpost of the little sisterhood of dental schools, fighting her way into existence and notice, but as the great central college of dental learning...You, gentlemen, will still continue to build up your schoolhouse, here, at the cross-roads, and train the sons of men for usefulness and honor in our noble profession.”

Halcyon days: From the address of Professor H. E. Peebles, delivered before the graduating class of the Missouri Dental College, at its second Commencement February 26, 1868.

dental radiography, taught at the School from 1926 to 1936. He returned to the faculty in 1945 to teach six more years.

- Russell Wheeler, class of 1919, wrote the leading text on tooth form, a book the dentistry profession has consulted for more than 60 years.

- George B. Winters, who taught at the School from 1927 to 1940, was largely responsible for establishing the specialty of exodontia, or tooth extraction.

- Winters, former dean O.W. Brandhorst, and W.R. Allstadt, D.D.S.'38, served as presidents of the American Dental Association, dentistry's leading organization.

Following a June 1989 Board of Trustees decision, Washington joins a number of independent universities, among them Georgetown, Fairleigh Dickinson, Oral Roberts, and Emory, whose dental schools have closed, or are in the process of closing. The School's demise is attributed to ever-increasing tuition rates; competition from less-expensive, state-funded dental schools; and a declining student pool nationally that caused applications to dental schools to drop from 15,000 in 1975 to less than 5,000 in 1990.

In response to the 1960s projections of a tremendous population increase and a corresponding need for more dentists, the federal government invested heavily in expanding dental education. Demand, however, failed to materialize. At the same time, fluoridation of water supplies, improved toothpastes, and better nutrition advanced the U.S. population's dental health. Subsequently, in 1967, shortly after St. Louis University closed its dental school, Washington University considered doing the same.

However, a group of faculty and alumni came vigorously to the School's support. Soon, hundreds of dental alumni joined enthusiastically in the campaign, pledging increased financial aid and other forms of assistance. Faculty members David Bensinger, Earl Shepard, Tom Moore, John Robert Ring, and Harold Rosenthal put together an educational, financial, and remodeling proposal that was accepted by

the Board and gave the School a new lease on life that was to last another 20 years.

"A school is never only bricks, mortar, and equipment," says Bensinger, a longtime faculty member who served as dean from 1987 to 1989. "It's the people who make it great." Among this group were the many part-time faculty members who served the school loyally for many years.

"They [part-time faculty] had the really great practices in town," offers John Durham, D.D.M.'56, who taught at the School from 1958 until 1973, when he became a member of the Missouri Dental Board. "I would never minimize what the full-time faculty did for us, but these part-time people gave much of their time to the School. They really polished us and made us who we are. What makes a school really good is that balance between full-time and part-time faculty, and we had that in spades when I was in school."

Durham entered the Army for a two-year stint after graduation and soon found himself at Fort Jackson, South Carolina, with 45 other new dentists. Through discussions with his peers, Durham says it was obvious that his Washington University education had stood him in good stead.

"We had been given a great education—a broad-minded approach to dentistry. The faculty graded harshly, and we knew that after we graduated, we would have to keep learning."

Those part-timers, who made up the majority of the faculty, were appreciated by everyone, including the full-time faculty.

Says Bensinger, "The part-time faculty

The dental school trained more than 3,000 dentists, many of whom built influential careers and advanced the profession in operative technique, scientific research, and clinical education.

possessed a level of seriousness, maturity, and ability that allowed them to guide students with a great deal of dedication."

Bensinger and Durham, a 1982 Distinguished Alumnus of the School, recalled the strength and dedication of such part-time faculty members as Sid Kieffer, Phil Verheller, Barney Brooks, Ed Hunter, Russell Wheeler, Gordon Fisher, Earl Shepard, Carl Lattner, Tom Moore, and Lester Jasper.

Of the full-time faculty during the 1950s and 1960s, one of the most revered was Dean Leroy Boling. "He was the embodiment of an academician," offers Bensinger. "He was the force that kept our School in contact with Washington University as a whole by maintaining a relationship with the Hilltop Campus."

"Leroy Boling was one of the most important teachers of anatomy," notes Jack Gilster, who headed the Department of Pediatric Dentistry from 1959 to 1967. "Not only was he a wonderful educator, he was a fine person. He was dedicated to good work, and he had consideration and respect for his students."

But a pioneering woman had the most impact on Gilster, even in the 1950s, when dentistry was populated mainly by men. "During my first nine years on the faculty," he recalls, "Ruth Martin guided and inspired me to accomplish everything I could."

Martin, a 1923 graduate of the School and faculty member from 1927 to 1959, motivated Gilster to take the American Board of Pediatric Dentistry exam. Martin founded the board, and for many years, Gilster was the only dentist in the country who had passed the rigorous exam—the pinnacle of pediatric dentistry.

Although former dean and naval Admiral George Selfridge didn't join the School until 1976, when he retired as the commanding officer of the National Naval Dental Center in Bethesda, Maryland, he says he knew of the School's reputation and its faculty long before his arrival to St. Louis.

"In the Navy, when someone came to us from Washington University, we knew they were ready to go to work. Their education



Clinical care: William F. Malone, associate dean for clinical affairs, clinic director, and professor and chair of restorative dentistry, left, and 1991 graduate Allen Conway minister to a patient's needs.



Heidi Weisman

gave them a leg up,” says Selfridge, who served as dean from 1976 until 1987 and is currently executive director of the American Board of Orthodontics.

“Closing the School of Dental Medicine was an extraordinarily difficult decision over which the administration and the Board of Trustees deliberated thoughtfully and caringly,” says Chancellor William H. Danforth. “But circumstances made it clear that the future held no option for us. Thanks to extraordinary dedication of the faculty and staff, the first- and second-year students were placed in other schools, and the third- and fourth-year students graduated from Washington University. Dean Smith and so many others worked unceasingly to make the best of this difficult transition. I am proud to be associated with the students, alumni, faculty, and staff of the School.”

Continuing a tradition of respect and integrity was the force behind the work of Dean Richard Smith as he guided the School toward closure during its last two years. He saw to the placement of students, faculty, staff, and resources and ensured the

***Last call:** From left, Carlos Diaz-Laboy, Lourdes Arguelles, and Samuel B. Sanders, from the class of 1991, were among the last graduates to be awarded degrees by the School of Dental Medicine.*

School’s continued accreditation.

“Ninety percent of my job over the past two years has focused on the people in this building and the consequences of the closure on them,” says Smith.

Student placement went exceptionally well, according to Smith, who credits Richard Brand, the School’s associate dean for student services and director of admission, and his staff. At the time of the closure announcement in 1989, the School had a full class of incoming freshmen, all of whom were placed in dental programs elsewhere. Members of the sophomore class also were placed in other schools. Because the School continued to qualify for accreditation during the closure, all juniors and seniors were able to complete their educations by 1991.

Washington University honored the status of the School’s 15 tenured professors and assisted untenured members in finding positions with other dental schools. Clinical faculty members were aided in their move to private practice. The University helped place many of the approximately 60 staff members in other areas of the University.

Although people were the School’s most valued asset, other resources required attention. The Harriett L. Steurnagel Dental Collection, named for the 84-year-old librarian emerita, became part of the medical school library. The School’s internationally recognized McKellops rare book collection—approximately 1,000 monographs and journals in dentistry and oral surgery—is being cataloged and retained by the medical school.

Bronze plaques of former deans, along with photographs and other memorabilia, are now housed in a room in Whittemore House. The alumni association plans to maintain contact with its members through its newsletter.

These efforts to keep alive the memory of the School are driven by 125 years of hard work, dedication, and commitment to excellence. In Bensinger’s words, “The memory of the great work that has been done here is what will help sustain us in the absence of the School itself.” ■



The Art of

Operating through elaborate mechanisms essential to their survival, pathogens have evolved into wily tricksters of the human immune system.

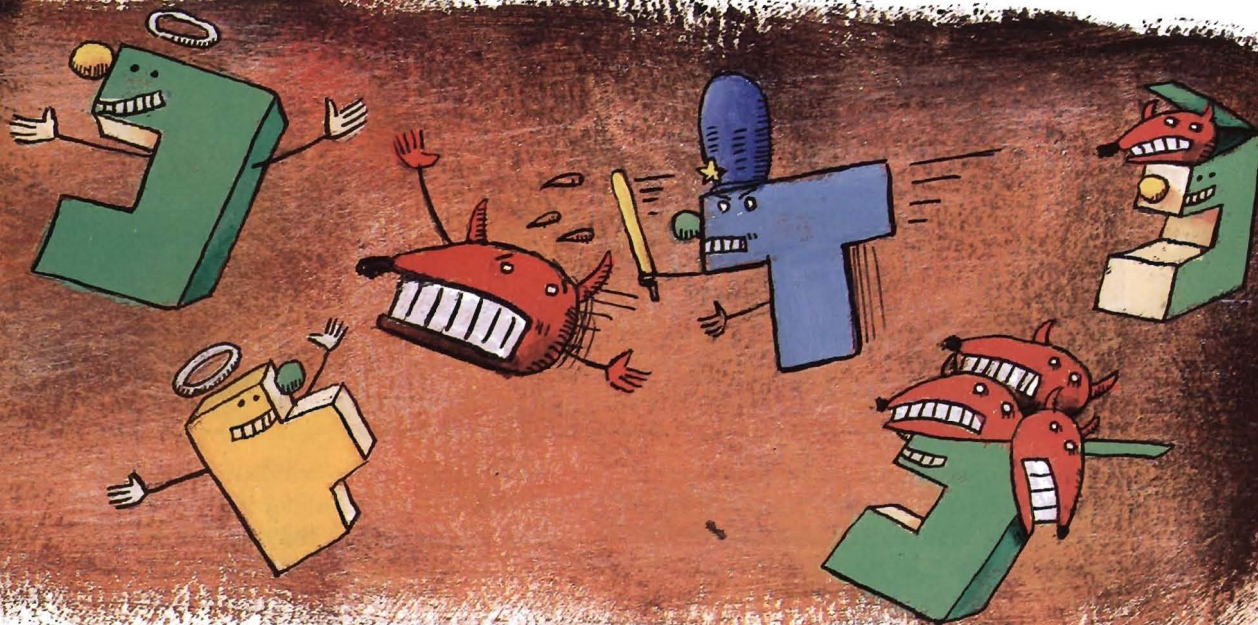


Deception has played a major role in mythologies and human affairs throughout the ages. From the Garden of Eden to the Trojan Horse, from Samson's surprise haircut at the hands of Delilah to General Norman Schwarzkopf's taking Kuwait by the back door, deception has been a common strategy. Humans have relied upon it for survival. And it may be the one thing we all fear most—to be deceived.

Being practiced at the art of deception, however, can be a biological imperative. Deep within the microscopic world of molecules and cells, battles of deception are being waged constantly between the forces of good—our immune systems—and the forces of evil—viral and bacterial pathogens. (This is, of course, the value judgment of humans and not of the microorganisms.) From the individual unit of life, the cell, to higher life forms, such as chimpanzees and humans, deception is an important tool of survival.

“Deception between species probably has been around since the first predator/prey relationships were established, and it continues today in particularly active forms in the war being waged between the mammalian immune system and microbial

by Tony Fitzpatrick



Molecular Deception

pathogens," says Ursula W. Goodenough, professor of biology. "Those pathogens extant have not been eliminated by immune systems. Numerous pathogens operate by deception. Given enough evolutionary time, the immune system might well come up with some defenses to thwart them, but meanwhile, we must understand their deceptive ways and figure out how to outsmart them."

Deception occurs throughout nature and transcends species, says Goodenough. Whether a cheating heart or a lying molecule, the concept is similar in many ways. Cells, like humans, are capable of the white lie, the black lie, and the big lie, although cells do not, of course, "scheme" like humans in their manners of deception.

The basic paradigm of molecular deception is the parasitic relationship of viruses and their hosts, says Goodenough. "A white lie occurs when a parasite invades a host cell, replicates itself, and departs, leaving it none the worse off," she says. "The black lie pathogen deceives the host and kills it. The big lie occurs repeatedly at the cellular level in symbiosis, the mutually beneficial life-pact between two dissimilar organisms. This big lie often starts out as a deception; an invading foreign cell tricks a host cell

into thinking they belong together. Originally the host probably launches an attempt to get rid of the invader, but as it turns out, the two co-exist, and the host no longer tries to repel the parasite."

Strategic Norms

Goodenough defines deception as occurring when a discrepancy between appearance and reality can be attributed to the causal influence of one organism on another. The deceiver—"A"—is the organism that contributes to the ignorance or delusion of another organism—"B." Self-deception occurs where A and B are the same. While humans are the only species capable of deceiving themselves, deception, says Goodenough, runs rampant throughout nature, as common in molecules as it is in humans.

To cast deception in the proper light, the question of intentionality must be posed.

"If you learn that someone makes the conscious decision to put NutraSweet in your tea to fool you, then you say that you have been deceived," Goodenough explains. "If you instead learn that the person

Tony Fitzpatrick is the science editor at Washington University.



grabbed the wrong packet by mistake, or didn't understand the difference between the packets, you don't call the transaction an act of deception. While your taste buds may have been deluded, you yourself have not been deceived. Thus, deception entails design and purpose. But this purpose does not have to be the result of conscious design. It can equally well be genetically hard-wired into the phenotype or behavior of a pre-conscious organism."

While nature's most elaborate perpetrator of deception is the human brain, Goodenough adds, it by no means holds dominion. Deception occurs throughout the biological kingdom; its purpose is to promote the survival of the deceiving organism.

The moth that perfectly mimics a green, quivering leaf uses a genetically determined deceptive strategy to hide on the limb of a tree. Similarly, the chimpanzee that leads its peers away from a hidden cache of food plays a game of trickery.

"Any human pathogen in existence today has somehow, by definition, been able to elude the human immune system," Goodenough says. "The immune system is designed to first perceive a pathogen and then kill it, and successful pathogens have come up with three basic strategies to deal with this challenge, namely, they disable, resist, or deceive the immune system."

A prime example of the disabling strategy is the bacterium *Streptococcus pyogenes*, which causes strep throats. It secretes a protein, streptolysin O, that penetrates and destroys the white blood cells that are mobilized to fight the infection. The *vaccinia virus*, another example, makes a protein that prevents the development of a pathway that normally acts to fight infection.

The second strategy, resistance, is illustrated by the bacterium *Yersinia pestis*, which caused the black plague. *Yersinia*

secretes an impenetrable coat around itself, in effect, a suit of armor that makes it impervious to both the complement proteins and to white blood cells that are "programmed" to kill it.

In the third strategy, pathogens often employ the use of a shared receptor with the host organism. Receptor is a generic term for the proteins displayed on cell surfaces that detect stimuli in the environment. Detection occurs when receptors interact with whatever stimulates them—they may interact with light, as visual receptors, or with other proteins, such as hormones. All cells have an abundance of receptors looking for normal signals from the environment. Pathogens take advantage of this arrangement to bind to receptors and trigger a response in the interest of the pathogen.

Goodenough cites three major types of molecular deceptions: those that use deception techniques to bind to the host receptor cells; those that hide from the immune system; and those that switch antigens, or surface-displaying proteins, to confuse the immune system.

Hide-n-seek

In the first case, Goodenough says the host cell is tricked into accepting the viral cell because it finds something biochemically attractive about the virus; once inside the host cell, the virus uses the machinery of the cell to replicate itself and promote its own infection cycle.

"The host cell is innocently duped," says Goodenough. "One of the prime examples is the herpes virus, which carries a molecule similar to the fibroblast growth factor receptor; it is speculated that this allows the virus to display the fibroblast growth factor, an important hormone, so that target cells consider it 'friendly,' in a sense, and take it up. Many viruses work this way."

The antibodies circulating throughout our bodies are a formidable armada for pathogens to deal with, but both viral and bacterial pathogens have developed their own bag of tricks to cope. Viruses, for instance, must propagate themselves inside the cells of their hosts for survival; furthermore, they often have a restricted range of target cells. The HIV virus, which causes AIDS, only infects helper T cells and macrophages, two chief body defenders that carry a surface protein called CD4, which can be considered the HIV receptor. HIV carries a specific binding site for this receptor on its surface. If the human host could make an antibody to the viral binding site and block it, then HIV would not infect T cells, and AIDS would not be the devastating plague that it has become.

But viruses such as HIV, polio, and influenza have developed an “ingenious camouflage,” according to Goodenough, to ensure their feet get in the cellular door. Their surfaces are folded in a series of what might be called mountains and canyons; their binding sites are on canyon floors. Antibodies can bind to the sites on the mountains that they biochemically perceive as foreign but are too fat to slip into the canyons. On the other hand, the cell receptors, CD4, are slim enough to easily slide into the canyons and mix with the viral binding sites.

Bacteria can be equally shady operators, but they’ve developed their own unique twists. Their most common method of eluding circulating antibodies is to bury

Viruses such as HIV, polio, and influenza have developed an “ingenious camouflage,” says Goodenough, to ensure their feet get in the cellular door.

themselves inside a host cell. The strategy is called intracellular parasitism, the prime *modus operandi* of such important human pathogens as *Chlamydia*, *Rickettsia*, *Shigella*, *Mycobacterium tuberculosis*, and malarial parasites.

Once inside the host cell, the intracellular parasites are camouflaged from circulating antibodies but are not entirely safe. They have to deal with a second line attack from membrane-surrounded endosomes, organs within cells that become acidified and fuse with lysosomes. The lysosomes contain acid-activated digestive enzymes that kill and dismantle the bacteria.

“Cells have evolved their own internal defense system to deal with invading organisms, but the intracellular parasites have devised mechanisms, not yet well understood, to prevent both the acidification of endosomes and lysosome fusion,” Goodenough says. “They apparently have found a way to alter the endosome membrane. So, they camouflage themselves not only from circulating antibodies, but also from the intracellular line of defense, assuring themselves of an immunologically privileged niche.”

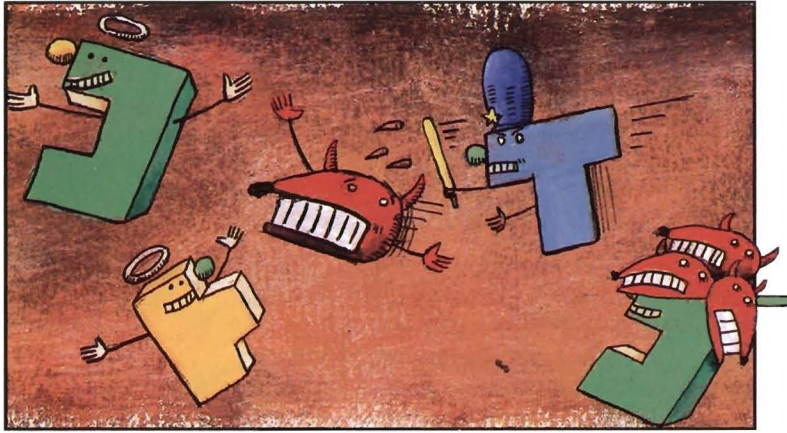
Stealth Operation

The second major kind of deception could be considered a stealth operation. Once inside a cell, the pathogen hides from the organism’s policemen, the T cells. After invading a cell, pieces of viral proteins called “non-self” are displayed on the surface of the infected cell, along with a “self” protein called the major histocompatibility locus, or MHC. This reaction is called antigen presentation. T cells policing the organism see this combination of self and non-self—the antigen—and attack and kill that cell.



Herb Weisman

Ursula Goodenough



Savvy to the scheming ways of molecules, molecular biologists have recently plied their own tricks in experiments to control genetic expression.

But one virus, the adenovirus, responsible for many colds, has evolved to the point where it makes a protein that combines with MHC inside the cell and prevents the MHC from going to the cell surface, thus sparing the adenovirus from annihilation by the T cells, and allowing it to replicate.

"The T cells don't realize the cell is infected," says Goodenough. "MHC and the adenovirus antigen normally go to the cell surface, which dictates the T cells move in for the kill. Instead, the adenovirus makes another protein, which combines with MHC, precipitates it out within the cell, and prevents the presentation of the antigen. Viruses such as the adenovirus have evolved this mechanism to keep T cells from seeing that the cell is infected."

The Antigen Shuffle

A third kind of deception involves shuffling antigens to confuse the immune system. There are two types of action: phase and antigenic variations. Phase variation is the less extreme of the two. In humans, such pathogens as *Hemophilus influenza* employ phase variation by switching surface molecules. It takes about two

weeks from the time a pathogen such as *Hemophilus* invades an organism for the immune system to launch antibodies to the original surface antigen, which can be called "A". After these two weeks, with plenty of antibody to A circulating throughout the system, the bacteria, in a sneaky flip-flop, switches from synthesizing A to synthesizing B, necessitating the launch of an entirely different antibody response.

In antigenic variation, long-term diseases such as African sleeping sickness are propagated by the pathogen's ability to present whole alphabets of constantly changing surface proteins, persistently straining the immune system to provide the proper antibodies. *Trypanosome* protozoa, transmitted by the tsetse fly and causing a form of African sleeping sickness, have more than 1,000 different genes for the same class of surface protein, Goodenough says.

Cellular Sleight of Hand

Savvy to the scheming ways of molecules, molecular biologists have recently plied their own tricks in experiments to control genetic expression, among other biological processes. One key advance in molecular biology is the development of "anti-sense" RNA, molecules that, when inserted into cells, block the programmed translation of the genetic message. Messenger RNA (ribonucleic acid) is the vehicle the cell uses to express DNA (deoxyribonucleic acid), the coded blueprint of life, into functional proteins and enzymes. By blocking its translation, scientists hope to prevent genetic expression of unwanted characteristics early in an organism's development. The whole process is a sort of cellular sleight of hand perpetrated on life forms by clever scientists.

Deception at the molecular level, Goodenough reminds us, is an adaptive process. "Unlike the notion of Satan deceiving humans into sin, molecular deception is not inherently evil," she says. "But, on a larger scale, deceptions throughout our culture and in nature operate much like viruses. A Bart Simpson commercial acts upon the same premise as a virus deceiving the immune system." ■

COMPLEX CLEANUP

How serious are the environmental problems
at the nuclear weapons complex?
A congressional study discloses the sordid truth.

by Cynthia Georges

In late April, a Santa Fe environmental group known as Concerned Citizens for Nuclear Safety launched an effort to transform the birthplace of the atomic bomb at Los Alamos into a laboratory that would address the nation's nuclear waste problems. Demonstrating an incongruity at its best, the notion establishes two well-defined points: A massive deployment of technologic weapons innovation emerged from WWII, and a dire lack of mechanisms to assess and control these technologies followed.

Since 1943, when the U.S. military joined forces with some of the nation's top scientists at this site, the country has built some 60,000 nuclear bombs and warheads at a cost of about \$300 billion.

The manufacturing of these devices has occurred at 15 facilities scattered over 13 states. Known as the nuclear weapons complex and operated by the Department of Energy (DOE), this arsenal network has become a doddering collection of factories surrounded by toxic waste. Contributing factors include decades of lax regulations and weak oversight of operations, neglect of environmental considerations, and the culture of secrecy that has pervaded the weapons industry since the Manhattan Project was first conceived.

The price of national security? Environmental con-

Cynthia Georges is the editor of Washington University Magazine.



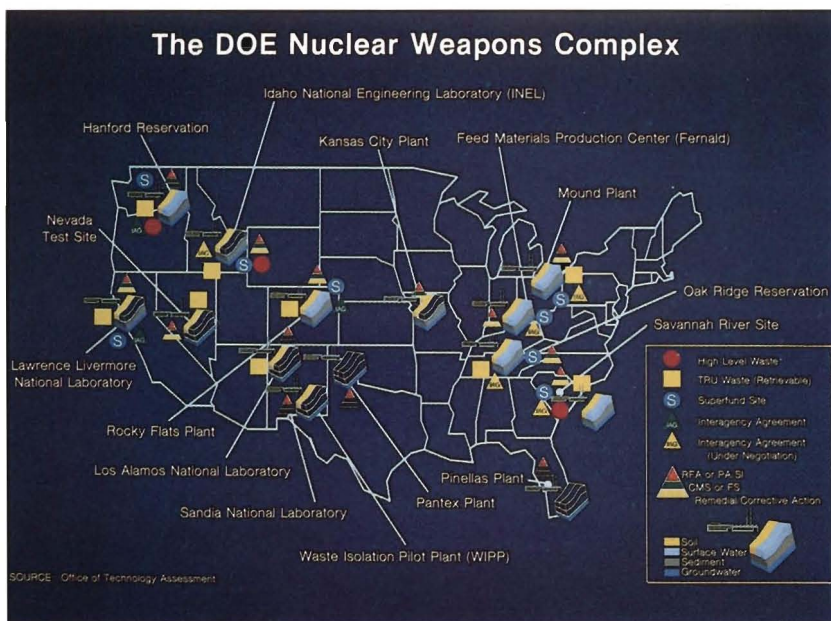
*Environmental legacy:
Nuclear waste disposal at
Hanford Reservation.*

tamination from toxic chemicals and radionuclides throughout the complex. As a result of recent investigations disclosing the careless management of such waste, politicians are storming Capitol Hill hearings; environmental grassroots groups are demanding their say; and the public is clamoring for a cleanup. In Senator John Glenn's (D-Ohio) words, recently delivered before the Senate Committee on Government Affairs, "We now face the equivalent of a balloon mortgage payment for the nuclear arms race."

"Our task as a society in dealing with the environmental legacy of nuclear weapons production is . . . monumental," says Washington University engineering professor Robert Morgan, leaning back in his chair, as if to make room for the adjective he chose to sum up his thoughts. "Even if we never generate another iota of electricity from nuclear power or we never produce more tritium or plutonium for weapons, we still have a lot of waste to deal with. Our production need in the foreseeable future for plutonium is next to nil. As one former Secretary of Energy said, 'We're awash in plutonium.' The issues are complicated, and there are no clear, simple answers."

The Elvera and William Stuckenberg Professor of Technology and Human Affairs, Morgan speaks as one who has procured an inside view of the scope and complexity of nuclear waste management. In 1989, he was invited to Washington, D.C., by the congressional Office of Technology Assessment (OTA) to examine the state of affairs at the nuclear weapons complex.

Created in 1972 as an analytical arm of Congress, OTA helps legislative policymakers assess technological changes and how they affect people's lives. Many assessments the organization has undertaken have been controversial, garnering praise and criticism from all points of the political spectrum. According to Morgan, these have included health care in rural America, neurotoxicology, the Human Genome Project, the U.S. and interna-



Overview: Cleanup of the nuclear weapons complex is taking place in the context of state and federal environmental laws and regulations formed during the past two decades. The national program is known as Superfund, or CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act of 1980). In the map's key, RFA indicates Resource Conservation and Recovery Act (RCRA) Facility Assessment, and PA/SI notes Preliminary Assessment/Site Assessment; CMS stands for RCRA Corrective Measures Study and FS notes Feasibility Study.

tional quest for fusion energy, and pollution of natural resources.

On sabbatical as visiting senior analyst, Morgan and a project staff that included a lawyer, a physician, two environmental/social scientists, and another engineer explored prospects for cleaning up the mess and safely managing the wastes. At Morgan's behest, two Washington University graduate students in the Department of Engineering and Policy—Laura L. Taylor and My K. Ton—interned at OTA for part of the year.

During the 18-month investigation, while Morgan and his OTA colleagues researched and visited waste and production sites, examined prospects for cleanup and safe waste management, and proposed policy options, the media broke news of studies revealing vast environmental degradation.

"At the time of our study, revelations of environmental contamination and cleanup costs were almost daily occurrences," recalls Morgan. "What made our task even more challenging was the fact that DOE had recently obtained dynamic new leadership in the presence of Admiral James Watkins, who early on admitted that there were big problems with the DOE complex and set about trying to improve things. We, in turn, had to keep track of a dynamic, changing situation."

Watkins has faced a prodigious task since taking the reins of an unwieldy DOE in 1989. The White House Office of Management and Budget had placed the Energy Department in the "high risk" category of federal agencies most vulnerable to waste and fraud. Despite Watkins' attempt to introduce "a new culture of accountability," the department is still wrestling with a credibility problem.

Several startling reports circulated while Watkins was settling into his post. One regarded 13,000 Washington State residents who lived near the Hanford Nuclear Reservation, sprawled over 560 square miles. From 1944 to 1947, the population was exposed to dangerous levels of radioactive iodine, released when fuel rods were dissolved in acid to retrieve plutonium for nuclear weapons. A cause of thyroid cancer, the iodine polluted crops, including the grass on which cows grazed.

Other accounts detailed the release of substantial quantities of uranium into the air and into the Ohio River at the Feed Materials Plant in Fernald, Ohio, and a series of reactor accidents and groundwater contamination at the Savannah River complex in South Carolina.

Morgan made the rounds, visiting Savannah River; Hanford, the first producer of weapons-grade plutonium; and West Valley, a nonweapons site in New York that processed some fuel commercially between 1966 and 1972. He explored sites at Los Alamos and Sandia, both weapons research and development laboratories. Donning a hard hat with carbide lamp and battery pack, he descended 2,100 feet into the salt mines of the Waste Isolation Pilot Plant (WIPP) in southeastern New Mexico to investigate the feasibility of DOE's plan to safely dispose of transuranic waste there.

Transuranic defense waste is the result of reprocessing plutonium-bearing fuel and irradiated targets and of operations required to prepare the recovered plutonium for weapons use. It includes metal scraps, glassware, laboratory waste, soil, clothing, and glove boxes. Morgan devoted a large part of his time in Washington to writing a

*The price of
national security?
Environmental
contamination
from toxic
chemicals and
radionuclides
throughout the
weapons complex.*

99-page OTA background paper on management of transuranic and high-level waste, as well as contributing to the overall study.

Most transuranic radionuclides decay by emitting helium nuclei, i.e., alpha particles, a heavily ionizing form of matter that "you can stop with a piece of tissue paper," he explains. "The big worry with plutonium, a common transuranic, is that you might inhale it; it gets stuck in your lungs. Plutonium-239 has a half-life of 24,400 years. This means half of this plutonium that exists now will still be around in the year 26,390."

Until 1970, transuranic waste, handled in much the same way as low-level waste, was dumped into pits and buried. Sketchy records of what substances were buried where, coupled with increased public knowledge of waste problems, prompted the Atomic Energy Commission to rule that the waste be stored in metal drums.

Since the 1970s, says Morgan, experts have looked to deep geologic repositories for disposal of both transuranic and high-level waste. The two repositories that DOE has targeted for this storage—WIPP, 26 miles east of Carlsbad, New Mexico, and Yucca Mountain, 100 miles northwest of Las Vegas, Nevada—have met with considerable public and scientific opposition. At the WIPP site, which was to have opened in 1988, there is fear of gas buildup in drums of untreated transuranic waste. Gas pressure from corrosion of the carbon steel drums and from biological degradation of organic materials could possibly create leakage within 50 to 100 years, says Morgan, by way of fissures in the salt. Although the theory initially was that the dry salt, present for millions of years, would isolate the waste, the presence of brine in the mine has been noted. The five-year test phase to determine whether WIPP will work as planned has not yet begun.

Rising out of the country's most arid land, Yucca Mountain, at 1,500 feet, was chosen by the government as the disposal site for the nation's most lethal (high-level radioactive) waste. The process of selection, says Morgan, was skewed, "a case where Congress may have put politics before

scientific consideration, which wouldn't be the first time in this country," he adds.

Originally, a carefully crafted political compromise, the 1982 Nuclear Waste Policy Act, was to name three storage sites east of the Mississippi and three sites west. After characterizing the sites, government officials were to select one on each side. Somewhere along the line, Morgan recalls, the policy was abandoned by the Reagan administration after governors from eastern states dissented. "The next thing you knew, in 1987, Congress decided Yucca Mountain was the place. They took a less populous state with two votes in the House and said, 'You are it!'"

Equally troubling are geologists' findings at the Yucca site. DOE scientist Jerry Szymanski voiced his concerns about groundwater under the mountain. Rising levels could flood the facility, causing fractures that might create earthquakes and drum explosions. Szymanski's concerns have prompted a National Academy of Sciences committee review of the scientist's claims. With site characterization work yet to begin, the repository could not open before the year 2010, says Morgan.

TYPES OF NUCLEAR WASTE

High-level waste: The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.

Transuranic waste: Without regard to source or form, waste that is contaminated with alpha-emitting transuranium nuclides with half-lives longer than 20 years and concentrations higher than 100 nanocuries per gram at the time of assay.

Low-level waste: Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, spent nuclear fuel, or byproduct material. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, provided the concentration of transuranics is lower than 100 nanocuries per gram.

Source: U.S. Department of Energy

Key findings Morgan and his OTA colleagues outlined in their study, released in February 1991, include the following:

- ◆ The DOE environmental cleanup program has yet to establish the credibility and capability necessary for massive cleanup of waste and contamination at the nuclear weapons facilities.
- ◆ A need exists for more rigorous assessments of public health effects, enhanced public involvement in decision making, and increased oversight of the cleanup.
- ◆ Cleanup efforts are hampered by a lack of available technical solutions, reliable data and qualified personnel, and inadequate assessment of off-site health.
- ◆ Most of the waste generated, as well as future waste, is destined to remain at the site of generation for decades to come, despite government efforts to open geological repositories in New Mexico and Nevada. DOE's stated goal—to clean up all weapons sites at a cost of \$150 billion within 30 years—is unfounded.

What distinguished the report from others, Morgan points out, was a multidisciplinary staff that examined and talked to a wide range of information sources including vociferous groups such as Santa Fe's Concerned Citizens. A broadly based advisory committee also helped illuminate issues.

An emphasis on health issues and public participation dominated the policy initiatives, which included increasing public access to information; strengthening site monitoring programs; establishing a new and separate health assessment office; appointing a national, independent environmental commission; creating citizen advisory boards with technical staff at each site; and authorizing an independent institution to regulate radioactive waste management activities now under DOE's jurisdiction.

"Currently, DOE is self-regulating in certain aspects of radioactive waste management," Morgan says. "Do we want the DOE to have this capability? True, there are some checks and balances through citizen action, the Environmental Protection Agency, and court rulings, but the one who calls the final shots on whether WIPP



Professor Robert Morgan

should be open is the Secretary of Energy. One of the initiatives we suggested at OTA was removing any last vestiges of DOE self-regulation in this particular area.”

Morgan’s training in nuclear and chemical engineering, coupled with his expertise in public policy, earned him the distinction of serving on the OTA project. He holds bachelor’s and doctor’s degrees in chemical engineering from The Cooper Union and Rensselaer Polytechnic Institute, respectively, and master’s and engineer’s degrees in nuclear engineering from Massachusetts Institute of Technology.

Morgan first visited Washington University in 1967 to define a new program in the area of technology and international development. A year later, he joined the faculty and since, has played an instrumental role in establishing degree programs in the areas of technology and human affairs and engineering and public policy.

Although Morgan has served on or chaired committees at the National Science Foundation, the National Aeronautics and Space Administration, the American Association for the Advancement of Science, and the National Academy of Engineering, he assigns his OTA experience to a special category. “I didn’t advise as much as I worked as part of a team,” he offers. “Our focus was unique for a government agency addressing the nuclear weapons complex. I attribute it to the assembled team, especially to the presence of an M.D. with a strong occupational health interest and to a lawyer

“In a democracy, the solution [to nuclear waste management] must be acceptable to the public. If it is not, whatever technological fix is devised is not likely to last.”

Robert Morgan

who thinks that public participation is important.”

Perhaps more poignant for Morgan, educated during the era of “atoms for peace—a time,” he recalls, “when there was a real interest in doing good things with nuclear energy”—is the historical perspective he holds on OTA. More than 20 years ago, in the spring of 1970, Morgan testified in one of three congressional subcommittee hearings on technology assessment and the environment. He remembers: “In response to increasing concerns about the fate of the environment in a world that is becoming more technological, and to a growing perception that technology had negative effects—pollution and destructive weapons, to name two—a Congressman named Emilio Daddario introduced The Technology Assessment Act of 1970. (Daddario later became OTA’s first director.) This served as the formal rationale for the hearings.”

Morgan has tracked the progress and efficacy of OTA studies ever since, serving as an OTA consultant on a study of education and employment of scientists and engineers in 1987. Impressed with the leadership of present OTA director John H. Gibbons, Morgan invited the nuclear physicist to deliver the annual Stuckenberg lecture to the University community in October 1991.

“We’re not dealing exclusively with the question of defense waste disposal,” Morgan continues. “Getting that first waste package down in the [WIPP] mine takes on symbolic value, with implications for the future of the nuclear power commercial industry. But there are still uncertainties and many unanswered questions. Are these the right technical solutions? Even if they seem technically sound, they still have to be acceptable. *Acceptable* is the operative word. It has to mean more than technically acceptable. In a democracy, the solution must be acceptable to the public. If it is not, whatever technological fix is devised is not likely to last.”

Concerned citizens everywhere might well applaud his words. ■

Walking with Howard Nemerov

That shock of white hair crowning the squarish face. The piercing but congenial blue eyes, sometimes framed by heavy, black glasses. The wry, plucky smile of a former fighter pilot. The blue-denim jacket and the book bag slung over the shoulder. The brisk, but otherwise leisurely gait.

And there you'd see him, strolling underneath the archway of Brookings Hall, as much a symbol of the University, it's been said, as the towered building itself.

Howard Nemerov, who died of cancer July 5, 1991, made it a habit of walking to work, which, in his last 22 years, was at Washington University. Here, he held two ponderous titles—Edward Mallinckrodt Distinguished University Professor Emeritus of English and Distinguished Poet in Residence. These and other honorifics—poet laureate of the United States from 1988 to 1990, winner in 1987 of both the Pulitzer Prize and the National Book Award—Nemerov wore lightly. He was, rather, a poetic Everyman. Or “a low-down fellow with lofty thoughts,” as he once said in typical self-deprecating fashion. “If you start on the ground, you can only go up.”

And what better way to start on the ground than by walking? The 2-mile trek from home to Room 110 in Duncker Hall not only strengthened his constitution, it also gifted his mind with stray thoughts and impressions that, at his desk, evolved into poems of dour but sympathetic irony. (He joked that their length depended upon how much he could remember from his jaunt.) The route, snaking through tree-shaded residential neighborhoods and down a bustling main street, epitomized his poetic breadth. He took the world—natural, domestic, civic, cultural, commercial, and religious—as it came.

Though it lent itself to variations,

*There you'd see
him, strolling
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building itself.*
by Robert Lowes

Nemerov's migratory path was as predictable as the poetic techniques and forms he employed—rhyme, meter (iambic pentameter), villanelle. Yet each day's tramp was as fresh and revelatory as the poetry. On foot, you hear the sounds of unrehearsed life denied to those pent up in automobiles: “A fountain's lazy splashing takes the ear.” When on foot, not blinded by road and destination, sight can become vision: “Four lonesome joggers slowly fleeing Death.”

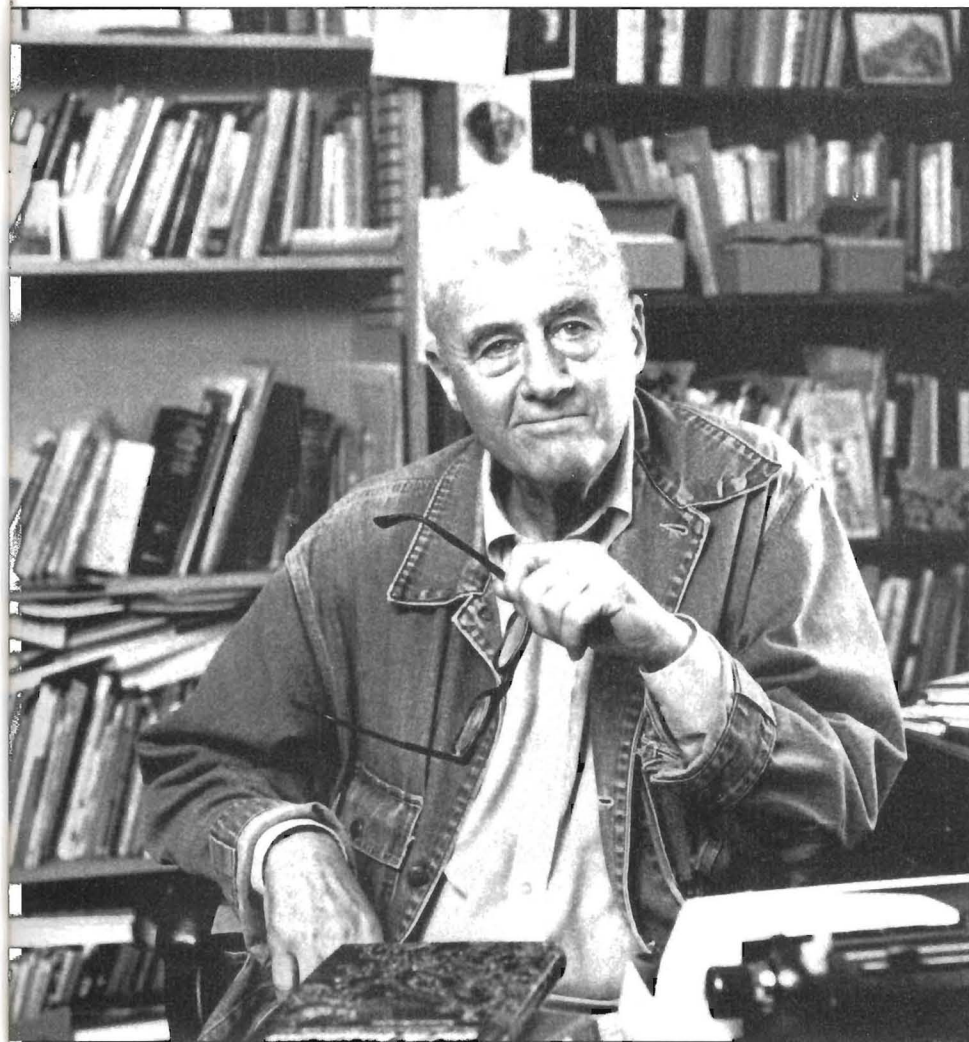
“Walking is very good for poetry,” Nemerov once punned unashamedly. “That's why it comes in feet.”

Nemerov wrote more than 25 books, including three novels and four books of essays and literary criticism. The poetry, of course, earned him his Pulitzer. “A hopeless hope is the most attractive quality in his poems,” wrote critic Helen Vendler, “which slowly turn obverse to reverse, seeing the permanence of change, the vices of virtue, and the errors of truth.”

He was the husband of Margaret Russell Nemerov for 47 years, a father of three sons, a friend to many, and a light to countless others. On August 28, he was richly honored with a memorial service at the University's Graham Chapel, a place where he often read his work. Fittingly, a friend, former poet laureate, and Pulitzer Prize-winner, Richard Wilbur, eulogized Nemerov in readings and recollection.

“He was a brilliant, civilized, affable, soldierly man who had the esteem and affection of several generations of readers and poets,” said Wilbur.

“Robert Frost once said, ‘I like his austerity.’ What he meant by that, I think, was that he prized in Howard a certain reserve that was perfectly consistent with sociability and warmth of feeling. And I think he also valued an honesty, which kept his great eloquence from saying anything he didn't mean.



Herb Weisman

“As for the latest generation, just last week I received a letter from one of our best young poets, telling me that Howard had been a generous mentor and a poetic father to him. ‘I miss him terribly,’ the letter said. ‘Not a day passes without my somehow having a dream of him, hearing his voice, seeing his mischievous, slightly curmudgeonly smile.’”

Someone once defined poetry as words that take up permanent residence in our hearts, unlike the prose that visits like a salesman or neighbor and eventually leaves.

Howard Nemerov bequeathed to the world much memorable speech, and that fact tempers our grief at his passing. Attend to his words closely, and you can still see the smile, still hear the slap of his shoes on the sidewalk, as he continues to stroll through our better-understood lives. ■

Robert Lowes, A.B.’75, is a St. Louis-based writer and frequent contributor to Washington University Magazine.

Literalist of the imagination:

Howard Nemerov (1920-1991), one of America’s most distinguished men of letters.

The Blue Swallows

Across the millstream below the
bridge
Seven blue swallows divide the air
In shapes invisible and evanescent,
Kaleidoscopic beyond the mind’s
Or memory’s power to keep them
there.

“History is where tensions were,”
“Form is the diagram of forces.”
Thus, helplessly, there on the bridge,
While gazing down upon those birds—
How strange, to be above the birds!—
Thus helplessly the mind in its brain
Weaves up relation’s spindrift web,
Seeing the swallows’ tails as nibs
Dipped in invisible ink, writing. . .

Poor mind, what would you have
them write?
Some cabalistic history
Whose authorship you might ascribe
To God? to Nature? Ah, poor ghost,
You’ve capitalized your Self enough.
That villainous William of Occam
Cut out the feet from under that
dream

Some seven centuries ago.
It’s taken that long for the mind
To waken, yawn and stretch, to see
With opened eyes emptied of speech
The real world where the spelling
mind

Imposes with its grammar book
Unreal relations on the blue
Swallows. Perhaps when you will have
Fully awakened, I shall show you
A new thing: even the water
Flowing away beneath those birds
Will fail to reflect their flying forms,
And the eyes that see become as
stones

Whence never tears shall fall gain.

O swallows, swallows, poems are not
The point. Finding again the world,
That is the point, where loveliness
Adorns intelligible things
Because the mind’s eye lit the sun.

(c) 1967 by Howard Nemerov. Reprinted with permission from the Nemerov family.

WASHINGTON

Tom and Mary Allen Extend Parental Roles

It is not unusual for graduates of an educational institution to commit time, energy, and resources to their alma mater — Washington University is rich in such loyal alumni. It's less common for a college or university to win the attention of those whose connection comes through the ties of another.

For the past four years, Tom and Mary Allen have moved well beyond the general concerns held by parents of a university student, giving the lie to the misbegotten image of parents *in absentia*.

The Allens are well acquainted with the skies between St. Louis and their home in Nashville, having made the trip several times in each of the years their daughter, Regina, was enrolled at Washington. They joined the University's Parents Council during Regina's freshman year, and Tom has subsequently served as a member of the Council's Executive Committee, as Parents Fund chair, and as Parents Council chair during the 1990-91 academic year.

"Washington University offered the only real choice our daughter had for combining studies in fine arts and liberal arts," says Tom. Regina, the youngest of the Allens' four children and their only daughter, graduated in May with an A.B. in English literature and a B.F.A. in painting. "She was very happy with her professors and the School," Mary adds. Although Regina has moved on, Tom continues his association with the University. He serves as a member of the National Council for the School of Fine Arts, which began its work on behalf of the School last fall.

Besides their involvement in parents' programming from the

moment their daughter enrolled at Washington, the Allens also made an early commitment to provide financial support. They joined the University's William Greenleaf Eliot Society four years ago, rising quickly through their generous gifts to the level of annual Patrons of the Society.

cerned. Without personal publicity, they put together a \$50,000 challenge for the Fine Arts Parents Fund to increase annual giving by parents of fine arts students. The challenge was successfully met in the last three months of the 1988-89 academic year, resulting in a record high total for annual gifts to the School.

More recently, they created a new fine arts prize fund for the best two-dimensional student work in any medium. The Southern Prize, as it is now known, provides cash awards to an undergraduate and a graduate student each year. Another of their gifts helped the School of Fine Arts purchase computer equipment, "which is changing photography, printmaking, metalsmithing, painting—all design and figurative art," says Tom.

The Allens' commitment to the training of artists stems from their own personal interest in art. Their new home was designed to showcase their personal collection, which includes works by Degas, Picasso, Gauguin, Miró, Boudin, Chagall, and others. "We have a very catholic collection," Tom says. "We appreciate art. It's nice to have values that transcend the necessities, to feed the mind."

The Allens value higher education, as their own schooling has proven. Tom, who did his undergraduate work at Vanderbilt, earned an M.B.A./M.S. degree and his Ph.D. in quantitative studies at the University of Florida. He has published four books and more than 100 articles in a variety of academic journals. Mary also graduated from the University of Florida, receiving a degree in education. "The educational system has been very kind to us," Mary says, and Tom adds, "and I believe it's necessary to return the favor."

The family business in Nashville,

♦

*"LOOKING AHEAD IS
THE JOB OF THE
COUNCIL," SAYS TOM,
"NOT ONLY TO HELP WITH
THE FUND-RAISING
PROCESS BUT TO HELP
THE UNIVERSITY AND THE
ART SCHOOL PREPARE FOR
THE NEXT CENTURY."*

♦

"We contribute to a number of institutions, and we thought it was worthwhile to aid Washington University," Tom says. "We looked at contributions to the schools and found that two might benefit most from our gifts — the School of Fine Arts and the School of Architecture. That's where we've directed our support. Greater financial support is needed for the training of young artists."

Tom and Mary Allen decided to help change that situation, at least where gifts from parents are con-



Committed to the arts: From left, Mary, Regina, and Tom Allen

Allen Consulting Group, Inc., provides a multitude of financial and consulting services to Fortune 500 and World 500 companies. During the past 25 years, business has taken the Allens to Europe, the Middle East, and the Orient, as well as across the United States.

Last winter, their plane flew to the aid of University students. The University's affiliate of the American Association of University

Students hosted the organization's national conference, which former President Jimmy Carter keynoted. When students began to arrange for President Carter's transportation, the Allens offered the use of their plane, pilot, and co-pilot; they looked forward to having an opportunity to spend the flight time in private conversation with the former president. As luck would have it, the plane made the trip—

without the Allens. Tom suffered a leg injury that prevented him from making the three-hour flight.

Tom will continue to provide active counsel to the University through his work on the National Council. He has been a leader in urging the School of Fine Arts and its dean, Joe Deal, to undertake long-range planning and thorough feasibility studies for its growth and progress.

"Looking ahead is the job of the Council," he says, "not only to help with the fund-raising process, but to help the University and the School prepare for the next century. Interaction between the University and the National Council provides input from the 'real world'—we've got people from business, graduates of the School, and professional artists looking at issues regarding teaching, bricks and mortar, enrollment, and how fast changes should be made."

Tom Allen likes to make things happen—through his active involvement and his financial support. In just four years, Tom and

Mary moved rapidly from indirect involvement with Washington to a role of leadership in helping the University define and achieve its goals. The University can only hope that Tom doesn't adhere to his own philosophy that "no one should have tenure on a council."

It would be nice to have the Allens stay around to see where their outstanding commitment will lead. ■

“Mother of Mercy — Is This the End of RICO?”

by Kathleen F. Brickey

Congress enacted RICO—the Racketeer Influenced and Corrupt Organizations Act—as part of the Organized Crime Control Act of 1970. Since then, RICO has become a powerful prosecutorial weapon not only in organized crime cases, but in cases involving sophisticated fraud in the public and private sectors as well. The much heralded prosecutions of Michael Milken and Drexel Burnham attest to that phenomenon.

But RICO is as controversial as it is powerful. A major source of the controversy is the statute’s creation of a private civil cause of action for those who are injured in their business or property by reason of a RICO violation. By authorizing two uncommon remedies—recovery of treble damages and recovery of attorneys’ fees—the civil statute provides strong incentives for litigants to allege RICO violations. In most instances, that translates into an allegation that the defendant participated in the affairs of an enterprise through a pattern of racketeering activity.

That the civil RICO provision is sufficiently broad to reach culprits in the savings and loan debacle, the securities and commodities fraud scandals, the impending banking insurance crises, and the like has added to the clamor to “reform” it—that is, to drastically narrow its scope. Predictably, those at the forefront of the RICO reform movement include the banking industry, the insurance industry, the securities and commodities industries, and the accounting profession.

The reform efforts are fueled by

widely disseminated myths. Principal among them are the myth that Congress contemplated that RICO would be used only as a weapon against organized crime; that civil RICO actions are inundating the federal courts with largely frivolous suits; that common-law fraud remedies are adequate without civil RICO; and that RICO is being used to resolve

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ordinary contract disputes.

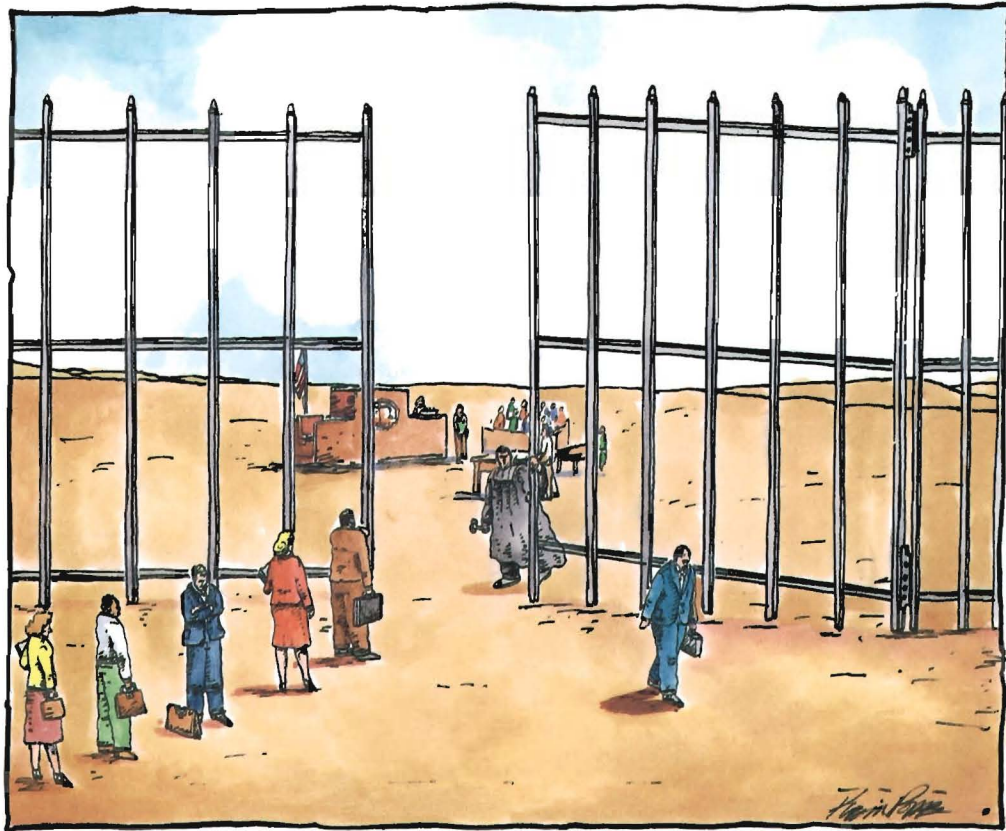
In consequence, Congress perennially considers RICO reform legislation, and 1991 has been no exception. The key proposal this year is H.R. 1717. One of the principal features this bill would use to screen out civil RICO suits is a so-called “gatekeeper” provision. This provision would require the court to dismiss an action upon a finding that the alleged wrongdoing does not rise to the level of “egregious criminal conduct.” Conduct is considered “egregious” only if it is committed under aggravating circumstances that make it “more reprehensible”

than the minimum conduct that is required to establish a criminal RICO violation.

This provision is problematic in several respects. First, one of the major complaints directed at the current statute is that it is “vague.” To the extent that there are legitimate concerns about the statute’s clarity, H.R. 1717 only compounds the problem by injecting imprecise concepts like “egregious” and “reprehensible” misconduct into the law. This creates new vagueness issues rather than resolving old ones, and it is likely that this language would spawn a torrent of litigation to resolve its meaning.

The gatekeeper provision is problematic in other respects as well. It declares civil RICO an “extraordinary” civil remedy that can be invoked only when the court is convinced that it serves the public interest. Why a civil litigant should have to persuade a court that a private cause of action for damages suffered by reason of another’s criminal conduct should be in the public interest is not readily apparent. Nor is it clear why a civil RICO defendant’s conduct must be *more* reprehensible than the average criminal RICO defendant’s conduct. It is unseemly to raise the liability threshold for civil defendants (i.e., the business community) while abandoning criminal defendants to the wolves (if wolves there be).

Alternative routes that the bill provides for passing through the gate are no more obviously suitable constraints on liability. Notwithstanding the limitations discussed above, a suit would be allowed to proceed if the defendant has previously been convicted of a RICO violation or of engaging in racketeering activity, or if the defendant was a “major participant” in the conduct causing the injury and the magnitude of the injury makes



Kevin Pope

resort to an extraordinary remedy appropriate.

As it is drafted, the prior criminal conviction requirement would insulate admitted crooks from civil liability. Consider, for example, criminal defendants who agree to plead guilty to lesser offenses to avoid having the offense of conviction be a RICO violation. Under H.R. 1717, even though these defendants would have a prior criminal conviction that grew out of an alleged RICO violation, the fact of conviction would not unlock the gate for the injured party. Likewise, coconspirators and accomplices who agree to testify for the government only in exchange for a grant of immunity from criminal prosecution could also indirectly gain immunity from civil RICO liability as well. One can only wonder why.

The major participant criterion is no less troublesome. Interpreta-

tional difficulties aside, the attempt to draw distinctions between "major" and "minor" participants is puzzling. The group danger rationale is the backbone of conspiracy law. The more participants there are in a criminal venture, the greater the likelihood that they will achieve more ambitious goals, regardless of how many of the participants can be categorized as "major." It may well be that major participants would not (or could not) have implemented the criminal scheme without the support and encouragement provided by their minor counterparts. Yet H.R. 1717 would insulate from civil liability those who give the major players the courage to proceed.

Other provisions in the bill that would require the plaintiff to satisfy an elevated burden of proof and would apply these "reforms" retroactively serve to reinforce the belief that H.R. 1717 stacks the deck

against parties who have been injured by criminal conduct in favor of those who committed the crimes.

In "Little Caesar," a film that loosely portrays the life of Al Capone, Edward G. Robinson played the title role of Caesar Enrico Bandello—a.k.a. "Little Caesar" or "RICO." As he lay dying of gunshot wounds, he uttered one of the most memorable lines in film history: "Mother of Mercy—Is this the end of RICO?"

From the perspective of those actively promoting "reform" of the civil RICO statute, it is reasonably clear that the preferred response to that dying utterance would be: "RICO, rest in peace." ■

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Golden ginkgo: Native to eastern China, the ginkgo is a hardy city dweller that provides shade to many areas of the University campus. The tree thrived 125 million years ago when dinosaurs roamed the earth. Since then, the genus has remained virtually unchanged.

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