

# InSight

IMAGERY FROM THE WORLD OF FSU RESEARCH & CREATIVITY

## Forms of Flight

Ernst Heinrich Phillip August Haeckel (1834-1919) was an eminent German biologist, naturalist, philosopher, physician, professor and artist, who, despite a long and controversial career, used his remarkable gifts as a scientist and artist to introduce the wonders of nature to millions.

In 1866, Haeckel traveled to the Canary Islands, where he met with Charles Darwin and began forming his own ideas about how evolution worked. In 1904, he published his best-known book, *Art Forms of Nature*. Designed to interest the general public in naturalism, the book included more than 100 images of mammals, plants, fish, reptiles, insects, spiders, marine invertebrates and microscopic organisms.

An exhibit featuring a series of fine-art reproduction panels depicting Haeckel's elegant illustrations of birds, plants and sea anemones, was put on display in the foyer of the FSU Fine Arts Building as part of the university's "Origins '09" celebration (see page 2).



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# Research in Review

A LANDMARK  
COURT  
DECISION  
PROMPTS A NEW  
LOOK AT WHAT  
RESEARCH SAYS  
ABOUT GUN  
OWNERSHIP  
IN THE U.S. p.22



# AMERICA ARMED

PLUS:  
CRUDE SCIENCE: OIL'S ID p.8  
THE OTHER SHAKESPEARE p.14  
BLABER'S PROTEIN PROMISE p.30



A SCHOLARLY TAKE ON  
THE GUN DEBATE

In a video interview that complements this issue's cover story, Gary Kleck, a criminology professor, discusses one of the nation's most divisive and hotly debated issues: the individual citizen's right to own a gun for personal use.

See [www.rinr.fsu.edu](http://www.rinr.fsu.edu)

# In This Issue

WINTER/SPRING 2009 • VOL.XVIII NOS. II & III

## FEATURES

### 22 IN DEFENSE OF SELF-DEFENSE [COVER STORY]

BY JEFF WORLEY

Last June, the U.S. Supreme Court struck down a 32-year-old law prohibiting residents in the nation's capital from owning handguns, claiming it violated the Constitution's Second Amendment. The top gun-control researcher in the country applauded the ruling, citing decades of scientific studies that make the decision the only rational choice.

### 8 CHECKING OIL'S I.D.

BY KRISTEN COYNE

While the U.S. stumbles forward on an energy policy that makes sense, crude oil is in little danger of losing its dominant role in our energy equation anytime soon. A new technique for picking good oil from bad may pay off handsomely where we need it most—at the pump.

### 14 THE OTHER SHAKESPEARE

BY ROBERT POOL

What's in a name? Try Thomas Middleton, the man who shared Shakespeare's company, celebrity, productivity, wit and genius. Yet for all that, this extraordinary man of letters of Elizabethan England has been all but forgotten until now.

### 30 PROTEIN PROMISE

CHRISTINE SUH

Of all our agues, heart disease remains our top killer. Now comes a natural molecule that shows remarkable promise for keeping the blood flowing.



# 22 COVER STORY



# 14 OTHER

## DEPARTMENTS

2 Abstracts  
Periscope on campus life & research

6 From The Field  
FSU research from around the globe

36 Reviews  
Recent works by FSU faculty

37 Portrait  
Spotlight on faculty

BACK CODER  
Insight  
Imagery from the world of FSU research & creativity



## Research in Review

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## A Community Celebrates Science & Discovery

**B** iologist E.O. Wilson, two-time Pulitzer Prize winner also known as “the father of sociobiology,” is among the headliners coming in March to be part of Florida State University’s tribute to the Year of Science 2009, a national grassroots effort to promote public appreciation of science and higher education.

Joining Wilson will be a stellar line-up of scholars from fields ranging from physics to jazz studies, all bringing engaging talks and demonstrations designed for general audiences. FSU’s two-week-long program, “Origins ’09: A Celebration of the Birth and Life of Beginnings,” begins March 17.

Acclaimed Harvard cosmologist **Lisa Randall** and **Ira Flatow**, host of National Public Radio’s popular weekly talk show, “Science Friday,” will be on campus March 20. The roster also includes **Don Johanson**, co-discoverer of “Lucy,” the world’s most famous fossil and, **Sean B. Carroll**, a distinguished popular science writer and professor of molecular biology and genetics at the University of Wisconsin-Madison.

Inspired by a worldwide celebration of the legacy of Charles Darwin, whose 200th birthday was Feb. 12, the Year of Science 2009 is America’s broader tribute to science and scholarship across disciplines. To that end, “Origins ’09” will include a number of leading scholars in the humanities, namely **Peter Harrison**, Oxford professor of science and religion; **Ron Numbers**, professor of the history of science and medicine also from the University of Wisconsin-Madison, and **Gary Mormino**, a prolific writer of Florida history from the University of South Florida.

Capping the community-wide celebration will be a tribute to America’s only homegrown musical art form on March 28. Florida State’s **Scotty Barnhart**, assistant professor of jazz trumpet and author, will direct “The Origin and Evolution of Jazz,” a rousing tour through jazz lore featuring performances by some of the best musicians and vocalists at FSU,

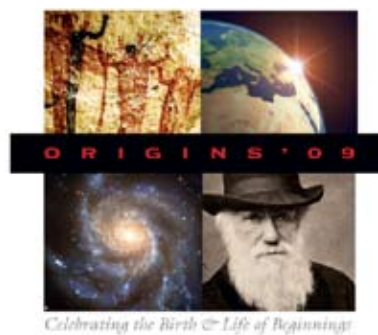


Florida A&M University and the Tallahassee community.

On Saturday, March 21, a daylong “**Science & Arts Fair**” will offer a smorgasbord of free events for all ages. The fair will be staged in and around the Challenger Learning Center downtown Tallahassee.

“Origins ’09” is being sponsored by the FSU Office of Research and the College of Medicine and co-sponsored by The Tallahassee Scientific Society, with major funding provided by The Florida Humanities Council, the FSU Research Foundation, the FSU College of Medicine, and the FSU Council for Research and Creativity. Most events are free and all are open to the public.

For the latest updates on “Origins ’09” check the schedule at [www.origins.fsu.edu](http://www.origins.fsu.edu).



**BRYAN CUEVAS**, associate professor of religion and Buddhist and Tibetan studies, has helped the university acquire a 25,000-volume collection of texts and micro-materials related to Asian religion and culture.

**T**he sheaf of papers on Bryan Cuevas’ desk contains writings from *The Tibetan Book of the Dead*. Long and narrow and culled from a handmade book tethered in pale orange ribbon, the oddly shaped pages were printed from old woodblocks most likely preserved by monks who fled Chinese communism in Tibet in the early 1960s.

Far from a dryly written manual on burial techniques, the text offers prayers for the dead, the physiological signs of death as well as a thorough explanation of the ritual methods “by which death can be averted and postponed so that living beings might be liberated from suffering.”

Cuevas, an associate professor of religion and Buddhist and Tibetan Studies at FSU, helped bring the text to the university last year as part of a massive, 25,000-volume acquisition of books and micro-materials related to religion and culture in Asia.

The collection, which includes items in English, Tibetan, Sanskrit,

Japanese, Chinese and Korean, as well as a large compilation of text on microfiche, elevates FSU to the top tier of universities that offer Asian studies in the southeastern United States.

In terms of research, Cuevas says, no other Florida universities can boast such a treasure: The collection consists of a significant percentage of materials from India and Tibet, and was amassed under what was known as the U.S. government’s Public Law-480 program from the 1960s to 1980s. Under the program, copies were made of everything from daily newspapers to fine art to prized antiquities such as old Hindi and Sanskrit texts dating to the 15th century.

Over two-decades, a flourish of PL-480 texts and materials were made available to about 20 U.S. institutions and universities, including the Institute for Advanced Studies of World Religions in Carmel, N.Y., established by C.T. Shen, co-founder of The Buddhist Association of the United States.

When Shen’s group donated

its collection to the University of Virginia a few years ago, the university’s rare books curator who happened to be a close friend of Cuevas’ sounded the bell.

Cuevas, who earned his doctoral degree from UVA, traveled back to his alma mater to see the cache first hand. The 25,000 books stacked floor to ceiling in room after room proved “stunning,” recalls Cuevas who was as intrigued by the collection’s sheer size (hauling it required two 18-wheel semi-tractor trailer trucks) as with its broad scope that includes a reach of topics from religion to medicine to science to political theory.

Because UVA had originally received a duplicate set of the Asian studies materials under the

PL-480 program, university officials decided to auction Shen’s collection among a select group of private bidders.

In 2008, FSU’s Department of Religion collaborated with the University Libraries, the Department of Modern Languages and Linguistics and the Office of the Provost to raise \$50,000 to buy the collection from UVA.

“To have a thriving research program,” explains Cuevas who has long opened his personal Asian studies book collection to undergraduates as well as graduate students learning to do research: “We have to have a thriving library.”

—E.B.



PHOTOS: RAY STANVARD

## Biology's Big New Eye

**T**hink of it as big and heavy, but fast and brainy. The Titan Krios electron microscope—a state-of-the-art robotic microscope soon to be acquired by FSU—is capable of producing Superman-swift 3D images of frozen biological specimens around the clock and then transmitting them over the Internet.

At 16-feet and weighing in at 1.7 tons (it's about as heavy as a mid-size SUV) the microscope can peer into the inner workings of the most complex molecules found in living cells, and with unprecedented speed and precision.

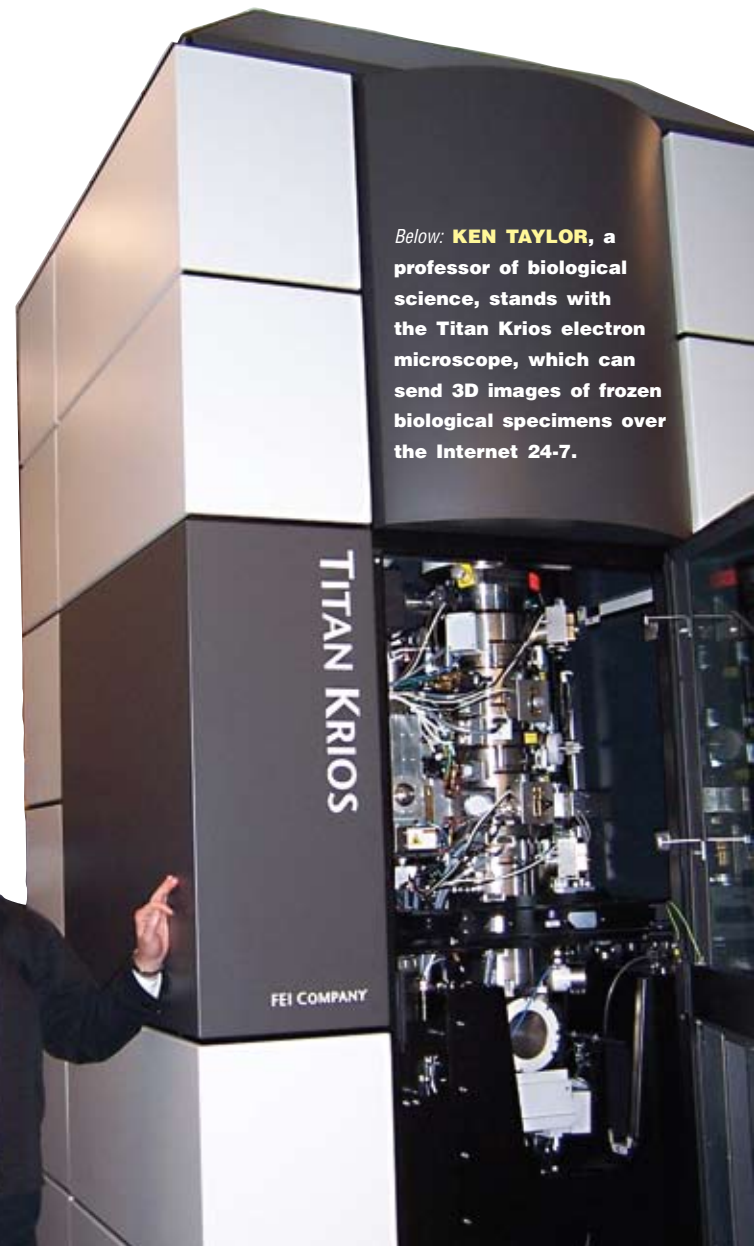
This rare instrument will make its home at FSU this year thanks to a \$2 million High-End Instrumentation grant from the National Institutes of Health. The university will sweeten the pot with an additional \$2.8 million to help buy the machine with funding set aside to support research.

"The instrument is cutting-edge in several ways," said Kenneth Taylor, a professor of biological science at FSU and the principal investigator on the grant application. "Not only is it robotic, collecting data continually without operation attention, in fact, it can be operated remotely."

Taylor is part of the university's Structural Biology Program within the Institute for Molecular Biophysics. The central mission of the program is to study the characteristics and behavior of huge biological molecules, primarily proteins.

The new microscope will catapult Florida State into the top ranks of structural biology imaging centers in the world, said Joseph Travis, biologist and dean of the College of Arts and Sciences. Only five such microscopes are installed or planned for near-term installation in the U.S. and abroad.

The microscope will serve as a crucial tool to FSU scientists who will use it to better study the biological foundations of HIV/AIDS, heart disease, hypertension and cancer.



Below: **KEN TAYLOR**, a professor of biological science, stands with the Titan Krios electron microscope, which can send 3D images of frozen biological specimens over the Internet 24-7.

PHOTO: COURTESY OF KENNETH TAYLOR

## Stem Cell Short-Cut?

**I**n the fast-paced world of today's scientific marketplace, few discoveries have sparked as much debate as the remarkable promise for curing disease found in embryonic stem cells.

Now, a new study, led by **David Gilbert**, professor of biological science, could make it easier to engineer artificial stem cells from adult tissue allowing for stem cell research without using human embryos.

One of the keys to taking adult tissue back to an embryonic state is a step-by-step understanding of what happens as stem cells become specialized.

A mammalian cell contains a lot of DNA—a gigantic molecule that would stretch to nine feet if uncoiled. To fit inside a nucleus, it must be folded thousands of times.

To explain DNA folding, Gilbert offers the analogy of organizing an office. Books and materials rarely used get put on

harder-to reach shelves while important items are placed at eye level.

By analyzing DNA replication, Gilbert and a team of molecular biologists focused on this rearrangement of DNA as embryonic

order is unique to each cell type, whether stem, heart, or nerve.

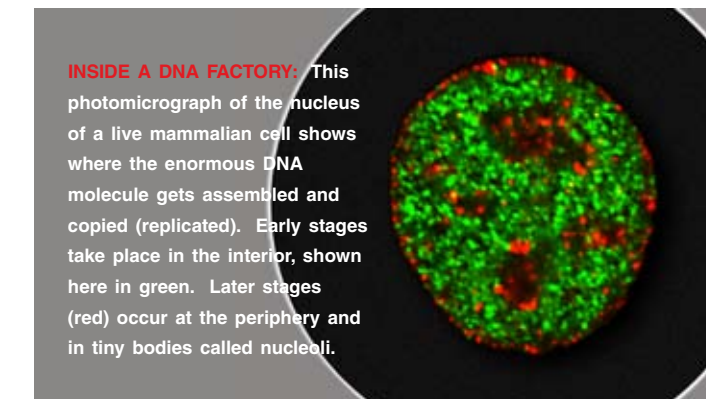
The order in which genes get copied also determines where they get packaged in the nucleus, with DNA copied later tending toward the edges. As

ity of stem cells to become most any other cell in the body—were discovered among those on the outer rim of differentiated cells. This suggests that, by replicating late, they were overcome with dense packaging and inactivated, Gilbert said.

With a catalogue of organizational fingerprints for different kinds of cells, and a detailed map to the buried treasure of pluripotency genes, researchers can now engineer tissues and coax adult cells back to an embryonic state with more efficiency and control than they have previously been able to do. After all, Gilbert says, the true application of stem cell research is "to study human disease from human tissue [taken from] the actual person who has the disease."

Gilbert's work appeared in the journal *PLoS Biology* last fall. **—E.S.**

To learn more about Gilbert's research, visit <http://gilbertlab.bio.fsu.edu>.



**INSIDE A DNA FACTORY:** This photomicrograph of the nucleus of a live mammalian cell shows where the enormous DNA molecule gets assembled and copied (replicated). Early stages take place in the interior, shown here in green. Later stages (red) occur at the periphery and in tiny bodies called nucleoli.

PHOTO: IMAGE BY RONG WU & ICHIRO HIRATANI, GILBERT LAB, FSU

stem cells from mice developed into specialized cells.

What Gilbert and his colleagues discovered is that the order in which segments of DNA get copied during cell division is different between stem cells and differentiated cells. In fact, the

arrangement ultimately affects what genes get turned on, this placement is the organizational equivalent of getting stuffed into a bottom drawer and forgotten.

Interestingly, the genes for pluripotency—the coveted abil-

## SHARKMAN

**DEAN GRUBBS**, an assistant scholar scientist at Florida State's Coastal and Marine Laboratory, uses satellite telemetry to monitor the movement patterns of bluntnose sixgill sharks. His work was featured in January 2009 on the National Geographic Channel program "Dangerous Encounters: Jurassic Shark." The sixgill sharks (shown below) are among the oldest sharks known, with fossil teeth dating to 190



PHOTOS: DEAN GRUBBS

million years. The fish, which can be found in the Gulf of Mexico, usually live on continental and insular slopes of the world's deepest oceans and in a few colder coastal areas

Grubbs (left) catches sixgill sharks by fishing overnight at depths of 800 to 1,300 feet off Hawaii and Virginia. He brings the sharks to the surface, measures them, collects tissue for genetics work, and then tags the sharks with a dart tag for future identification. He also tags a subset with archival pop-off satellite transmitters. **—E.B.**



## In Pursuit of the Wily Harpacticoid

Few things fire up the blood of an oceanography grad student as much as thoughts of going to sea for the first time to do real, in-the-salt research.

And so it was that on the cool Saturday morning of September 13, 2008, six students—three from Florida State and three from Texas A&M, Galveston—were eagerly checking and re-checking their equipment aboard the 135-foot *R/V Point Sur*. The research vessel's twin 550-horsepower Caterpillars had been throbbing for a half-hour as the captain and crew made final plans for a 9 a.m. cast-off.

The *Point Sur* was headed due north on a 21-day research cruise out of its home base at Moss Landing Marine Laboratory, located just above Monterey, California. Leading the contingent of students was David Thistle, a veteran member of FSU's oceanography department faculty.

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TO SEE MORE FROM THISTLE'S VOYAGE

A specialist in biological oceanography, Thistle was returning to familiar waters. In the 1970s, he earned his doctorate at Scripps Institution of Oceanography at San Diego. It was there he first learned about a group of deep-ocean animals called *harpacticoids* (har•PACK•tih•koids).

Thistle's team had spent the better part of three years getting ready for this dedicated harpacticoid hunt. They would be "fishing" in the deep, lightless voids beyond the continental shelf off the Pacific west coast. Using some of the most sophisticated gear yet devised for such work, they would be attempting one of the trickiest feats in marine fieldwork—gathering undisturbed samples of the ocean floor from depths reaching close to three miles.

Thistle is a widely recognized authority in the ecology of harpacticoids, which are one of several types of tiny crustaceans known as copepods, the Lilliputian cousins of crabs and shrimp. These minuscule animals live in great profusion throughout Earth's waterways, from freshwater lakes and tidal streams to the deepest ocean floor. Copepods eat dead plant and animal matter and help keep the planet's waters clean. Some groups also play vital roles in the food webs of fish and other marine organisms.

But mainly because of where they live in the oceans—smack on

### about our researcher



**DAVID THISTLE**  
*Professor of Oceanography*  
David Thistle ranks as one of the foremost deep-ocean benthic biologists in the world. For nearly three decades he has made the study of the ecology

and biogeography of deep-ocean harpacticoid copepods his specialty. David earned his doctorate in oceanography from Scripps Institution of Oceanography, San Diego, and joined FSU's oceanography faculty in 1977.

the bottom—scientists know comparatively little about the harpacticoid group of copepods. Thistle's mission on this cruise was to capture as many samples as possible of deep-ocean mud—with harpacticoid populations intact—to determine what species live off the west coast and where. But a big part of the mission also was to give a small contingent of tomorrow's ocean scientists a taste of real-time experience aboard ship, something no amount of time in even the finest land-based lab can match.

**An undescribed, deep-sea harpacticoid copepod, about 700 microns long—roughly three one-hundredths of an inch.**



PHOTO: THISTLE LAB, FSU DEPT. OF OCEANOGRAPHY

*Research in Review* editor Frank Stephenson was invited along to chronicle the venture. Thanks to an unusually benign stretch of weather and sea conditions—and the *Point Sur's* ability to keep an almost unbroken connection to a constellation of communication satellites—the effort paid off much better than expected. The *Point Sur* returned to port Oct. 3 with a freezer-chest packed with nearly 800 samples and a happy, if tired, science team. Since they've returned to campus, Thistle's students have been hard at work analyzing their finds, work expected to extend well into 2010.

To follow the adventures—and misadventures—of the *Point Sur* expedition almost as they happened, visit [www.rinr.fsu.edu/GoesToSea](http://www.rinr.fsu.edu/GoesToSea). Thistle's team—and this magazine—are indebted to the National Science Foundation for funding this project and the magnificent crew of the *R/V Point Sur* for making it happen. —F.S.



**A)** Samples got careful labeling after every "cast" of the multi-corer device (below). **B)** David Thistle oversees the extraction of a marine worm found by Texas A&M students Allison McInnes, Sam Dorado, and Russ Carvalho. **C)** A four-inch-long worm called an echiuran (ekky-YOUR-an) and a red brittlestar starfish were among a variety of large invertebrates caught accidentally by the corers. **D)** The 135-foot *Point Sur* heads out to sea **E)** The *Sur's* multi-corer apparatus swings aboard with all eight coring tubes holding good samples collected from two-and-a-half miles down. **F)** By trip's end, nearly 800 cups of sediment were chilled and ready for shipment home.

**POINT SUR VOYAGE—** Markers denote the position of the *R/V Point Sur* on its 21-day research cruise.

BY KRISTEN COYNE

DESPITE EVERYTHING, FOSSIL FUELS WILL BE WITH US FOR A LONG TIME. HERE'S NEWS OF A WAY TO MAKE THE MOST OF EARTH'S REMAINING CRUDE OIL RESERVES.

# CHECKING OIL'S I.D.

**C**all it trickle-down science.

Few natural resources are as prized as crude oil. Turns out, it's also by far the most chemically complex of them all—nature makes it in staggering varieties.

Many people are surprised to learn that all crude isn't the same. Oil pumped from one well can be vastly different from oil found only a few miles away. Of late, companies have become increasingly aware of this fact as easily

accessible, quality oil reserves have become harder to find and drill.

The phenomenon poses serious supply-side problems, experts say. Every drop of black gold can contain tens of thousands of compounds, some of which can corrode or clog pipes, pollute too much or be too much trouble to drill for. Considering the oil dilemma the U.S. faces today, it's a problem begging for a solution.

A lab run by FSU chemist Alan Marshall may hold the answer. A professor of chemistry and biochemistry, Marshall has spent his career prying secrets from complex substances, using a revolutionary analytical tool he co-invented and has refined over the decades. Now he says he wants to share that ability with oil companies—knowledge that may eventually help consumers deal with wildly fluctuating prices at the gas pump.

"We want as many people as possible to benefit from what we know,"

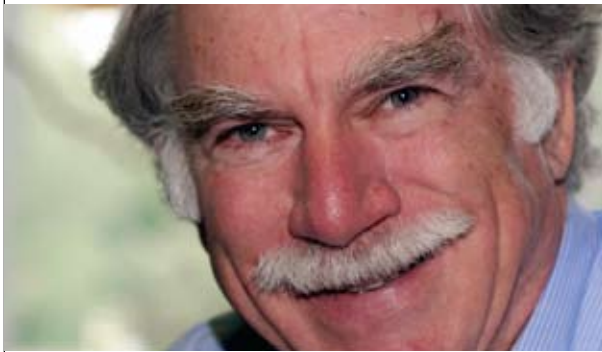
said Marshall, who directs the Ion Cyclotron Resonance program at the National High Magnetic Field Laboratory, headquartered at and partly operated by FSU. "We can't do this all by ourselves, so it's better to have a company that has the responsibility to spread the ideas around."

## ● MOTHER OF INVENTION

Until recently, oil companies had little need for fancy analyses of their product. They were pumping up the cream of the crude—sweet, light crude, in the parlance of the industry, meaning low in sulfur and low density. It was as simple as canola oil, and easily refined into profitable products from gasoline to heating oil to asphalt.

But with our avid appetite for Texas tea—the world guzzles some 30 billion barrels of it a year, a quarter of that in the U.S.—we've burned up much of the good stuff that's easy to reach. Burgeoning economies in China, India and elsewhere are demanding a greater share. Oil companies have had to turn to the less desirable, less profitable crudes. Consumers, still reeling from recent record high prices for gasoline, diesel fuel and heating oil, have begun to feel the consequences of more expensive exploration and processing.

These sour, heavy crudes are tricky mixtures, Marshall said. Without a careful chemical analysis, an oil company could make some very costly mistakes.



ALAN MARSHALL

**“IN 70 MILLION YEARS, AT HIGH TEMPERATURE AND PRESSURE, NATURE HAS MADE JUST ABOUT EVERY POSSIBLE COMBINATION OF ATOMS IN THESE MOLECULES...”**

“The petroleum industry is making this transition on the fly,” explained Ryan Rodgers, director of environmental, petroleum and forensic applications in Marshall’s group. “Sometimes things can go terribly wrong.” Rodgers offered the cautionary tale of a refinery built to last for 30 years. Unbeknownst to the operators, their oil was full of acids. Within 18 months, their pipes had rusted through.

Chemical analyses cost money, but the price of ignorance is often higher.

“You didn’t need it when the oil was simple and straw-colored and easy to pour,” noted Marshall. “But as those rules change, you’re going to need to know more about the sample.”

Oil companies began coming to Marshall in the 1990s, drawn by the promise of his pioneering work in a field known as ion cyclotron resonance mass spectrometry. Developed by physicists in the 1930s, the technique uses radio waves to bombard fields of electrically charged molecules, or ions, of a wide variety of complex substances. When confined to a high-intensity magnetic field, the ions are forced into distinct orbits, sorted out by molecular weight, by the radio waves. The technique thereby gave scientists a useful, if extremely slow, tool for sorting out the ingredients in a complex substance.

But in 1973, Marshall co-invented (with Melvin Comisarow of the University of British Columbia) a vast improvement on the process. The new method, based on Fourier transform technology dramatically increased the speed of analysis as well as the accuracy. Since joining the High Magnetic Field Laboratory in 1990, Marshall has steadily improved the technique with the aid of the lab’s powerful array of magnets. Today, the tool can rapidly identify with uncanny accuracy and resolution.

Thanks to Marshall’s aggressive development of the technique—along with Nobel Prize-winning advances in

ionization methods—the field of Fourier transform-based spectrometry has exploded over the years. The technique is used to study of a wide range of macromolecules, from proteins to explosives to pharmaceuticals. Petroleum, formed miles beneath the Earth’s surface from ancient algae and zooplankton, is the most complex organic material on the planet, and thus a natural target for his analytical tool, Marshall said.

“In 70 million years,” said Marshall, “at high temperature and pressure, nature has made just about every possible combination of atoms in these molecules, up to a certain size.”

Marshall’s group has amassed a database of 60,000 different substances they have detected in crude oil. The group pioneered, and continues to dominate, the field of petroleomics—the study of crude oil.

### ● BAD APPLES

In some ways, crude oil is actually quite simple, made up mostly of hydrogen and carbon atoms. But they can be arranged in a seemingly infinite variety of ways. And a sprinkling of trouble-causing ingredients (sulfur, nitrogen and oxygen are the primary culprits) keeps things interesting for chemists—and creates headaches for oil companies. In mega molecules dominated by hard-working, energy-producing, hydrogen and carbon, a few bad atoms have the potential to spoil the whole bunch.

Sulfur is a harmful pollutant, tightly controlled by the Environmental Protection Agency. Oxygen can rust pipes; nitrogen clogs them up, and pollutes as well.

The first step in getting rid of these problem atoms is finding them. Where in the molecular maze of C’s and H’s, of chains and rings and double and single bonds, are those offending N’s, S’s and O’s hiding out?

Despite the advances brought by Marshall’s technique,

PHOTO: NATIONAL HIGH MAGNETIC FIELD LABORATORY

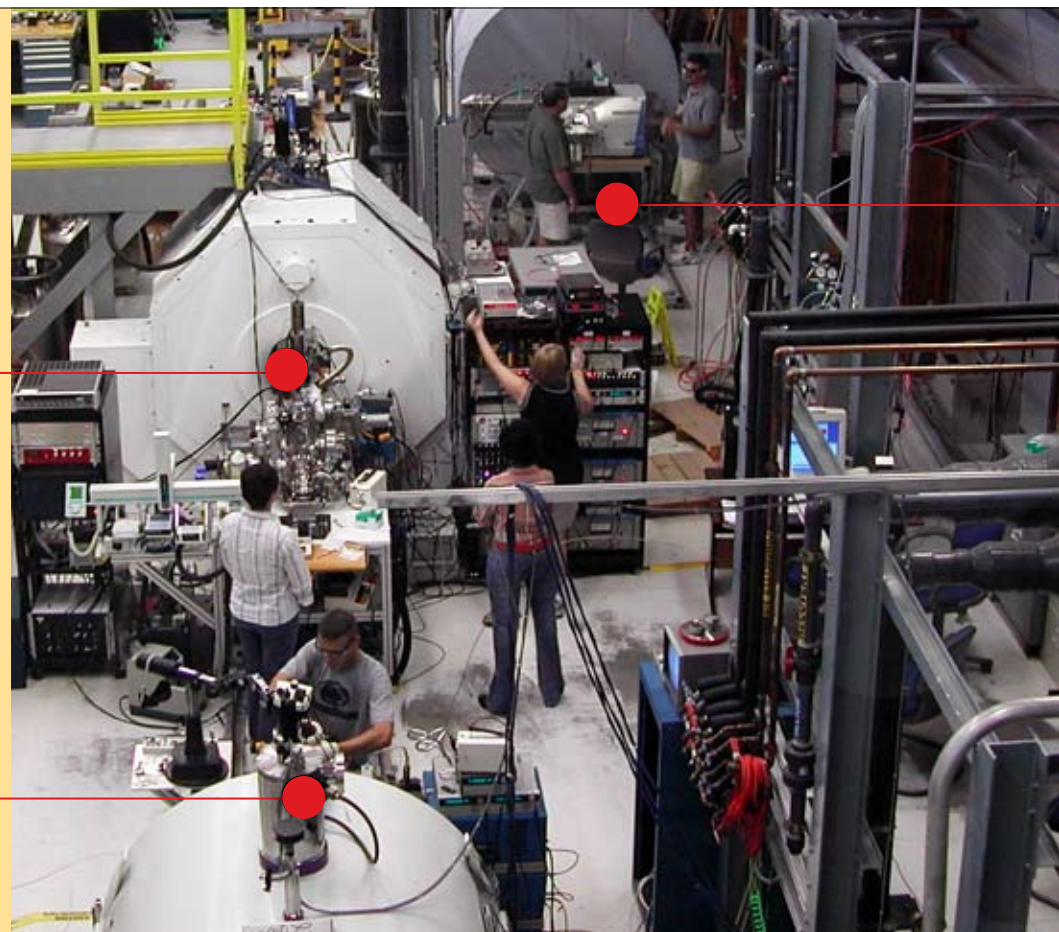


**CRUDE SAMPLES:** Graduate student Amy McKenna places a sample into the 14.5 Tesla FT-ICR mass spectrometer, the most powerful instrument of its kind in the world.

PHOTO: RAY STANWARD

# THE MARSHALL LAB

NATIONAL HIGH MAGNETIC FIELD LABORATORY



**9.5  
TESLA  
MAGNET**

**14.5  
TESLA  
MAGNET**

**SCIENTISTS AT WORK** in the ICR bay at the National High Magnetic Field Laboratory. Included in the space are three FT-ICR mass spectrometers.



**9.5  
TESLA  
MAGNET**

it still can take weeks of sorting through the mountain of data produced—studying and calculating, juggling Excel spreadsheets and Access databases—to completely figure out what’s in a sample of crude. The speed of Marshall’s machines was of little use if it took months to figure out what the data meant. Oil companies needed to make critical decisions much faster than that. “They need the information *now*,” said Rodgers.

Marshall’s team eventually solved the problem by developing a set of powerful algorithms that a computer can use to deftly cut through the maze of data quickly and efficiently. The software has the potential to revolutionize the process of characterizing crude oil, Marshall believes.

“If you’re interested in sulfur-containing molecules, we can zoom in on just those,” explained Marshall. “If it’s acids, we can zoom in on just those. So we can pick out particular things, particular components that have the properties you’re interested in.”

In 2008 Marshall’s lab signed a licensing agreement with a California-based software firm, Sierra Analytics. The company’s main job is to take the powerful software developed by Marshall’s group, put it on the market, and keep it current through close ties with Marshall’s team.

Sierra Analytics president David Stranz said his customers are flooded to find out that manual analyses that previously took months to complete could, with the new software, be churned out in minutes.

That type of turn-around can save oil companies significant time and money. A sample extracted from deep at sea, for example, could be sent ashore for testing. Within days the company would know whether to keep drilling—or cut bait and hunt elsewhere. Companies can also monitor their work in real time, periodically analyzing the oil as they refine it and fine-tuning their techniques accordingly.

“I think the most exciting thing about it is that, for the first time, we’re taking research in a very complicated area and making it commercially accessible,” said Stranz. “Because of the difficulty of getting the information out of the data, it’s been pretty much unattractive for oil companies to get into the business of analyzing this data themselves.”

As expertise trickles down from academia to industry, the consumer stands to benefit from not just lower prices, but a cleaner environment, as well. In some of the heavier crude oils, up to half of what’s pumped out ends up as trash.

“This stuff doesn’t boil,” said Rodgers. “If they don’t

PHOTO: NATIONAL HIGH MAGNETIC FIELD LABORATORY

find something to do with this material, they’re going to bury it.” The more a company knows about its crude oil, the more efficiently and effectively it can process it.

Marshall’s technique can also disclose the origin of oil seepages (natural or man-made?) and provide information on how it diffuses in water and degrades on land. And by pinpointing the nitrogen and oxygen in a sample, the reports help companies get rid of these destructive substances, thus lowering the chance of oil spills by preventing blocked and corroded pipes. Rodgers calls it good molecular management.

## ● LAB TO REAL LIFE

The collaboration benefits the company with an exciting new product in a market that stands to mushroom as drillable petroleum reserves become harder to find. And it benefits the university by creating greater visibility in a vital worldwide industry for research conducted at the mag lab. Still, those benefits are eclipsed, Marshall says, by the good that will come of getting the powerful new tool in the hands of those who can make the best use of it.

“We don’t want to be the only ones in the world that can do this,” said Marshall. “We want everybody to be able to do that.”

“Helping the oil companies does help at the pump, but it also makes them better stewards of the resources they’re taking from the ground,” Rodgers said. “So hopefully we’re helping them use them as wisely as possible.”

Few scientists ever see their basic research bear practical fruit. Marshall, as busy as ever at 64, has experienced that satisfaction. The small ripple of an idea that first occurred to him as a 20-something professor gradually grew into a wave that revolutionized analytical chemistry. That wave has now washed over from academia into industry. If it fulfills its promise, it will ultimately lap across the toes of every consumer on the planet. It’s a feat Marshall can be reminded of every time he fills up the tank of his red sports car.

Recalling those early days when his now snowy moustache was still dark brown, Marshall allows himself a satisfied grin.

“We started this in ’73,” he says, crow’s feet crinkling, papers piled high around him in his mag lab corner office. “That’s 35 years. Good thing I was 30 at the time.”

PHOTO: ISTOCK





Thomas Middleton  
*is rediscovered as the  
Bard's genuine peer.*

**G**ary Taylor's eureka moment came inside a rare books room in a library at Oxford in 1985. Reading a passage from a play written nearly four centuries earlier by a little-known contemporary of Shakespeare's, Taylor found himself laughing out loud.

"And I started wondering," he remembers. "Why isn't this stuff better known? I have a Ph.D. in English literature—why have I never read all this? Why haven't I been told about all these characters?"

And so it was that an idea was born. At the time Taylor, now the George Edgar Matthew Professor of English at Florida State, was working with another Shakespeare scholar at Oxford to publish a new volume of the collected works of Shakespeare.

# The Other Shakespeare

BY ROBERT POOL

But suddenly, Taylor knew what his next project would be. He was compelled to introduce the world to this devilishly clever writer whose name, for reasons he couldn't grasp, was all but forgotten.

Taylor didn't realize the full significance of his find back then, but he soon learned that Shakespeare had a genuine peer—a contemporary whose works at the time were just as popular and who also was every bit as prolific and witty as the Bard himself.

Taylor had found Thomas Middleton, the figure he likes to call “our other Shakespeare.” With the 2007 release of the first-ever single-volume collection of Middleton's entire canon—at least what has been found—along with a volume of commentary, Taylor has taken the first major step toward reacquainting the world with the man who rivaled the most celebrated talent in English letters.

## Curtains Rise on New Entertainment

Middleton's story starts in London where he was born in 1580, just as the city was about to embark on what Taylor calls “an incredible flowering of playwriting” that lasted about 40 years.

The best-known name from that era was, of course, William Shakespeare, who produced his plays from about 1590 to 1613, but there were many others, including Ben Jonson, Christopher Marlowe, and John Fletcher. By the early part of the 1600s, London had around 20 professional playwrights—men who made their living writing plays—as well as a great many nonprofessionals who wrote plays but who either supported themselves with another job or were independently wealthy. At this time London was a city of only

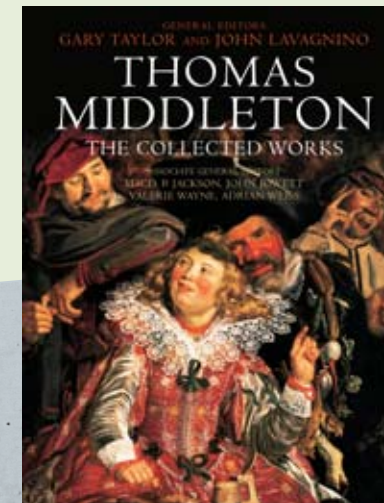
about 200,000 people, so the number—and the quality—of the playwrights was in retrospect quite astonishing, said Taylor.

Taylor ascribes this flowering to the creation of a new “niche.” In evolutionary biology, when a new ecological niche appears, a number of new species develop to fill that niche, and the same thing happened in London in the late 1500s. For the first time London had enough people to support a regular theater business. The city had recently doubled in size, as people flocked to it from the countryside, and these people had

### GARY TAYLOR ▼



PHOTO: RAY STANFORD



SHAKESPEARE'S SWAN THEATRE (below) as sketched by Johannes De Witt, a Dutch traveler who created the drawing while visiting London in 1596. (left) *The Collected Works of Thomas Middleton*. Taylor, who co-edited the volume, likes to call Middleton, a popular writer, songwriter, choreographer and playwright of his era, “our other Shakespeare.”

little entertainment—no newspapers, no books or magazines, and certainly no television or Internet. To meet this need for entertainment, the idea of a commercial theater grew up. In the past, entertainers had offered their performances in public and hoped that people liked it enough to pay them. “Now people were coming into a building to be entertained,” Taylor said. “They were paying in advance without knowing whether they'd like it or not. This was a completely new approach to commercial entertainment.”

The popularity of the theaters grew quickly. By the early 1600s, London had three or four theaters operating six days a week. A play would generally be performed once or at most a few times, and the theater would then offer something else, which led to a “ferocious demand for new plays,” Taylor said. For the first time in history it became possible to make a living writing plays, and so it was that the profession of playwright appeared.

With so much work available, London developed a high concentration of talented playwrights who lived and worked in a relatively small area. These writers knew each other and were constantly learning from one another, each seeing what worked—and what didn't—in the others' work and using that knowledge to improve their own writing. They also collaborated regularly, and many of the plays of that time were the product of two or more authors, Taylor said.

It was just such a collaboration that led Taylor to his eureka moment.

## Unearthing Middleton

Taylor had come to England's Cambridge University (from U. Kansas) in pursuit of a doctorate in English. His first job found him working at Oxford University Press as one

of two general editors on a massive new collected works of Shakespeare. He was something of a prodigy, landing the plum job straight out of graduate school and, eight years later, publishing the master work when he was still just 33.

In 1984, as he was tying up some loose ends for the collected works, he tackled one of the long-standing mysteries about Shakespeare's plays: *Was Measure for Measure* written completely by the Bard, or were pieces of it written by someone else? The only surviving version of the play contained a song written by someone else, prompting scholars to wonder if the play had been modified after Shakespeare's death. Looking into it further, Taylor and his co-editor were convinced that, like *Macbeth*, *Measure for Measure* had indeed been revised by someone after Shakespeare died. The question then was who.

There were only three possible candidates, Taylor said, and if the question came up today, deciding among them would be a relatively simple manner. Because the works of Shakespeare and other writers of the era are now available on literature databases, one can do computer searches to

of his plays in graduate school, but he had never realized just how much Middleton had written or just how good it was. It was passages from Middleton's plays that had him laughing out loud. "These plays were fabulous."

But if the only way to read all this Middleton was to find a well-stocked rare books library and camp out there, few were likely to share his experience, Taylor realized. Shakespeare's collected works had been available in a single edition since the *First Folio* was published in 1623. Jonson, Fletcher and other London writers of the era had had collected works published, but not Middleton. Taylor decided that this was an oversight that needed correcting, and even before the new collected works of Shakespeare was published in 1986, he had a contract with Oxford University Press to publish a parallel volume of the collected works of Thomas Middleton.

The project would take him 22 years and a team of 74 contributors from 12 countries to complete, but in late 2007, the Oxford press released the 2,018-page, seven-pound *Thomas Middleton: The Collected Works*. Taylor's

of the next 15 years Thomas watched his mother fight with his stepfather over these funds both in and out of court. Meanwhile he was receiving the literature-heavy education of a London grammar school, reading and writing in several languages. Afterward he spent several terms at Queen's College at Oxford, but he left before graduating.

With little left of his inheritance, Middleton had to find a way to support himself, and he explored a number of approaches, most of them related to writing. Early on he wrote and published three long poems, none of which was particularly successful, but one did have the distinction of being publicly burned because it had offended the Archbishop of Canterbury and the Bishop of London. Middleton was only 19 at the time, and this willingness to tweak religious, political, and other sensitivities would be a hallmark of his writing throughout his career.

Middleton found more success with the publications known as Renaissance pamphlets. These were somewhat lengthy documents—generally about the size of a long magazine article today—that could be on any subject,

fiction or nonfiction, written in prose or a mixture of prose and poetry. They were sold unbound—binding was extra, performed by a separate guild—and, in an era with no newspapers, no magazines, no novels, they were the main way the public satisfied its appetite for the latest writings. Middleton's pamphlets, which tended to be what Taylor describes as "experimental fiction," earned him a decent living and today are seen as some of the best examples of the genre from that time.

Middleton was even better known during his day as the writer of many so-called "Lord Mayor" shows. These were Renaissance-era London's version of the Super Bowl halftime show—large public spectacles held once a year and performed in front of stadium-size audiences. The shows were produced to mark the introduction of a new lord mayor for the city of London. Middleton, Taylor said, was considered to be his era's best writer of these pageants.

Middleton was a songwriter and choreographer as well. He wrote the most popular theatrical song of that period and two of his dances were among the most popular of the era.

“But if the only way to read all this Middleton WAS TO FIND A WELL-STOCKED RARE BOOKS LIBRARY AND CAMP OUT THERE, few were likely to share his experience, Taylor realized.”

look for similarities in wording and determine the most likely author of a particular passage. But such databases were not available in 1984, which left Taylor and his collaborators with the task of doing the same sort of analysis by hand. They memorized the bits in question from *Measure for Measure* and set out to read everything they could find from the three candidates in hopes of discovering passages that were similar to those in Shakespeare's play.

By 1985, the evidence was overwhelming that Thomas Middleton, one of Shakespeare's peers in the London writing community, had rewritten parts of *Measure for Measure* after Shakespeare's death. Mystery solved. Taylor documented his discovery, and he moved on to other tasks necessary for finishing the book.

But he couldn't forget Middleton. Reading everything he could find by Middleton in the rare books room of the Oxford library had been a revelation. He had read a couple

co-editor for this mammoth work was John Lavignino, a lecturer in the Centre for Computing in the Humanities, King's College London.

## Middleton the Man

One of Taylor's first tasks was to develop a biography of Middleton. Who was this person, and what were his influences? By collecting existing information and uncovering some new details about Middleton's life, Taylor was able to sketch out a reasonably detailed picture of his life.

Middleton was born in London in April 1580. His father, William Middleton, was a prosperous businessman who died when Thomas was five. His mother, Anne, quickly remarried, and Thomas's stepfather was soon trying to get his hands on his stepchildren's inheritance. For much

**BALCONY VIEW:** London in the early 17th century, looking at St Paul's cathedral from the south bank of the Thames. The image, based on a painting by Claude de Jongh, is featured on the cover of *The Oxford Shakespeare: The Complete Works*, which Taylor co-edited.



But more than anything else, Middleton built a reputation as a dramatist. Between 1603 and 1624 Middleton wrote or co-wrote more than 30 plays that survive today and that can be definitively attributed to him. A number of his plays have been lost, Taylor said, including several whose titles survive but nothing else, and attribution has been a problem on a number of plays.

Perhaps the best example, Taylor found, is *The Revenger's Tragedy*, which for 200 years was recognized as one of the finest tragedies of that era but whose authorship was uncertain. It was only in the 1970s that experts in the field came to agree that the play was Middleton's. In his work preparing Middleton's collected works, Taylor had to address a number of such issues. He solidified the case for Middleton being an author of a tragedy called *The Bloody Banquet*, for example, and showed that another play was not his work.

## The Bard's Peer

Having studied Middleton's plays exhaustively, Taylor revealed a list of characteristics that sets Middleton apart from every other playwright from that era besides Shakespeare.

Middleton and Shakespeare are the only playwrights from that day who wrote plays that are still considered masterpieces in each of the four major genres: comedy, tragedy, history, and tragicomedy. When *The English Treasury of Wit and Language*, a compilation of popular quotations from English plays, was published in 1655, Middleton and Shakespeare had far more quotations than any other writer; depending on how the quotations are counted, either Middleton slightly edges out Shakespeare, or vice versa.

And it was Middleton who wrote the all-time, number-one hit play of the era, *A Game at Chess*. That number-one status is based on a variety of measures, Taylor explains: The play had the longest initial run, it generated more contemporary comment, it was the first play to be published with an engraved title page (an option usually considered too expensive for a play), and it has far more surviving manuscripts than any other play from that time, indicating that interest in the play was particularly high at the time that it was being performed. There are certainly some measures by which Shakespeare beats out Middleton—no Middleton play got printed as many times as Shakespeare's *Henry IV, Part 1*, for example—but together the two men stood by themselves atop the Renaissance-era playwrighting heap.

## Different Takes on Life & Sex

*Thomas Middleton: The Collected Works* contains poems, pamphlets, pageants, and the 35 plays that Middleton is known to have written or co-written. The volume finally makes it possible to properly assess Middleton and, in particular, to see how he compares with Shakespeare, Taylor said.

What is known beyond any doubt about the two is that they collaborated on at least one play (*Timon of Athens*). Despite that, the research shows that Middleton and Shakespeare shared far more differences than similarities—in just about everything.

Shakespeare liked to write about royalty and heroic figures—think of the various historical kings (John, Richard II and III, Henry IV, V, VI, and VIII), of *King Lear*, *Hamlet*, *Macbeth*, *Julius Caesar*, and *Anthony and Cleopatra*. Middleton, by contrast, focused mainly on the middle class and the working class. “His characters have jobs, and they worry where the money is coming from,” Taylor said. “They are closer to the contemporary reader's experience of the world.”

Similarly, Shakespeare liked to write “big roles for big characters,” he said. Shakespeare's company featured the actor Richard Burbage, a major star of the time, and Shakespeare wrote many of his trademark soliloquies for him. “Middleton's plays are much more about people in groups and how people interact with each other,” said Taylor. Instead of soliloquies, Middleton's calling card was his asides, where a character spoke his thoughts aloud for the audience to hear. Middleton was also far more interested than Shakespeare in religious, political, and cultural issues.

But perhaps the most obvious difference to anyone who reads a few plays by each of the writers is how they handle love and sex. “Shakespeare is interested in women who are virgins and in falling in love and first relationships,” Taylor said. Think of *Romeo and Juliet* or even *The Taming of the Shrew*. Middleton's plays involve characters who have moved well past those first innocent moments.

“Middleton was very interested in sex,” Taylor explained. “Any kind of sex you can think of—and some you might prefer not to think about—you can find in Middleton. But it's never just sex.”

Middleton liked to examine how sex interacts with all the other aspects of human life—political, economic, psychological, and religious. “He saw sex as central to human

experience.” For example, in *The Changeling*, a woman uses the promise of sex to convince an admirer to kill her fiancé so that she is free to marry the man she loves. In *A Trick to Catch the Old One*, a young man deep in debt conspires with his ex-mistress to use her wiles (and sex) to trick an old moneylender into paying off the man's debts.

Shakespeare's plays did have plenty of sexual slang and innuendo, Taylor notes, but Middleton was much more explicit and used a variety of tricks to get as close as possible to actually portraying sex onstage. In *The Changeling*, the stage instructions call for the main female lead, Beatrice, to drop her glove and her admirer, De Flores, to pick it up after she has gone and thrust his fingers into it. “It's like watching sex,” Taylor quipped. In another Middleton play, *A Mad World, My Masters*, the audience can hear two lovers having sex just offstage.



## Dramatic Demise

The two playwrights provide very different views of the human experience, Taylor said. Shakespeare was more of the establishment playwright, while Middleton “was pushing the limits from the time he was 19.” Indeed, his career was cut short by reactions to the satirical (and enormously popular) *A Game at Chess*, a thinly veiled attack on Catholicism, the king of Spain, and the king's sympathizers in England.

Using a law that prohibited the portrayal of any modern Christian king on stage, England's Privy Council shut down the theater that was showing the play, fined Middleton and the actors, and forbade any further performance of the work. Middleton never wrote another play, and some have speculated that this was part of his agreement with the council to avoid further punishment. In 1620, Middleton was appointed official chronologer for the City of London, a post he held until his death at age 47 in 1627.

In the following decades, Middleton's plays were performed less and less often. “They were particularly hard to

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“Shakespeare is interested in women WHO ARE VIRGINS AND IN FALLING IN LOVE... Middleton's plays involve characters WHO HAVE MOVED WELL PAST THOSE FIRST INNOCENT MOMENTS.”





# IN DEFENSE OF SELF-DEFENSE

A landmark case comes down on the side of Americans' individual right to arm themselves. What the best research has to say about what it all means, and why.

BY JEFF WORLEY



Last year, the U.S. Supreme Court tackled one of the most divisive and hotly debated issues in the past half century: the individual citizen's right to own a gun for personal use.

At issue was the District of Columbia's 1976 ban on handguns, the strictest gun-control law in the country, a law that banned residents from owning handguns, automatic firearms, and high-capacity semi-automatic firearms. The statute also prohibited possession of unregistered firearms.

Dick Anthony Heller, a security guard, challenged the District of Columbia's law, and his lawyers began amassing the strongest arguments from the most highly respected researchers in the country to support their client's challenge. Among those experts identified for support was Gary Kleck, a criminology professor in the College of Criminology and Criminal Justice at Florida State University.

"I didn't have any active involvement," says Kleck, sporting a tightly cropped white beard and surrounded in his Hecht House office by books on criminology, guns and violence, and criminal justice ethics. "But after the Heller challenge, I was asked every few weeks or so by his law team for reprints of my articles. They were obviously building the empirical side of the case."

On June 26, in the case of *District of Washington, D.C. v. Heller*, the Supreme Court ruled 5 to 4 to overturn the handgun ban, effectively interpreting the Second Amendment's language to include a guarantee of the right of individual Americans to bear arms. As it turned out, Kleck's research was

cited by Justice Breyer on the losing side of the case. Even so, Kleck's initials are now carved in the oak tree of Supreme Court lore.

"Oddly," says Kleck, "my work was cited by the losing side—the ones who thought the D.C. law should stand. They claimed that because there are various scholarly findings and opinions on the issue, mine being one of them, the court wasn't qualified to adjudicate anything."

This decision pleased Kleck, in part because it repealed a law that simply didn't work—the number of violent deaths in the nation's capital *increased* after the law was passed. In 1977, the first full year of the ban, the city recorded 192 homicides. The total rose to 223 in 1981, and 482 by 1991. Even as the homicide toll declined in D.C. after 1991, the percentage of killings committed with firearms remained far higher than when the ban was passed. Guns were used in 63 percent of the city's 188 slayings in 1976. Last year, out of 169 homicides, 81 percent were shootings.

Another reason Kleck applauded this decision is that, now, citizens in D.C. will be

able to legally arm themselves against criminal attack. Why is this a good thing? Through years of grueling research, Kleck has found strong evidence that crime victims who use guns during a crime are less likely to be injured or killed, and less likely to lose property than crime victims who adopt any other strategy, including non-resistance.

But doesn't this point of view run counter to claims by gun-control advocates that trying to resist a would-be criminal by using a gun defensively will just get you hurt—or killed?

"Yes," Kleck says, "it was often claimed in early pro-control propaganda that when victims attempt to use guns defensively, offenders take guns away from them and use them against the victim. That is false," he says, his tone underlining the word "false." He adds that the only quasi-factual foundation for this claim appears to be the idea that police officers are occasionally killed with their own guns. "This is extremely rare," Kleck says. "Over the period from 1997 through 2006, an annual average of 4.8 police officers in the U.S. were killed with

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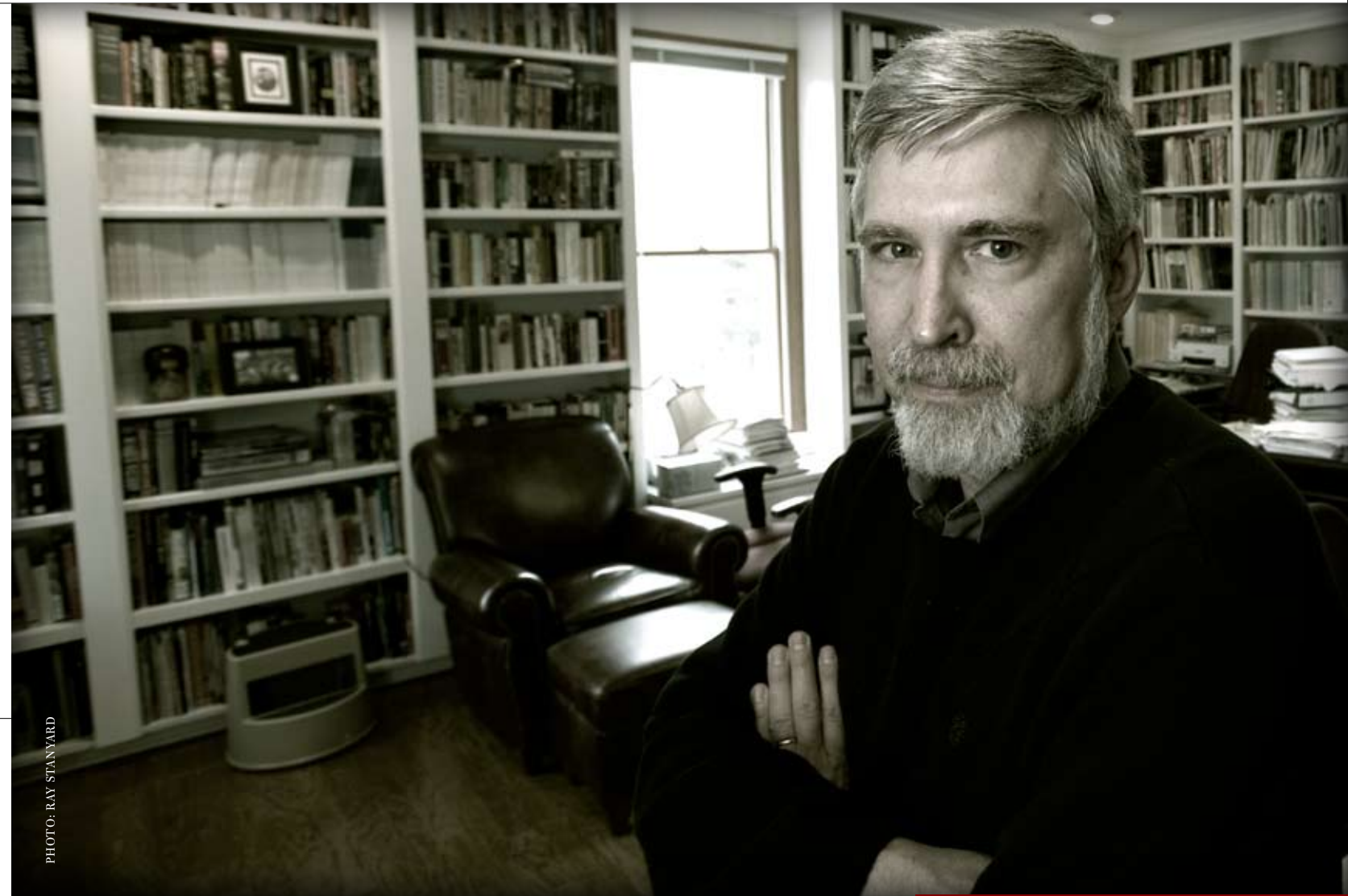


PHOTO: RAY STANFORD

**GARY KLECK**

- Born: 1951
- Native City: Lombard, Illinois
- Latest Book Published: *Armed* (Prometheus, 2001)
- Favorite Political Party: Democrat
- Hobbies: movies, building model aircraft
- Favorite writer: Thomas Pynchon
- Bonus: He juggles.

**“Oddly...my work was cited by the losing side—the ones who thought the D.C. law should stand.”**



# Gun Control: The Obama Effect?

ONLY HOURS AFTER BARACK OBAMA WAS ELECTED PRESIDENT on Nov. 4, Florida gun-dealers were swamped with hungry gun-owners trying to get guns before the government does. According to newspaper reports, fears that President-elect Obama planned to ban certain firearms had fueled a frenzy for assault weapons—AR-15s and AK-47s—and other weapons with high-capacity magazines.

There's no question Obama favors tighter restrictions on individual gun ownership. But politically, it's irrational to think that the new president will try to pry guns from the hands of the average American gun enthusiast, says the top gun control researcher in the country.

The new president has more pressing concerns, said Gary Kleck, FSU professor in criminology and criminal justice, and pushing strict gun controls would make it hard for Obama to hold coalitions together to address big issues like the nations tanking economy.


"There's no doubt he's strongly pro-control," said Gary Kleck, FSU criminologist. "But...it's not realistic in light of his clear need to build a coalition. It would be like a designed, coalition-destroying initiative to restore the assault weapons ban."

Obama worked hard during his campaign to reassure uneasy gun owners, telling his audiences that he supports an individual's right to bear arms. According to a white paper on Obama's campaign web site, "He will protect the rights of hunters and other law-abiding Americans to purchase, own, transport, and use

firearms...for hunting and target shooting." Pressed to clarify his stance during an April 2008 debate in Philadelphia, Obama told ABC News anchor Charles Gibson that he "never favored an all-out ban on handguns" but rather common-sense safety measures that keep "illegal guns" off the streets.

As a senator, Obama supported measures to ban assault weapons and a limit on an individual's handgun purchases to one a month. While gun control was not a key issue in the presidential race, the NRA advertised Obama's gun-control voting record, saying he would make "the most anti-gun president in history."

Regardless of any campaign rhetoric, Obama is unlikely to enact a gun ban or change the rights of gun owners. Obama's administration therefore isn't likely to present a challenge to last June's razor-thin Supreme Court vote that overturned the District of Columbia handgun ban, Kleck said. Nor is it likely to alter gun-control sentiments in the population as a whole.

"It's very hard to shift peoples' opinions on guns, one way or the other," Kleck said. 

CONTINUED FROM PAGE 23

their own guns, out of a total of 665,555 full-time sworn officers in the nation."

## A "BORINGLY SCHOLARLY" APPROACH

Kleck's ability to easily rattle off such stats comes from three decades of intense research on gun control, gun ownership and crime. And he is quick to point out that he didn't come to the pro side of this debate through his ideology.

"Landing on this side of the issue is the most unnatural thing in the world to me. I didn't come to this stance through my social background—I grew up in the wilds of suburbia, where guns are scarce. I'm a member of the American Civil Liberties Union, Amnesty International USA, and I'm a lifelong Democrat," he says, pausing briefly in this recitation. "I'm not now and have never been a member of the National Rifle Association, Handgun Control, Inc., and I've never received a penny in funding for research from any such organization."

Kleck makes the simple but important point that his way into this pro-handgun position is

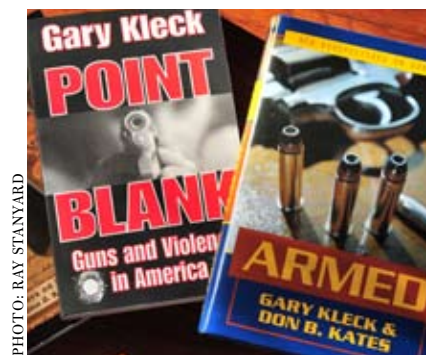


PHOTO: RAY STANFORD



PHOTO: ISTOCK

**"The simple fact is, if criminals have guns and use them in attacks on people, the victims are more likely to die."**

evidenced-based. "I'm boringly scholarly, having studied this issue for nearly 30 years." The result of this research is impressive by any standards: three books, 50 published articles in journals and in newspapers such as *The New York Times* and *The Wall Street Journal*, 10 book chapters, and 40 presented papers. Kleck has published more articles on the defensive use of guns than anyone else on the planet.

And, he adds, he's one of the media's favorite "resource persons."

"Oh yes," he says, laughing, "I'm in quite a few rolodex files under the heading 'pro gun' or 'gun-friendly.'" Sometimes, though, he disappoints pro-gun reporters, because he talks about how complicated these issues are. "Oftentimes, someone will want me to say something loud and clear and direct, like, 'Gun availability is a good thing,' but that's just not the case. Having

more guns available is a bad thing if these guns are falling into the hands of criminals."

"The simple fact is, if criminals have guns and use them in attacks on people, the victims are more likely to die." It's the "if" that Kleck has explored in hammering detail in his research.

## DISARM AT OUR PERIL?

It's no news flash, Kleck says, that firearms are heavily involved in crime in America, especially homicide.

"In 2006, about 11,600 homicides were committed by criminals armed with guns, claiming 68 percent of all homicides," he says. Based on data from the National Criminal Victimization Survey (NCVS), as many as 500,000 violent crimes were committed in the United States in 2006 by offenders armed with guns, and around 26 percent of robberies and 7 percent of assaults were committed by gun-armed offenders.

These facts have led many people to conclude that America's high rate of gun

**TARGETED READING:** Books by Gary Kleck: *Point Blank: Guns and Violence in America* (1991) and *Armed: New Perspectives on Gun Control* (2001) co-written with Don B. Kates.

ownership must be at least partially responsible for the nation's high rates of violence, or at least its high homicide rate, says Kleck, adding that this belief in a causal effect of gun levels on violent crime rates has, in turn, led many to conclude that limiting the availability of guns would substantially reduce violent crime, especially the murder rate.

"What's not so widely known, though, is that large numbers of crime victims in America also use guns in the course of crimes (but) in self-defense," says Kleck.

Based on 16 national surveys of samples

the gun for self-protection, he explains. "It wasn't using the gun that got them hurt. And once this flaw in the research was fixed, it was found that people who use guns for protection are almost never injured after that."

There's also evidence to support the common-sense belief that many criminals are deterred from robbery attempts in the first place by the possibility of victims using guns against them. "Criminals interviewed in prison indicate that they have refrained from committing crimes because they believed a potential victim might have a gun," Kleck said.

Protection of body and property are usually achieved without the victim shooting the gun and are almost always achieved without wounding or killing the criminal. "Only 24 percent of gun defenders even fired the gun (including warning shots), only 16 percent tried to shoot the perpetrator, and at most 8 percent wounded the offender," Kleck points out.

But don't guns provoke the criminal? What about the old joke punch line: Don't shoot the bear again, you'll just make him mad.

Kleck laughs. "Just not true. Victim defensive use of guns almost never angers or otherwise provokes offenders into attacking and injuring the resisting victims. It's extremely rare that once a victim shows or uses a gun, he is injured."

In any case, Kleck says, summarizing this crime scenario, it is clear that

regardless of whether victim gun use occasionally provokes the offender the net effect of victim gun use is to reduce the likelihood that the offender will hurt the victim. In a 2004 study, Kleck and his FSU colleague, Mark Gertz, a professor of criminology, analyzed data from the NCVS and found that among 45 sample cases of victims who used a gun to attack the offender, none were injured after using the gun, and of 202 sample cases of victims who used a gun to threaten the offender, just 7.7 percent were injured after using the gun.

### THE DEADLY BARGAIN

Most U.S. gun laws are aimed largely or solely at handguns. Why is this the case, and is singling out handguns an effective policy?

"One of the political temptations of

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## By the time most Americans are adults, they've heard the popular wisdom—if you try to use a gun to protect yourself, you'll only get hurt.

of the U.S. population, he continues, the evidence indicates that guns are used by victims in self-protection more often than crimes are committed by offenders using guns. Victims used guns defensively two to two-and-a-half million times in 1993, for example, compared to about 850,000 crimes in which offenders possessed guns.

But aren't these gun-toting would-be victims risking injury or death? By the time most Americans are adults, they've heard the popular wisdom—if you try to use a gun to protect yourself, you'll only get hurt.

"Well, there was a lot of early research that claimed this was the case," says Kleck, "but this research was based on a basic error—the error of what happened first." Researchers reported instances of people being hurt and using guns defensively, but these were cases where someone was first hurt and then used

Evidence also supports the hypothesis that U.S. burglars are careful to avoid residences where victims are home because they fear being shot—an estimated 46 percent of the citizens in the United States own firearms, in contrast to, for example, England, where handgun ownership was banned in 1997. While 43 percent of British residential burglaries are committed while victims are at home, only 9 percent of residential burglaries in the United States are committed under such circumstances.

"None of this evidence is strong or decisive," Kleck is quick to point out. "But we can say it is consistent with the hypothesis that criminals are deterred from attempting some crimes by the possibility of being on the wrong side of a gun."

Defensive gun use by crime victims is not only effective in preventing injury, but also in preventing property loss, Kleck has found.

**TEST YOUR GUN I.Q.**  
Think you're savvy when it comes to the politically hot topic of gun control? Take this simple true/false test to find out (answers, based on the latest research, on page 34).

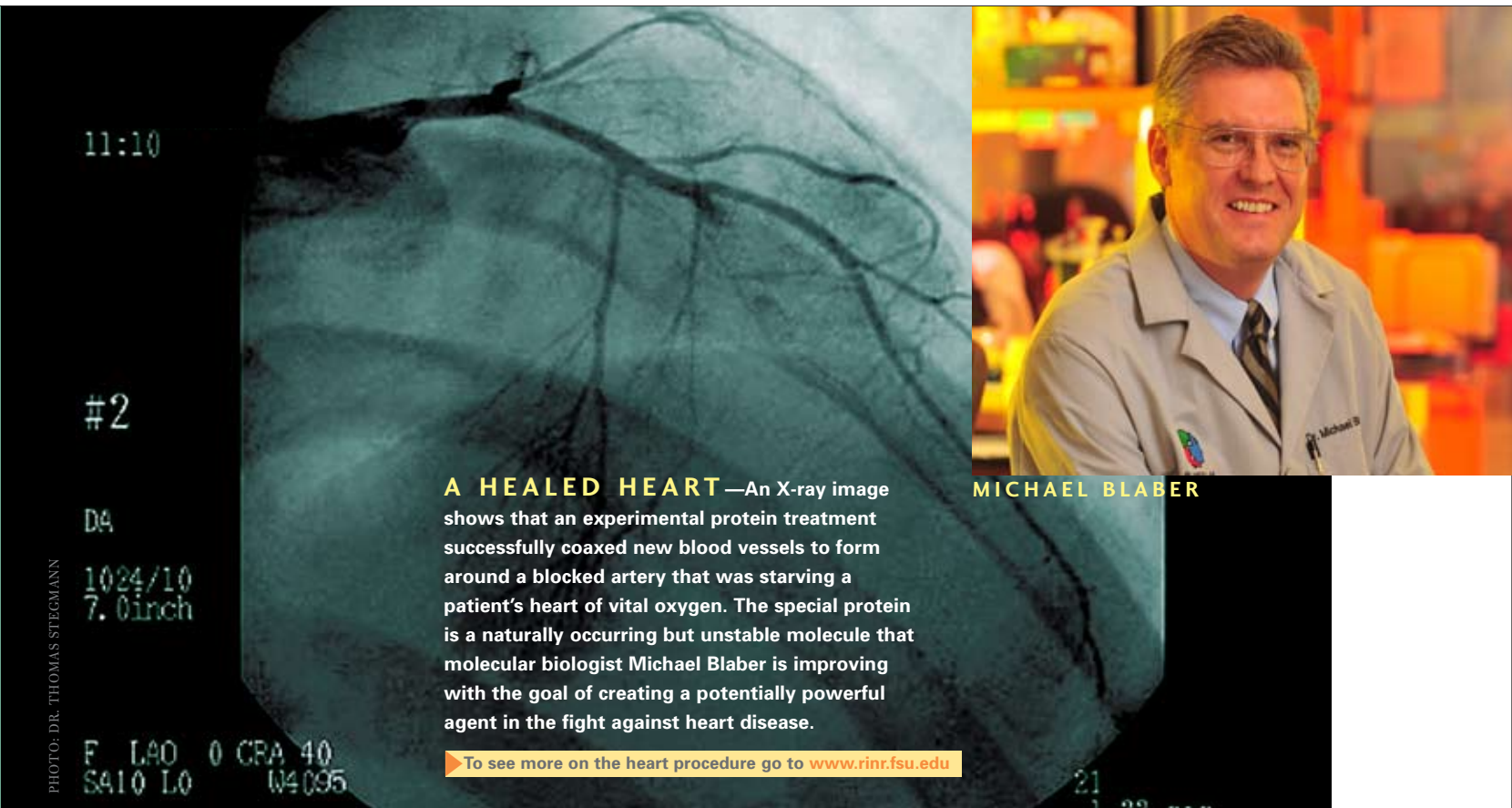
- 1** Crime victims often use personal firearms in self-defense. T • F
- 2** Rifles and shotguns are the most commonly owned firearms in the United States. T • F
- 3** The United States is the most heavily armed society in the world. T • F
- 4** Gun ownership is generally highest in those groups where violence is highest. T • F
- 5** Only a small percentage of handguns used in violent crimes can be traced to organized gun trafficking operations. T • F
- 6** Gun transactions between private citizens are subject to background checks under federal law. T • F
- 7** Most Americans oppose bans on gun ownership. T • F
- 8** Since widespread passage of "right to carry" or "shall issue" laws that make it easier for non-criminals to get permits to carry concealed weapons in public, there has been no appreciable increase in acts of violence involving permit holders. T • F
- 9** Burglars in the United States are less willing to enter occupied homes than burglars in other countries. T • F
- 10** Using a gun to resist a criminal is dangerous to your own safety. T • F



BY CHRISTINE SUH

# PROTEIN PROMISE

AN AMAZING MOLECULE SHOWS PROMISE  
IN THE FIGHT AGAINST THE  
NATION'S NO. 1 KILLER.



MICHAEL BLABER

To see more on the heart procedure go to [www.rinr.fsu.edu](http://www.rinr.fsu.edu)

**I**N THE MID-1990S, a small group of Germans whose hearts were straining to keep them alive signed up to try an experimental drug.

As the first people to try the risky treatment, the 20 patients—all suffering from severe heart disease—were facing long odds: doctors had given them two years before the disease would claim their lives.

In the U.S., despite the best modern medicine can do, heart disease kills someone every 37 seconds. The malady remains the deadliest in the country, making the search for the next great heart drug a very glum business. Patients die taking experimental drugs to give future heart disease sufferers a fighting chance.

The Germans chose that risk. So surgeons opened the patients' chests and injected directly into their hearts a compound known as fibroblast growth factor-1—a protein that induces cells to divide.

The results were both thrilling and elegant. As hoped, new vessels sprouted from existing ones, re-routed blood around the patients' coronary arteries that were blocked by fatty plaques. Oxygen-rich blood was able to flow once again to the starving parts of the patients' hearts.

After a second successful test run in Germany, fibroblast growth factor-1 was looking like a magic molecule. On that promise, early testing began in the U.S. and is still under way.

But as with any experimental therapy no matter how tantalizing, this fascinating protein known as FGF-1 has its downsides.

"As far as properties go for a drug, this one is awful," said Michael Blaber, professor of biomedical science at the College of Medicine. Perhaps most importantly, it's a finicky, unstable protein that unfurls when it gets warm.

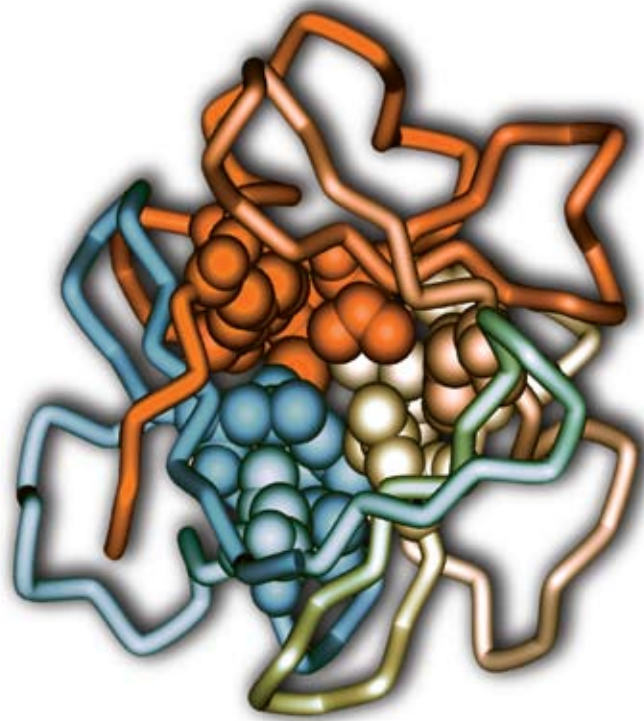
Blaber ought to know. He has been studying the protein's structure since 1994, around the same time the German trials were running. He has been tweaking the protein atom by atom to see if he could make the protein more stable, and has engineered hundreds of versions of it in the process.

"We've been just blazing away, making all kinds of mutants, asking basic biophysical questions," he said.

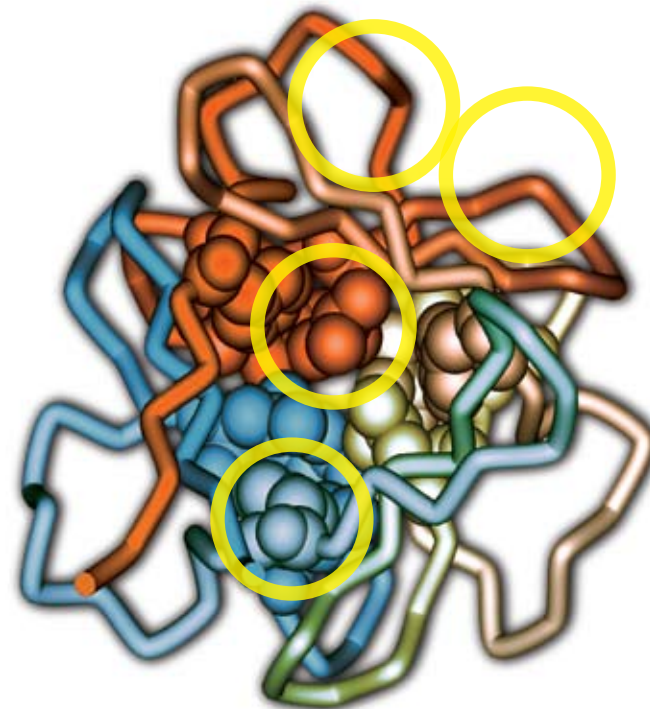
Developing a new drug was far from Blaber's mind when he first started tinkering with the problematic protein, but along the way, he just may have created one with palpable promise.



ORIGINAL



MUTANT



**W**hen Blaber was introduced to the growth-factor protein years ago, he did it out of pure, scientific curiosity. As a post-doctoral researcher, he became the first to solve the protein’s crystal structure (there are 22 types of fibroblast growth factor). He figured out that the protein’s chain of 140 amino acids fold up into a globular shape with a hollow middle and three-fold symmetry—that is, if the protein is standing on one end, it looks triangular from above.

“It was amazing to think that in living systems, part of their underlying atomic structure and basis could be something that was symmetric and absolutely wonderful, and I wanted to study that as an idea,” he said. “What are the limitations of symmetric proteins?”

Blaber became fascinated by the growth factor’s properties. The symmetry of the protein reminded him of the intricate lattices of snowflakes. He became absorbed in changing the structure to see if the symmetry somehow played a part in its stability. He wondered whether the hollow structure of the protein was responsible for its instability.

Blaber’s first hunch was that these structural factors were directly responsible for the protein’s instability.

NEW AND IMPROVED

**Top: In its native form, fibroblast growth factor-1 has shown tantalizing promise as a treatment for heart disease, but its unstable structure gives it a poor shelf life. Below: An altered version of the protein, tweaked at four key regions of the molecule, is far more stable than the original. It is one of hundreds of modified proteins molecular biologist Michael Blaber has engineered and is testing for possible use as a heart disease drug.**

ILLUSTRATIONS: COURTESY MICHAEL BLABER

“Along with that,” he said, “this architecture has not been found in bacteria. And you have bacteria that live at 100 degrees centigrade (212F). Maybe this architecture isn’t that useful to an organism that lives at 100 degrees.”

To test his theory, Blaber started with what scientists call the “wild type” protein, the native version that is found in human cells. To make lots of it, he turned bacteria into little manufacturing plants. He inserted DNA for human fibroblast growth factor-1 into bacteria to churn out the precise amino acid sequence that comprises the protein. To make different versions of it, he tweaked the DNA that programs the protein and put that modified DNA in the bacteria so they would produce the custom-designed proteins.

To test the mutants, Blaber broke open the bacteria, separated the growth factor, and heated it up. If it takes more heat to unfold the modified protein than the original, then the mutant is more stable. Thinking he might be able to improve the stability by only a little bit, Blaber started heating up his altered proteins. A few degrees later, many of them remained intact. He added more and more heat.

Blaber was stunned. He had created modified proteins that didn’t melt even as the temperature broke water’s boiling point.

“(The protein’s shape is) intrinsically capable of unbelievable stability,” he said. “We have one (modified protein) that has 18 mutations in it. It still folds up in the same architecture, and it won’t unfold even at 100 degrees centigrade.”

**A**round 2001, Blaber heard about the success of the clinical trials in Germany and quickly recognized the potentially profound implications his own work could have for the direction of research the German researchers had set.

In FGF-1, the cardiovascular surgeon who led the German trials, Dr. Thomas Stegmann, had discovered a promising drug candidate, but it was unstable, which can be a disastrous trait for a drug. The growth factor could be stabilized with the addition of heparin, a complex sugar, but the molecule is not always innocuous. Heparin has to be isolated from pigs, an expensive process, which also has the risk of being tainted by disease, Blaber said. And it causes allergic reactions in some recipients.

When it became clear that his molecules could be used to treat a deadly disease, and do it more safely than the native

protein, Blaber’s next move was to take his basic science research to the next level and apply it to something more tangible.

First, he had to start looking at function. A stable protein is useless if it no longer works the way it’s supposed to. Blaber set out to test his mutants, feeding dishes of cells with his modified proteins to see if the cells would respond the way they would to FGF-1 in its original form.

His luck held out. Despite the changes Blaber’s lab made to the protein, many of the forms still did what the wild type protein is designed to do. Not only that, but some versions caused more cell growth than the original protein.

Blaber’s mutants were looking like very promising drug candidates. But any one of them has more tests to pass. As mutants, when administered as a drug in the human body, the immune system might recognize them as a threat and mount an attack that could be harmful, even deadly. But there are ways to try to shield the altered proteins from roaming immune cells on the lookout for foreigners.

Blaber is also not the only one pursuing the perfect FGF-1. He knows of two other labs that are trying to do what he’s doing, but Blaber started long before its direct application became obvious.


“Our advantage is that we’ve been doing this for a while,” Blaber said. “We have a large body of data that will be useful. The other folks have been looking at it only in the last year or two. I think we have a great head start.”

**T**en years after the small group of Germans became the first to receive FGF-1, most had survived, elated, for a celebratory reunion hosted by the original researchers.

News reports said two had passed away from causes unrelated to their heart disease.

Though trials involving the protein have only enrolled small numbers of people, no serious side effects have emerged so far. Researchers and patients are hopeful this could be the next life-saving drug for patients suffering from heart disease.

It’s too early to tell how Blaber’s work will contribute to the development of the protein as a drug, but his research shows enough promise that a private company is investing in it to begin testing his protein forms in animals. He has filed two provisional patents for his modified proteins, with several more in the pipeline.

If the testing goes as smoothly as past trials with the protein have run, in years to come many more cardiac patients will be rejoicing literally with all their heart. 

# IN DEFENSE OF SELF-DEFENSE

CONTINUED FROM PAGE 23

handgun-only control is that it appears to be a satisfactory compromise between doing nothing about gun violence, which would alienate pro-control voters, and restricting all gun types, which would alienate many long gun owners,” Kleck states. “I think it’s a very bad idea to have stricter controls over handguns than long guns, because such controls inadvertently encourage the substitution of long guns if they are less regulated. Kleck envisions the scenario of a convicted felon buying a gun at a dealership.

Felon: “Hey, give me that .38 over there, OK?”

Gun dealer: “Great—Let’s run you through a background check.”

Felon: “Oh, never mind. I guess I want that shotgun over there instead.”

“Well, you haven’t prevented him from getting a gun,” Kleck says pointedly. “You’ve basically shifted him from the least lethal variety of gun, the handgun, and the hardest to aim accurately, to a much more lethal weapon—more accurate and though not as concealable, concealable enough.”

Kleck explains: “He can saw off part of the barrel and the stock in 10 minutes with a hacksaw and have something that’ll look just fine underneath a raincoat or a sports coat,” adding that now there would be a man on the street who has a gun that is several times more likely to kill if he shoots anybody with it.

And Kleck’s view is backed with some preliminary research he’s done. He has run statistical simulations that suggest a result of criminals substituting long guns for handguns would be more homicides. “A clear policy recommendation follows from what should be the first principle of weapons regulations: Never place restrictions on a subcategory of weapons without also placing restrictions at least as stringent on more deadly, easily substituted alternative weapons,” Kleck states strongly.

But while decision-makers ponder policy, the facts remain grim: more than 80 people die every day in the United States from gun violence, and America lives with one of the world’s worst murder records.

For Kleck, that makes both impassioned and reasoned study and debate of gun laws and violence all the more imperative. Most of all, he wants decision-makers to base policy decisions on research, not emotion. He wants them to think critically about how ineffective gun laws could produce unintended but perhaps deadly results. He asks: “Do we really want to keep a gun out of the hands of someone who might someday need it to defend his—and his family’s—life?”

## GUN I.Q. ANSWERS

[ CONTINUED FROM PAGE 23 ]

**1. True.** Many studies indicate that hundreds of thousands of law-abiding U.S. citizens use guns in self-defense. A 1993 national survey conducted by Gary Kleck, Florida State University criminologist, estimated that ordinary gun owners use their weapons to defend themselves at least two million times that year. After Kleck’s study, the Department of Justice sponsored a survey in 1994 called *Guns in America: National Survey on Private Ownership and Use of Firearms*. Using a smaller sample size than Kleck’s, the survey estimates 1.5 million defensive gun uses annually.

**2. True.** The preference for these shoulder weapons (as opposed to handguns) is rooted in the country’s agrarian past and ongoing enthusiasm for hunting and hunting-related sports, according to Kleck. Unlike European nations where a feudal history kept control of hunting land in the hands of the aristocracy, the United States has a history of wide ownership of farmland and millions of acres of public land available for hunting, making the pastime accessible for many ordinary Americans. Widespread gun ownership, then, Kleck notes, predates any push for control over firearms.

**3. True.** By all reports, the U.S. is the most armed society in the history of the world. There is a gun of some kind in almost one of every two American households. According to Kleck, at the end of 1999, there were probably more than 260 million guns in private hands in the United States. About 36 per cent of them were handguns.

**4. False.** Quite the opposite. According to Kleck, gun ownership is higher among whites than blacks, among the middle-aged than young, among the rich than poor, in rural areas than urban—patterns that are the reverse of the way that violent criminal behavior is distributed.

**5. True.** It is true that most criminals get their guns outside of licensed and regulated channels—but not from gunrunners. According to Kleck’s research, such large-scale illicit gun trafficking organizations are rare, and they add only a tiny share (under 1 per cent) to the stock of guns available to American criminals. Instead, most criminals acquire their guns through theft (as in a residential burglary) and from private parties as gifts or as purchases from other criminals who have stolen or found a gun).

**6. False.** There is no federal law requiring checks for such transactions between private citizens, nor is there a national registry of guns or gun owners. However, anyone purchasing a gun of any kind from a licensed dealer must pass a background check for a criminal conviction and other disqualifying attributes. At the same

time, a number of federal laws control gun possession: It is unlawful for a convicted felon to purchase a gun or for a dealer to sell a gun to a felon; it is unlawful for any convicted felon to possess a gun of any kind, regardless of how it was obtained; and it is unlawful, everywhere in the United States, for a juvenile to possess a handgun, and unlawful to sell guns to juveniles.

**7. True.** According to Kleck, most Americans oppose bans on ownership of major categories of guns, but support a wide variety of moderate regulatory measures aimed at keeping guns away from criminals.

**8. True.** Between 1986 and 1998, 22 states amended their gun laws to make it easier for non-criminal adult residents to get permits allowing them to carry concealed firearms in public places. Critics of these laws feared that the increase in legally authorized gun carriers would result in increased acts of violence involving permit holders. But Kleck found statewide data on permit revocations in Florida that indicates that only about eight persons a year had their carry permits revoked due to a gun crime conviction, compared to 194,356 people holding permits on September 30, 1995.

**9. True.** According to Kleck, most Americans take it for granted that a burglar won’t burglarize them when they’re home. Only about 12 percent of U.S. burglaries take place when people are home, compared to 40 to 50 percent in England, Canada, and the Netherlands, where gun laws are more restrictive and ownership is much lower.

**10. False.** Kleck has found that no forms of armed resistance provoked criminals into attacking and injuring victims in a substantial number of crimes. When victims who resist are hurt, it usually has been an injury that came first (before the victim tried to resist). Injury after resisting offenders occurred in fewer than 3 percent of all those who resisted, and the few injuries that were inflicted were usually no more serious than cuts and bruises, Kleck found.

### Scoring:

**7-10 correct: *Congrats—you know your gun facts!***

**4-6 correct: *Surprised?***

**3-0 correct: *You’re not alone.***

## THE OTHER CONTINUED FROM PAGE 23

performed less and less often. “They were particularly hard to perform after 1680, when censors became more hostile to sexuality,” Taylor said.

The main reason for Middleton’s disappearance, however, was something else altogether. When Shakespeare died, he left a very profitable company behind that performed his plays on a regular basis. It was an early case of “artistic branding”—think Walt Disney or Steven Spielberg—and thus it was no accident that 36 of Shakespeare’s plays were collected and published in the *First Folio* (1623) within a decade of his death.

Middleton, by contrast, was a freelancer who wrote for a wide variety of theatrical companies (including Shakespeare’s). “Nobody owned him, no one had an economic incentive to invest in him as their flagship writer,” Taylor said. Thus Middleton’s work was never collected and published in one place like the work of Shakespeare or other contemporaries. Decades or centuries later, when plays from the Renaissance era were performed, they tended to be plays that had been published in big collections and were easily accessible—plays by Shakespeare, Jonson, and Fletcher, but not Middleton.

This is the oversight that Taylor hopes to correct 380 years after the fact. “If there had been a Middleton *First Folio*, English literature could have had a very different history,” he said, but better late than never. The publication of Middleton’s collected works, along with the accompanying book of commentary, will move Middleton beyond a tiny group of specialists and into the mainstream of English literature, Taylor predicts.

For 20 years now, Taylor has been teaching Middleton and Shakespeare side by side to the students in his English classes. He knows that some students will always prefer Shakespeare; others Middleton. But he’s convinced that it is nothing more than historical accident that causes the world’s playhouses to regularly put on *Julius Caesar* or *A Midsummer Night’s Dream* rather than *The Revenger’s Tragedy* or *A Chaste Maid in Cheapside*.

Will the name Thomas Middleton ever rival that of the storied Bard of Avon? Taylor says that a Middleton revival already is under way, thanks to his and his colleagues’ hard work.

“For two years I told my collaborators ‘Yes we can!’ Now I can finally tell them ‘Yes we did!’ And I can tell everyone, ‘Yes we will!’ The new edition will change—is already changing—how people think about Middleton, about Shakespeare, about the whole history of English literature.”



**FLORIDA VOICES OF THE NEW DEAL**

*Looking for the New Deal: Florida Women's Letters During the Great Depression* Edited by Elna C. Green: The University of South Carolina Press, 2007, 243 pages, \$39.95

Comparing the Great Recession of the late 2000s to the Great Depression of the 1930s is a popular parlor game these days. The similarities are even more striking when you focus on Florida.

The Depression kicked Florida when it was down. When things went south economically in 1933, the state had the southeast's highest unemployment rate and had just suffered two major hurricanes, a land boom and subsequent bust, and the inauspicious arrival of the Mediterranean fruit fly. The homeless and jobless considered it a relatively good place to live, because at least it was warm, and they crossed the border at the rate of about a hundred per day.

By the time Franklin D. Roosevelt took office and the New Deal was signed into law in 1933, the women of Florida had come to see both their president and Florida governor Doyle Car-

lton almost in *loco parentis*. Both had campaigned tirelessly and Carlton often visited their hometowns, and many felt they knew them and could count on them to help with almost anything: finding work, getting short- or long-term loans, buying land, getting a husband out of jail, forcing dead-beat dads to pay child support, qualifying for widow's pensions. So hundreds of them put pen to paper and asked.

Women of every background, race and socioeconomic situation wrote letters to Tallahassee and Washington during 1933-40, the years covered in this book, which is itself a part of a series "Women's Diaries and Letters of the South" by The University of South Carolina Press.

Very often, instead of addressing the president or governor directly, they appealed to the men's wives. Women wrote to Eleanor Roosevelt asking her to slip her husband their letters over breakfast and personally intervene on their behalf. In letter after letter, they detailed their previous efforts to help themselves, indicating that their appeals to her were a last desperate resort. They wrote as though their letters would be read, their stories remembered and their requests fulfilled. "I sent the President an Easter Card and poem—wonder if he read it," one wrote.

*Looking for the New Deal* is plaintive and heartbreaking. Reading it gives you an idea of what might be in many of those emails showing up in the White House today as the nation ponders another deal for yet a new day of dire need.

—Kim MacQueen



**A LIFE WITH CREEPY-CRAWLIES**

*"Stalking the Plumed Serpent and Other Adventures in Herpetology,"* by D. Bruce Means: Pineapple Press, Inc., 2008, 238 pages, \$19.95.

Bank on it: when Bruce Means, renowned herpetologist and former director of the Tall Timbers Research Station near Tallahassee, visits a wild place, he will find something of note. Lucky for us, he takes us along—and it's the ride of a lifetime.

Drawing heavily on his field notes, Means leads us through some of the finest "froggy/lizardy/snakey/insecty-looking habitat" in the Americas and Australia. We share his delight as he discovers that frogs eat bats, cottonmouths don't really chase people, and some rattlesnakes are "as placid as dishrags."

Means' focus amid chaos is impressive. In one episode he escapes the eruption of a volcano, only to pause mid-flight to write about the event, as ash and embers fall all around him.

He needs that calmness in the face of danger, because his excitement at the prospect of nabbing a prime specimen often gets the better of him. Means seems heedless of his own safety—reaching deep into black water where snapping turtles lurk, pouncing on a venomous snake while wearing shorts and sandals—and although he chides himself after every risky encounter, he dives into the next one with the same gusto.

But the real value of his close calls isn't the adrenaline rush. It's the chance to meet little-known species up close and learn about how they live. With familiarity comes appreciation, he hopes; and he gives us ample cause to celebrate the creepy-crawly creatures he loves.

"Finding snakes is like catching fish," Means writes. "Some days you don't get a bite. Other days you fill the boat."

In this book, Means fills the boat and then some.

—Cherie Winner



PROFESSOR OF MECHANICAL ENGINEERING  
**FARRUKH ALVI**

PHOTO: RAY STANFORD

**ABOUT A HALF CENTURY AGO** from Florida's Cape Canaveral, the United States launched its first satellite—and the space industry boomed. But the aging workforce and shuttle fleet along with a faded and sometimes controversial public image has left the state's place in aerospace on shaky ground.

Today, Florida's aerospace industry along with its sister sector, aviation, rank third in the country, with 83,000 employees. That could drop as the shuttles and many workers retire with few young engineers entering the field, which lost its sheen years ago. Yet the need for more efficient, lighter jets, new spacecraft, quieter airplanes and alternative fuels continues to grow.

Having spent the past 15 years

at the Florida A&M University-Florida State University College of Engineering, mechanical engineering professor Farrukh Alvi was well positioned to observe these trends—and do something about them.

"We (in Florida) have this expertise, and I knew what else was out there nationwide," Alvi said. "I knew that if we collaborated, we could be as good as any other group."

In a turbulent economy, Alvi applied last year for funding to create the Florida Center for Advanced Aero-Propulsion, a center to serve as the go-to group in key aerospace and aviation areas for the state, private industry and government organizations such as NASA and the military.

"Perhaps I was naïve, and that's why I kept going," he said.

In fact, naivety would play no part in the proposal. The legislature jumped on Alvi's plan, giving it a \$13 million budget for the next three years and ranking it second out of more than 40 candidates vying for support from the state's Center of Excellence initiative that funds emerging technology research programs.

Alvi is now director of the center, which joins researchers at FSU, Embry-Riddle Aeronautical University, the University of Central Florida and the University of Florida. Alvi's own lab will contribute its nationally recognized expertise in the areas of noise and flow control. He remains optimistic despite recent bad news that the center will have to absorb a \$3.6 million cut by the Florida Legislature: "We will try to do 80

to 90 percent of what we said we wanted to do with 75 percent of the funding," he said.

Although the center will have to trim some programs like student outreach, their core mission remains strong: growing the research of scientists and faculty "because that's what develops technology and attracts industry."

Alvi admits engineers have been talking about a revolution in the aerospace and aviation industries for a long time. But researchers are solving many problems that were impediments to dramatic improvements, he says, with a few key technologies still in the works. When all the pieces—including a better economy—align, Alvi predicts the center will be in a strong position to help the long-anticipated, air revolution finally lift off.—C.S.

**Farrukh Alvi**, professor of mechanical engineering, earned his Ph.D. in mechanical engineering from Pennsylvania State University in 1992. In 2007 he was named director of the newly created Florida Center for Advanced Aero-Propulsion, which joins researchers at FSU, the University of Central Florida, the University of Florida and Embry-Riddle Aeronautical University.