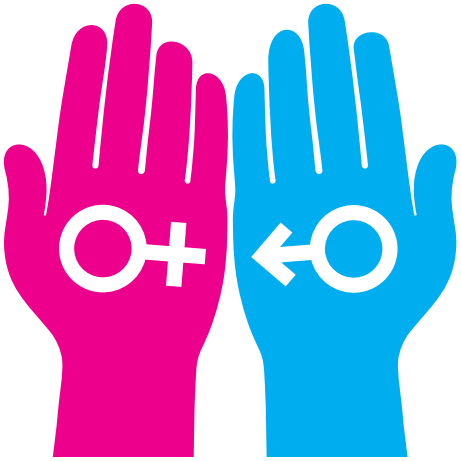
# Extracts

*College of Medicine*

## Ring finger proportions offer health insights



**Biologists at the University of Florida have found a reason why men's ring fingers are generally longer than their index fingers — and why the reverse usually holds true for women.**

The finding could help medical professionals understand the origin of behavior and disease, which may be useful for customizing treatments or assessing risks in context with specific medical conditions.

Writing in the *Proceedings of the National Academy of Sciences*, developmental biologists Martin Cohn and Zhengui Zheng of the Howard Hughes Medical Institute and the Department of Molecular Genetics and Microbiology at the UF College of Medicine, show that male and female digit proportions are determined by the balance of sex hormones during early embryonic development. Differences in how these hormones activate receptors in males and females affect the growth of specific digits.

The discovery provides a genetic explanation for a raft of studies that link finger proportions with traits ranging from sperm counts, aggression, musical ability, sexual orientation and sports prowess to health problems such as autism, depression, heart attack and breast cancer.

It has long been suspected that the digit ratio is influenced by sex hormones, but until now direct experimental evidence was lacking.

"The discovery that growth of the developing digits is controlled directly by androgen and estrogen receptor activity confirms that finger proportions are a lifelong signature of our early hormonal milieu," Cohn said. "In addition to understanding the basis of one of the more bizarre differences between the sexes, it's exciting to think that our fingers can tell us something about the signals that we were exposed to during a short period of our time in the womb. There is growing evidence that a number of adult diseases have fetal origins. With the new data, we've shown that the digit ratio reflects one's prenatal androgen and estrogen activity, and that could have some explanatory power."

Cohn and Zheng, also members of the UF Genetics Institute, found that the developing digits of male and female mouse embryos are packed with receptors for sex hormones. By following the prenatal development of the limb buds of mice, which have a digit length ratio similar to humans, the scientists controlled the gene signaling effects of androgen — also known as testosterone — and estrogen.

Essentially, more androgen equated to a proportionally longer fourth digit. More estrogen resulted in a feminized appearance. The study uncovered how these hormonal signals govern the rate at which skeletal precursor cells divide, and showed that different finger bones have different levels of sensitivity to androgen and estrogen.

Since Roman times, people have associated the hand's fourth digit with the wearing of rings. In many cultures, a proportionally longer ring finger in men has been taken as a sign of fertility.

"I've been struggling to understand this trait since 1998," said John T. Manning, a professor at Swansea University in the United Kingdom, who was not involved in the current research. "When I read this study, I thought, thank goodness, we've attracted the attention of a developmental biologist with all the sophisticated techniques of molecular genetics and biology."

In dozens of papers and two books, including the seminal "Digit Ratio" in 2002, Manning has studied the meaning of the relative lengths of second and fourth digits in humans, known to scientists as the 2D:4D ratio.

"When Zheng and Cohn blocked testosterone receptors, they got a female digit ratio," Manning said. "When they added testosterone they got super male ratios, and when they added estrogen, super female ratios. And they've provided us with a list of 19 genes that are sensitive to prenatal testosterone and prenatal estrogen.

"I find this completely convincing and very useful," Manning said. "We can now be more focused in our examination of the links between digit ratio and sex-dependent behaviors, diseases of the immune system, cardiovascular disorders and a number of cancers."

Cohn, who uses the tools of genetics, genomics and molecular biology to study limb development, said his lab began studying the digit ratios after Zheng became determined to find an explanation.

"He suggested that the 2D:4D ratio would be an interesting question, and I have to admit to being skeptical," Cohn said. "When he came back with the initial results, I was blown away. We looked at each other's hands, then got busy planning the next experiment."

The National Institute of Environmental Health Sciences and the Howard Hughes Medical Institute supported this research.

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*John Pastor*

Scan the QR code with your smartphone to see video about this research.

# Tundra Fires Could Accelerate Climate Warming

**After a 10,000-year absence, wildfires have returned to the Arctic tundra, and a University of Florida study shows that their impact could extend far beyond the areas blackened by flames.**

In a study published in the journal *Nature* in July, UF ecologist Michelle Mack and a team of scientists including fellow UF ecologist Ted Schuur quantified the amount of soil-bound carbon released into the atmosphere in the 2007 Anaktuvuk River fire, which covered more than 400 square miles on the North Slope of Alaska's Brooks Range. The 2.1 million metric tons of carbon released in the fire — roughly twice the amount of greenhouse gases put out by the city of Miami in a year — is significant enough to suggest that Arctic fires could impact the global climate, said Mack, an associate professor of ecosystem ecology in UF's department of biology.

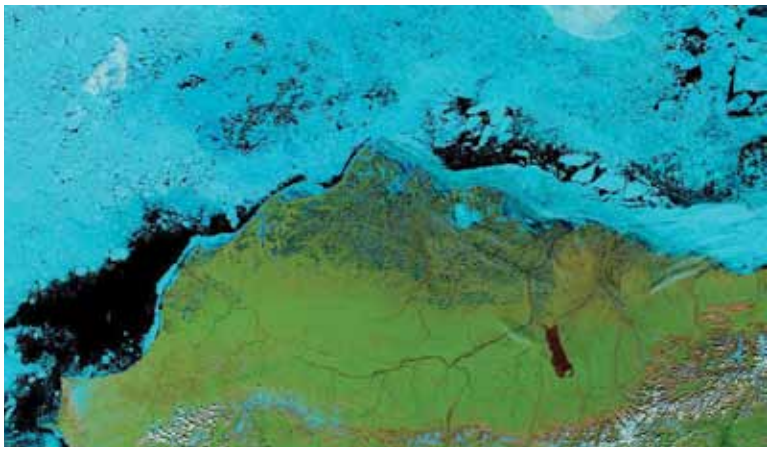
"The 2007 fire was the canary in the coal mine," Mack said. "In this wilderness, hundreds of miles away from the nearest city or source of pollution, we're seeing the effects of a warming atmosphere. It's a wakeup call that the Arctic carbon cycle could change rapidly, and we need to know what the consequences will be."

Smoke from the fire pumped greenhouse gases into the atmosphere, but that's just one part of a tundra fire's potential impact. The fire also consumed up to 30 percent of the insulating layer of organic matter that protects the permafrost beneath the tundra's shrub- and moss-covered landscape.

In a pine forest, fire would burn up leaf litter on the ground but not the soil beneath. Because the Arctic tundra has a carbon-rich, peaty soil, however, the ground itself is combustible, and when the fire recedes, some of the soil is gone. In a double whammy, the vulnerable permafrost is not only more exposed but also covered by blackened ground, which absorbs more of the sun's heat and could accelerate thawing.

"When the permafrost warms, microbes will begin to decompose that organic matter and could release even more carbon that's been stored in the permafrost for hundreds or thousands of years into the atmosphere," Mack said. "If that huge stock of carbon is released, it could increase atmospheric carbon dioxide drastically."

The study shows how isolated fires can have a widespread impact, said University of Alaska biology Professor Terry Chapin. "When you think about the massive carbon stocks and massive area of tundra throughout the world, and its increasing vulnerability to fire as climate warms, it suggests that fire may become the dominant factor that governs the future carbon balance of this biome," Chapin said. "The paper by Michelle and her colleagues raises this possibility for the first time. It presents a very different perspective on the way in which climate change may affect this biome in the future."



NASA

*This image from NASA's MODIS satellite shows the North Slope of Alaska and the Anaktuvuk River, with the scar from a 2007 fire clearly visible in the lower right quadrant.*

Using radiocarbon dating, co-author Schuur and researchers from the University of Alaska Fairbanks, the Alaska Fire Service and Woods Hole Marine Biological Laboratory found that carbon up to 50 years old had been burned in the 2007 fire.

Mack also developed a new method that can now be used by other tundra researchers to measure soil loss. By comparing the tussocks of sedge plants, which resprout after a fire, Mack was able to quantify soil heights and densities before and after the burn.

Mack hopes her findings will open a dialogue about how tundra fires are managed. Because the Anaktuvuk River fire was in a wilderness area, it was not suppressed or contained. With better data on the long-term impact of tundra fire on global climate warming, Mack says, putting out these fires might become more of a priority.

"This fire was a big wakeup call, and it can happen again, not just in Alaska but in other parts of the Arctic, like Canada and Russia," Mack said. "Suppressing a fire in the wilderness is costly, but what if the fire causes the permafrost to melt? We need to have that discussion."

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*Alisson Clark*

# Extracts

*Florida Museum of Natural History*

## Study finds cats are mockingbird nests' number one predator

A new study by researchers at the Florida Museum of Natural History indicates that cats are the dominant predator to mockingbird nests in urban areas.

Using small security cameras, researchers filmed northern mockingbird nests in urban and natural habitats around the vicinity of Gainesville, Fla., during the nesting seasons from 2007 to 2009. They found that cats were responsible for more than 70 percent of the predator attacks on mockingbird nests.

The 57 incidents captured on tape showed that Cooper's hawks were the most successful mockingbird nest predators in rural areas. But cats were the most common nest predators in urban areas.

The study focused on mockingbirds, but the researchers said that it could be assumed that the cats were predating other songbirds' nests in similar numbers.

Most of the attacks happened at night, which made it difficult to determine if the cats were feral or domesticated. However, the researchers said that some of the cats were wearing collars.

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*Danielle Torrent*

*Post-doctoral researcher Christine Stracey prepares to weigh a mockingbird hatchling in a Gainesville residential neighborhood in 2007 as part of a study showing that cats are the dominant predator to mockingbird eggs and nestlings in urban areas. The study used video cameras to monitor nest predators.*

*College of Liberal Arts and Sciences*

## Lava Deposits Reveal Haiti's Geological Roots

UF geologists analyzing samples from an ancient volcanic eruption in Haiti were surprised to find that portions of Hispaniola's rocky interior actually originated from a source more than 1,000 miles away.

When the team first collected the samples more than 20 years ago, they noticed that the lava had higher levels of alkaline elements than the surrounding volcanic rock and lavas typically found in the Caribbean. But the technology available at that time could yield no deeper analysis to explain the anomaly, so the samples were shelved.

In 2004 the UF geology department purchased a state-of-the-art plasma mass spectrometer that could break down the samples to their most basic atomic ingredients. Those basic ingredients include unique isotope ratios and trace elements — sort of an "inorganic DNA"— that can be used to trace a sample back to its original source.

Researchers using the new equipment recently reexamined the samples and traced them to bedrock underlying much of Central and South America.

The geologists suspect that tens of millions of years ago portions of the earth's mantle underlying what is now Central and South America became embedded in Hispaniola's landmass as the Caribbean tectonic plate shifted eastward between North and South America. The hitchhiking mantle rock melted and erupted to the surface as lava less than 1 million years ago when fault lines crossing Haiti violently ripped open.

The researchers say that the volcanic eruptions in Haiti 1 million years ago were unusual because all other active volcanism in that area appears to have stopped more than 30 million years ago.

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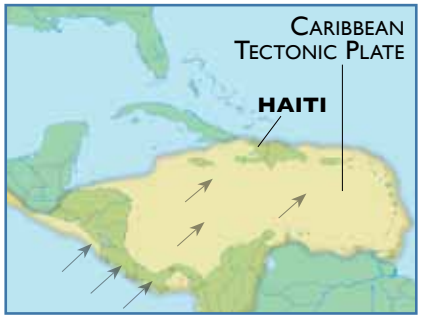
*Donna Hesterman*




*Research by two UF geologists has found that the rocks underlying the island of Hispaniola, home to Haiti and the Dominican Republic, actually migrated more than 1,000 miles during the breakup of the supercontinent Gondwana tens of millions of years ago.*

## A New Option for Control of Feral Cats

**UF researchers, in collaboration with the U.S. Department of Agriculture, report that a single-dose contraceptive vaccine effectively controls fertility in adult female cats for up to five years.**

Because feral cats do not typically live more than five years in the wild, the researchers said that the period of effectiveness should be enough to reduce feral cat numbers in most cases. The drug is not intended for use in pets because pet owners prefer their cats to be sterilized permanently.

The vaccine, GonaCon, is already registered by the Environmental Protection Agency for use in controlling fertility in white-tailed deer, and the researchers said that they hope the drug will soon be approved for cats.

Current trap-neuter-return methods for controlling feral cat populations are expensive and labor-intensive. Although surgical sterilization offers the benefit of permanent infertility, there are many regions in the United States and internationally that lack adequate access to spay and neuter services to humanely manage cats in their communities. A single-dose vaccine would likely be a welcome addition to the more costly, time-consuming methods and surgical programs currently employed by municipalities across the country.

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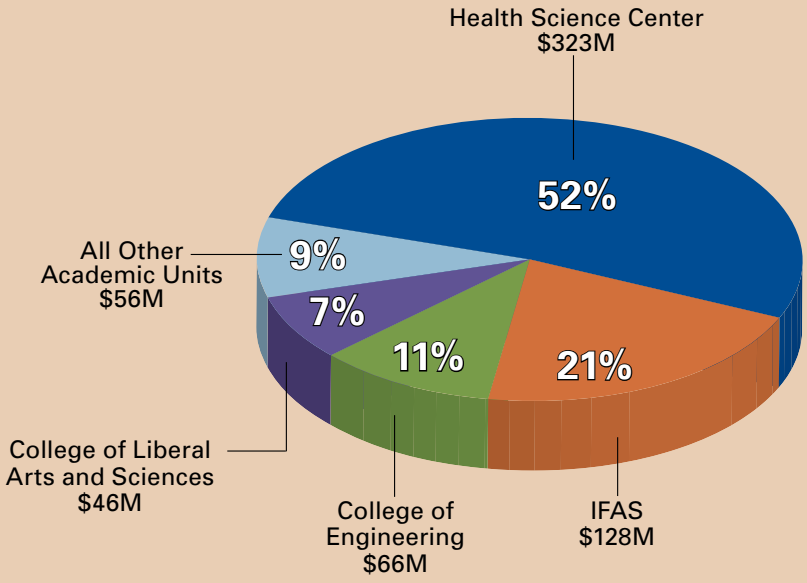
*Sarah Carey*

*Dr. Julie Levy of the UF College of Veterinary Medicine led a study showing that a single-dose contraceptive vaccination could aid efforts to humanely manage free-roaming cat populations in the United States.*

Scan the QR code with your smartphone to see video about this research.

## UF Research Funding at $619 million for 2011




A banner year for the Institute of Food and Agricultural Sciences brought in $128 million, a 25-percent increase over 2010 funding. Total research funding for the university was down by 8.7 percent from last year due mostly to reductions in federal stimulus spending.

# Extracts

*Center of Excellence in Marine Genomics*

## Researchers Revamp the Mollusks Family Tree

Seemingly simple animals like snails and squid have ransacked the genetic toolkit over the last half billion years to find different ways to build complex brains, nervous systems and shells.

Using genomics and computational approaches, an international team of researchers, including a UF neuroscientist with the Whitney Laboratory for Marine Bioscience, has reconstructed the evolutionary history of the entire phylum Mollusca. Mollusca includes more than 100,000 living species, ranging from giant squid to microscopic marine worm-like creatures.

One of the surprising outcomes of the study suggests that the formation of a complex brain in mollusks has independently occurred at least four times during the course of evolution — a finding that may prove useful to regenerative medicine scientists trying to develop new ways to help people with degenerative brain diseases.

By looking at the genomic data collected from the various classes and families of mollusks, the scientists were able to better understand the relationships between worm-like aplacophorans, slugs and snails, octopuses and squid, and a variety of shell-producing creatures.

Researchers extracted RNAs from dozens of marine organisms for sequencing and backed that information with all publicly banked data, revealing for the first time a blueprint of the molluscan life history on Earth.

*Leonid Moroz*

The study noted that cephalopod mollusks — octopuses and squid that are known for intelligence — represent one of the earliest branches of shelled mollusks, while simpler mollusks such as clams and oysters evolved later.

Organisms like sea slugs and the octopuses are thought to be good biomedical models for understanding learning, memory and disease in people, the researchers said.

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*John Pastor*

*College of Agriculture and Life Sciences*

## Making Plastics from Yard Waste

Plastic may compete with paper in the grocery line, but it doesn't have to compete with the world's food supply, according to University of Florida researchers.

They've developed a way to produce plastic that doesn't use valuable natural resources, such as food or fuel, for raw materials.

The new method uses a strain of bacteria to create bioplastic from discarded plant material, such as yard waste.

Bioplastic, or plastic from renewable resources, is produced when an organism such as a bacterium creates lactic acid while fermenting carbohydrates. The lactic acid can then be converted into long chains of molecules to form plastic.

Current bioplastic production uses food carbohydrates, such as cane sugar or corn starch, as raw materials. Traditional plastic production requires petroleum.

Keelnatham Shanmugam, a UF microbiology and cell science professor, Lonnie Ingram, a distinguished professor in microbiology and cell science, and their co-workers made the development. Their research appeared in the *Journal of Industrial Microbiology and Biotechnology*.

"As we start using more and more bioplastics, we are infringing upon the use of food material," said Shanmugam. "We'd like to switch away from food-based carbohydrates to non-food-based carbohydrates for producing plastics."

Using discarded plant material to produce plastic helps keep commodity prices down. The plastic produced from the process is both biodegradable and recyclable, Shanmugam said.

In the study, the researchers tested the bacterium

*Keelnatham Shanmugam, a microbiology and cell science professor, is developing ways to make plastics out of organic material like yard waste.*

## Acoustic Monitors Could Help Grape Growers Thrive

**Help may be on the way for grape growers in the southeast battling a crop-devouring pest called the grape root borer.**

The grape root borer, a wasp-looking moth, lays its eggs on the leaves of grapevines along the east coast from Virginia to Florida. When the eggs hatch, hungry little larvae drop to the ground, tunnel down to the plant's roots and devour major portions of the plant's root system — depriving the vine of the nourishment it needs to thrive.

Once the larvae have eaten their fill, they burrow back to the surface, transform into their adult moth form and begin the cycle anew by laying eggs on the leaves.

Growers have few defenses against the pest. The only pesticide known to be effective against the moth is also toxic to birds, fish and bees. And mounding — piling up dirt near the base of the plant stem to stop an infestation — is labor intensive.

But what if you could tell exactly where the moth larvae were feasting?

UF researchers recently tested a device previously used to detect pests in grain silos to see if it could also help grape growers in their battle against the root borer. The device, called an accelerometer, "listens" for telltale sounds of munching and crunching underground.

After testing the device in vineyards in Florahome and Lithia, Florida, the researchers determined that the device could not tell a root borer from other subterranean insects. However, it could be used to determine which areas were pest-free, and that could reduce the number of plants that require mounding by as much as 75% — a substantial savings in time and money for growers in the southeast.


Richard Mankin

*A field researcher listens to the accelerometer in a Florida vineyard.*

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*Mickie Anderson*

— *Bacillus coagulans* strain 36D1 — for its ability to produce lactic acid in a variety of conditions typical of bioplastic production. The bacterium was collected from a geyser in Calistoga, Calif., which was one of the many places the researchers sampled for bacteria.

Previous attempts to produce lactic acid from discarded plant materials using microorganisms have not yielded enough lactic acid and weren't cost effective.

However, Shanmugam and Ingram found that by adding calcium carbonate to the process, they achieved lactic acid yields as high as those achieved by organisms that fermented food carbohydrates.

Additionally, the heat-tolerant bacterial strain also cut production costs significantly by allowing the process to run at a higher temperature, which reduced the amount of expensive, plant-digesting enzymes required by up to four times.

Cost savings are also achieved by eliminating the need for food carbohydrates as raw materials since discarded plant waste is less expensive. For example, using straw as a raw material is 13 times less expensive than sugar and five times less expensive than corn or wheat.

Mark Ou, a UF biological scientist and the study's lead author, said increases in oil prices over the last several years have led to more interest in petroleum alternatives for plastic production.

"If we can save some of our oil and turn our plants into our plastic cups and packaging, then we can increase our national security by reducing our dependence on foreign oil," Ou said.

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*Robert H. Wells*

# Extracts

College of Engineering

## Discovery could make LEDs more affordable

University of Florida researchers may help resolve the public debate over America's future light source of choice: Edison's incandescent bulb or the more energy-efficient compact fluorescent lamp.

It could be neither.

Instead, America's future lighting needs may be supplied by a new breed of light-emitting diode, or LED, that conjures light from the invisible world of quantum dots.

According to an article in the journal *Nature Photonics*, moving a QD LED from the lab to market is a step closer to reality thanks to a new manufacturing process pioneered by two research teams in UF's Department of Materials Science and Engineering.

"Our work paves the way to manufacture efficient and stable quantum dot-based LEDs with really low cost, which is very important if we want to see widespread commercial use of these LEDs in large-area, full-color flat-panel displays or as solid-state lighting sources to replace the existing incandescent and fluorescent lights," said Jiangeng Xue, the research leader and an associate professor of materials science and engineering "Manufacturing costs will be significantly reduced for these solution-processed devices, compared to the conventional way of making semiconductor LED devices."

A significant part of the research carried out by Xue's team focused on improving existing organic LEDs. These semiconductors are multilayered structures made up of paper-thin organic materials, such as polymer plastics, used to light up display systems in computer monitors, television screens, as well as smaller devices such as MP3 players, mobile phones, watches and other handheld electronic devices. OLEDs are also becoming more popular with manufacturers because they use less power and generate crisper, brighter images than those produced by conventional LCDs (liquid crystal displays). Ultra-thin OLED panels are also used as replacements for traditional light bulbs and may be the next big thing in 3-D imaging.

Complementing Xue's team is another headed by Paul Holloway, distinguished professor of materials science and engineering at UF, which delved into quantum dots, or QDs. These nanoparticles are tiny crystals just a few nanometers (billionths of a meter) wide, comprised of a combination of sulfur, zinc, selenium and cadmium atoms. When excited by electricity, QDs emit an array of colored light. The individual colors vary depending on the size of the dots. Tuning, or "adjusting," the colors is achieved by controlling the size of the QDs during the synthetic process.

By integrating the work of both teams, researchers created a high-performance hybrid LED, comprised of both organic and QD-based layers. Until recently, however, engineers at UF and elsewhere have been vexed by a manufacturing problem that hindered commercial development. An industrial process known as vacuum deposition is the common way to put the necessary organic molecules in place to carry electricity into the QDs. However, a different manufacturing process, called spin-coating, is used to create a very thin layer of QDs. Having to use two separate processes slows down production and drives up manufacturing costs.

John Jernigan

*Ying Zheng, vice president and chief engineer at NanoPhotonica, demonstrates color-saturated light emission from quantum dot LEDs.*

According to the *Nature Photonics* article, UF researchers overcame this obstacle with a patented device structure that allows for depositing all the particles and molecules needed onto the LED entirely with spin-coating. Such a device structure also yields significantly improved device efficiency and lifetime compared to previously reported QD-based LED devices.

Spin-coating may not be the final manufacturing solution, however.

"In terms of actual product manufacturing, there are many other high throughput, continuous "roll-to-roll" printing or coating processes that we could use to fabricate large area displays or lighting devices," Xue said. "That will remain as a future research and development topic for the university and a start-up company, NanoPhotonica, that has licensed the technology and is in the midst of a technology development program to capitalize on the manufacturing breakthrough."

Other co-authors of this article are Lei Qian and Ying Zheng, two postdoctoral fellows who worked with the professors on this research. The UF research teams received funding from the Army Research Office, the U.S. Department of Energy, and the Florida Energy Systems Consortium.

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*John Dunn*

*U.S. News and World Report* quoted UF economics professor, Stanley Smith, in an article about the 10 U.S. cities with the oldest average populations. Five of the cities were in Florida.

The article reported that some cities' mean ages rise because young people move away, but that isn't the case in Florida. Florida's average age is higher because many people move there to retire. Smith cited Florida's low taxes as a draw for retirees. The article said that older people tend to flock to cities with an abundance of retirement communities, pleasant weather and amenities that appeal to seniors.

The *New York Times* reported the results of a study by Stephen Grobmyer, director of the UF Breast Center that showed surgical breast biopsies were being used too extensively.

Needle biopsies are safer, less invasive and cheaper than surgical biopsies, according to the article, but doctors are opting for surgical biopsies at three times the rate current medical guidelines would suggest.

The article reported that Grobmyer and his colleagues started the research because they kept seeing patients referred from other hospitals who had undergone surgical biopsies when a needle biopsy should have been used.

The article suggested that doctors are choosing surgery over needle biopsies because they do not want to refer their patient to a radiologist and lose the biopsy fee.

Zhong-Ren Peng, chairman of UF's Department of Urban and Regional Planning, was quoted in a *National Geographic News* article about the 2011 winner of the Sustainable Transport Award.

Peng is an expert in transportation planning in China. In the article he said that the city of Guangzhou did a lot of work upgrading its infrastructure when it was preparing to host the Asian Games November 2010.

Guangzhou received the award in recognition of its state-of-the-art bus system, which ties in with the city rail network, and an abundance of tree-lined bike paths that make the city greener and more accessible for citizens at every income level.

Scott Tomar, UF professor of dentistry, was quoted in a *Wall Street Journal* article that announced the federal government was lowering its recommended limit for the amount of fluoride to be added to U.S. water supplies.

A five-year study conducted by the Centers for Disease Control and Prevention found that many kids between the ages of 8 and 12 were showing signs of dental fluorosis, a condition caused by an excess of fluoride in the diets of children under the age of 8.

The condition is not harmful, but it causes spotting and streaking on the teeth because fluoride causes the tooth enamel to become more opaque and dense. Tomar said that extra fluoride doesn't affect adult teeth because their enamel is already formed.

An article in the *London Telegraph* tells the true story that inspired the Warner Brothers film, "Dolphin Tale."

The film's star, a dolphin named Winter, was brought as a baby to an aquarium in Clearwater, Florida to be rehabilitated after an accident severed her tail from her body. While there, she was treated by a caring staff and was eventually fitted with a prosthetic tail that enabled her to learn how to swim.

The article mentions Mike Walsh, associate director of aquatic animal health at the UF College of Veterinary Medicine, who treated the young dolphin in 2005 when she was brought to the aquarium.

In the film, Harry Connick Jr. plays a character loosely based on Walsh.

*Stanley Smith*

*Scott Tomar*

*UF researchers use a thermography camera to study the effect of the prosthetic tail on Winter's sensitive skin.*