

## The shoppers' choices: Paper, plastic or Prada?

NATURE'S SECRETS  
MEG LOWMAN



WERNER VON BRAUN

Science... tells us that nothing in nature, not even the tiniest particle, can disappear without a trace.

Probably the most oft-asked question of most Carolina shoppers is "Paper or plastic?" Every grocery customer is confronted with this choice, perhaps several times per week. Given this frequency, many citizens assume the environmental and economic impacts of these materials have been carefully researched. But this is not the case. When my students researched this topic for the state of Florida, they could not find any published, peer-reviewed scientific studies where decay rates of paper versus plastic in a regional landfill were experimentally compared. (This might be a worthy science fair project.)

An average American family of four uses approximately 1,500 plastic bags per year, requiring up to 1,000 years to decompose, according to the Worldwatch Institute. Though the technology of plastic bags has advanced, some scientific studies have shown that once-promising "degradable polyethylenes" do not really break down as quickly in nature as predicted. A whopping 88.5 billion bags are utilized annually in America, but less than 10 percent are recycled. Around the globe, a staggering 500 billion plastic bags are used per year, with the majority coming to rest in landfills or littered in ecosystems where they strangle wildlife. A large mass of plastic debris swirls in the Pacific Ocean; it's estimated to be as large as Texas and is composed of plastic bits called "nurdles." This plastic trash island causes marine wildlife mortality – and also releases harmful styrene compounds into the water.

However, paper bags also pose liabilities: They require the logging of 14 million trees annually, and require excessive fossil fuels to transport them. Rather than debate the merits of "paper versus plastic," consumers should consider avoiding both. Cloth bags, including designer tote bags, are becoming the rage for all earth-friendly shoppers – to represent a personal ethic to tout logos, advertise causes or exemplify global stewardship. A new year's resolution for a shopper's stewardship campaign might be "Paper, plastic or Prada?"

Fashion designers are on the bandwagon. When British bag doyen Anya Hindmarch issued her first recycled bag several years ago, buyers queued up at 2 a.m. to purchase one of her canvas totes, notably decorated with a message: "I'm not a plastic bag." Other designers selling recyclable shopping bags include Louis Vuitton, Hermes, Prada and even Paul McCartney's daughter, Stella.

In their effort to encourage recycling, some grocery stores offer credit for returning plastic bags or discounts for using cloth bags. Show your support for Mother Nature – use recycled tote bags when shopping. The debate is no longer about paper versus plastic, but about creating a new ethic for shopping with cloth!

Meg Lowman, an N.C. State University professor and forest canopy expert, directs the N.C. Museum of Natural Sciences' Nature Research Center. Online: [www.canopymeg.com](http://www.canopymeg.com).

## REACH OUT

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# Mother Nature's steroids

N.C. State researchers find muscle-building substance in mustard greens, broccoli



PHOTOS BY LEAH CHESTER-DAVIS - N.C. STATE

Slavko Komarnytsky and Debora Esposito inspect seeds from one of the cabbage cultivars available to them for experimentation through the N.C. State cabbage germplasm collection.

BY AMBER VEVERKA  
Correspondent

It turns out Mom was right – greens really are good for us.

But what Mom didn't know is that vegetables such as kale, mustard greens and broccoli are more than just healthy foods – they may contain a substance that one day could strengthen the muscles of people suffering from debilitating disease and the effects of aging.

A team of N.C. State and Rutgers University researchers has discovered that natural steroids from plants such as mustard greens, collards and kale may hold the secret to stronger muscles, with none of the worrisome side effects of animal-derived steroids.

Debora Esposito, a postdoctoral associate at Rutgers University and N.C. State who is hosted at the NCSU Plants for Human Health Institute, and Slavko Komarnytsky, metabolic biologist and assistant professor at the N.C. State institute, together with a researcher at Rutgers, have evidence that the steroids produced by certain plants can increase lean body mass, the number of muscle fibers and the endurance of the muscles themselves.

### Nature's steroids

Mention "steroids" and "stronger muscles" and the first thing that probably comes to mind is athletes injecting themselves to gain an edge in performance. But Komarnytsky said there are countless people whose muscles have been made weak through age, long hospitalization or such diseases as cancer and muscular dystrophy who could



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The goal: Muscle help from a healthy substance that the aging and infirm can take orally.

benefit from a muscle-building substance that comes without harmful side effects.

The NCSU-Rutgers team first exposed rat muscle cell cultures to synthetically created brassinosteroids, natural plant steroids found in mustard greens, cabbage, broccoli, kale and other members of the brassica family. Then they fed the plant steroids to rats. After 24 days, they tested both the brassinosteroid-fed animals and those that got regular food.

"The (brassinosteroid-fed) animals gained more lean body mass – more muscle tissue – than the control animals," Komarnytsky said. Not only that, but rats that were fed plant steroids had larger muscle fibers and more of the type of muscle fibers that give endurance, he said. The other surprise was that the



The researchers examine the cell culture after an in vitro experiment.

plant steroids seem to be targeting a different part of the body than do traditional steroids, the type that once were derived from animals, such as testosterone.

Those steroids can come with dangerous side effects, such as an enlarged prostate, liver damage, and a surge in secondary sexual characteristics. The brassinosteroids the researchers tested don't appear to pose the same problems, Komarnytsky said, though more study is needed.

"Classic animal steroids act through an ... androgen receptor present everywhere in our body. The plant steroids don't have high affinity for those receptors," he said. "Our data suggests there is yet another unknown target in the cell... which is responsible for mus-

cle increase and muscle strength and less responsible for androgenic effects."

Next, the researchers will feed brassinosteroid extracts to horses, Esposito said. Like Komarnytsky, she began the plant steroid research at Rutgers and has continued it after a move to N.C. State. "One downside of the project so far is (the steroids) are present in plants in very low levels," she said.

The team plans to look at varieties of broccoli and other vegetables to identify which have the highest amounts of the substance.

And though eating cabbage, greens and other brassicas is certainly a healthy choice, extrapolating from the dose the rats got, it might take more than 60 pounds of the vegetables to provide a human



EMILY RASINSKI - MCT

### Brussels sprouts.

### All in the family

Vegetables in the brassica family also are called cruciferous – "cross-bearing," in Latin – because the four petals on the flowers of each often resemble a cross.

They include kale, collard greens, broccoli, Brussels sprouts, mustard greens, turnip, rutabaga, cabbage, bok choy, Napa cabbage, kohlrabi cauliflower and canola/rapeseed.

— STAFF REPORTS

with the muscle-building qualities of the concentrated steroid, the researchers said.

"Our goal is for... a person who is aging, a person who is in the hospital and cannot exercise, a person who had surgery and cannot go to the gym" to get muscle help from a healthy substance they can take orally, Esposito said.

All in all, she said, the research "looks very promising."

## Science briefs

### » Lack of prey didn't kill off Calif. saber-tooths

When prey is scarce, large carnivores may gnaw prey to the bone, wearing their teeth down in the process. A new analysis of the teeth of saber-toothed cats and American lions reveals that they did not resort to this behavior just before extinction, suggesting that lack of prey was probably not the main reason these large cats became extinct. The results, published Dec. 26 in the open access journal PLOS ONE by Larisa DeSantis of Vanderbilt University and colleagues, compares tooth-wear patterns from the fossil cats that roamed California.

The saber-toothed cat and American lion were among the largest terrestrial carnivores that lived during their time, and they went extinct along with other large animals approximately 12,000 years ago.

Previous studies have suggested many reasons for this extinction, including a changing climate, human activity and competition from humans and other animals for food, which may have grown scarce as a result of these changes.

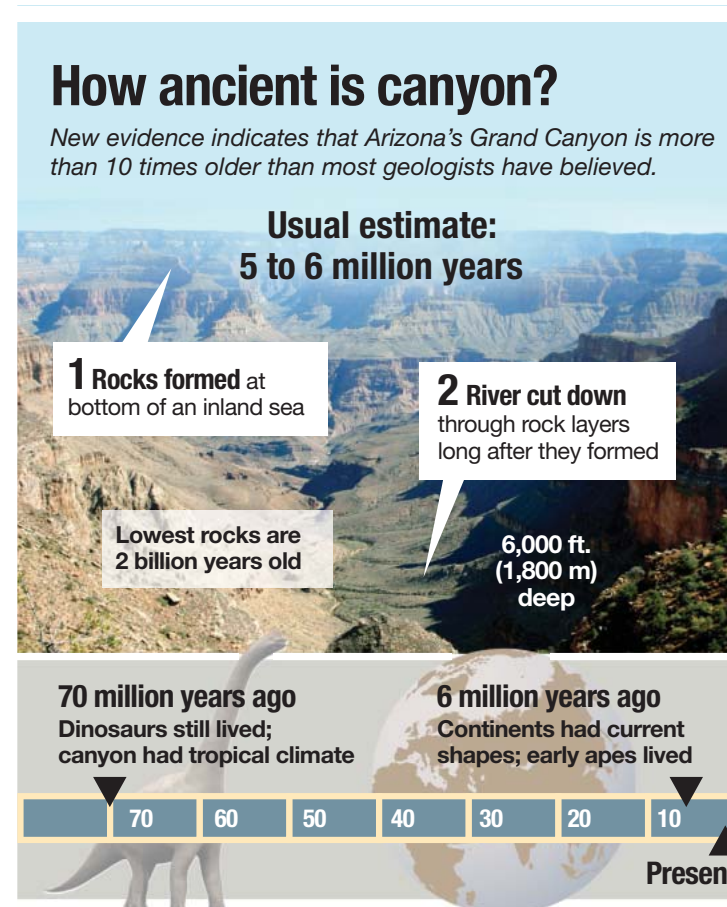
In the current study, the authors found that saber-toothed cats likely consumed carcass bones regularly, but they found no differences in bone consumption between older fossils and more recent ones. Based on this, they suggest that the cats' diet did not change significantly near the time they became extinct. In contrast, American lions did not consume much bone even near extinction and had tooth-wear patterns similar to cheetahs, who actively avoid bone in their prey.

— EUREKALER.ORG

### » Comb jellies packed with light proteins

Although comb jellies seem to be little more than tennis ball-sized blobs in the sea, these organisms are relatively sophisticated in how they use light. The creatures flash a blue-green light at predators, for example, possibly to startle them.

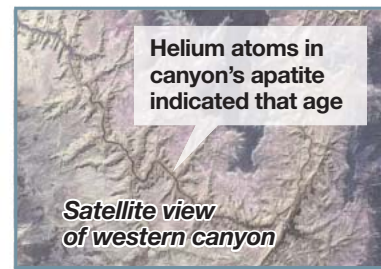
Researchers studying the genome of the comb jelly, also known as a ctenophore, have discovered that the bioluminescent creatures pack in 10 proteins for generating light. They have



### Latest estimate: 70 million years

**1** The mineral apatite contains uranium and thorium

**2** As they lose radioactivity, they release helium atoms



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Source: Rebecca Flowers of University of Colorado Boulder, Kenneth Farley of Colorado Institute of Technology, Science magazine  
Graphic: Helen Lee McComas

other proteins called opsins that detect light even though comb jellies lack eyes, the team reported Dec. 21 in BMC Biology. It's not clear what the opsins do in this animal. The genome is the first to be sequenced from a bioluminescent animal.

Because ctenophores appear to sit at the base of the animal tree of life, the findings suggest that light-generating and sensing proteins evolved at the same time as multicellularity. — SCIENCENOW

### » Piranha ancestor had quite the bite

Pound-for-pound, an ancient relative of today's piranhas had a stronger bite than gators, sharks and even the mighty Tyrannosaurus rex. That's the conclusion of field studies carried out on the

black piranha (Serrasalmus rhombus), the largest living species in the carnivorous clan (skeleton).

The largest of the 15 fish tested, a 2.4-pound specimen measuring about 14 1/2 inches long, clamped down on researchers' test equipment with a force almost 30 times its own weight – a ratio unmatched among vertebrates, researchers revealed online Dec. 20 in Scientific Reports.

Extrapolating 10 million years back, the team estimates that the jaw-tip bite force of the black piranha's extinct relative – Megapiranha paranensis, which might have reached lengths of about 4 feet 3 inches and weighed up to 160 pounds – could have been as high as 1,067 pounds. — SCIENCENOW

# Why it's so hard to grab a live fish

Sensory organs on and under their skin work to detect mechanical vibrations in water

BY BRIAN PALMER

Washington Post

Ever noticed how difficult it is to touch a fish in the water? The fish will let you get close, even reach out to touch them. But the instant before your finger can make contact, they dart off. How do they do that?

"Fish have what some people call a 'sixth sense' or 'touch at a distance,'" says Allen Mensinger, who studies how fish sense and respond to cues at the University of Minnesota at Duluth and the Marine Biological Laboratory in Woods Hole, Mass. "They can detect mechanical vibrations in the water."

Here's how it works: Fish have sensory organs known as neuromasts located both on their skin and in channels just beneath the skin. When water passes over the neuromast, it pushes hairlike cells that are surrounded by a gel called cupula. The cupula detects that the hair has been displaced and sends a signal to the brain to indicate that



AZUL

In Matthew McHenry's experiments, zebra fish swimming in complete darkness detect and evade predators three-quarters of the time.

something is moving in the water nearby.

"It's very similar to the system in the human ear," says Matthew McHenry, who studies animal sensation and movement at the University of California at Irvine. "We have cilia in our ear that are displaced by waves, sending signals to the brain to help with hearing and balance. In invertebrates, the cilia appear on the skin."

Those are the basics, but there are still several mysteries as to how fish

make this system useful. Water is always passing over a fish's skin and not always because of a predator or prey. It could be because of currents, detritus or even the movement of the fish itself.

Fish also integrate visual clues with the information they receive from their sensory system. Some fish can see predators many yards away, which helps them identify what's causing disruptions in the water as the threat approaches. But sight can't

help all of them. Many fish inhabit muddy waters and have terrible vision, yet they usually avoid predators. Some researchers think that, using their "sixth sense" alone, fish can construct a fairly detailed picture of what's approaching.

Although neuromasts are located in many places along the body, in many fish they form a straight line down the side in what is called a lateral line. "The lateral line is a sensor array, with neuromasts located in many places along the body. Fish may know that predators or prey create a characteristic wave frequency along the array, allowing them to distinguish different types of flow changes," McHenry says.

Although the lateral line seems borderline magical to humans, it has serious limitations.

"It's a short-range system," Mensinger notes. "The conventional wisdom is that fish can only use the lateral line to detect objects two body lengths away, but it's probably even less than that."

That partially explains why fish seem to wait until the last minute to flee from divers. The lateral line kicks in only as an object gets very close, triggering a fish's escape response.

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ENVISION CHARLOTTE  
UNITING FOR A SUSTAINABLE CITY

POWERING ENERGY EFFICIENCY

Duke Energy Smart Energy Now

## Charlotte Energizes Sustainability Initiative

Queen City's business district amps up efforts to reduce energy use

Charlotte's ambitious project to create the most sustainable U.S. urban center is shifting into overdrive. Envision Charlotte – sponsored by Duke Energy, Cisco Systems and Verizon Wireless – is a program to cut the Queen City's air, water and energy waste by 20 percent by 2016. A year after launch, more than 60 organizations inside the I-277 loop business district have signed on to participate.

### POWERING ENERGY EFFICIENCY

Duke Energy's Smart Energy Now® is a key component of the project. It uses a digital network to measure and display electric usage within office buildings and identifies ways to conserve. Uptown's 82,000 workers can also learn how to better manage their own energy use through interactive kiosks

placed in lobbies of participating buildings. By encouraging simple changes in their daily work habits, such as turning off lights or closing the blinds in the summer, workers can help make a big energy difference.

### DECLARING CHANGE

In addition, 32 organizations – from Bank of America to Mecklenburg County – have signed our "Declaration of Change" pledge to significantly cut their energy consumption. These listed companies are going above and beyond to reduce energy consumption and we thank them for that.

### THE FUTURE WE WANT

Envision Charlotte is promoting a healthy place to live, work and play. Together we can make a difference. For more information, visit [envisioncharlotte.com](http://envisioncharlotte.com), or follow us on Twitter: @envisioncitt or @de\_smartenergy.