For overweight, underweight children, the same hurdle: poverty. Living/Arts, C7

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Health|Science

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Classified C4

THE BOSTON GLOBE MONDAY, OCTOBER 9, 2006

Tagging along

Scientists track individual birds to learn how birds migrate and where they stop along the way.

DARREN SCOTT, UNIV. OF OTAGO, NEW ZEALAND

Scott Shaffer of the University of California, Santa Cruz, hopes the tags will help reveal how birds chart their flight paths.

ADRIAN FARMER

Biologist Bridget Olson tags a marbled godwit to see where it will stop over during its twice-a-year migration seasons.

NEWSCOM

Without a map

As tracking devices shrink, scientists are hoping to learn how migrating birds navigate

PNAS

Researchers used tagging technology to develop this migration map of sooty shearwaters, which breed in New Zealand and winter in Japan or the United States.

By Naila Moreira
GLOBE CORRESPONDENT

Each fall, billions of birds undertake a migratory odyssey that can span the globe or carry them only a few states away. They fly thousands of miles toward warmer climates or more abundant food — then reverse their trips each spring.

Despite the regularity of these journeys, scientists know surprisingly little about bird migration. How do birds know where to go? What exact routes do they take to reach their destinations?

Now, scientists have new tools that many believe will revolutionize bird migration research. Tracking technologies like satellite transmitters and GPS units — formerly too bulky to be placed on any but the largest birds — now fit on duck-sized birds without hindering their flight.

Scientists can now map complete migration routes for individual birds from the comfort of their offices, in contrast to the demands of previous research methods — such as bird banding — which provided only the start and finish-point of a bird's travels.

"There will be a tremendous number of new things to learn from these tracks covering the individual full journey over the years," said ornithologist Thomas Alerstam of Lund University in Sweden.

The new techniques come at a time of increasingly urgent questions about bird migration. Birds' extinction rates now average one species a year, according to a July report in the Proceedings of the National Academy, raising the stakes for protecting migratory habitats and understanding how birds cope with climate change.

Moreover, as bird flu wings its way across Eurasia on the backs of wild swans and bird-carried West Nile virus spreads in the United States, migration routes have a direct impact on human health.

And the miniaturized technology is already shedding light on how birds use signals to navigate.

Birds use both geographic cues like the sun and magnetic cues from the earth's magnetic field to orient themselves as they migrate, Alerstam said. But scientists don't yet know which sense the birds rely on the most, or how birds cope if their different methods provide conflicting information.

"We can make predictions, like, if this is the way they sense the magnetic field, we would expect them to follow the following trajectory," he said.

By placing satellite transmitters on predatory birds like peregrine falcons and osprey — large, handsome brown-and-white birds — Alerstam and his colleagues showed that the birds fly in an essentially straight line from breeding to wintering grounds.

If the birds had relied on a magnetic compass, their routes would curve, he said. That's because magnetic north differs slightly from geographic north, and the angle between true

MIGRATION, Page C3

Images confirm what patients know: Chemo can hurt the brain

By Ishani Ganguli
GLOBE CORRESPONDENT

For the first time, scientists have used brain imaging to visualize how cancer drugs can affect breast cancer survivors years after treatment. These findings help pinpoint what happens in patients who complain of "chemo brain" — chronic difficulties with concentration, multitasking, and particularly short-term memory.

Researchers at the University of California, Los Angeles, took PET scans of the brains of 34 women as they performed short-term memory tests. Those who had received chemotherapy five to 10 years earlier required significantly more blood flow in a brain region associated with short-term memory than healthy women or those who only had surgery to treat the cancer.

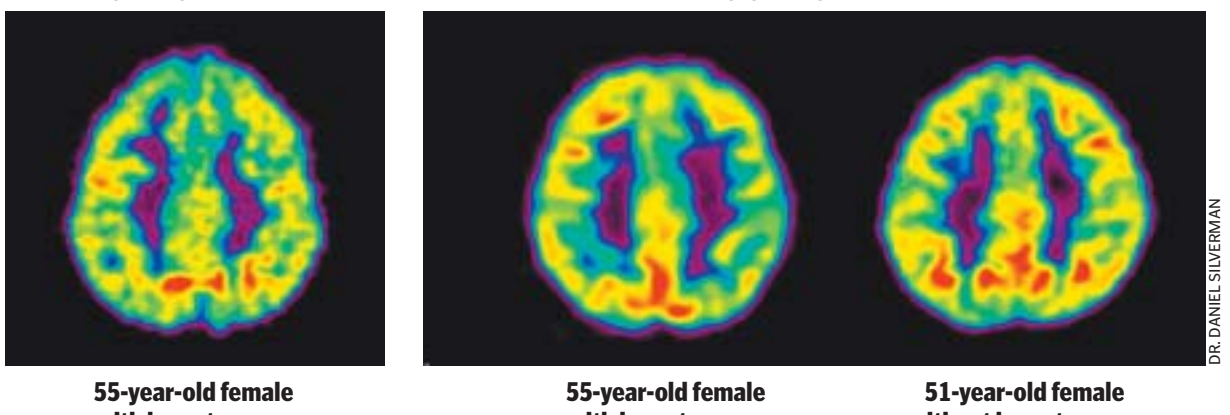
Their brains were clearly working harder to perform the same tasks, said the lead author, Dr. Daniel Silverman. For these women, brain cells in that memory region also showed lower basic levels of activity when they were at rest, meaning they have reduced capacity to communicate with other nerve cells.

The brain scans of women who al-

BRAIN, Page C2

Brain changes

A PET scan of a breast cancer survivor treated with chemotherapy, at left, shows less brain activity at rest (red and yellow) than the scans of women who did not receive the therapy. Both women at right — one with cancer, one without — show similar activity, suggesting it was chemotherapy, not cancer, that caused the change.



DR. DANIEL SILVERMAN

CHEMOTHERAPY
55-year-old female with breast cancer

NO CHEMOTHERAPY
55-year-old female with breast cancer
51-year-old female without breast cancer

Nobel breakthrough launched a race for genetic cures

University of Massachusetts Medical School researcher Craig C. Mello shared the Nobel Prize in medicine last week for discovering a way to turn off individual genes — a finding that has transformed the field of biology.

Mello and his colleague, Andrew Z. Fire of Stanford University, found in 1998 that a special kind of double-stranded molecule called RNA could be used to shut off genes in the microscopic roundworm C. elegans.

Since then the technique — called "RNA interference" or gene silencing — has opened the doors to new therapies and given scientists unprecedented insight into basic gene function in all living beings, from primitive organisms to people.

Biotech companies are racing to develop drugs that will shut off errant genes to treat diseases. Researchers are using the technique to find genes that are crucial for organisms to wreak havoc. Scientists are examining the role that RNA interference plays in normal cells as a kind of thermostat that regulates the genetic climate.

Globe reporter Carolyn Y. Johnson spoke with Mello late last week.

JESSICA RINALDI/REUTERS

CRAIG C. MELLO

Q. *What's next for your research?*

A. We're still trying to understand the mechanism of RNA [interference] . . . identifying the genes and the proteins that function in the process.

MELLO, Page C2

HEAR THE INTERVIEW
Audio is online at boston.com/globe

Also today

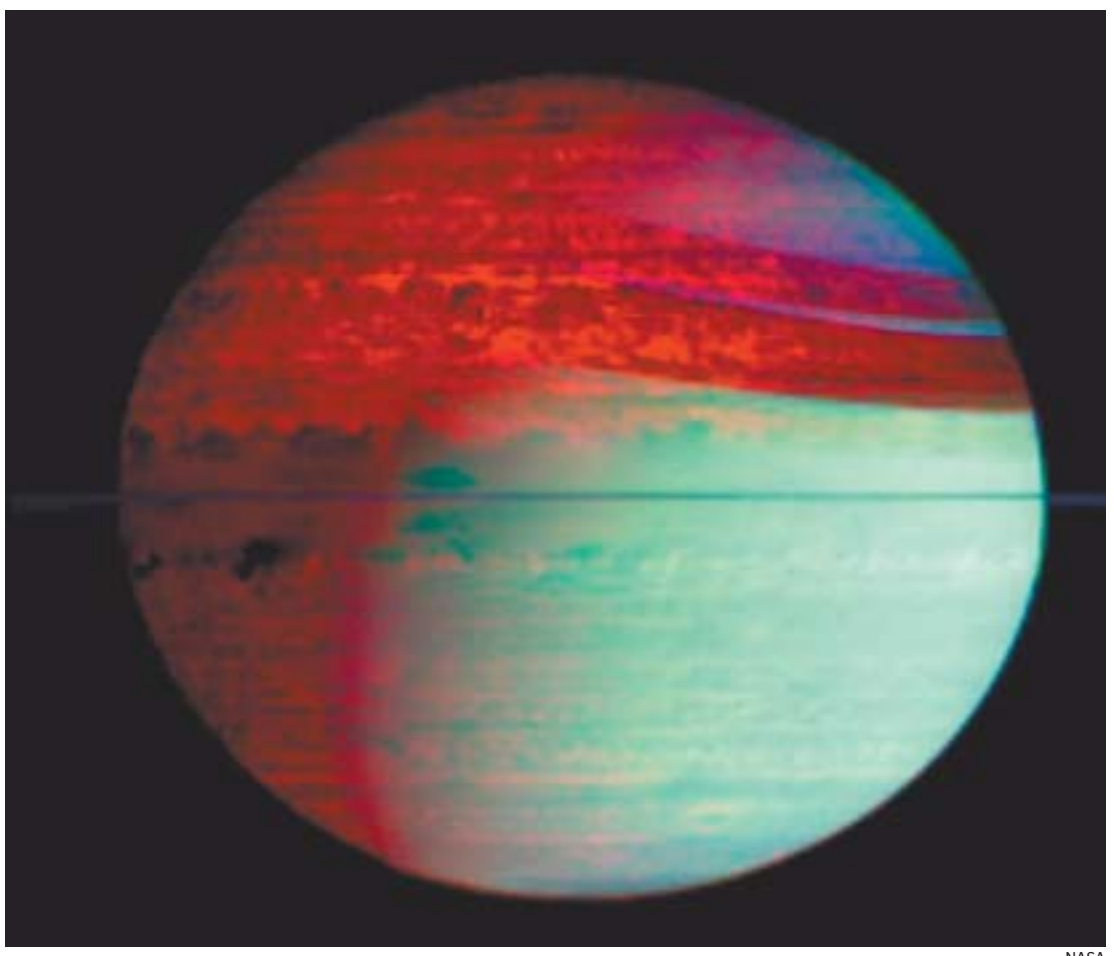
Dr. Knowledge

How do glow sticks work, and why don't people use these instead of flashlights (no batteries!)? **C3**

Health Answers

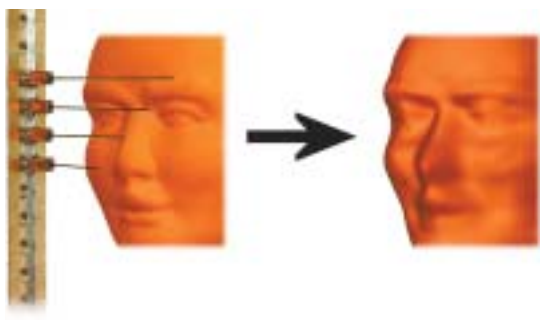
Studies support new, costly treatment for a leading cause of blindness in older people. **C3**

Discoveries



NASA

DEEPER VIEW — A "Chinese lantern" effect was created in this new image, showing Saturn's deep clouds silhouetted against the warm, glowing interior. Several recent images obtained by the Cassini spacecraft's visual and infrared mapping spectrometer were combined to produce this mosaic.



JH SOLOMON AND MJ HARTMANN/NORTHWESTERN UNIVERSITY

Robotic whiskers brushed over a sculpted head enabled researchers to construct an image of the head.

ROBOTICS

Researchers build whiskers to sense the environment

Researchers at Northwestern University have demonstrated the power of an animal's whiskers. The team built a set of freely moving robotic whiskers, each armed with a sensor. They then brushed the whiskers across a complex 3D surface — a sculpted head — and reconstructed the surface in detail, using only the sensor data. This shows how rats use their whiskers to feel their way, and the team expects the technique might be useful for robots, giving them a new way to sense their environment.

BOTTOM LINE: An animal's whiskers, when mimicked robotically, can provide detailed information about an object simply by touching it — a finding that has implications for robot designers as well as biologists.

CAUTIONS: The experiment doesn't show that whiskers would be more effective for robots than other kinds of sensors.

WHAT'S NEXT: The work will likely be followed up by two sets of people: biologists interested in how whiskers work naturally and robot builders looking for creative ideas.

WHERE TO FIND IT: Nature, Oct. 5

GARETH COOK

PROSTATE CANCER

PSA test may be less accurate for obese men, studysays

Blood tests used to detect prostate cancer may not be accurately diagnosing the disease in obese men, according to researchers at Vanderbilt University Medical Center. Screening for prostate cancer involves testing blood for prostate specific antigen, or PSA, a protein produced by the prostate gland. Higher-than-normal blood PSA levels may indicate cancer, since more protein leaks into blood when a tumor is present in the prostate gland. Past studies showed that African-American men had higher levels of this protein than Caucasian men. To find out how obesity affected blood PSA levels in the two racial groups, the study's authors tested blood from 299 healthy men — 150 African-Americans and 149 Caucasians. They also calculated subjects' body mass indices, a measure of obesity, and found PSA levels were lower in obese men of both races. Therefore, a marginally elevated PSA level — rather than levels usually used to diagnose cancer — might indicate cancer in obese men, although the study did not look at that question directly.

BOTTOM LINE: "We need to be careful while screening obese men for prostate cancer," said Jay Fowke, the study's lead author. "For some reason, PSA levels are suppressed in obese men."

CAUTIONS: The study was conducted on a small group and looked only at healthy men, so the research showed only that obese men seem to have lower PSAs than men of normal weight — and not if the PSA tests are underdiagnosing cancer in obese men.

WHAT'S NEXT: The researchers are going to look at PSA levels and obesity in both healthy men and men with prostate cancer.

WHERE TO FIND IT: Cancer, Nov. 15

SENA DESAI GOPAL

Health Answers

What's best for treating macular degeneration?

The short answer is a new drug called Lucentis, approved by the US Food and Drug Administration in June. However, the drug has side effects, is extremely expensive, and is useful for only the rarer form of the disease. Macular degeneration and its new treatments were the focus of five separate articles in last week's New England Journal of Medicine.

There are two kinds of macular degeneration — a disease of the retina that affects more than 9 million Americans and is a leading cause of blindness in people over 55.

In the "dry" form, which 90 percent of patients have, there is a loss of the light-sensing cells in the retina and the cells that nourish them. Vision is often disturbed but not destroyed altogether, said Dr. N.A. Adams of the Wilmer Eye Institute at Johns Hopkins Hospital in Baltimore.

There is no treatment for this form of the disease, said Pat D'Amore, a senior scientist at the Schepens Eye Research Institute in Boston.

"Wet" macular degeneration is rarer but far more devastating. Abnormal blood vessels grow into the macula — the central part of the retina — where they bleed, leak, and cause swelling, often leading to irreversible blindness.

Three relatively new drugs — Lucentis, Macugen, and Avastin — all attack VEGF, the growth factor that stimulates blood vessel growth. All must be injected directly into the eye. Lucentis "actually improves vision in 30 to 40 percent of patients," said Dr. Emily Chew of the National Eye Institute in Bethesda, Md.

Lucentis costs $1,950 per dose, but a very similar drug, Avastin — which is approved for treating colon cancer and can be used "off-label" to treat macular degeneration — costs only $17 to $50 per dose. A head-to-head comparison of the two drugs, both made by Genentech, has just been approved.

Macugen was approved for the wet disease two years ago but appears to be less effective.

Anyone with the wet form of the disease should ask his or her doctor about starting one of these drugs, Adams said. But be cautious: Some of the drugs can have rare but serious side effects, including glaucoma, cataracts, inflammation, and infection. And these risks are incurred repeatedly because patients must have injections every four to six weeks.

JUDY FOREMAN

E-mail health questions to Foreman@globe.com.

Ask Dr. Knowledge

How do glow sticks work? Why don't people use these instead of flashlights (no batteries!)?

Glow sticks are based on chemical reactions that release light but produce very little heat. This is sometimes referred to as "cold light" to contrast it with the light that one sees from chemical reactions associated with fire.

There are always two key chemicals involved, and these are kept apart by an easily breakable barrier within a leakproof container.

The first chemical is usually a variant of phenyl oxalate ester, a molecule known by the trademark Cyalume, mixed with a dye. The other chemical is hydrogen peroxide, which is mixed with water in a combination that is stronger than drugstore disinfectant.

If you break the barrier keeping the chemicals separate, the phenyl oxalate ester and hydrogen peroxide mix and produce an unstable compound that can transfer its energy to the dye. The dye is the type used in posters that glow under ultraviolet — or "black" — light, but here the energy to make it glow comes straight from the unstable compound rather than from ultraviolet light. The type of dye determines the color of the light.

FILE/THE BOSTON GLOBE

Glow sticks, popular with trick-or-treaters, work because of a chemical reaction that releases light but produces very little heat.

There can be other chemicals present, including solvents to keep things dissolved and catalysts to help the reaction go.

These things are great but unlikely to compete with flashlights. Flashlights (and their batteries) are generally brighter for longer, are cheaper, and can be easily turned on and off.

Dr. Knowledge is written by physicists Stephen Reucroft and John Swain, both of Northeastern University. E-mail questions to drknowledge@globe.com or write Dr. Knowledge, c/o The Boston Globe, PO Box 55819, Boston, MA 02205-5819. Include your initials and hometown.

Scientists on track of migration

► MIGRATION
Continued from Page C1

north and magnetic north changes as a bird travels.

The finding, published in the current issue of Animal Behavior, suggests that these birds use mostly the sun for navigation. Alerstam's team is repeating the study using GPS transmitters, which provide location data within 5 meters — far more accurately than ordinary satellite transmitters.

Complete migration data can pinpoint the habitats birds rely on as they travel. Birds need breeding grounds, wintering sites, and a network of food-rich stopover sites where they can rest and refuel.

Bridget Olson, a wildlife biologist with the US Fish and Wildlife Service, studies marbled godwits, long-legged shorebirds that stalk western prairies and marshlands like the Bear River Migratory Bird Refuge in Utah, where Olson works. In April and again in August, Olson and colleague Adrian Farmer of the US Geological Survey attached solar-powered satellite transmitters on two godwits.

The tiny transmitters weigh only 12 grams — as much as five pennies. At 3 percent of a female godwit's body weight, they're just light enough for the birds to comfortably carry.

By plotting the birds' routes on maps generated by Google Earth, Olson and Farmer discovered that one of the godwits relied heavily on conservation sites linked through the Western Hemisphere Shorebird Reserve Network, a program administered by the Manomet Center for Conservation Sciences.During spring migration, the bird stopped only three times — each time at a network site.

"She's a really good advertisement for this program, of how important the Western Hemisphere sites are," said Farmer.

This fall, researchers are using larger GPS technology to track whooper swans in western Mongolia — birds that began mysteriously dying last year of a virulent bird flu strain. Swans aren't likely to transmit the virus directly to humans, who tend to catch bird flu by handling domestic poultry or through the illegal wild bird trade. But swans may serve as carriers for the flu virus, said John Takekawa, a biologist with the US Geological Survey.

Size still limits the use of satellite transmitters and GPS units to mid-sized or larger birds.

The 10 swans Takekawa and his colleagues released in August have only just begun migrating. Surprisingly, some have flown northward into Russia instead of south into China as expected.

"If we can get an idea of where they're going in the winter, we may be able to help shape management plans . . . to make sure influenza doesn't spread to people," Takekawa said.

For now, size still limits the use of satellite transmitters and GPS units to midsized or larger birds. But, as the technology continues to shrink, even tiny songbirds will eventually wear them.

Flocks of these fist-sized migrants wash past biologist Martin Wikelski's office at Princeton University every fall, traveling the eastern US migratory corridor toward South America and other destinations. But, says Wikelski, researchers know almost nothing about songbirds' exact routes and migratory habits.

So far, "we only have one single track for six days for one individual thrush," Wikelski said.

To bring transmitters down to a size suitable for songbirds, Wikelski and colleague Kasper Thorup, head of the Danish Bird Ringing Center in Copenhagen, are collaborating with engineers to design new satellites that will sit at a lower orbit than current commercial satellites. This low orbit would require less power for transmission, allowing transmitters to be lighter.

Both the European Space Agency and NASA have expressed interest in the projects. Wikelski said. He hopes to have a satellite up and running by the end of the decade. That will free Thorup from sitting on the roof to track the take-off of radio-tagged white-crowned sparrows.

Unlike satellite data, radio transmission travels only a short distance, so Thorup must monitor the birds while colleagues wait below to follow them by car or plane.

"I'm sitting alone on this roof right now," said Thorup while perched atop the Department of Ecology, Princeton University's tallest building, last month. "We can't wait until the satellite transmitters work."