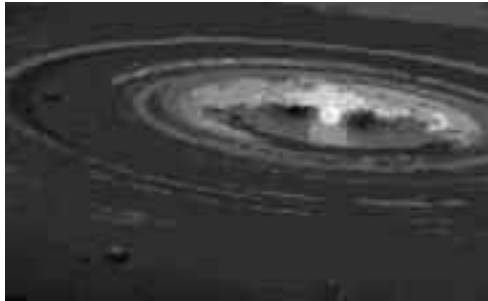


# World Science News In Review

## [Astronomy]

### Planets: Small, New, and Diamond-Filled

Since the first planet was discovered outside our solar system by Penn State University astronomer Alex Wolszczan in 1992, more than a hundred such planets have been found.



A recently spotted disk of planet-building material orbiting a planet-sized star. Scientists wonder whether this material can be designated as a planet, a moon, or something else.

stellation approximately 1500 light years away from Earth. Since the other three planets in that system have similar spatial arrangements to our solar system, it appears to be a smaller replica.

Other scientists using NASA's Spitzer Telescope have found OTS 44, a brown star fifteen times the mass of Jupiter. This failed star has a surrounding disk of material similar to that which was once believed to have encircled our sun, and from which the Earth supposedly formed. "We have identified the smallest body that is known to have the building blocks around it for making planets," commented Kevin Luhman, the head author of a study by the Harvard-Smithsonian Center for Astrophysics.

The strangest planets, however, may be those with thick layers of diamonds lying beneath the surface. While planets like Earth, Venus, and Mars contain silicon-based crusts, it remains possible that with more carbon or less oxygen, carbon-based planets could form. Under high pressure from the surface, graphite could transform into diamonds. Since the amount of carbon in the galaxy is increasing, diamonds thus may soon become more abundant.

Findings related to other newly-discovered planets were also presented at the February 2005 Winter Conference on Astrophysics. —P. Mulligan

Source: "'Diamond Planets' Hint at Dazzling Promise of Other Worlds"; [http://news.nationalgeographic.com/news/2005/02/0208\\_050208\\_planets.html](http://news.nationalgeographic.com/news/2005/02/0208_050208_planets.html)

### Chunk of Universe's Missing Matter Found

Astronomers recently discovered the missing "ordinary matter" that has long puzzled scientists. Also known as baryons, this visible matter makes up five percent of all matter in the universe; the other 95 percent consists of dark matter and dark energy.

The original problem with "ordinary matter" was that, even using state-of-the-art optical telescopes, scientists were only able to detect half the quantity of baryons that were estimated to currently exist in the universe.

Recently, Fabrizio Nicastro and his team from the Harvard-Smithsonian Center for Astrophysics analyzed x-ray spectra of baryons newly discovered by the Chandra X-ray Observatory. The density of this matter was found to com-

pensate for the other 50 percent of material that scientists had, up to this point, been unable to determine using conventional methods. The original hypothesis involved entrapment by the missing baryons inside hot intergalactic gas.

The collection and analysis of the spectrum of this gas, along with the complete results of the research findings, were published in the February issue of *Nature*. —J. Lam

Source: Wong, Kate. *Scientific American*. 03 Feb 05  
<http://www.scientificamerican.com/article.cfm?chanID=sa003&articleID=00048DA2-5C8A-1201-947F83414B7F4945>

## [Biology]

### Key Mechanism in Genetic Inheritance During Cell Division

Scientists at the Lawrence Berkeley National Lab and the University of California, Berkeley recently discovered a mechanism that solves the mystery of how proteins help microtubules perform cell division. They found proteins called kinetochores attached to microtubules, or spindles, in a ring-like form. This is a key feature in the evolutionary succession of cell division.

The attachment of kinetochores allows the spindles to bundle and preserve their structural form, which is crucial to separating out chromosomes to each daughter cell during the anaphase cycle of mitosis. Furthermore, the kinetochores' attachments to their microtubules minimizes potential mutations in the cells by monitoring the correct number of chromosomes that each daughter cell receives. One result, a lower quantity of mutations that occur during cell division, further impedes genetic diseases and other fatalities such as cancer.

Termed "Dam 1" by scientists, the kinetochores are made up of 10 proteins attached together. Georjana Barnes of UC Berkeley's Department of Molecular and Cell Biology, along with several other scientists, used *E. coli* bacteria to recreate the Dam 1 molecule and several mutant forms. By comparing their effects on the spindles during cell division, the scientists were able to map out the structure and surface of the area that kinetochores bind to the spindles.

—J. Lam

Source: "Key Mechanism In Genetic Inheritance During Cell Division Identified" *Science Daily*. 08 Feb 05.  
<http://www.sciencedaily.com/releases/2005/02/050205121836.htm>

### Why Do Insects Stop 'Breathing'? To Avoid Damage from Too Much Oxygen, Say Researchers, Challenging Previous Theories

Why do insects stop breathing for minutes at a time? This age old mystery may finally be solved. Researchers, Timothy Bradley, Professor of Ecology and Evolutionary Biology at UCI, and Stefan Hetz, Assistant Professor of Physiology at Humbolt University propose that insects such as grasshoppers, moths, butterflies, fruit flies, beetles, and bugs close off their respiratory systems so to keep out excess oxygen, thus preventing damage to their tissues.

When these insects are active, they breathe in oxygen at an extremely high rate so that they can sustain their ability to fly. Yet when these insects are inactive and resting, they continue to breathe in oxygen at this extremely high rate, resulting in excess internal oxygen that can cause oxidative damage, the

destructive of biomaterial such as tissues due to excess oxygen. Hence to protect their bodies, insects stop breathing.

Bradley explains, "Even in our own case, our bodies have to supply oxygen to our tissues, but they must also keep out excess oxygen to prevent oxidative damage to the tissues. This damage is closely related to aging. Hence, perhaps, the many anti-oxidative creams flooding the market [is] to combat aging. The concentration of oxygen in the air we breathe is toxic to us. Indeed, fruit flies, which have been studied closely for decades, die sooner from aging in a high-oxygen environment."

It has been found that insects typically maintain a lower concentration of oxygen in their bodies than that in the atmosphere. To do this, the insect breathes for a period of time, releases a small burst of carbon dioxide, then stops breathing, closing off its respiratory system so to maintain a low concentration of oxygen in their bodies. In a low-oxygen environment, however, the insect breathes for a longer period of time. Furthermore, it is clear that insects' respiratory systems behave in such a way that indicates they are regulating oxygen.

—D. Zhang

Source: "Why Do Insects Stop 'Breathing'? To Avoid Damage From Too Much Oxygen, Say Researchers, Challenging Previous Theories"  
<http://www.sciencedaily.com/releases/2005/02/050218133922.htm>

## [Medicine]

### A Chemical Detector for Alzheimer's Disease

**D**iagnosing Alzheimer's disease often fails to generate definitive results unless accompanied by an autopsy. However, a team led by Dimitra Georganopoulou of Northwestern University may have found chemicals called amyloid beta-diffusible ligands (ADDLs) whose presence in the cerebrospinal fluid can be used as an indicator of Alzheimer's disease. The experiment consisted of tests conducted on two groups of fifteen patients, one of which consisted of those confirmed to have Alzheimer's after death, and the other of those free of the disease. These tests supported Georganopoulou's hypothesis in all cases except two, a significant improvement over the fifteen percent error margin associated with current diagnostic techniques of brain scans and memory tests.

Georganopoulou and her team inserted iron particles coated with antibodies into the cerebrospinal fluid, then used magnets to extract them. The antibodies would attach to the ADDLs, and extract them along with the iron. Also included were gold particles, which are nonmagnetic and coated with antibodies. Since they would also combine with ADDLs, the presence of gold in the extracted clump would indicate the presence of ADDLs. In addition, the gold particles contained complementary DNA strands which allowed matching DNA strands to bind, simplifying detection by light beams.

Since they were commonly found in the brains of people with Alzheimer's, ADDLs had long been suspected to be present in the cerebrospinal fluid—yet no test until this one had been sensitive enough to detect more than a few dozen molecules. In fact, this nanoparticle test is a million times more sensitive than previous methods. The aim now is to test a wider population and to further improve the sensitivity and accuracy of this procedure.

—P. Mulligan

Source: "Disease Detector: Chemical test may spot Alzheimer's"  
<http://www.sciencenews.org/articles/20050205/fob1.asp>

### Compound in Carrots Reduces Cancer Risk

**R**esearch has long shown that eating large amounts of fruits and vegetables can reduce a person's risk of cancer, but it remains largely uncertain as to which chemicals are responsible for the cancer-preventing effects.



Falcarinol, found in carrot compounds, has been shown to slow the progression of cancer.

Research lead by Kirsten Brandt of Britain's Newcastle University shows that falcarinol, an anti-fungal compound found in carrots, reduces the risk of developing cancer by one-third.

Brandt's team of researchers assigned 24 rats with precancerous colorectal tumors to three groups, each on different

diets. After 18 weeks, rats that were fed raw carrots with their normal feed and those that had falcarinol added were one-third less likely to develop cancer in comparison to the rats that had neither dietary supplement in their food. While previous epidemiological research showed that eating large quantities of carrots can reduce the risk of cancer in humans by 40 percent, the specific benefit of the cancer-fighting compound falcarinol remained unknown until now.

Further research is necessary to understand the mechanism behind falcarinol's effects and to discover the amount of falcarinol necessary to attain such results. As falcarinol is neither a vitamin nor a mineral, its anticancer effects may help explain why eating vegetables is significantly better for your health than taking a vitamin supplement. In addition, Brandt's findings may be used to engineer carrots that produce more falcarinol or to develop new treatments for cancer. In the meantime, we can benefit from falcarinol's anticancer effects by simply increasing our consumption of carrots.

—N. Benedetti

Source: "Carrot Compound Shows Promise for Slowing Cancer"  
<http://www.scientificamerican.com/article.cfm?chanID=sa003&articleID=000948D4-3498-1209-B49883414B7F0000>  
"Crunch! Carrots May Cut Cancer Risk"  
<http://health.excite.com/article/id/523895.html>

### The Compact Helix

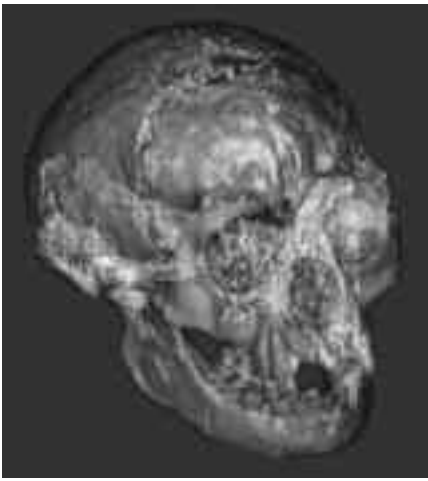
**W**hile long twisting strands of DNA may not at first seem to possess the most space-efficient configuration, recent research suggests otherwise. A recent study finds that the frequent appearance of helical structures in the natural world may be explained by helices' ability to conserve space in often crowded areas.

Professor Randall Kamien, professor at the University of Pennsylvania and lead other of the study, noted that traditional explanations—that helical shape "is dictated by bonds between molecules"—fail to explain the reasons behind a given molecular configuration. He investigated the issue and ultimately developed a mathematical explanation—molecular shapes are instead "dictated by the space available in a cell". By viewing a cell as a grouping of hard spheres surrounding an elastic tube, Kamien was able to calculate which tube's design minimized the quantity of spheres displaced from the system. The geometry of the resulting design closely approximated that of natural helices.

In addition to a low volume, the helical arrangement also ensures a relatively high surface area. This can facilitate DNA transcription by allowing messenger RNA to easily access most parts of the molecule.

—D. Barclay

Source: "Why Is The Helix Such A Popular Shape? Perhaps Because They Are Nature's Space Savers"  
<http://www.sciencedaily.com/releases/2005/02/050223135535.htm>



Skull with red brain cast of the "hobbit" fossil.

## Another Human Ancestor

**A** new analysis of fossils unearthed last fall suggests that a small mammalian species that disappeared in about 16,000 BC may have been a human ancestor. Despite their small brain cavities and height of three feet, these "Hobbits" were found to bear a greater resemblance to humans than pygmies or other subspecies.

Researchers at Florida State University led an effort to create a digital representation of the Hobbit's brain case based upon a fossilized skull found in Indonesia. Although the brain itself had long since rotted away, it had left tiny impressions on the skull's interior which suggested "that a particular brain structure was there," according to author Charles Hildebolt of the Washington University in St. Louis. By comparing these structures to known records of human and simian skulls, the researchers were able to determine the Hobbit's most appropriate classification.

The key piece of evidence was the location of the Hobbit's lunate sulcus, a fissure found near the back of its brain in similarity with modern humans. This ruled out pygmy or microcephalic classifications, in which chromosomal irregularities hinder normal brain growth, and placed the Hobbit squarely within the human genus. Scientists are considering a name of *Homo floresiensis*, after the island on which the fossilized remnants were discovered.

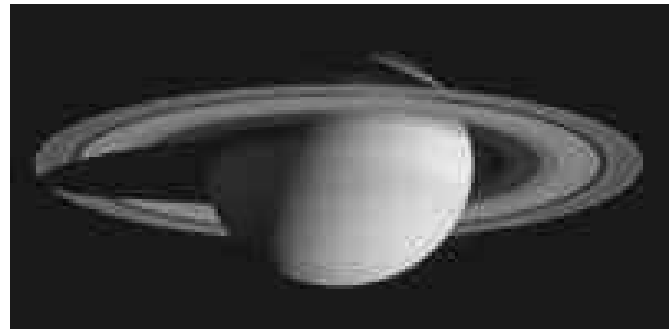
The findings thus suggest that the Hobbit may have had cognitive capabilities out of proportion to its small physical brain size—a proposition supported by the presence of tools and ashes near the fossils' location—which in turn could have implications for neural research. —D. Barclay

Source: "'Hobbit' Fossil Likely Represents New Branch On Human Family Tree"  
<http://www.sciencedaily.com/releases/2005/03/050304175249.htm>

## Exploring Saturn's Moons and Storms

**T**he Cassini space probe, in its eight month orbiting Saturn, has gathered new data on the planet that promises to clear up two longstanding mysteries.

**Moons.** Within Saturn's rings have been found numerous small moons—as well as several lower-density sub-rings—whose existence was never before known. Further away from the planet, images collected of Saturn's outermost moon Phoebe showed the impact of numerous craters, two dozen of which are large enough to merit names. The moon's mottled nature implies the collision of numerous small space objects over the course of a long period of time, sug-



The face of Saturn.

gesting that Phoebe is older than previously thought. Also, the images indicated the potential presence of ice about 400 meters below the moon's surface.

**Storms.** Saturn's winds—which can travel at ten times those of Earth—are not only fast, but variable. Convection heat emitted from within the planet creates conditions in which higher altitude winds attain even greater velocities than their counterparts at ground level. These intense storms were also found to account for lightning and other electrostatic activity that had been observed by Cassini's predecessor, the Voyager probe, a quarter century ago.

—D. Barclay

Source: "Saturn Submits to a Planetary Paparazzo"  
<http://www.sciam.com/article.cfm?chanID=sa003&articleID=000D5FE3-8EC9-121F-8EC983414B7F0000>

## Predicting Surgical Outcomes

**D**espite recent major advances in surgical procedures, systematic projections of their likely outcomes have remained elusive. Researchers at Stanford University hope to change that, by constructing a computer model capable of predicting the results of surgery with sufficient accuracy to improve diagnoses.

Assistant Professor Charles Taylor, leading the study, notes that complex blood flow mechanics render it "impossible to guess what will happen during a surgery." But by synthesizing individualized diagnostic data with mathematical fluid dynamic models, Taylor hopes to model patients' physiologies and thus limit such speculation to a narrow range of potential outcomes.

Currently Taylor's team has only performed after-the-fact studies, in which hypothetical pre-surgery predictions are made. Several of these forecasts have been within ten percent of actual values, a figure that may improve once the team incorporates additional factors into the model. For example, early assumptions did not account for the flexibility of blood vessels, which was added only recently.

Eventually, the team of course hopes to extend its model to use in actual diagnoses, or in Taylor's words, "intervene first on the computer before going to the patient".

—D. Barclay

Source: "Computer Model Being Developed At Stanford May Help Surgeons Better Predict Patient Outcomes"  
<http://www.sciencedaily.com/releases/2005/02/050223122716.htm>

