Smallest thing in the Universe

THE answer to the enduring question of the smallest thing in the universe has evolved along with humanity. People once thought grains of sand were the building blocks of what we see around us. Then the atom was discovered, and it was thought indivisible, until it was split to reveal protons, neutrons and electrons inside. These too, seemed like fundamental particles, before scientists discovered that protons and neutrons are made of three quarks each.

"This time we haven't been able to see any evidence at all that there's anything inside quarks," said physicist Andy Parker. "Have we reached the most fundamental layer of matter?"

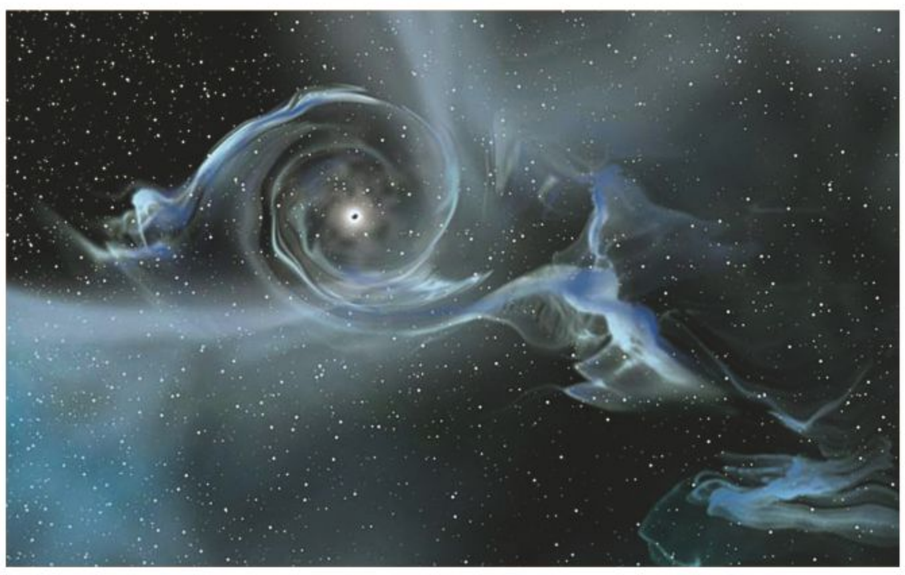
And even if quarks and electrons are indivisible, Parker said, scientists don't know if they are the smallest bits of matter in existence, or if the universe contains objects that are even more minute.

Parker, a professor of high-energy physics at England's Cambridge University, recently hosted a television special on the U.K.'s BBC Two channel called "Horizon: How Small is the Universe?"

Strings or points?

In experiments, teensy, tiny particles like quarks and electrons seem to act like single points of matter with no spatial distribution. But point-like objects complicate the laws of physics. Because you can get infinitely close to a point, the forces acting on it can become infinitely large, and scientists hate infinities.

An idea called superstring theory could solve this issue. The theory posits that all particles, instead of being point-like, are actually little loops of string. Nothing can get infinitely close to a loop of string, because it will always be slightly closer to one part than another. That "loophole" appears to solve some of these problems of infinities, making the idea appealing to physicists. Yet scientists still have no experimental evidence that string theory is correct.



One contender for the smallest thing in the universe is the singularity at the center of a black hole. (Shown here, an artist's drawing of a black hole pulling gas away from a companion star.

Another way of solving the point problem is to say that space itself isn't continuous and smooth, but is actually made of discrete pixels, or grains, sometimes referred to as space-time foam. In that case, two particles wouldn't be able to come infinitely close to each other because they would always have to be separated by the minimum size of a grain of space.

A singularity

Another contender for the title of smallest thing in the universe is the singularity at the center of a black hole. Black holes are formed when matter is condensed in a small enough space that gravity takes over, causing the matter to pull inward and inward, ultimately condensing into a single point of infinite density. At least, according to the current laws of physics.

But most experts don't think black holes are really infinitely dense. They think this infinity is the product of an inherent conflict between two reigning theories general relativity and quantum mechanics and that when a theory of quantum gravity can be formulated, the true nature of black holes will be revealed.

"My guess is that [black hole singularities] are quite a lot smaller than a quark, but I don't believe they're of infinite density," Parker told LiveScience. "Most likely they are maybe a million million times or even more than that smaller than the distances we've seen so far."

That would make singularities roughly the size of superstrings, if they exist.

The Planck length

Superstrings, singularities, and even grains of the universe could all turn out to be about the size of the "Planck length." [Tiny Grandeur: Stunning Photos of the Very Small]

A Planck length is 1.6 x 10^-35 meters (the number 16 preceded by 34 zeroes and a decimal point) an incomprehensibly small scale that is implicated in various aspects of physics.

The Planck length is far and away too small for any instrument to measure, but beyond that, it is thought to represent the theoretical limit of the shortest measureable length. According to the uncertainty principle, no instrument should ever be able to measure anything smaller, because at that range, the universe is probabilistic and indeterminate.

This scale is also thought to be the demarcating line between general relativity and quantum mechanics.

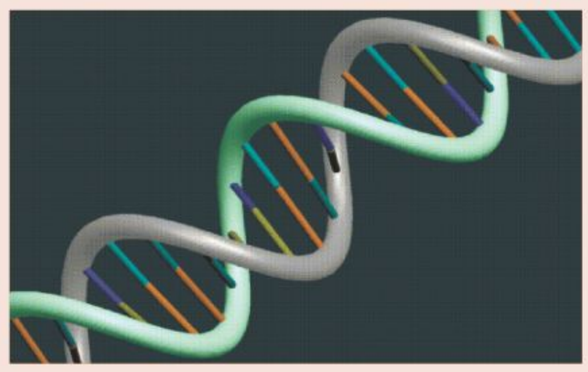
"It corresponds to the distance where the gravitational field is so strong that it can start to do things like make black holes out of the energy of the field," Parker said. "At the Planck length we expect quantum gravity takes over."

Perhaps all of the universe's smallest things are roughly the size of the Planck length.

Source: **Live Science**

GOLDEN CODE

Jute Genome project



TO bring back the golden era of jute, Bangladesh entered the world of genome research at the end of 2009. As a tripartite combination of the public-private-government partnership, Dhaka University, IT firm DataSoft and Bangladesh Jute Research Institute, the country first time in world decoded the jute genome. On 16 June 2010, the Prime Minister Sheikh Hasina announced at the National Parliament, the success of Bangladeshi scientists.

The research team was led by Professor Maqsudul Alam from University of Hawaii, who also successfully led the genome discovery of papaya in USA and rubber in Malaysia.

After the discovery of jute genome, it becomes a pressing need to have a high yielding jute variety released for cultivation through out the country. With an aim to meet this need and to deliver the benefit of this success directly to the farmer's hand, the next step was taken by the Agriculture Minister, Begum Matia Chowdhury on November, 2010 at the initiative of "Basic and Applied Research on Jute (BARJ)" at Bangladesh Jute Research Institute. One of the main aims of the project is to deliver the disease and stress tolerant, high yielding jute variety to the farmers. Simultaneously, the project also emphasizes to create a platform for genome research with global partnership.

BARJ

Basic & Applied Research on Jute (BARJ) is a government funded scientific research project in Bangladesh with a goal of determining the jute genome sequence of from both physical and functional standpoint. It is a follow-up of the jute genome project to improve the productivity and quality of jute fiber by utilizing genome information.

LIGHTS

First woman Nobel Llaureate

Marie Sklodowska Curie

MARIE Sklodowska Curie was a French-Polish physicist and chemist. She was born in Warsaw on November 7, 1867. She was the first woman to win a Nobel Prize, the only woman to win in two fields, and the only person to win in multiple sciences. She was also the first female professor at the University of Paris (La Sorbonne), and in 1995 she became the first woman to be entombed on her own merits in the Panthéon in Paris. She is renowned for her pioneering research on radioactivity.

She studied at Warsaw's clandestine Floating University and began her practical scientific training in Warsaw. In 1903, she won the Nobel Prize in Physics, from Russian Empire, in recognition of the extraordinary services they have rendered by their joint researches on the radiation phenomena discovered by Professor Henri Becquerel. She then shared her that Nobel Prize with her husband Pierre Curie and with the physicist Henri Becquerel. In 1911, she was the sole winner of the Nobel Prize in Chemistry.

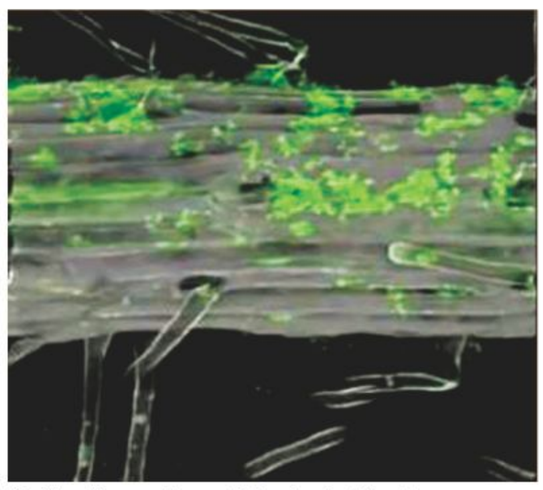
Her achievements included a theory of radioactivity, techniques for isolating radioactive isotopes, and the discovery of two elements: polonium and radium. Under her direction, the world's first studies were conducted into the treatment of neoplasm, using radioactive isotopes. She founded the well-known Curie Institutes in Paris and in Warsaw. During World War I, she established the first military field radiological centres.

On July 4, 1934, Curie died of aplastic anemia due to years of exposure to radiation.

Source: **Wikipedia**

LEADING HIJACKER

Dark side of beneficial soil bacteria



Biofilm formed by soil bacteria (Bacillus subtilis) on the roots of an Arabidopsis plant.

IT'S a battleground down there -- in the soil where plants and bacteria dwell. Even though beneficial root bacteria come to the rescue when a plant is being attacked by pathogens, there's a dark side to the relationship between the plant and its white knight.

According to research reported by a University of Delaware scientific team in the September online edition of Plant Physiology, the most highly cited plant journal, a power struggle ensues as the plant and the "good" bacteria vie over who will control the plant's immune system.

"For the brief period when the beneficial soil bacterium Bacillus subtilis is associated with the plant, the bacterium hijacks the plant's immune system," says Harsh Bais, assistant professor of plant and soil sciences, whose laboratory group led the research at the Delaware Biotechnology Institute.

In studies of microbe-associated molecular patterns (MAMPs), a hot area of plant research, the UD team found that B. subtilis produces a small antimicrobial protein that suppresses the root defense response momentarily in the lab plant Arabidopsis.

"It's the first time we've shown classically how suppression by a benign bacteria works," Bais says. "There are shades of gray -- the bacteria that we view as beneficial don't always work toward helping plants."

In the past, Bais' lab has shown that plants under aerial attack send an SOS message, through secretions of the chemical compound malate, to recruit the beneficial B. subtilis to come help.

In more recent work, Bais and his collaborators showed that MAMP perception of pathogens at the leaf level could trigger a similar response in plants. Through an intraplant, long-distance signaling, from root to shoot, beneficial bacteria are recruited to forge a system-wide defense, boosting the plant's immune system, the team demonstrated. In that study, the Bais team also questioned the overall tradeoffs involved in plants that are associated with so-called beneficial microbes.

In the latest work, involving the testing of more than 1,000 plants, the researchers shed more light on the relationship. They show that B. subtilis uses a secreted peptide to suppress the immune response in plants. It is known that plants synthesize several antimicrobial compounds to ward off bacteria, Bais says.

The team also shows that when plant leaves were treated with a foliar MAMP -- flagellin, a structural protein in the flagellum, the tail-like appendage that bacteria use like a propeller -- it triggered the recruitment of beneficial bacteria to the plant roots.

"The ability of beneficial bacteria to suppress plant immunity may facilitate efficient colonization of rhizobacteria on the roots," Bais says. Rhizobacteria form an important symbiotic relationship with the plant, fostering its growth by converting nitrogen in the air into a nutrient form the plant can use.

"We don't know how long beneficial bacteria could suppress the plant immune response, but we do know there is a very strong warfare under way underground," Bais says, noting that his lab is continuing to explore these interesting questions. "We are just beginning to understand this interaction between plants and beneficial soil bacteria."

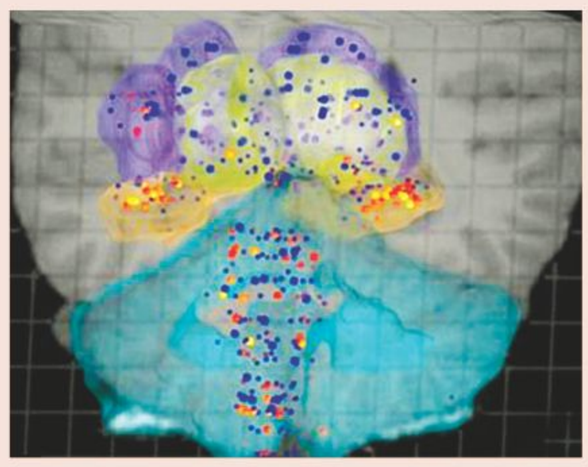
The lead author of the research article was Venkatachalam Lakshmanan, a postdoctoral researcher in the Department of Plant and Soil Sciences; Sherry Kitto, professor of plant and soil sciences; Jeffrey Caplan, associate director of UD's Bio-Imaging Center; Yu-Sung Wu, director of the Protein Production Facility; Daniel B. Kearns, associate professor in the Department of Biology at Indiana University; and Yi-Huang Hsueh , of the Graduate School of Biotechnology and Bioengineering at Yuan Ze University, Taiwan.

The research was supported by grants from the National Science Foundation.

Source: **Science Daily**

MIND MAP

Human brain gene map



Before mapping the human brain, the researchers mapped the brain of a mouse

HUMAN brains follow the same basic molecular pattern despite different individual personalities, a 3D map of where our genes are expressed suggests.

The map draws on more than 100 million gene expression measurements found in three human brains cut into 900 pieces.

Researchers from the Allen Institute for Brain Science in Seattle and Edinburgh University said the project might help understand how genetic disorders cause brain disease.

The study appears in Nature journal.

The human brain is the most complex structure in the world, composed of 100 billion cells, but it is still not fully understood.

Prof Ed Lein, from the Allen Institute for Brain Science, one of the authors of the paper, said this atlas could provide vital information in the general understanding of "brain function, development, evolution and disease".

The teams says that the majority of genes in the human brain are expressed in patterns very similar from one brain to another - showing that despite different individual personalities, our brains are in fact strikingly similar.

Mice and men

Although the human genome was sequenced some time ago, it was now "essential to understand how it makes all of the genes and where they are expressed in the human brain", said Prof Seth Grant from the neuroscience department at Edinburgh University.

Before mapping the human brain, the researchers had spent years performing similar studies on mice.

But since in people the organ is a lot more complex, they had to modify their approach to get the best results.

After cutting individual brains into tiny pieces, the scientists analysed each piece using computer software to work out the pattern of gene expression in the brain.

"In the earlier studies, individual genes were studied in the mouse brain, and each one was mapped one at a time to find where in the brain they are expressed," said Prof Grant.

Source: **BBC News**

LEAVES

This magnificent view shows the multihued beauty of the Adirondacks, a mountain range located in the northeastern part of New York.

SOURCE: LIVE SCIENCE

Day of Fall

It's time to kiss long days and warm weather goodbye and welcome in crisp temperatures and crunchy leaves. The first day of fall, also known as the autumnal equinox, is Saturday, Sept. 22.

The equinox gets its name from an astronomical curiosity. During both the spring and fall equinoxes, the sun transits directly over the Earth's equator. Day and night are approximately equal length on equinoxes, which is how the days got their name it means "equal night" in Latin.

CRUNCHY DID YOU KNOW?

What's the most popular pet bird?

Aratinga solstitialis -captive

Parrots are the most popular pet birds in the world. They are being kept because of their colorful plumage and for their intelligence. There are 372 known species of parrots and they found in most warm and tropical regions with several species inhabiting the temperate Southern Hemisphere as well. The greatest diversity of parrots is found in South America and Australasia.

The Sun Parakeet

The Sun Parakeet or Sun Conure (Aratinga solstitialis) is a medium-sized brightly colored parrot native to north-eastern South America. The adult male and female are similar in appearance, with predominantly golden-yellow plumage and orange-flushed underparts and face.