Where is the missing planet?

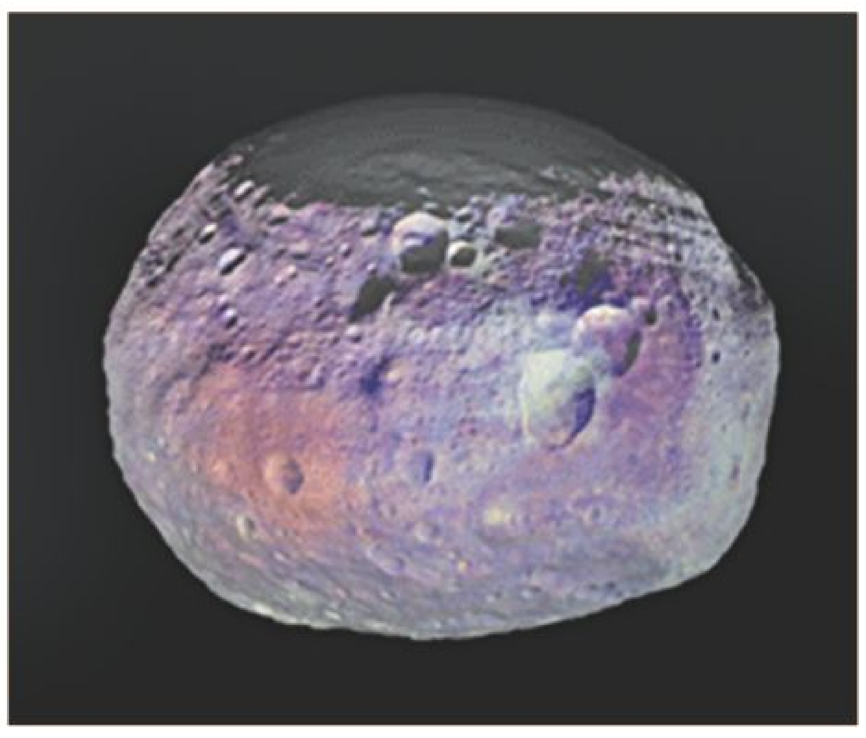
QUAMRUL HAIDER, PH.D

IN 1766, a German physicist named Johan Titius found a simple mathematical rule to explain the arrangement of the planets in the Solar System. The rule was popularized by another German named Johann Bode and today it is known as the Titius-Bode Law. The law relates the average distance of a planet from the Sun in terms of the average Earth-Sun distance which is one astronomical unit (a.u.) or 93 million miles.

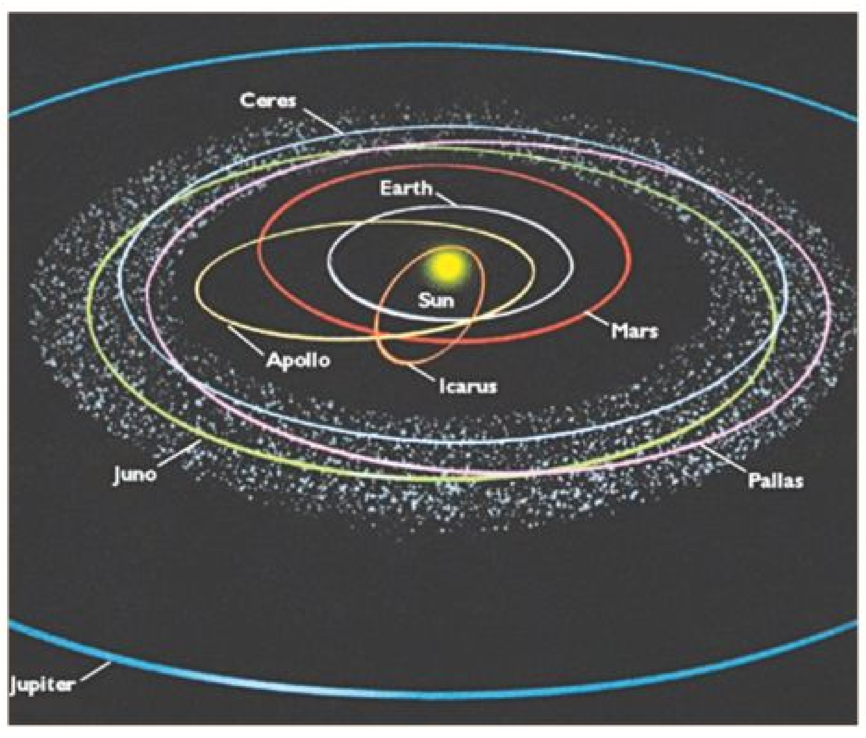
Consider the sequence of numbers 0, 3, 6, 12, 24, 48, 96, and so on. Each of the numbers, except the first two, is double its predecessor. Now add 4 to each number in the sequence and divide the sum by 10; we end up with the numbers 0.4, 0.7, 1.0, 1.6, 2.8, 5.2, and 10.0 which correspond closely to the observed planetary distances in astronomical units. How simple but remarkable the law is. The only problem is with the 2.8 a.u. where no planet was known to exist. The discovery of Uranus in 1781 and the recognition that its measured distance of 19.2 a.u. is close to the distance (19.6 a.u.) given by the next number (192) in the sequence aroused a great deal of interest in the "missing" planet between Mars and Jupiter.

Astronomers set out to find the missing planet and on the first night of 1801, a Sicilian monk Giuseppe Piazzi discovered an object 2.77 a.u. away from the Sun. He named it Ceres, after the patron goddess of Sicily. In early 1802, the Viennese physician Heinrich Olbers discovered another faint, star-like object much smaller than Ceres. He named it after the Greek goddess of wisdom Pallas. Between 1802 and 1807, two more small planet-like bodies, Juno and Vesta, were discovered between 2.3 and 2.8 a.u. The small size of these objects precluded them from being characterized as planets. Instead, they were called "minor planets" or asteroids (Greek for "star-like"). Just like the planets, they orbit around the Sun in the same direction.

Since Ceres or Pallas, the two largest asteroids, is not the missing planet, the question arose: Did the missing planet even exist? There are many views about the origin of the



Asteroid Vesta photographed by the spacecraft Dawn.



Asteroid Belt.

asteroids. Some astronomers speculated that perhaps they are objects left over from the giant cloud of gas and dust that condensed to create the Sun, planets, and moons some 4.6 billion years ago. Others suggested that they are the residuals of large planetary embryos that were destroyed in a massive collision long ago. The most natural explanation seems to be that there had once been a full-sized planet that somehow broke apart or exploded to produce a population of rocky matters orbiting between Mars and Jupiter that never successfully coalesced into a planet. The search was on to discover this population.

By mid-1800's several hundred more asteroids were discovered. As of today, there are over 500,000 of these vagabonds with known orbits about the Sun. The region of the solar system between the orbits of Mars and Jupiter where most of these nomads are is called the "asteroid belt" and the asteroids are called "belt asteroids." There are also asteroids outside of Jupiter's orbit. They are known as Trojan asteroids.

Some asteroids come perilously close to the Earth and are known as Earth-Crossing asteroids. They generally survive 10 million years or so before colliding with the Earth. In the past, the Earth has been hit many times by these asteroids. Depending on their size, such a collision can cause massive damage on local to global scales.

It is believed that sometime in the near future, the Earth will suffer a colossal cosmic impact. Will it be this year? Let us hope that the Mayans are messed up with their calendar or the asteroids miss us. How could a civilization that could not predict the demise of its own culture foretell our destruction? Even if the Mayans are right, we have until December to figure out how to alter their orbit or destroy them in space before we meet with the same fate as the dinosaurs.

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SENSIBLE

Fearful plankton

A tiny marine plant has been caught acting like an animal, find scientists who discovered a species of phytoplankton, a microscopic alga, could swim away from its predators.

Their finding could shed new light on what causes some colorful plankton blooms.

"It has been well observed that phytoplankton can control their movements in the water and move toward light and nutrients," marine scientist Susanne Menden-Deuer, of the University of Rhode Island, said in a statement. "What hasn't been known is that they respond to predators by swimming away from them. We don't know of any other plants that do this."

In lab experiments, Menden-Deuer and her team observed that groups of the phytoplankton Heterosigma akashiwo flee when in the presence of predatory zooplankton. What's more, the tiny plants swim away from areas that previously contained the predators even if the immediate threat is gone.

"The phytoplankton can clearly sense the predator is there," Menden-Deuer said. "They flee even from the chemical scent of the predator but are most agitated when sensing a feeding predator."

The algae do this to stay alive. If the phytoplankton have no place to hide, they'll get eaten up by their zooplankton predators within a day. But the algae double in population every two days if they have a refuge, the researchers said. If the same is true for other species of phytoplankton, this discovery could offer a new explanation for some plankton blooms.

Source: **Live Science**

Researchers have discovered a tiny plant, a phytoplankton called Heterosigma akashiwo can flee from its zooplankton predator.

LIGHTS

Pierre Curie

PIERRE Curie was born on May 15. He was a French physicist, a pioneer in crystallography, magnetism, piezoelectricity and radioactivity. In 1903 he received the Nobel Prize in Physics with his wife, Marie Curie and Henri Becquerel, "in recognition of the extraordinary services they have rendered by their joint researches on the radiation phenomena discovered by Professor Henri Becquerel."

He was educated by his father, and in his early teens showed a strong aptitude for mathematics and geometry. When he was 16, he earned his math degree. By the age of 18 he had completed the equivalent of a higher degree, but did not proceed immediately to a doctorate due to lack of money. Instead he worked as a laboratory instructor.

In 1880, Pierre and his older brother Jacques (18561941) demonstrated that an electric potential was generated when crystals were compressed, i.e. piezoelectricity.

In 1881, they demonstrated the reverse effect: that crystals could be made to deform when subject to an electric field. Almost all digital electronic circuits now rely on this in the form of crystal oscillators.

When introduced by a friend, Pierre met Mariecurie. He proposed to her but Maria (Marie) refused, even though she loved him, too. She finally agreed to marry him on 26 July 1895.

Furthermore, Pierre studied ferromagnetism, paramagnetism, and diamagnetism for his doctoral thesis, and discovered the effect of temperature on paramagnetism which is now known as Curie's law.

Pierre was killed in a street accident in Paris on April 19, 1906.

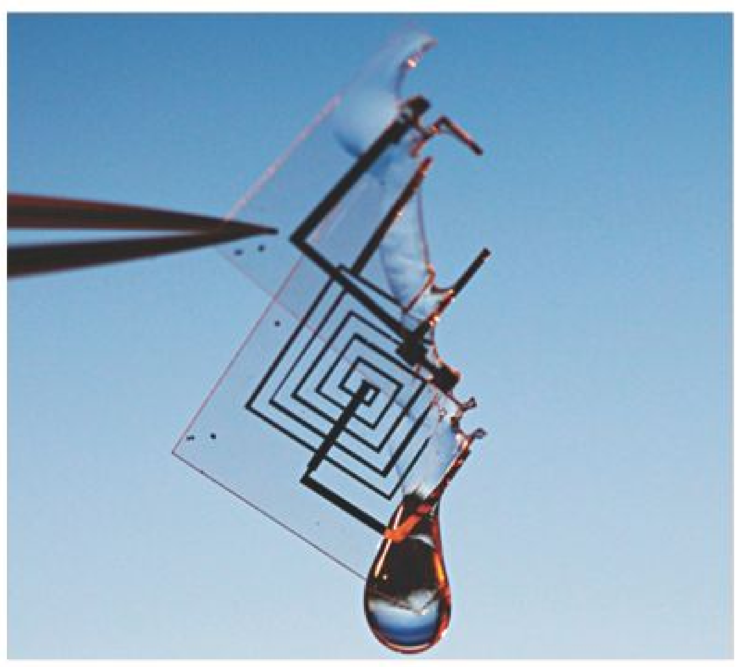
Source: **Wikipedia**

LEADING SOLUBLE

Device that rot

TECHNIQUE combines silicon, magnesium and silk for medical implants, transistors and digital cameras that can melt away

Imagine your old phone dissolving away after you've traded up, or a pacemaker that's absorbed by the body when it's no longer needed. Such gadgetry may not be far off: Scientists have developed a technique for making electronic devices that disappear without a trace. Constructed of silicon, magnesium and silk, the transient electronics can be tuned to last for days, weeks or even a year and then disappear.



A biodegradable circuit dissolves in water.

Scientists used the approach to make a bacteria-fighting medical implant that melts away after a few weeks, and a simple 64-pixel sensor array like those found in digital cameras, which was designed to last for about a day. The researchers also made temperature and strain sensors, solar cells, transistors, radio antennas and wireless power coils all of which degrade into nothing. The team describes the work in the Sept. 28 Science.

"This is a huge step. It is a pinnacle," says materials engineer Mihai Irimia-Vladu of Johannes Kepler University in Austria. "It's a very elegant demonstration of making functional devices that are biodegradable."

Superthin slices of semiconducting silicon and components made of magnesium perform the hardware and semiconducting tasks. The silk serves as scaffolding and packaging, which largely determines the lifetime of the device. So a unit might have a magnesium resistor, a silicon diode and a capacitor made out of magnesium and magnesium oxide. These delicate structures are stamped onto a sheet of silkworm silk and then packaged in more silk.

By liquefying the silk beforehand and then manipulating the concentration of various silk proteins, the researchers can package the device so it lasts for just a few days or for up to a year or longer, says study coauthor John Rogers of the University of Illinois at UrbanaChampaign. Extensive calculations that incorporate chemical reaction rates, such as rates of solubility and diffusion, allow the researchers to predict and program the lifetime of a particular device.

In one demonstration, the scientists made a wireless-controlled implant that emits heat, killing bacteria. Three weeks after implanting it on a rat's surgical wound, the device had nearly disappeared.

While there is still testing to be done before such implants are used in people, the ingredients have a good track record: Silk has been used as sutures for wounds for decades and is known to safely disintegrate. The quantity of magnesium used in the devices is far less than that in a daily vitamin. Silicon has also been under investigation for some time as a means of delivering drugs to a specific site in the body.

In the new study, the rat's implant was designed to break down after absorbing a certain amount of body fluid. But it's possible that pH, temperature or other environmental cues might kick off the disappearing act.

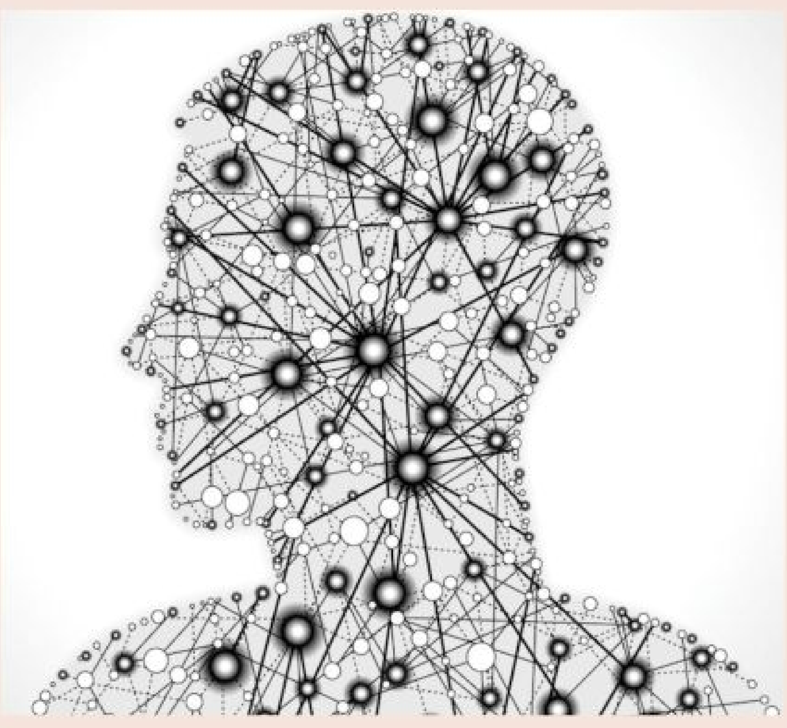
In addition to implants that release drugs or heat at a wound site, the approach could be used for crafting other temporary implants, such as pacemakers needed for a short time following heart surgery. The environmental realm is another promising area: Say there's an oil spill you want to monitor for a year. Instead of dropping sensors you have to collect later or that would drop to the bottom of the sea, they could just decompose. Eventually, such transient electronics might even make their way into consumer devices.

"Many electronics are built to last forever, and that's fine, but think about smart phones today nobody wants to keep them after a couple of years," says Rogers. "In the longer term this is also about not contributing to an unmanageable waste stream."

Source: **Science News**

BI-FI

Biological Internet



Bioengineers creat biological internet.

IF you were a bacterium, the virus M13 might seem innocuous enough. It insinuates more than it invades, setting up shop like a freeloading houseguest, not a killer. Once inside it makes itself at home, eating your food, texting indiscriminately. Recently, however, bioengineers at Stanford University have given M13 a bit of a makeover.

The researchers, Monica Ortiz, a doctoral candidate in bioengineering, and Drew Endy, PhD, an assistant professor of bioengineering, have parasitized the parasite and harnessed M13's key attributes -- its nonlethality and its ability to package and broadcast arbitrary DNA strands -- to create what might be termed the biological Internet, or "Bi-Fi." Their findings were published online Sept. 7 in the Journal of Biological Engineering.

Using the virus, Ortiz and Endy have created a biological mechanism to send genetic messages from cell to cell. The system greatly increases the complexity and amount of data that can be communicated between cells and could lead to greater control of biological functions within cell communities. The advance could prove a boon to bioengineers looking to create complex, multicellular communities that work in concert to accomplish important biological functions.

Medium and message

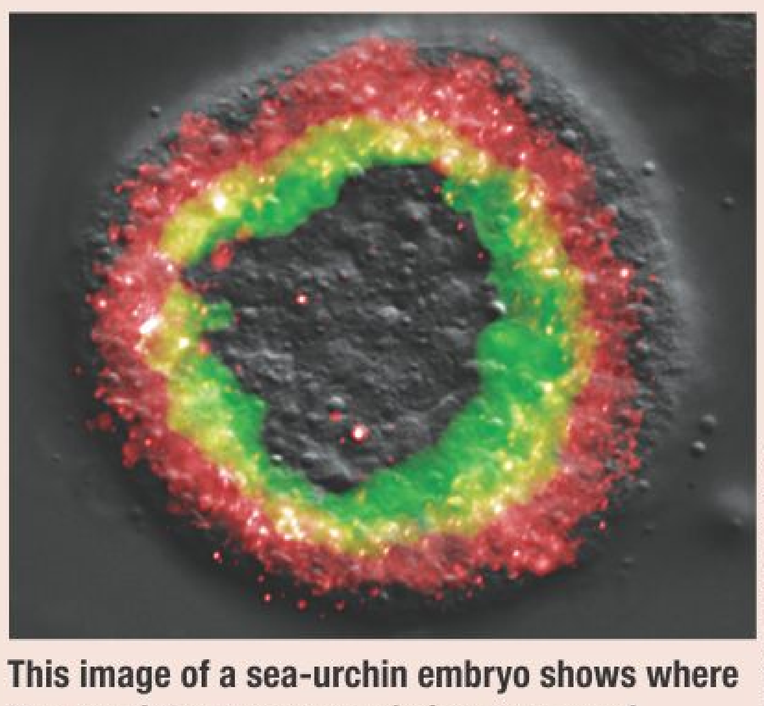
M13 is a packager of genetic messages. It reproduces within its host, taking strands of DNA -- strands that engineers can control -- wrapping them up one by one and sending them out encapsulated within proteins produced by M13 that can infect other cells. Once inside the new hosts, they release the packaged DNA message.

The M13-based system is essentially a communication channel. It acts like a wireless Internet connection that enables cells to send or receive messages, but it does not care what secrets the transmitted messages contain.

"Effectively, we've separated the message from the channel. We can now send any DNA message we want to specific cells within a complex microbial community," said Ortiz, the first author of the study.

Source: **Science Daily**

URCHIN WAY



This image of a sea-urchin embryo shows where two regulatory genes are being expressed.

SOURCE: LIVE SCIENCE

Gene regulatory network

As an animal develops from an embryo, its cells take diverse paths, eventually forming different body parts muscles, bones, heart. The cells are following a genetic blueprint, which consists of complex webs of interacting genes called gene regulatory networks.

Biologists at the California Institute of Technology have for the first time built a computational model of one of these networks. Their work is based on roughly a decade of research into how gene networks control development in sea-urchin embryos.

The scientists say the model is remarkably good at calculating what sea-urchin gene regulatory networks do to control the fates of different cells in the early stages of development. The model confirms that the interactions among a few dozen genes suffice to tell an embryo how to start developing different body parts in the right places.

DID YOU KNOW?

What is a tachyon?

Because a tachyon always moves faster than light, we cannot see it approaching. After a tachyon has passed nearby, we would be able to see two images of it, appearing and departing in opposite directions.

Tachyon or tachyonic particle is a hypothetical particle that always moves faster than light. The word comes from the Greek: tachys, meaning "swift, quick, fast, rapid", and was coined by Gerald Feinberg in a 1967 paper. Feinberg proposed that tachyonic particles could be quanta of a quantum field with negative squared mass. However, it was soon realized that excitations of such imaginary mass fields do not in fact propagate faster than light, but instead represent an instability known as tachyon condensation.