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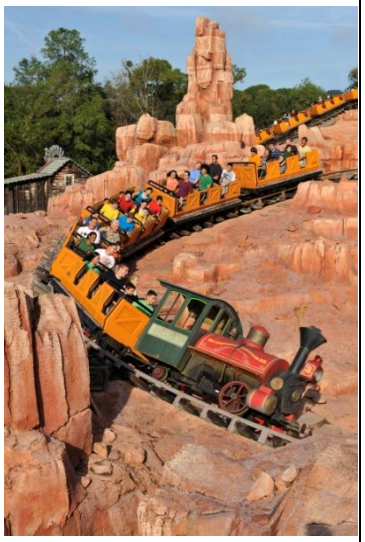
This Roller Coaster Helps People Pass Kidney Stones (Yes, Really)

Doctors may have found an unconventional way to get rid of painful kidney stones — but it will cost you a trip to Disney World.

By Sara G. Miller, Staff Writer | September 26, 2016 03:45pm ET

Researchers found that riding the Big Thunder Mountain Railroad roller coaster at Disney World could help ease the passage of small kidney stones, according to the new study.



Riders on the Big Thunder Mountain Railroad roller coaster at Disney World.
Garth Vaughan, Walt Disney World

Kidney stones are hard masses of minerals that form in the kidneys. They can range in size, from a tiny grain of sand to, in extreme cases, the size of a golf ball. Patients with kidney stones don't always need treatment, because the stones can pass out of the body on their own, but the process of passing them can be quite painful. The stones must travel from the kidney down the ureter and to the bladder, and then exit the body through the urethra.

The authors of the new study, published today (Sept. 26) in the Journal of the American Osteopathic Association, noticed that several of their patients had reported passing kidney stones after going on the Big Thunder Mountain Railroad roller coaster at Disney World in Florida.

In one instance, for example, a man told the doctors that he passed a stone after three consecutive rides on the roller coaster, according to the study.

Studying this phenomenon required a bit of ingenuity from the researchers. To test the effects of riding a roller coaster with kidney stones, they created a 3D model of a kidney that could be taken along for the ride (concealed in a backpack, of course).

In the experiment, the researchers placed three real kidney stones and some urine in the model kidney. The kidney stones were different sizes: small (4.5 cubic millimeters), medium (13.5 cubic mm) and large (64.6 cubic mm).

The researchers took the model kidney on the Big Thunder Mountain Railroad roller coaster 20 times. They experimented with the position of the different sizes of kidney stones in different parts of their kidney model. On one ride, for example, the largest stone was placed in the upper part of the kidney; on another, the large stone was placed in the middle of the kidney. Ultimately, each stone was placed in each location of the kidney for at least one ride.

The researchers noted that one aspect of the experiment that they could not control was where they sat on the roller coaster. Indeed, "seat assignment on the roller coaster was random and determined as a function of place in the waiting line," they wrote.

But seat assignment turned out to be important. When the researchers were seated in the rear car of the roller coaster, the kidney stones, regardless of their size or location in the kidney, passed nearly 64 percent of the time, according to the study.

When the researchers sat in the front of the roller coaster, however, the stones passed only about 17 percent of the time, the researchers found.

The preliminary study's findings "support the anecdotal evidence that a ride on a moderate-intensity roller coaster could benefit some patients with small kidney stones," Dr. David Wartinger, a professor emeritus of urology at the Michigan State University College of Osteopathic Medicine and a co-author of the study, said in a statement.

Riding a roller coaster after having treatments such as lithotripsy — a procedure that aims to break up kidney stones into smaller particles using ultrasound shock waves — could prevent stones from getting larger and causing additional problems, Wartinger said.

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New 'Artificial Synapses' Pave Way for Brain-Like Computers

A brain-inspired computing component provides the most faithful emulation yet of connections among neurons in the human brain, researchers say.

By Edd Gent, Live Science

The so-called memristor, an electrical component whose resistance relies on how much charge has passed through it in the past, mimics the way calcium ions behave at the junction between two neurons in the human brain, the study said. That junction is known as a synapse. The researchers said the new device could lead to significant advances in brain-inspired — or neuromorphic — computers, which could be much better at perceptual and learning tasks than traditional computers, as well as far more energy efficient.

"In the past, people have used devices like transistors and capacitors to simulate synaptic dynamics, which can work, but those devices have very little resemblance to real biological systems. So it's not efficient to do it that way, and it results in a larger device area, larger energy consumption and less fidelity," said study leader Joshua Yang, a professor of electrical and computer engineering at the University of Massachusetts Amherst.

Previous research has suggested that the human brain has about 100 billion neurons and approximately 1 quadrillion (1 million billion) synapses. A brain-inspired computer would ideally be designed to mimic the brain's enormous computing power and efficiency, scientists have said.

"With the synaptic dynamics provided by our device, we can emulate the synapse in a more natural way, more direct way and with more fidelity," he told Live Science. "You don't just simulate one type of synaptic function, but [also] other important features and actually get multiple synaptic functions together."

Mimicking the human brain

In biological systems, when a nerve impulse reaches a synapse, it causes channels to open, allowing calcium ions to flood into the synapse. This triggers the release of brain chemicals known as neurotransmitters that cross the gap between the two nerve cells, passing on the impulse to the next neuron.

The new "diffusive memristor" described in the study consists of silver nanoparticle clusters embedded in a silicon oxynitride film that is sandwiched between two electrodes.

The film is an insulator, but when a voltage pulse is applied, a combination of heating and electrical forces causes the clusters to break up. Nanoparticles diffuse through the film and eventually form a conductive filament that carries the current from one electrode to the other. Once the voltage is removed, the temperature drops and the nanoparticles coalesce back into clusters.

Because this process is very similar to how calcium ions behave in biological synapses, the device can mimic short-term plasticity in neurons, the researchers said. Trains of low-voltage pulses at high frequencies will gradually increase the conductivity of the device until a current can pass through, but if the pulses continue, this conductivity will eventually decline.

The researchers also combined their diffusion memristor with a so-called drift memristor, which relies on electrical fields rather than diffusion and is optimized for memory applications. This allowed the scientists to demonstrate a form of long-term plasticity called spike-timing-dependent plasticity (STDP), which adjusts connection strength between neurons based on the timing of impulses.

Previous studies have used drift memristors by themselves to approximate calcium dynamics. But these memristors are based on physical processes very different from those in biological synapses, which limits their fidelity and the variety of possible synaptic functions, Yang said.

"The diffusion memristor is helping the drift-type memristor behave similarly to a real synapse," Yang said. "Combining the two leads us

to a natural demonstration of STDP, which is a very important long-term plasticity learning rule."

Accurately reproducing synaptic plasticity is essential for creating computers that can operate like the brain. Yang said this is desirable because the brain is far more compact and energy efficient than traditional electronics, as well as being better at things like pattern recognition and learning. "The human brain is still the most efficient computer ever built," he added.

How to build it

Yang said his group uses fabrication processes similar to those being developed by computer memory companies to scale up memristor production. Not all of these processes can use silver as a material, but unpublished research by the team shows that copper nanoparticles could be used instead, Yang said.

Hypothetically, the device could be made even smaller than a human synapse, because the key part of the device measures just 4 nanometers across, Yang said. (For comparison, an average strand of human hair is about 100,000 nanometers wide.) This could make the devices much more efficient than traditional electronics for building brain-inspired computers, Yang added. Traditional electronics need roughly 10 transistors to emulate one synapse.

The research is the most complete demonstration of an artificial synapse so far in terms of the variety of functions it is capable of, said neuromorphic computing expert Ilia Valov, a senior scientist at the Peter Grunberg Institute at the Jülich Research Centre in Germany.

He said the approach is definitely scalable and single-unit systems should certainly be able to get down to the scale of biological synapses. But he added that in multiunit systems, the devices will likely need to be bigger due to practical considerations involved in making a larger system work.

The study's findings were published online today (Sept. 26) in the journal Nature Materials.

http://bit.ly/2dKzda6

How cancer's 'invisibility cloak' works

UBC researchers have discovered how cancer cells become invisible to the body's immune system, a crucial step that allows tumours to metastasize and spread throughout the body.

"The immune system is efficient at identifying and halting the emergence and spread of primary tumours but when metastatic tumours appear, the immune system is no longer able to recognize the cancer cells and stop them," said Wilfred Jefferies, senior author of the study working in the Michael Smith Laboratories and a professor of Medical Genetics and Microbiology and Immunology at UBC.

"We discovered a new mechanism that explains how metastatic tumours can outsmart the immune system and we have begun to reverse this process so tumours are revealed to the immune system once again."

Cancer cells genetically change and evolve over time. Researchers discovered that as they evolve, they may lose the ability to create a protein known as interleukein-33, or IL-33. When IL-33 disappears in the tumour, the body's immune system has no way of recognizing the cancer cells and they can begin to spread, or metastasize.

The researchers found that the loss of IL-33 occurs in epithelial carcinomas, meaning cancers that begin in tissues that line the surfaces of organs. These cancers include prostate, kidney breast, lung, uterine, cervical, pancreatic, skin and many others.

Working in collaboration with researchers at the Vancouver Prostate Centre, and studying several hundred patients, they found that patients with prostate or renal (kidney) cancers whose tumours have lost IL-33, had more rapid recurrence of their cancer over a five-year period. They will now begin studying whether testing for IL-33 is an effective way to monitor the progression of certain cancers.

"IL-33 could be among the first immune biomarkers for prostate cancer and, in the near future, we are planning to examine this in a larger sample size of patients," said Iryna Saranchova, a PhD student

in the department of microbiology and immunology and first author on the study.

Researchers have long tried to use the body's own immune system to fight cancer but only in the last few years have they identified treatments that show potential.

In this study Saranchova, Jefferies and their colleagues at the Michael Smith Laboratories, found that putting IL-33 back into metastatic cancers helped revive the immune system's ability to recognize tumours. Further research will examine whether this could be an effective cancer treatment in humans.

This study was published in the journal Scientific Reports. This research was funded by the Canadian Institutes for Health Research.

Background

This research was completed with co-authors: Jeff Han, Hui Huang, Franz Fenninger, Kyung Bok Choi, Lonna Munro and Cheryl Pfeifer at the Michael Smith Laboratories, the Centre for Blood Research, the Djavad Mowafaghian Centre for Brain Health, and the departments of medical genetics, zoology and microbiology and immunology at UBC; as well as Alexander Wyatt, Ladan Fazli and Martin Gleave at the Vancouver Prostate Centre, a research hub hosted by UBC and Vancouver Coastal Health Research Institute; and Ian Welch in UBC Animal Care Services.

How does IL-33 work?

Cancer cells genetically change and evolve. As the cells evolve, they lose the ability to create a protein known as interleukein-33 (IL-33). This protein influences another protein complex, known as the major histocompatibility complex (MHC), that act as beacons to help identify whether a given cell is a good cell or a bad cell. With these proteins working, primary tumour cells put warning flags on the outside of the cell so that immune cells recognize it and destroy it. When interleukin-33 disappears in the tumour, the flag-displaying pathway falls apart and body's immune system has no way of recognizing the cancer cells and they can begin to spread, or metastasize.

Iryna Saranchova, Jeffrey Han, Hui Huang, Franz Fenninger, Kyung Bok Choi, Lonna Munro, Cheryl Pfeifer, Ian Welch, Alexander W. Wyatt, Ladan Fazli, Martin E. Gleave, Wilfred A. Jefferies. Discovery of a Metastatic Immune Escape Mechanism Initiated by the Loss of Expression of the Tumour Biomarker Interleukin-33. Scientific Reports, 2016; 6: 30555 DOI: 10.1038/srep30555

http://bit.ly/2dBmI1t

It Takes 2: RNA–DNA Mashup May Have Kick-Started Life on Earth

New research shows each molecule needed the other one

By Melissae Fellet, ChemistryWorld on September 26, 2016

Early life may have emerged from a mixture of RNA and DNA building blocks, developing the two nucleic acids simultaneously instead of evolving DNA from RNA.

According to the RNA world hypothesis, early life used RNA to carry genetic information and perform biochemical catalytic reactions. Over time, DNA developed from RNA as the carrier of genetic information and proteins appeared as biochemical catalysts.

As RNA gave way to DNA, some think a mixture of nucleotide building blocks would have been inevitable. As these nucleotides connected to form strands, the thermodynamic and kinetic stability of pure RNA and DNA duplexes would drive these nucleic acids to accumulate in primitive cells, while less thermally stable complexes containing one strand of RNA and one strand of DNA fell apart.

Ramanarayanan Krishnamurthy, at the Scripps Research Institute, and colleagues wondered if duplexes where each strand contains both RNA and DNA nucleotides were stable enough to have been possible intermediates during the transition from RNA to DNA. The researchers purchased commercially synthesised sequences of RNA and DNA, six to 16 bases long. In some sequences, they systematically changed purine RNA nucleotides, containing the bases adenine or guanine, into the corresponding DNA purines. In others, they changed pyrimidine RNA nucleotides, with cytidine or uracil bases, into pyrimidine DNA nucleotides with cytidine or thymidine bases. The result was several series of nucleic acid duplexes that ranged from having all RNA nucleotides to none at all.

To test the thermal stability of these sequences, the researchers heated each duplex to separate the strands. Then they measured the increase in UV absorption as the strands melted. The faster the absorption increased as the temperature increased, the faster the strands separated, indicating a less stable duplex. Many mixed duplexes with strands containing both RNA and DNA nucleotides melted as much as 20 degrees before pure RNA or pure DNA duplexes, indicating they were significantly less thermally stable than the pure duplexes.

Krishnamurthy says they were surprised to see this instability trend hold for a variety of sequences. Without ways to prevent these mixed sequences from forming or primitive catalysts to overcome their instability, the researchers imagine that the most efficient path to pure RNA and pure DNA duplexes would start from a mixture of both nucleotides, rather than that nucleotide mixture developing from a pool of pure RNA.

'This paper presents significant results that will influence our thinking about the way that RNA and DNA could have interacted in primitive life,' says David Deamer, at the University of California, Santa Cruz, US. Depending on conditions, however, RNA and DNA have very different abilities to withstand chemical changes like depurination, deamination, and hydrolysis. The chemical stability of these two nucleic acids should also be considered when thinking about how they could become incorporated into the earliest forms of life, he adds.

The assumption that a primitive world was not chemically sophisticated enough to differentiate RNA and DNA building blocks challenges some evidence for the capabilities of the RNA world, says Steven Benner, of the Foundation for Applied Molecular Evolution in the US. Small molecules that enhance the activity of modern enzymes, such as coenzyme A, have RNA nucleotide tails. This indicates that these RNA cofactors could have been part of a RNA world able to assemble pure RNA and pure DNA from a pool of both nucleotides, he says.

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Artificial Blood Vessels Grow After They're Implanted

Researchers have engineered artificial blood vessels that can grow after they are implanted, according to a new study done in lambs.

By Agata Blaszczak-Boxe, Contributing

The blood vessels were engineered to replace real vessels that would normally carry blood from the lambs' hearts to their lungs. The results could one day help to make vessels that could prevent the need for repeated surgeries in children with certain heart defects, although more research is needed to test whether these vessels could eventually be implanted in humans, the researchers said.

Children who have certain heart defects may need surgery to replace the vessels connecting the heart to the lungs. But the reconstructed vessels that are currently used in these surgeries are made of a material that can't grow as the child grows, said study co-author Robert Tranquillo, a professor of biomedical engineering at the University of Minnesota. "There is no material that grows with a person," Tranquillo told Live Science. As a result, these children may have to undergo five to seven surgeries during their lifetimes, just to keep getting new, larger replacements for the vessels.

In the new study, the researchers wanted to address this problem and create a material that would be capable of growth and that could eventually eliminate the need for these children to have multiple surgeries.

To engineer the artificial blood vessels, the researchers first placed sheepskin cells into a special tube, and then pumped nutrients into the fluid around the cells, allowing the cells to grow. Eventually, the cells formed a sheet that took on the shape of the tube. The pumping caused the cells to stretch and deposit proteins into their surroundings. These proteins would eventually serve as building blocks for the vessels.

Then, the researchers washed the cells away, and all that was left was a tube-shaped protein scaffold. The researchers hoped that if they got rid of the cells, the blood-vessel grafts would not be recognized as

foreign bodies and, in turn, would not be rejected by the recipients' immune systems.

Next, the researchers implanted those blood-vessel grafts in three 5-week-old lambs, to replace parts of the vessels connecting the heart and the lungs. They found that the protein scaffolds became populated by the lambs' own cells after transplantation, and grew together as the lambs grew.

The researchers followed the sheep until they turned almost 1 year old and were about four to five times larger than they were when the vessels were implanted. The lambs did not seem to experience any negative side effects from the transplants, according to the study, published Sept. 27 in the journal Nature Communications.

Also at that time, the researchers removed the grafted blood vessels from the lambs, and examined the vessels' features. They found that the grafts had grown from relatively small tubes to larger structures that were about 50 percent longer and wider than their original lengths and widths, and were functioning almost like normal arteries in the adult sheep, Tranquillo said.

http://nyti.ms/2dB3aGs

Americas Region Declared Free of Endemic Measles

Global health authorities on Tuesday declared the Americas free of endemic measles, the first region to be so certified.

By DONALD G. McNEIL Jr. SEPT. 27, 2016

The hemisphere's last case of endemic measles — meaning one that did not spring from an imported strain — was in 2002.

Normally, it takes three years without cases to declare a disease eradicated from a region, but in this instance it took 14 years.

Experts at the Pan American Health Organization in Washington, D.C., where the announcement was made, cited several reasons for the delay: poor communication between local and national health departments in some countries, large numbers of unvaccinated mobile migrants in others, and parts of other countries that were unreachable because of fighting.

The certification process "is really hard," said Dr. Merceline Dahl-Regis, who chaired the expert committee that made the announcement. "It's not an easy task." She did not name the countries that delayed the certification, but she did congratulate Brazil for working especially hard to vaccinate children and look for cases in recent years.

Despite the elimination of endemic measles, outbreaks of imported strains continue. A case of measles in the United States was reported earlier this month, for example. In December 2014, an outbreak of hundreds of cases started in California's Disneyland and spread to several western states and then to Mexico and Canada.

The outbreak, involving a strain of measles circulating in the Philippines, was declared over in April 2015. But its rapid dissemination exposed the fact that nine million American children were not fully vaccinated against measles and led to tightening of vaccination rules for California schoolchildren.

In February 2015, P.A.H.O. and the World Health Organization warned that vaccination rates in the United States and Brazil appeared to be "below levels needed to prevent the spread of imported cases."

Dr. Susan Reef, a measles and rubella specialist at the Centers for Disease Control and Prevention consulting with P.A.H.O., said that the 2015 outbreak was "a tiny issue compared to tens of thousands of cases" seen in countries where measles is endemic. Transmission in that instance was not considered endemic because it did not go on for more than a year, she said. "That outbreak was stopped very quickly," she said, adding that the unvaccinated Americans to whom measles spread were "a very, very tiny group."

Measles is one of the most infectious diseases known, and its elimination has been a goal of the W.H.O. for decades. Worldwide, cases have dropped nearly 80 percent in the last two decades, as donors began pouring money into buying vaccines for poor countries.

But 315 children worldwide still die of measles every day, said Dr. Mary Agocs, an adviser to the Red Cross.

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Pilots, air traffic controllers shifting to text messaging

Most of the nation's busiest airports will switch by the end of the year

September 27, 2016 by Joan Lowy

Airline pilots and air traffic controllers are on schedule to switch to text communications at most of the nation's busiest airports by the end of the year, a milestone that holds the potential to reduce delays, prevent errors and save billions of dollars in fuel cost, says the Federal Aviation Administration.

Controllers and pilots will still use their radios for quick exchanges like clearance for takeoff and in emergencies and situations where time is critical. But the nation's air traffic system is gradually shifting to text messages for a majority of flying instructions.

That's a big advantage, say government and industry officials, because up until now longer and more complicated instructions like a route change for pilots of planes waiting to take off are communicated verbally, with each word laboriously spelled out in the radio alphabet.

For example, HARD becomes "Hotel Alfa Romeo Delta." And it is hard to get it right. Pilots have to write down the directions as the controller reads them—then they read them back, also spelling out each word. If there is a mistake, the controller reads the directions back to the pilot again the same way, and so on. Even when there are no mistakes, the process can eat up valuable minutes.

If controllers want to reroute planes around a thunderstorm, they have to contact each plane by radio to relay instructions individually. With dozens of planes waiting for their turn to get instructions, the process can take 30 minutes or longer.

With the new system, called Data Comm, a controller can type a few instructions into a computer, tap a key and send the message directly to the flight management computers in each plane that needs the information. Pilots read the information on cockpit display screens and decide with the push of a button whether to accept it. The controller's message is also sent directly to airline flight dispatch computers, eliminating more time-consuming steps. Typing errors are always a risk with text messaging, but officials said the system has built-in safeguards that cause it to reject messages with certain errors.

"Data Comm will allow passengers to get off the tarmac, into the air and to their destinations more quickly," said Jim Eck, FAA's assistant administrator for modernization of the air traffic system. "Airlines will be able to stay on schedule and packages will be delivered on time."

Data Comm was rolled out at Dulles International Airport outside Washington, D.C., three weeks ago. "We're all loving it," said controller Sharlotte Yealdhall. "It has made a huge difference."

So far, Dulles controllers have been able to substitute Data Comm for voice communications for about 10 to 20 percent of their departures. That share will increase as airlines equip more of their planes to use the technology. Eight U.S. passenger and cargo airlines—American, Delta, Hawaiian, Southwest, United, Virgin America, United Parcel Service and FedEx—and 17 international carriers have told the FAA they plan to add Data Comm to their planes.

Delta estimates that Data Comm can shave one minute off the time it takes a plane to taxi for takeoff. Spread over Delta's fleet of planes, the airline says that adds up to a savings of about $20 million a year.

The FAA estimates Data Comm will save airlines more than $10 billion over the next 30 years and the government another $1 billion.

The FAA began testing Data Comm in 2013 at airports in Memphis, Tennessee, and Newark, New Jersey. At the start of this year, it was in use at five airports. The FAA says it expects the system to be in use at 50 airports by the end of the year.

Planes waiting to take off at airports are one phase of the Data Comm rollout. The system is already in use in for high-altitude air traffic on busy trans-Atlantic routes, but not during the high-altitude phase of domestic flights. The FAA expects to have the system ready at its air traffic centers that handle high-altitude flights beginning in 2019.

http://bbc.in/2dJpP3I

Elon Musk outlines Mars colony vision

Entrepreneur Elon Musk has outlined his vision for establishing a human colony on Mars for people that can afford a $200,000 ticket price.

By Rob Coppinger Spaceflight writer, Guadalajara, Mexico

Mr Musk, who founded private spaceflight company SpaceX, was speaking at the International Astronautical Congress (IAC) in Guadalajara, Mexico, on Tuesday.

His colonisation plan uses a fully reusable transportation system that would take 100 people and 80 days to get to Mars and eventually as little as 30 days. This transportation system consists of a spaceship that is refuelled with methane and oxygen in Earth orbit and also on Mars after landing there.

Mr Musk explained that to achieve the $200,000 price, the entire transportation system has to be reusable. He spoke of a colony of a million people to make it self-sustaining and that, with his plan, that could take 100 years. To reach a million, Mr Musk said: "I want to make Mars seem possible, something we can do in our life times… and that anyone can go if they wanted to." The first Mars flight could take place in 2022, according to SpaceX's timeline for Mars colonisation.

Mr Musk said that he would like to name the first spacecraft that goes to Mars, The Heart of Gold, after a starship in Douglas Adams' book, The Hitchhiker's Guide to the Galaxy. The launch site will be Nasa's Kennedy Space Centre pad 39, from where the Apollo Moon missions flew.

The reason why Mr Musk wants to go to Mars is, he said: "Without someone with a real ideological commitment, it didn't seem we were on any trajectory to become a spacefaring civilisation." The prototype spaceship is planned to make test flights in four years, initially going into space, but not into orbit.

At the weekend, Mr Musk announced that SpaceX had carried out its first test of the Raptor rocket engine that will power the spaceship and the booster that puts it into orbit.

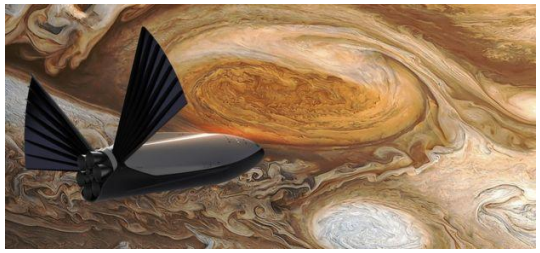
A prototype booster fuel tank has been built and tested and Mr Musk showed a picture of the enormous tank with staff standing next to it.

The combination of the booster and spaceship is called the Interplanetary Transportation System (ITS) and together they stand 122 metres tall, bigger than an Apollo-era Moon programme Saturn V rocket. The booster will have 42 Raptor engines. Arranged in concentric circles, there will be an outer circle of 24 engines, an inner circle of 14 and in the centre seven Raptors.

Future versions of the ITS could be larger to accommodate bigger spaceships with up to 200 passengers. The spaceship will have nine Raptor engines, carry 450 tonnes of people and cargo and have an open plan "occupant compartment" for colonists, according to Mr Musk. He envisages communal living during the eighty-day trip with movies and lectures and zero gravity games.

The ITS' development will be funded by profit from SpaceX, Mr Musk's own wealth. He sees the colonisation of Mars as a "huge public private partnership", and said, "that is how the United States was established".

Spaceships would be sent every two years when Mars is closest to Earth and the two worlds will be 57.6 million kilometres apart in 2018.



The SpaceX founder wants to open up access to the whole of the "Greater Solar System" **SpaceX**

At their furthest, they can be 400 million kilometres apart and in the past they have only been as close as 100 million kilometres.

Once it reaches Mars, the spaceship is shaped so that it will naturally be decelerated as it passes through the atmosphere. Its engines will

then fire to slow it down to land vertically on legs, like SpaceX's Falcon 9 rocket does today.

Mr Musk outlined a future where 1,000 spaceships could be in orbit. "The Mars colonial fleet would depart en masse." He expected a spaceship to last 12-15 flights. The price could eventually come down to $100,000 to $140,000. If someone wanted to return to Earth they could take a returning spaceship, "for free", Mr Musk commented.

SpaceX also plans to launch the spacecraft it calls Red Dragon to Mars in a couple of years when the Earth and Mars are closest.

Red Dragon is a version of SpaceX's Dragon spacecraft that is carrying cargo to the International Space Station, and a human version is being developed for astronauts. SpaceX will offer the Red Dragon flights to governments and private organisations to send scientific and commercial payloads to the Red Planet.

http://bbc.in/2cK68f6

Teens with spots tend to stay looking younger for longer, new research suggests

If you're a teenager who has acne, it can feel like the end of the world. But your adult self may thank you for it.

By Anna Collinson

New research from King's College London, based on 1,205 female twins, suggests adolescents with spots tend to stay looking youthful for longer, compared to peers with "perfect skin". Experts claim it's because people with acne have a built-in protection against ageing. That means things like wrinkles and thinning skin often appear later.

Why?

This study has taken a look at white blood cells taken from acne sufferers and found they had longer protective caps on the ends of

These caps are called telomeres and are like the plastic tips on shoe laces which stop them from becoming frayed. This prevents chromosomes from deteriorating.

Telomeres shrink over time and people with long ones tend to age more slowly than those with short ones. The conclusion? Teenagers who have spots are more likely to look youthful for longer.

The science part

In the King's College study, a quarter of the female twins who took part in the research had acne. Analysis of skin samples highlighted a gene pathway called p53 which regulates the death of cells. This can be triggered when telomeres become too short. However, the p53 pathway was found to be less active in the skin of acne sufferers.

What the experts say

For a long time dermatologists have known that the skin of people with acne appears to age more slowly, but until now they weren't sure why. "Our findings suggest the cause could be linked to the length of telomeres which appears to be different in acne sufferers and means their cells may be protected against ageing," explains lead researcher Dr Simone Ribero from King's College London.

Co-author Dr Veronique Bataille said: "Longer telomeres are likely to be one factor explaining the protection against premature skin ageing in individuals who previously suffered from acne."

The researchers say more investigations are needed.

http://bit.ly/2cKVUWJ

Freezing technique is an effective alternative to lumpectomy for early stage breast cancer, study finds

Cryoablation is a viable alternative to traditional surgery in many early-stage breast cancers

A deep-freezing technique known as cryoablation is a viable alternative to traditional surgery in many early-stage breast cancers, New York-Presbyterian and Weill Cornell Medicine researchers find in a new clinical study. The results are published in the Annals of Surgical Oncology.

"Minimally invasive techniques are becoming increasingly popular in cancer care, and cryoablation represents a valid option for early stage breast cancer treatment," said Dr. Rache Simmons, chief of breast

surgery at NewYork-Presbyterian/Weill Cornell Medical Center and the Anne K. and Edwin C. Weiskopf Professor of Surgical Oncology at Weill Cornell Medicine. "The results from this trial are extremely promising, and we look forward to exploring the technique for a greater number of patients."

In cryoablation, doctors use ultrasound imaging to insert a thin, needle-like device into the patient's tumor. Once inside, the device emits liquid nitrogen, which freezes and destroys the cancerous tissue. The technique can be performed in an outpatient setting under local anesthesia, and has been used for many years to treat cancers of the liver, lung and kidney, as well as noncancerous breast tumors, known as fibroadenomas.

Physicians have only recently begun using it for early-stage breast cancer, which is traditionally treated by a combination of radiation and surgery. The phase II, non-randomized trial examined 86 patients with 87 cancers at 19 centers across the country. The technique successfully treated 92 percent of the targeted cancers, and 100 percent less than one centimeter. The primary tumor was removed from the patients within 28 days of the cryoablation.

The trial marks the first time cryoablation has been studied for the treatment of early-stage breast cancer in a multicenter study.

"Further study is needed, but cryoablation appears to represent a unique and patient-friendly option for treatment of some breast cancers," Dr. Simmons said. "We're excited to see what the future holds for this technique."

Rache M. Simmons, Karla V. Ballman, Charles Cox, Ned Carp, Jennifer Sabol, Rosa F. Hwang, Deanna Attai, Michael Sabel, David Nathanson, Andrew Kenler, Linsey Gold, Cary Kaufman, Linda Han, Aaron Bleznak, J. Stanley Smith, Dennis Holmes, Bruno Fornage, Carisa Le-Petross, Syed Hoda, Linda McCall, Kelly K. Hunt. A Phase II Trial Exploring the Success of Cryoablation Therapy in the Treatment of Invasive Breast Carcinoma: Results from ACOSOG (Alliance) Z1072. Annals of Surgical Oncology, 2016; 23 (8): 2438 DOI: 10.1245/s10434-016-5275-3

http://bit.ly/2dBezKV

Time window to help people who have had a stroke longer than previously shown

New research finds that removing blood clots has benefits for people up to 7.3 hours following the onset of a stroke.

Time is of the essence when getting people stricken with acute ischemic strokes to treatment. And the use of stent retrievers -- devices that remove the blood clot like pulling a cork out of a wine bottle -- has proven to be a breakthrough for removing the life-threatening blockage of blood flow to the brain.

Current professional guidelines recommend that the procedure be performed within six hours for people to benefit. But researchers on a UCLA-led study published in the Journal of the American Medical Association have found that the procedure has benefits for people up to 7.3 hours following the onset of a stroke.

"Extending the time window for therapy will let us help more patients, including patients who were not able to get to a hospital right away because the stroke started while they were asleep or made them unable to call for help," said Dr. Jeffrey Saver, director of the UCLA Comprehensive Stroke Center and the study's lead author.

The researchers also found that for each six-minute delay, there is a 1 percent increase in the proportion of people who end up disabled, underscoring the need for people to seek treatment as quickly as possible when they experience symptoms of a stroke. The study examined the relationship between the onset of the stroke, the amount of time until the blockage was treated and patient outcomes.

The first coil-shaped clot retriever was invented at UCLA and cleared for use in 2004. For this study, researchers primarily used a newer generation of stent retrievers, which were cleared for use in 2012. First, doctors insert the small mesh tubes through an artery in the leg to the blockage in the artery that takes blood to the brain. Next, they open the mesh tubes in the middle of the clot and then extract the stent and the clot to restore blood flow to the brain.

The current study combines data from five clinical trials involving a total of 1,287 people, including the SWIFT PRIME trial led by Saver, that show these devices improved outcomes for people with acute ischemic strokes due to large vessel blockage. The researchers analyzed the relationship between time from onset of the blockage to treatment and outcome among these patients.

The researchers found that people treated earlier with the retrievers plus standard medical therapy were less likely to be disabled three months after surgery than people who only received medical therapy. Outcomes were the best if the procedure was done within the first two hours of a stroke, but those treated up to 7.3 hours after a stroke continued to show a lesser benefit.

Earlier treatment is better than later treatment to restore blood flow and prevent or limit damage to the brain, Saver noted.

"It is important for the public to know the critically important relationship between time to treatment and outcome, so they know to activate the 911 system as soon as possible when they detect stroke symptoms in themselves or friends, family and co-workers," he said. "And it is important to reorganize regional systems of stroke care to ensure that ambulances transport appropriate patients to hospitals that perform this procedure quickly and safely."

The people in these trials were seen at mostly academic medical centers, so the question remains as to whether these same results can be achieved at non-academically affiliated medical centers. Other elements that could skew the results include differences in trial entry criteria and patient characteristics, and that these results may not apply to people who did not qualify for the trials.

In future studies, the researchers plan to use brain imaging techniques to determine if it is possible to identify a specific, smaller group of people who can benefit from the clot retrieval therapy seven to 24 hours after stroke onset, said Dr. Reza Jahan, professor of radiology and neurosurgery at UCLA, and a co-author of the study.

The five trials were funded by European and Canadian government agencies and by companies that make retrieval devices. This pooled analysis was funded by Medtronic, a maker of the retriever devices. The funding went to the University of Calgary, which collaborated on this study.

Jeffrey L. Saver, Mayank Goyal, Aad van der Lugt, Bijoy K. Menon, Charles B. L. M. Majoie, Diederik W. Dippel, Bruce C. Campbell, Raul G. Nogueira, Andrew M. Demchuk, Alejandro Tomasello, Pere Cardona, Thomas G. Devlin, Donald F. Frei, Richard du Mesnil de Rochemont, Olvert A. Berkhemer, Tudor G. Jovin, Adnan H. Siddiqui, Wim H. van Zwam, Stephen M. Davis, Carlos Castaño, Biggya L. Sapkota, Puck S. Fransen, Carlos Molina, Robert J. van Oostenbrugge, Ángel Chamorro, Hester Lingsma, Frank L. Silver, Geoffrey A. Donnan, Ashfaq Shuaib, Scott Brown, Bruce Stouch, Peter J. Mitchell, Antoni Davalos, Yvo B. W. E. M. Roos, Michael D. Hill. Time to Treatment With Endovascular Thrombectomy and Outcomes From Ischemic Stroke: A Meta-analysis. JAMA, 2016; 316 (12): 1279 DOI: 10.1001/jama.2016.13647

http://bbc.in/2dQSTte

One in 10 children has 'Aids defence'

A 10th of children have a "monkey-like" immune system that stops them developing Aids, a study suggests.

By James Gallagher Health and science reporter, BBC News website

The study, in Science Translational Medicine, found the children's immune systems were "keeping calm", which prevented them being wiped out.

An untreated HIV infection will kill 60% of children within two and a half years, but the equivalent infection in monkeys is not fatal. The findings could lead to new immune-based therapies for HIV infection.

The virus eventually wipes out the immune system, leaving the body vulnerable to other infections, what is known as acquired human immunodeficiency syndrome (Aids).

The researchers analysed the blood of 170 children from South Africa who had HIV, had never had antiretroviral therapy and yet had not developed Aids. Tests showed they had tens of thousands of human immunodeficiency viruses in every millilitre of their blood.

This would normally send their immune system into overdrive, trying to fight the infection, or simply make them seriously ill, but neither had happened.

Keep calm and carry on

Prof Philip Goulder, one of the researchers from the University of Oxford, told the BBC: "Essentially, their immune system is ignoring the virus as far as possible. "Waging war against the virus is in most cases the wrong thing to do."

Counter-intuitively, not attacking the virus seems to save the immune system. HIV kills white blood cells - the warriors of the immune system. And when the body's defences go into overdrive, even more of them can be killed by chronic levels of inflammation.

Prof Goulder said: "One of the things that comes out of this study is that HIV disease is not so much to do with HIV, but with the immune response to it."

For scientists, the way the 10% of children cope with the virus has striking similarities to the way more than 40 non-human primate species cope with simian immunodeficiency virus or SIV. They have had hundreds of thousands of years to evolve ways to tackle the infection. "Natural selection has worked in these cases, and the mechanism is very similar to the one in these kids that don't progress," Prof Goulder said.

War or peace?

This defence against Aids is almost unique to children. Adult humans' immune systems tend to go all-out to finish off the virus in a campaign that nearly always ends in failure. Children have a relatively tolerant immune system, which becomes more aggressive in adulthood - chickenpox, for example, is far more severe in adults due to the way the immune system reacts. But this does mean that as the protected children age and their immune system matures, there is a risk of them developing Aids. Some do, some remain Aids-free.

Dr Ann Chahroudi and Dr Guido Silvestri, from Emory University in the US, said the study may have found the "very earliest signs of coevolution of HIV in humans". In a commentary, they added: "It is not known whether it would be clinically safe for these newly identified HIV infected paediatric non-progressors to remain off-therapy. "This assessment is further complicated by the fact that prevention of HIV transmission to sexual partners becomes relevant in adolescence."

People with HIV can have normal life-expectancy if they have access to antiretroviral drugs. But their super-heated immune system never returns to normal, and they face greater risks of cardiovascular disease, cancer and dementia.

Prof Goulder believes these findings in children could ultimately help rebalance the immune system in all HIV patients.

He told the BBC: "We may be identifying an entirely new pathway by studying kids that in the longer term could be translated to new treatments for all HIV infected people."

http://bbc.in/2dyNFxY

Common painkillers 'increase heart failure risk'

Taking a common kind of painkiller is linked to an increased risk of heart failure, a study suggests.

Non-steroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen and naproxen and diclofenac, are commonly used to treat pain and inflammation.

The British Medical Journal study looked at 10 million people, aged 77 on average, who took the drugs. UK experts said the findings had little relevance for most under-65s but were a possible concern for elderly patients.

The study analysed data for the 10 million users - who were from the UK, the Netherlands, Italy and Germany - and compared them with people who did not take the drugs.

The researchers, from University of Milano-Bicocca in Italy, found taking NSAIDs increased the risk of being taken to hospital with heart failure by 19%.

Since most people in the study were older - and those on NSAIDs were, in general, in poorer health - UK experts said the findings had very little relevance for most under-65s but may be a concern for elderly patients.

'Use with caution'

The British Heart Foundation (BHF) said patients should be on the lowest dose possible of NSAIDs for the shortest possible time.

Prof Peter Weissberg, medical director at the BHF, said: "This large observational study reinforces previous research showing that some NSAIDs, a group of drugs commonly taken by patients with joint problems, increase the risk of developing heart failure.

"It has been known for some years now that such drugs need to be used with caution in patients with, or at high risk of, heart disease.

"This applies mostly to those who take them on a daily basis rather than only occasionally.

"Since heart and joint problems often coexist, particularly in the elderly, this study serves as a reminder to doctors to consider carefully how they prescribe NSAIDs, and to patients that they should only take the lowest effective dose for the shortest possible time. "They should discuss their treatment with their GP if they have any concerns."

Younger patients

Helen Williams, consultant pharmacist for cardiovascular disease at the Royal Pharmaceutical Society, told BBC Radio 4's Today programme that the focus needed to be on older patients with conditions or diseases that might put them at increased risk of heart failure anyway. "Hypertension, diabetes, maybe kidney problems - it's in those patients when we add these drugs on top that there might be a small increase in their risk," she said.

Stephen Evans, professor of pharmacoepidemiology at the London School of Hygiene and Tropical Medicine, said: "The consequence is that it is of very little relevance to most people below age 65 taking painkillers, but in the very elderly, say, above 80, that the effects are of more relevance."

Ms Williams said that younger patients who took short courses of ibuprofen, for example, should not be worried. However, she did warn against young people taking the drugs regularly. "If you take a very occasional course - it's like most people will do for aches and pains, sports injuries etcetera - then there's no need to worry."

But she added: "I think I would say if you're a young person who is regularly going to buy these drugs, and effectively taking them all the time, you probably should be supervised by a clinician because there are other issues with these drugs and we might want to keep an eye, for example, on your kidneys."

Ms Williams also said it was important to use over-the-counter painkillers for the right reasons. She said: "Ibuprofen are anti-inflammatory drugs so if you've damaged your muscles where there's likely to be inflammation, then ibuprofen might be appropriate.

"If you've got a headache, it's unlikely that there's going to be an inflammation issue and paracetamol is fine."

http://bit.ly/2cL5LMd

Consumption of a bioactive compound from Neem plant could significantly suppress development of prostate cancer

Oral administration of nimbolide, over 12 weeks shows reduction of prostate tumor size by up to 70 per cent and decrease in tumor metastasis by up to 50 per cent, report investigators.

A team of international researchers led by Associate Professor Gautam Sethi from the Department of Pharmacology at the Yong Loo Lin School of Medicine at the National University of Singapore (NUS) has found that nimbolide, a bioactive terpenoid compound derived from Azadirachta indica or more commonly known as the neem plant, could reduce the size of prostate tumor by up to 70 per cent and suppress its spread or metastasis by half.

Prostate cancer is one of the most commonly diagnosed cancers worldwide. However, currently available therapies for metastatic prostate cancer are only marginally effective. Hence, there is a need for more novel treatment alternatives and options.

"Although the diverse anti-cancer effects of nimbolide have been reported in different cancer types, its potential effects on prostate

cancer initiation and progression have not been demonstrated in scientific studies. In this research, we have demonstrated that nimbolide can inhibit tumor cell viability -- a cellular process that directly affects the ability of a cell to proliferate, grow, divide, or repair damaged cell components -- and induce programmed cell death in prostate cancer cells," said Assoc Prof Sethi.

Nimbolide: promising effects on prostate cancer

Cell invasion and migration are key steps during tumor metastasis. The NUS-led study revealed that nimbolide can significantly suppress cell invasion and migration of prostate cancer cells, suggesting its ability to reduce tumor metastasis.

The researchers observed that upon the 12 weeks of administering nimbolide, the size of prostate cancer tumor was reduced by as much as 70 per cent and its metastasis decreased by about 50 per cent, without exhibiting any significant adverse effects.

"This is possible because a direct target of nimbolide in prostate cancer is glutathione reductase, an enzyme which is responsible for maintaining the antioxidant system that regulates the STAT3 gene in the body. The activation of the STAT3 gene has been reported to contribute to prostate tumor growth and metastasis," explained Assoc Prof Sethi. "We have found that nimbolide can substantially inhibit STAT3 activation and thereby abrogating the growth and metastasis of prostate tumor," he added.

The findings of the study were published in the April 2016 issue of the scientific journal Antioxidants & Redox Signaling. This work was carried out in collaboration with Professor Goh Boon Cher of Cancer Science Institute of Singapore at NUS, Professor Hui Kam Man of National Cancer Centre Singapore and Professor Ahn Kwang Seok of Kyung Hee University.

Neem -- The medicinal plant

The neem plant belongs to the mahogany tree family that is originally native to India and the Indian sub-continent. It has been part of traditional Asian medicine for centuries and is typically used in Indian Ayurvedic medicine. Today, neem leaves and bark have been incorporated into many personal care products such as soaps, toothpaste, skincare and even dietary supplements.

Future Research

The team is looking to embark on a genome-wide screening or to perform a large-scale study of proteins to analyse the side-effects and determine other potential molecular targets of nimbolide. They are also keen to investigate the efficacy of combinatory regimen of nimbolide and approved drugs such as docetaxel and enzalutamide for future prostate cancer therapy.

Jingwen Zhang, Kwang Seok Ahn, Chulwon Kim, Muthu K. Shanmugam, Kodappully Sivaraman Siveen, Frank Arfuso, Ramar Perumal Samym, Amudha Deivasigamanim, Lina Hsiu Kim Lim, Lingzhi Wang, Boon Cher Goh, Alan Prem Kumar, Kam Man Hui, Gautam Sethi. Nimbolide-Induced Oxidative Stress Abrogates STAT3 Signaling Cascade and Inhibits Tumor Growth in Transgenic Adenocarcinoma of Mouse Prostate Model. Antioxidants & Redox Signaling, 2016; 24 (11): 575 DOI: 10.1089/ars.2015.6418

http://bbc.in/2d7W8Z5

Prescribing holidays 'could help fight infections'

Scientists are investigating whether prescribing holidays, music or a change of scene might boost our immune system and help us to fight off disease.

In tests on mice, they discovered that sprucing up their living space, with a running wheel, toys and a colourful box, did wonders for their T cells. These cells are essential for immunity and help to protect against disease. The Queen Mary University of London researchers said the same approach should be tested on humans.

In their study, the mice living in the enriched surroundings of a larger cage with lots of stimulation - as opposed to a plain, old cage of sawdust - were found to be better prepared for fighting infections.

Higher levels of molecules which are good at responding to infections were found in their white blood cells.

'Holiday resort'

Prof Fulvio D'Acquisto, lead study researcher from QMUL, said: "This effect is remarkable because we haven't given them any drugs.

"All we've done is change their housing conditions. "You could say that we've just put them in their equivalent of a holiday resort for two weeks and let them enjoy their new and stimulating surroundings."

In another study on mice with disease, he discovered that very small changes in bedding had an impact on their health. Giving them better quality blankets and more comfortable sleeping conditions meant their illness was shortened from four days to two days.

When it comes to the human immune system, how the environment we live in influences the body's primary defence against disease is not known. But it is thought that factors such as pollution, location, psychological state and social status could all play a role.

Body boost

Prof D'Acquisto says research shows that there is a link between emotional response and immune response. No-one yet knows how this works but one theory is that heightened emotion makes bone marrow perform better, which in turn receives more nutrients, boosting the body's immune system.

He says we should all be thinking about what we can do to moderate our own emotions - and not pretend we are all the same. "We shouldn't flatten out personality. "We should acknowledge the differences and ask - what can I do to make me happier? Should I change my living conditions? "We should really ask what's best for us."

Whether it's a walk on the beach, listening to a piece of music or more comfortable bedding in hospital, Prof D'Acquisto wants to find out if patients' health and well-being could be improved by making small changes to our environment.

http://bit.ly/2cWU20A

The DEA's Decision to Keep Pot Restrictions Perpetuates Hypocrisy

Keeping existing federal rules in place is an exercise in hypocrisy

By Carl Hart | Scientific American October 2016 Issue

In early August the Drug Enforcement Administration declined to reclassify marijuana under the federal Controlled Substances Act. The drug is currently listed on Schedule I, meaning that it is viewed as having "no currently accepted medical use in treatment" and is therefore technically banned by federal law. The proposed change would have moved it to Schedule II, where it would join morphine, opium and codeine. That would make marijuana potentially available by prescription nationwide. Such a change would have been good for patients and scientists, and it would have represented a big step toward resolving the hypocritical mess that characterizes current law.

Despite many people's assumptions to the contrary, the existing law does not ban scientific investigation into the harms and benefits of the drug. It's true that scientists studying marijuana must jump through multiple bureaucratic and regulatory hoops, and one of these just became a bit easier to navigate. Currently researchers who want to study the drug must get it from the University of Mississippi, which is the only university now permitted to grow marijuana plants for research purposes. When the DEA announced in August that it would not reschedule marijuana, it did say that it would let other institutions apply for permission to start growing the plants as well. That was a step in the right direction—but it's not enough.

Despite the regulatory barriers, dozens of scientists—myself included—have been engaged in research on the harms and benefits of marijuana for decades, and the evidence shows that the drug has many helpful therapeutic uses. For example, it stimulates appetite in HIV-positive patients, which could be a lifesaver for someone suffering from AIDS wasting syndrome. It is also useful in the treatment of neuropathic pain, chronic pain, and spasticity caused by multiple sclerosis.

Therapeutic benefits such as these have compelled citizens to vote repeatedly, over the past two decades, to legalize medical marijuana at the state level. Today 25 states and the District of Columbia allow patients to take the drug for specific conditions. And yet federal law

still technically forbids the use of medical marijuana. The inconsistency of federal law with reality at the state level—and with the growing body of research demonstrating the benefits of the substance—makes marijuana's Schedule I status seem like medical and bureaucratic hypocrisy.

There is now a general sentiment among scientists that the failed war on drugs has biased the DEA against acknowledging any therapeutic potential for marijuana. The petition to reschedule the substance that the agency responded to this past summer was five years old. It is hard to avoid the impression that DEA leadership was stalling, hoping that the public would simply forget about the issue. Last year DEA acting administrator Chuck Rosenberg described the very concept of medical marijuana as “a joke.”

Perhaps it's also a joke that a law-enforcement agency has the final word on a medical issue.

As a scientist and educator, I am worried that our illogical, unscientific scheduling of marijuana is costing us credibility with young people and with those seeking treatments for a variety of conditions. I am further concerned that people most in need of our help and advice will reject other drug-related information from “official” sources, even when it is accurate. And when patients reject official advice and proved medicine, they become more susceptible to quackery. It's time we lessened the outsized influence of a law-enforcement agency on medical decisions and started to rebuild our credibility as scientists on the issue of marijuana.

http://bit.ly/2dkll8i

How to be a male without the Y chromosome

Key sex-determining genes continue to operate in a mammalian species that lacks the Y chromosome, taking us a step further toward understanding sex differentiation.

Hokkaido University researchers have revealed that key sex-determining genes continue to operate in a mammalian species that lacks the Y chromosome, taking us a step further toward understanding sex differentiation.

In most placental mammals, the Y chromosome induces male differentiation during development, whereas embryos without it become female.

The sex-determining gene SRY is present on the Y chromosome and induces other regulatory genes that suppress female differentiation. The Amami spiny rat (Tokudaia osimensis) is exceptional as it lacks a Y chromosome and thus the SRY gene, raising the question of why male differentiation can still occur.

Tomofumi Otake and Asako Kuroiwa of Hokkaido University in Japan performed gene mapping to determine the chromosomal locations of sex-related genes in the T. osimensis genome. They then compared its nucleotide and amino acid sequences with those of the mouse and rat. Furthermore, using cultured cells, they examined how the sex-related genes were regulated.

SRY has been well-investigated in previous research and is known to turn on a range of regulatory genes such as Sox9 and AMH that play an important role in male differentiation.

The team's results suggest that, even though there is no SRY gene in T. osimensis, the regulatory genes that normally turns on are present and operate as they do in other placental mammals.

"We speculate that there is an unknown gene that acts as a substitute for SRY in T. osimensis," says Professor Kuroiwa. "The mammalian Y chromosome has been shrinking through an evolutionary process by reducing the number of its genes, and some scientists think that it will completely disappear at some point. I hope our research will help in the understanding of the sex determination mechanism that is independent on the Y chromosome and its evolutionary aspect."

Tomofumi Otake, Asato Kuroiwa. Molecular mechanism of male differentiation is conserved in the SRY-absent mammal, Tokudaia osimensis. Scientific Reports, 2016; 6: 32874 DOI: 10.1038/srep32874

http://bit.ly/2dDrdo6

Universal flu vaccine designed by scientists

Scientists have designed a new generation of universal flu vaccines to protect against future global pandemics that could kill millions.

Researchers have devised two universal vaccines; a USA-specific vaccine with coverage of 95% of known US influenza strains; and a universal vaccine with coverage of 88% of known flu strains globally.

An international team of scientists have designed a new generation of universal flu vaccines to protect against future global pandemics that could kill millions.

The vaccine could give protection for up to 88% of known flu strains worldwide in a single shot, spelling the end of the winter flu season.

The collaboration involving the universities of Lancaster, Aston and Complutense in Madrid have applied ground-breaking computational techniques to design the vaccine in a study published in the journal Bioinformatics. The researchers have devised two universal vaccines;

· ***a USA-specific vaccine with coverage of 95% of known US influenza strains***

· ***a universal vaccine with coverage of 88% of known flu strains globally***

Dr Derek Gatherer of Lancaster University said: "Every year we have a round of flu vaccination, where we choose a recent strain of flu as the vaccine, hoping that it will protect against next year's strains. We know this method is safe, and that it works reasonably well most of the time.

"However, sometimes it doesn't work -- as in the H3N2 vaccine failure in winter 2014-2015 -- and even when it does it is immensely expensive and labour-intensive. Also, these yearly vaccines give us no protection at all against potential future pandemic flu."

Previous pandemics include the "Spanish flu" of 1918, and the two subsequent pandemics of 1957 and 1968, which led to millions of deaths.

Even today, the World Health Organisation says that annual flu epidemics are estimated to cause up to half a million deaths globally.

Dr Gatherer said: "It doesn't have to be this way. Based on our knowledge of the flu virus and the human immune system, we can use computers to design the components of a vaccine that gives much broader and longer-lasting protection."

Dr Pedro Reche of Complutense University said: "A universal flu vaccine is potentially within reach. The components of this vaccine would be short flu virus fragments -- called epitopes -- that are already known to be recognized by the immune system. Our collaboration has found a way to select epitopes reaching full population coverage.

Dr Darren Flower of Aston University said: "Epitope-based vaccines aren't new, but most reports have no experimental validation. We have turned the problem on its head and only use previously-tested epitopes. This allows us to get the best of both worlds, designing a vaccine with a very high likelihood of success." The team are now actively seeking partners in the pharmaceutical industry to synthesize their vaccine for a laboratory proof-of-principle test.

Qamar M. Sheikh, Derek Gatherer, Pedro A Reche, Darren R. Flower. Towards the knowledge-based design of universal influenza epitope ensemble vaccines. Bioinformatics, 2016; btw399 DOI: 10.1093/bioinformatics/btw399

http://bit.ly/2dox9CK

Genetically engineered crops are safe, review of studies finds

Genetically engineered (GE) crops are no different from conventional crops in terms of their risks to human health and the environment, according to a report published in May 2016 by the U.S. National Academies of Sciences, Engineering, and Medicine.

Leland Glenna, associate professor of rural sociology and science, technology and society in Penn State's College of Agricultural Sciences, served on the committee that authored the report.

"The study committee found no substantiated evidence of a difference in risks to human health between currently commercialized GE crops -- specifically soybean, maize and cotton -- and conventionally bred

crops, nor did it find conclusive cause-and-effect evidence of environmental problems from the GE crops," said Glenna. "These findings should not be interpreted to mean that there are not still many challenges related to both conventional and GE crops, just that currently available GE crops and conventional crops are not different in terms of their risks to human health and the environment."

Glenna, a sociologist who studies how social institutions influence scientific research agendas and who, for the past 15 years, has studied the social impacts of agricultural science and technology, noted that GE crops commonly are portrayed either as the solution to social and economic problems or as the cause of them.

"GE crops are also commonly presented as though there are only two sides to this debate: either you are for them or against them," he said. "But new technologies bring both promises and perils; what seems promising to some might seem perilous to others.

"However, there is still insufficient research to make conclusive statements on the social and economic impacts of GE crop technologies. I hope that those who read and discuss this report do not shoehorn it into the existing paradigm but, instead, recognize the complexity and nuances of GE crops."

The researchers used data published during the last two decades from more than 900 research and other publications to evaluate the positive and negative effects of GE crops -- crops that have been engineered to resist insects or herbicides. The scientists also heard from 80 diverse speakers and read more than 700 comments from members of the public to expand their understanding of GE crop issues.

Nearly 180 million hectares of GE crops were planted globally in 2015, roughly 12 percent of the world's planted cropland that year.

According to the report, Bt crops, those that contain an insect-resistant gene from the soil bacterium Bacillus thuringiensis, comprise a large segment of GE cropland. The researchers found that from 1996 to 2015, the use of Bt maize and cotton contributed to a reduction in synthetic insecticide use and in crop losses. Some pest-insect populations dropped; however, insect biodiversity increased overall. Insect resistance to Bt proteins was slow to develop only when the crops produced a dose of Bt protein that was large enough to kill insects. Damaging levels of resistance did evolve in some species when resistance-management strategies were not followed.

The team found that the use of herbicide-resistant (glyphosate-resistant) crops contributed to greater crop yield by reducing weed pressure. When such crops first were adopted, total kilograms of herbicide applied per hectare of crop per year declined, although the decreases generally have not been sustained. Some weed species have evolved resistance to glyphosate; however, the team noted that delaying such resistance is possible with integrated weed management.

To examine the human health effects of GE crops and foods, the team examined animal experimental studies and found a lack of evidence that animals are harmed by eating foods derived from GE crops.

"Many people are concerned that consuming GE foods may cause cancer, obesity and disorders such as autism spectrum and allergies," Glenna said. "However, the committee examined epidemiological datasets over time from the United States and Canada, where GE food has been consumed since the late 1990s, and similar datasets from the United Kingdom and western Europe, where GE food is not widely consumed. We found no differences among countries in specific health problems."

The team also found that economic outcomes of GE crops have been favorable for most producers who have adopted these crops. However, the cost of GE seed may limit the adoption of GE crops by smaller, resource-poor farm holders. Furthermore, economic benefits tend to accrue for early adopters. The team concluded that enduring and widespread use of GE crops will depend on institutional support and access to profitable local and global markets.

The report can be downloaded from the National Academies of Sciences, Engineering, and Medicine website: http://nas-sites.org/ge-crops/

http://bbc.in/2dxzYDj

Cancer clusters at nuclear sites 'not linked to radiation'

An investigation into clusters of cancer cases around Sellafield and Dounreay nuclear sites has found they were very unlikely to have been caused by radiation exposure.

A report from the Committee on Medical Aspects of Radiation in the Environment (Comare) said the clusters had gone.

It also found no evidence of a spike in thyroid cancers following the Windscale reactor fire in 1957.

The committee said rural population mixing may have been a factor.

Comare - an expert Department of Health committee - now wants more research to be carried out into the role that infection plays in the development of leukaemia and non-Hodgkin lymphoma.

It has been suggested that an infectious agent could be introduced into rural communities by an influx of people, triggering a rise in cases of these rare cancers.

Around 500 children under 14 develop leukaemia every year in the UK, making it the most common cancer among children.

Cluster cases

Previous reports found an increased incidence of leukaemia and non-Hodgkin lymphoma in children and young adults under 25 years of age living in Seascale, a village near Sellafield on the west coast of Cumbria, and around Dounreay, on the north coast of Scotland.

These clusters of cases occurred between 1963 and 1990 - but the committee's report concluded that radiation doses from the plants were too small to be the reason behind the excess cases.

No increase in cases and no new cases have been reported in children living close to either site between 1991 and 2006. However, the cause of the clusters of leukaemia around Sellafield and Dounreay is still not clear.

The report also looked at the incidence of thyroid cancer around Sellafield, after high excess rates were found in Cumbria in those born between 1954 and 1958.

But any link with radioactive releases from the Windscale reactor fire in 1957 has been ruled out after similarly high rates were found for those born after the fire, who would not have been affected by the iodine gases released.

Prof Alex Elliott, past-chairman of Comare, said regulations around routine radiation processes at nuclear installations were very tight.

He said: "People shouldn't worry about cancer risk from radiation."

But he was concerned that data on national childhood cancers should be protected and continue to be made available to researchers studying disease rates.

http://bit.ly/2dDxlwA

Scientists find lethal vulnerability in treatment-resistant lung cancer

Researchers working in four labs at UT Southwestern Medical Center have found a chink in a so-called "undruggable" lung cancer's armor -- and located an existing drug that might provide a treatment.

The study, published this week in Nature, describes how the drug Selinexor (KPT-330) killed lung cancer cells and shrank tumors in mice when used against cancers driven by the aggressive and difficult-to-treat KRAS cancer gene. Selinexor is already in clinical trials for treatment of other types of cancer, primarily leukemia and lymphoma but also gynecological, brain, prostate, and head and neck cancers.

Lung cancer is the No. 1 cancer killer in the U.S., responsible for more than 158,000 deaths a year, according to the National Cancer Institute (NCI), and the KRAS oncogene is believed to be responsible for about 25 percent of all lung cancer cases. The 5-year survival rate for lung cancer is below 18 percent.

Cancers caused by the KRAS mutation have been a target for researchers since the mutation was discovered in humans in 1982. But, due in part to this oncogene's almost impervious spherical shape, no one was able to find an opening for attack, said Dr. Pier Scaglioni,

Associate Professor of Internal Medicine at UT Southwestern and a contributing author to the study.

Dr. Michael A. White, Adjunct Professor of Cell Biology and senior author of the study, assembled multiple research teams and used robotic machines to create and sift through trays with thousands of cancer cell/potential drug combinations to uncover the KRAS mutation's weakness.

The scientists found that targeting and inactivating the protein XPO1, found in the cell nucleus and used to transport gene products from the nucleus to the cytoplasm, killed most of the KRAS mutant cancer cells.

"We found that inhibiting the XPO1 gene kills lung cancer cells that are dependent on KRAS," Dr. Scaglioni said. "The unexpected coincidence here is that there is an existing drug that will inhibit XPO1."

"We know that this drug hits the XPO1 target in people," added Dr. White, also a research executive at Pfizer Inc. "But we will not know whether the drug will be effective until clinical trials are done, which should be completed in about two years."

Based on the results of this study, Selinexor, developed by Karyopharm Therapeutics, will be the focus of a multicenter lung cancer clinical trial led by UT Southwestern's Dr. David Gerber, Associate Professor of Internal Medicine. That trial is expected to open for enrollment next year.

In preclinical results from cancer cells and mouse models in the Nature study, 83 percent of the KRAS mutant lung cancers responded to Selinexor. The study found the remaining 17 percent of lung cancers could be killed by adding a second drug to inhibit YAP1, a gene known to be involved in the promotion of several other cancers.

Here too, there was an existing drug, Verteporfin, which appeared to be effective in blocking YAP1. Verteporfin is currently used to treat blood vessel disorders in the eye.

Jimi Kim, Elizabeth McMillan, Hyun Seok Kim, Niranjan Venkateswaran, Gurbani Makkar, Jaime Rodriguez-Canales, Pamela Villalobos, Jasper Edgar Neggers, Saurabh Mendiratta, Shuguang Wei, Yosef Landesman, William Senapedis, Erkan Baloglu, Chi-Wan B. Chow, Robin E. Frink, Boning Gao, Michael Roth, John D. Minna, Dirk Daelemans, Ignacio I. Wistuba, Bruce A. Posner, Pier Paolo Scaglioni, Michael A. White. XPO1-dependent nuclear export is a druggable vulnerability in KRAS-mutant lung cancer. Nature, 2016; DOI: 10.1038/nature19771

http://bit.ly/2cX15Xh

Gary Johnson's 'Aleppo Moments': Why We Get Brain Freeze

In an interview with MSNBC's Chris Matthews, Libertarian presidential candidate Gary Johnson couldn't come up with a single name when posed the question, "Who's your favorite foreign leader?"

By Talal Al-Khatib, Discovery News | September 30, 2016 12:15pm

In a callback to an earlier televised appearance in which Johnson struggled with recall, the candidate himself admitted he was having an "Aleppo moment" and a "brain freeze," citing the "former president of Mexico," but unable to name him. With an assist from a member of the audience, Johnson did eventually come up with former Mexican president Vicente Fox.

We've all had memory lapses during inopportune moments, but what causes them? Memory can often let us down during stressful or anxiety-inducing events, and it gets worse with age, according to a 2014 study published in the Journal of Neuroscience.

Spikes in levels of cortisol, the naturally occurring hormone that surges when we are stressed, can lead to memory problems as we get older, found a team of University of Iowa researchers. Although cortisol is important to survival, long-term stress negatively impacts the prefrontal cortex, a part of the brain linked to short-term memory.

When an individual endures repeated, high levels of stress for a long period of time, elevated levels of cortisol can lead lead to a shrinkage and eventual loss of synapses, connections in the brain that allow us to process, store and recall information, what researchers describe as a "weathering of the brain."

Even over a shorter time period, stress can impair our ability to learn as well as recall memories, found a 2008 study by researchers from

the University of California - Irvine. A shorter time frame doesn't just mean months or weeks, but even a few hours of stress can inhibit brain-cell communication. Instead of cortisol, the researchers in this study identified corticotropin releasing hormones (CRH), activated during periods of acute stress, as the culprit.

CRH limit the way in which synapses collect and store memories in the hippocampus, a region of the brain that is the center learning and memory. For this earlier study, the researchers observed that the release of cortisol led to the disintegration of dendritic spines, tiny protrustions on neurons that receive synaptic input.

Another possible culprit for an occasionally faulty memory is sleep deprivation. Political candidates are notoriously busy, and often struggle to get enough sleep as a result. Sleep deprivation harms memory, and research published as recently as last month backs that up.

According to a study in mice published in the journal eLife, just five hours of sleep deprivation is enough to lead to a loss in connectivity of neurons in the brain. The researchers observed that losing sleep reduced the length and density of dendrites in the hippocampus. A three-hour catch up nap, however, was enough to reverse the damage.

http://nyti.ms/2dm7vyT

Children Who Get Zika After Birth Tend Not to Fall Seriously Ill, Study Finds

Serious complications are rare among children infected with the Zika virus after birth, federal health researchers concluded in a study published on Friday — a rare bright spot in the unfolding story of the epidemic.

By CATHERINE SAINT LOUIS and DONALD G. McNEIL Jr. SEPT.

About 160 teenagers and toddlers infected with Zika virus have been reported to the Centers for Disease Control and Prevention since 2015. The agency's new study marks the largest survey yet of laboratory-confirmed cases in children.

All of the infections were the result of travel, most commonly to the Dominican Republic and Puerto Rico. About 100 of the cases occurred in June and July alone. The report represents just a fraction of the actual number of children in the continental United States infected with Zika.

The children, aged 1 month to 17 years, were initially identified because they had symptoms of infection; only those who became ill were included in the research. Yet most people who are infected have no symptoms at all.

The virus can profoundly injure developing fetuses, leading to a range of birth defects including irreparable brain damage, hearing loss and eye defects. But the C.D.C. researchers, reassuringly, found no serious injury among infected children.

Typically, these children got only mildly ill: 129 had a rash, C.D.C. researchers found, while half were feverish and a quarter had red eyes or joint pain. One hundred and eleven had two or more of the four main symptoms.

Five teenagers, ages 16 and 17, were pregnant when they developed symptoms, highlighting the need for sexually active teenagers to protect themselves from Zika, especially after travel to affected places.

None of these children developed a kind of temporary paralysis called Guillain-Barré syndrome, which may be triggered by Zika infection.

Older adults are generally thought to be at higher risk for Guillain-Barré. But at the height of the Zika epidemic in Brazil, officials reported that a few children had developed the paralysis, as well as meningoencephalitis, a dangerous inflammation of the brain and spinal cord.

Still, the C.D.C. urged health care providers to test children with suspected Zika infection, to notify state health departments of all cases, and to remain vigilant for neurological complications even in the very young.

No child died in the C.D.C. study, but two were hospitalized. A four-year-old with a fever, a cough, and trouble eating or drinking spent

three days under observation. A one-year-old with a cough and rash spent a night in a hospital.

Also on Friday, the C.D.C. announced that men who have visited areas in which the Zika is circulating should wait six months before having unprotected sex in order to avoid transmitting the virus, even if they have not had symptoms.

The C.D.C. had recommended that men refrain for six months if they had experienced symptoms of Zika infection, but only eight weeks if they had not. The change brings the C.D.C.'s advice in line with guidelines from the World Health Organization.

The new guidelines also suggest that both women and men in couples planning a pregnancy in the near future consider avoiding travel to areas where Zika is being transmitted, and that they use condoms or abstain from sex for at least six months after travel before trying to conceive.

The Zika virus lingers in semen, the reproductive fluid that contains sperm. On Thursday, French researchers reported that the virus can penetrate individual spermatozoa.

The study, published in The Lancet Infectious Diseases, found the virus in about 4 percent of the spermatozoa of a 32-year-old man who had had Zika symptoms more than four months earlier.

The discovery did not change the likelihood that the man could pass on the virus through sex, since he also had virus in his semen, the researchers from Toulouse University Hospital said. But the finding has implications for in vitro fertilization. Sperm donations from men with some viruses, including H.I.V., can be "washed" by removing the seminal fluid, since the virus does not penetrate the sperm.

Although it is unknown whether the Zika virus inside the man's sperm is infectious, the researchers said, the discovery suggests that fertility centers will need to screen donations carefully for the virus.

Another brief report in The Lancet by researchers in Madrid described a case in which a 53-year-old man who had a vasectomy in 2007 apparently infected his wife with Zika.

The case suggests that the virus penetrates the prostate, seminal vesicles or bulbourethral glands, which together produce pre-ejaculate and seminal fluid.

http://nyti.ms/2dDmp6B

New Drug for Severe Eczema Is Successful in 2 New Trials

Results of two large clinical trials of a new drug offered hope to aboutt 1.6 million adult Americans with an uncontrolled, moderate-to-severe form of atopic dermatitis, which is a type of eczema

By GINA KOLATA OCT. 1, 2016

The disease is characterized by an itching, oozing rash that can cover almost all of the skin. The constant itch, to say nothing of the disfigurement, can be so unbearable that many patients consider suicide. There has never been a safe and effective treatment.

On Saturday, the results of two large clinical trials of a new drug offered hope to the estimated 1.6 million adult Americans with an uncontrolled, moderate-to-severe form of the disease, atopic dermatitis, which is a type of eczema.

Most patients who got the active drug, dupilumab, instead of a placebo reported that the itching began to wane within two weeks and was gone in a few months, as their skin began to clear. Nearly 40 percent of participants getting the drug saw all or almost all of their rash disappear.

For some, relief was almost instantaneous.

"I knew immediately I was on the drug" and not the placebo, said Daniela Velasco, an event planner in Playa del Carmen, Mexico. Within a couple of weeks, the ugly red rash that had covered 90 percent of her body was almost gone. Even better, she said, "for the first time I didn't feel any itch at all."

Before entering the trial, Mrs. Velasco, 36, had seen 40 doctors about the disease and tried dozens of drugs and treatments, to no avail. To participate in the study, she spent more than $95,000 to fly to Mount Sinai in New York on a regular basis and stay in hotels. She realized

she might get a placebo but also knew that when the study ended everyone, including the placebo patients, would be able get the drug if the trial was successful.

The drug blocks two specific molecules of the immune system that are overproduced in patients with this and some other allergic diseases. The only side effects were a slight increase in conjunctivitis, an inflammation of the outer membrane of the eye, and swelling at the injection site.

"This is a landmark study," said Dr. Mark Boguniewicz, an atopic dermatitis expert at National Jewish Health and the University of Colorado School of Medicine who was not involved with the study. "For us in atopic dermatitis, we are entering a new era."

The studies, lasting 16 weeks and involving nearly 1,400 people, were published in the New England Journal of Medicine.

Dr. George D. Yancopoulos, the president and chief scientific officer at Regeneron, which, in partnership with Sanofi, makes the drug, said he expects the Food and Drug Administration to rule on dupilumab by March 29, 2017. The drug's brand name will be Dupixent. The agency has given the drug breakthrough status, which provides expedited development and review of drugs for serious or life-threatening diseases.

Dr. Yancopoulos declined to speculate on dupilumab's price, saying only that it will be "consistent with the value of the drug." It is a biologic, the most expensive type of drug, and is injected every two weeks.

Atopic dermatitis experts said they have longed for a safe and highly effective treatment. In desperation, some prescribed other drugs off-label, like powerful immunosuppressants or high doses of steroids, which are far from ideal because even if they helped, their side effects can be severe — kidney failure with immunosuppressants, bone loss and even psychotic breaks with high-dose steroids.

Patients are miserable, Dr. Boguniewicz said. "Our patients and families haven't slept through the night, not for days or weeks, but for months or years."

Many doctors provide no treatments other than perhaps creams and ointments that do not stop the itching or soothe the red and weeping rash, said Dr. Jonathan I. Silverberg of Northwestern University's Feinberg School of Medicine and a principal investigator in one of the studies.

Many sufferers can relate to the plight of the defense lawyer played by John Turturro in the HBO series "The Night Of." He suffers from atopic dermatitis that started on his legs and his feet and later spread to his neck and head. Like so many patients, he tries treatment after treatment — bleach baths, covering the rash in Crisco and wrapping it with plastic wrap, steroids, Chinese medicine. He scratches it with chopsticks and disgusts people near him. But all to no avail.

Such experiences explain the excitement over the new drug, although researchers say they would like to see longer-term data.

"What we are seeing are some really impressive efficacy numbers," Dr. Silverberg said. "But efficacy alone is not enough. It is the safety profile that is the real key. Everything we are seeing really looks great."

Dr. Jon M. Hanifin, a professor of dermatology at Oregon Health and Science University and founder of the National Eczema Association, agreed. While not a principal investigator in the study, Dr. Hanifin did oversee the care of some patients enrolled in it.

"It's wonderful," he said. "We walk in the room and patients are smiling. These patients are the worst of the worst. Their life was destroyed."

Dr. Yancopoulos was inspired in part to develop the drug because his father had severe atopic dermatitis, which he developed shortly after he got lung cancer at 70.

"More so than the cancer and the chemo, this rash and its horrible itch started dominating his life and ruining its quality," Dr. Yancopoulos said. "Here's a guy with Stage IIIB lung cancer — basically a death

sentence — and he is more concerned and miserable about his skin and his itch."

One participant in the trial, Lisa Tannebaum, a 53-year-old harpist in Stamford, Conn., was so thrilled that she wrote a letter to Regeneron suggesting they use her before and after photographs in advertisements. She developed a severe form of the disease 14 years ago and tried everything imaginable in conventional and alternative medicine without relief — specialized diets, immunosuppressive drugs, special clothing, bleach baths. She even had the gold fillings removed from her teeth on the theory that they may be causing an allergic response, but to no avail.

"It was like every day I had poison ivy and fire ants on myself," she said. "You don't sleep at all. You can't go out, you have staph infections all the time," because the skin's protective barrier is broken by the rash. "I couldn't drive my kids to school because the itching was so bad I couldn't put my hands on the steering wheel."

Now, she is performing again and will be playing her harp at Carnegie Hall on Oct. 30.

Herb Bull, 71, a retired Merck scientist in Westfield, N.J., had mild atopic dermatitis for years until three years ago, when it took a turn for the worse. The rash covered his entire body. Sleep was impossible, itching a constant torment. Even walking was difficult.

"He had weeping lesions all over his body," said his doctor, Dr. Emma Guttman-Yassky, a principal investigator in the trial and professor of dermatology and immunology at Mount Sinai School of Medicine.

"I thought I might as well give up and die," Mr. Bull said.

It took months for the drug to work, he said, but when it did, the change was miraculous. His rash and the itching went away.

The new drug, Mr. Bull said, "saved my life."

http://bit.ly/2dDyl49

Where Did Satan Come From?

The devil goes by many names — Satan, the Prince of Darkness, Beelzebub and Lucifer to name a few — but besides this list of aliases, what do people really know about the brute? That is, how did the story of Satan originate?

By Laura Geggel, Senior Writer | October 2, 2016 08:10am ET

Many ancient religions have scriptures detailing the struggle between good and evil. For instance, in the Zoroastrian religion, one of the world's earliest, the supreme deity, Ormazd, created two entities: the chaotic and destructive spirit Ahriman and his beneficent twin brother, Spenta Mainyu, said Abner Weiss, a psychologist and the rabbi at the Westwood Village Synagogue in Los Angeles.

"The ancient world struggled with the coexistence of good and evil," Weiss told Live Science. "They hypothesized a kind of demonic, divine force that was responsible for evil, arising out of the notion that a good god could not be responsible for bad things."

However, Satan was not a prominent figure in Judaism. In Hebrew scripture, a demon-like figure appears only in the Book of Job. In that book, an "adversary" or "tempter" asks God whether the prosperous man Job would continue to praise God after losing everything. God takes up the challenge, and strips Job of his wealth and family, leaving the man wondering why such a horrible fate befell him.

But in this story, God wields more power than this adversary; as such, this evil tempter challenges God, who then takes away Job's fortune, Weiss said.

"[Judaism] found the notion of God having to share authority as limiting the omnipotence and even the omniscience of God," Weiss said. "And therefore, Satan was never personified as a source of evil that was equally powerful."

But Satan did become a part of certain Jewish sects beginning around the time of the Common Era, when Jesus was born, Weiss noted. Moreover, Judaism's mystical teachings, called the Kabbalah, mention

a light side and a dark side, but the dark side is never given equal power to the light, Weiss said.

Christianity's devil

Any Sunday school student can tell you that Satan is a fallen angel, but this fall actually isn't described in the New Testament, or the Christian bible, said Jerry Walls, a professor of philosophy at Houston Baptist University and author of "Heaven, Hell and Purgatory: Rethinking the Things That Matter Most" (Brazos Press, 2015).

However, Satan suddenly appears in the gospels as the tempter of Jesus, with nary an introduction of how the evil presence got there. So, Christian theologians have come to this conclusion: If God created the universe, and everything God creates is good, then Satan must have been something good that went bad, Walls said.

"The only thing that can go bad by itself is a free being," Walls said. "Since there was evil before human beings came on the scene, the inference is [Satan] must have been a fallen angel."

There are other references to Satan in the Bible, depending on different interpretations. The Hebrew Bible has two passages about people who aren't respectful toward God. In these passages, Isaiah 4 and Ezekiel 28, human rulers make outrageous boasts, and some Christians interpret these actions as expressions of Satan, Walls said.

Moreover, the gospel of Paul in the New Testament refers to the snake from the Garden of Eden as Satan, though the snake isn't described that way in Genesis, Walls said. In this sense, the snake and Satan can be seen as tempters that try to get people to disobey God, but aren't always successful, Walls said. [Spooky! Top 10 Unexplained Phenomena]

"The first Adam fell to the temptation of Satan," Walls said. "Christ is described as the second Adam, who successfully resisted temptation."

Satan as "the enemy" Satan can also emerge as the enemy — the "other," or an "outside" group.

"I thought of Satan as a kind of a joke, kind of a throwaway character," said Elaine Pagels, a professor of religion at Princeton University and author of "The Origin of Satan" (Random House, 1995). "In the Book of Job, he's practically a device to explain what happened to Job."

The Hasids, a Jewish sect whose name translates into "The Holy Ones," were the first group in Judeo-Christian history to seriously discuss Satan, she said. The Hasids lived just before the Common Era and didn't like how the Romans and some of their Jewish collaborators ruled their country, Pagels said.

So, the Hasids withdrew from Jewish society and began preaching about the end of times, when God would destroy all of the evil people, "which meant all of the Romans and all of the Jews who cooperated with them," Pagels said.

The Hasids took a radical position: They said that they were following God, while their enemies had turned to the dark side, possibly without even knowing it. "So now, it's the 'Sons of God' against the 'Sons of Darkness,'" Pagels said. "It's a split Jewish group."

At this point of her research, Pagels had an epiphany, she said: The concept of Satan emerges when communities split. Radical groups want a clean break between themselves and their enemies, and so they describe their enemies as Satan, as devils who will one day face God's wrath.

"I realized that when people talk about Satan — like if somebody says, 'Satan is trying to take over this country' — they're not thinking of some supernatural battle up there in the sky," Pagels said. "They can give you names and addresses. They know whom they're talking about."

For instance, extremists might say, "America is the Great Satan." That's because "when people talk about Satan, they're talking about people, too," Pagels said.

The Hasids likely had a big influence on early Christianity, because Jesus and John the Baptist preached similar ideas to those of the Hasids. That is, they said that the end of the world was coming and

that God wouldn't tolerate evil people, Pagels said. This meant the Romans and the people working with them, she said.

Turning an enemy into Satan is useful, she added. It suggests that "our opponents are not just people we disagree with — they're bad. You can't negotiate with them. You can't do anything with them, because they're essentially evil."

http://bit.ly/2dm4PSD

Shrinking Mercury is all it's cracked up to be

Amid all the crashing onto comets and planning trips to Mars, you may be forgiven for missing a wonderful scientific result from NASA: the discovery that tiny Mercury joins Earth as the only other tectonically active rocky planet.

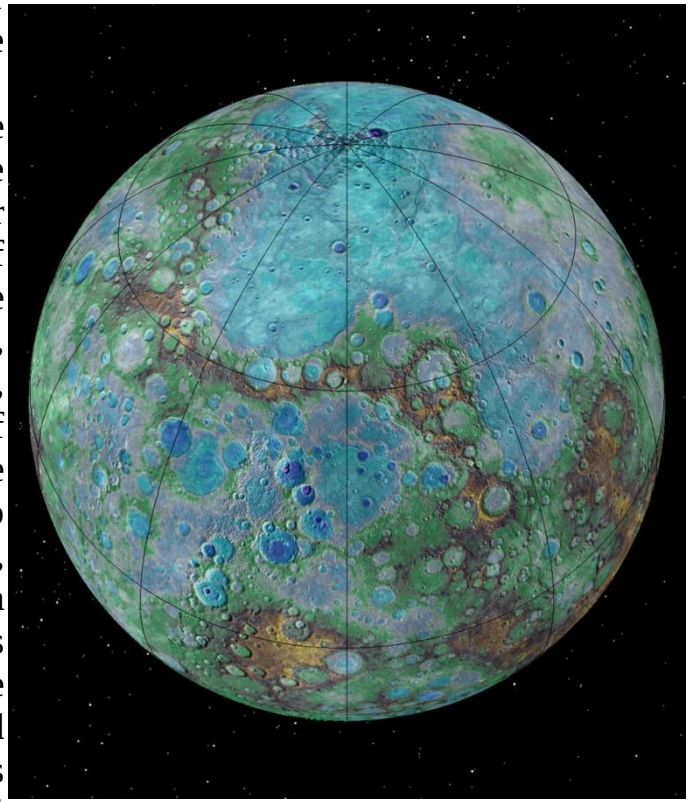
Alan Duffy Research Fellow, Swinburne University of Technology

Mercury's small size means that the core has cooled to such a degree that the surface should be in a dull, geologically dead state, like that of Mars. Yet close-up views of the surface from NASA's MESSENGER (MErcury Surface, Space ENvironment, GEochemistry, and Ranging) spacecraft have challenged that picture.

Small troughs (or graben) have been found alongside previously seen step-like cracks (or fault scarps) in the surface caused by the shrinking of the planet. These troughs, however, haven't suffered weathering by the frequent meteor bombardments. This suggests that tectonic activity has occurred relativity recently, in the last few million years, rather than billions. Activity in a world only fives time more massive than our Moon.

As a raisin wrinkles as it gets smaller, the shrinking inner core of Mercury as it cools causes cracks to form in the single tectonic plate that makes up the surface. This surface plate is more like a single eggshell than the Earth's multiple plates.

These cracks, or scarps, can be step-like cliffs over a kilometre high and run for hundreds of kilometres along the surface – a consequence of the entire planet shrinking by 7km over billions of years. Just as the Rosetta mission recently plunged to its destruction in Comet 67P to get a final closeup view the MESSENGER spacecraft plunged into Mercury last year, ending its mission spectacularly to provide us with views of the smaller troughs alongside the scarps.



False colour image of Mercury taken by NASA's MESSENGER spacecraft. Without a hot central core this should be a geologically dead world yet recent images suggest it's still active. **NASA/JHUAPL/Carnegie Institution of Washington/USGS/Arizona State University**

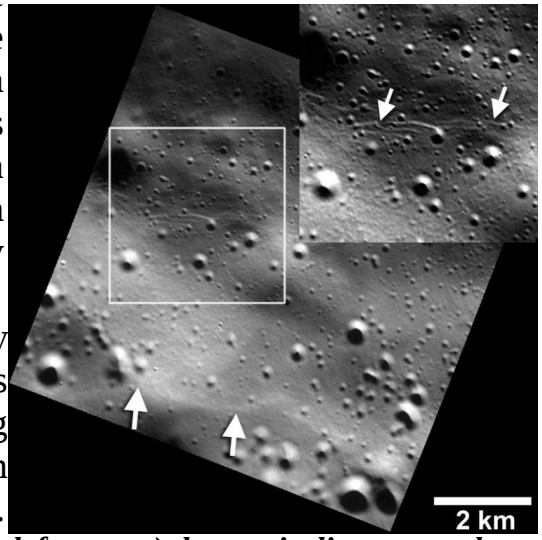
The presence of these troughs mean that there may be another familiar feature to us on Earth of a tectonically active surface: earthquakes (or, perhaps more accurately, Mercury-quakes). If seismometers could be placed on the surface to measure these quakes, we could build up a picture of the planet's interior – just as the refracting (bending) and timing of seismic waves through our planet reveal Earth's structure.

This latest result joins a growing list of surprises on Mercury that have come courtesy of MESSENGER's exploration. There was the spectacular discovery of water ice on a planet whose surface reaches 430℃ during the day. The dark surface colouring was revealed to be caused by layers of graphite – the "lead" in pencils. This was so unexpected that MESSENGER lacked the capability to search for it,

and it had to be deduced indirectly using a combination of several instrument readings.

The latest close-up view of the tiny world merely heightens the anticipation for the next mission to Mercury, BepiColombo. This joint mission by the European Space Agency and Japan Aerospace Exploration Agency will reach Mercury by 2024.

As with Rosetta, these planetary space missions show that there is no substitute for directly exploring distant targets. Up close, foreign worlds are always full of surprises.



Alongside the fault scarps (bottom left arrows) there exist linear troughs or graben which can be seen in the close up inset. These troughs are narrow, just a few tens of metres wide, and remarkably undisturbed by the frequent meteor bombardment suggesting they formed recently. **NASA/JHUAPL/Carnegie Institution of Washington/Smithsonian Institution**