http://www.eurekalert.org/pub_releases/2014-10/bu-anw100114.php

A new way to extract bone-making cells from fat tissue

Within our fat lives a variety of cells with the potential to become bone, cartilage, or more fat if properly prompted.

PROVIDENCE, R.I. [Brown University] - This makes adipose tissue, in theory, a readily available reservoir for regenerative therapies such as bone healing if doctors can get enough of those cells and compel them to produce bone.

In a new study in the journal Stem Cell Research & Therapy, scientists at Brown University demonstrate a new method for extracting a wide variety of potential bone-producing cells from human fat. They developed a fluorescent tag that could find and identify cells expressing a gene called ALPL. Expression of the gene is an indicator of bone-making potential. If the tag finds the RNA produced when the gene is expressed, it latches on and glows. A machine that detects the fluorescing light then separates out the ALPL-expressing cells.

In the paper, the scientists report that their method produced more than twice the yield of potential bone-makers (9 percent) compared to their best application of another method: sorting cells based on surface proteins presumed to indicate that a cell is a stem cell (4 percent). Brown University has applied for a patent on the method of gene expression tagging for producing a tissue.

Meanwhile, the ALPL-expressing cells produced on average more than twice as much bone matrix (and as much as nine times more in some trials) during three weeks of subsequent cultivation than a similar-sized population of unsorted adipose tissue cells and almost four times more bone matrix than cells that don't express ALPL. ALPL-expressing cells were also better at making cartilage or fat.

A couple of other research groups have also sorted stem cells based on gene expression, but they have not done so specifically with the goal of enriching cell populations for a specific tissue, the researchers said.

Lead author and Brown graduate student Hetal Marble said targeting gene expression rather than surface proteins for the purpose of gathering cells to make a new tissue is a "paradigm shift" in the following regard: Gene expression provides a way to target any cell based on whether it can produce another tissue, while targeting surface proteins limits researchers to harvesting cells that fit a presumed definition of being a stem cell. The new approach, she said, is more pragmatic for the purpose.

"Approaches like this allow us to isolate all the cells that are capable of doing what we want, whether they fit the archetype of what a stem cell is or not," Marble said. "The paradigm shift is thinking about isolating populations that are able to achieve an end point rather than isolating populations that fit a strictly defined archetype."

In their experiments, though, the team tolerated a four-day delay that they'd like to dispense with in the future. It takes that long for the maximum number of cells to express ALPL when cells are chemically primed to do so.

In future research, said senior author Eric Darling, the Manning Assistant Professor of Molecular Pharmacology, Physiology and Biotechnology and a member of the Center for Biomedical Engineering assistant professor of medical science, the team would like to target a gene expressed much earlier in the differentiation process to see if they can avoid a priming period.

If they can apply the method based on a gene that's expressible within a matter of hours, that could allow future surgeons working on bone healing to take out some of a patient's fat cells, sort out the best bone-producers (primed or not) and then implant those cells in the bone break within the same surgical session.

"If you can take the patient into the OR, isolate a bunch of their cells, sort them and put them back in that's ideally where we'd like to go with this," Darling said. "Theoretically we could do this with other genes that might upregulate very quickly or are innately expressed.

In addition to Marble and Darling, other authors are Bryan Sutermaster, Manisha Kanthilal, and Vera Fonseca.

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http://www.eurekalert.org/pub_releases/2014-10/pu-ngs100614.php

Natural gene selection can produce orange corn rich in provitamin A for Africa, US

Orange corn, which is naturally high in provitamin A carotenoids, could help combat vitamin A deficiency in developing countries

WEST LAFAYETTE, Ind. - Purdue researchers have identified a set of genes that can be used to naturally boost the provitamin A content of corn kernels, a finding that could help combat vitamin A deficiency in developing countries and macular degeneration in the elderly.

Professor of agronomy Torbert Rocheford and fellow researchers found gene variations that can be selected to change nutritionally poor white corn into biofortified orange corn with high levels of provitamin A carotenoids - substances that the human body can convert into vitamin A. Vitamin A plays key roles in eye health and the immune system, as well as in the synthesis of certain hormones.

"This study gives us the genetic blueprint to quickly and cost-effectively convert white or yellow corn to orange corn that is rich in carotenoids - and we can do so using natural plant breeding methods, not transgenics," said Rocheford, the Patterson Endowed Chair of Translational Genomics for Crop Improvement.

Vitamin A deficiency causes blindness in 250,000 to 500,000 children every year, half of whom die within a year of losing their eyesight, according to the World Health Organization. The problem most severely affects children in Sub-Saharan Africa, an area in which white corn, which has minimal amounts of provitamin A carotenoids, is a dietary mainstay.

Insufficient carotenoids may also contribute to macular degeneration in the elderly, a leading cause of blindness in older populations in Europe and the U.S.

Identifying the genes that determine carotenoid levels in corn kernels will help plant breeders develop novel biofortifed corn varieties for Africa and the U.S. The dark orange color of these corn varieties also makes them more culturally acceptable to consumers in African countries where yellow corn is generally fed only to animals, Rocheford said.

Previous research by Rocheford and his colleagues identified two genes that contribute to provitamin A carotenoid levels in corn kernels, but "we wanted more cookies in the jar for breeders to pick from," he said.

The researchers used a combination of statistical analysis and prediction models to identify and assess the potential usefulness of genes associated with carotenoid levels in corn. They evaluated data sets from about 200 genetically diverse lines of corn at varying scopes of investigation - from the entire corn genome to stretches of DNA surrounding small sets of genes. They uncovered four genes that had not previously been linked to carotenoid levels in corn kernels.

Though many genes likely contribute to carotenoid levels in corn, "we're pretty confident that our previous and current research has now identified several genes that are the major players," Rocheford said.

Their study found that a combination of visually selecting corn with darker orange kernels and using a number of these favorable genes could be an effective way to rapidly convert white and yellow corn varieties to orange corn with higher levels of provitamin A and total carotenoids.

"We now have the genetic information needed to begin developing a major public-private sector collaboration with the goal of providing orange corn with high levels of provitamin A to farmers throughout Sub-Saharan Africa," he said.

The study also showed that using a more targeted approach to predicting the usefulness of a small set of genes was as effective as evaluating the whole corn genome, said Brenda Owens, doctoral candidate and first author of the study.

"Having this smaller list of genes to select for means that we can make the improvement of carotenoid levels in corn a simpler, faster process for plant breeders," she said.

Their research - in collaboration with HarvestPlus and the International Maize and Wheat Improvement Center, also known as CIMMYT - has yielded varieties of orange corn with markedly higher amounts of provitamin A carotenoids. But further efforts to produce even higher levels will be necessary to offset degradation of nutrients after harvest and reduce the amount of corn African consumers would need to eat to attain enough provitamin A, Rocheford said.

Varieties of orange corn are currently being grown in Zambia, Zimbabwe, Nigeria and Ghana. An open-pollinated variety of orange corn could be available for organic and local grower operations in the U.S. by 2016, he said.

The paper was published online in Genetics and is available

A video presentation of Rocheford discussing the research behind biofortified orange corn and its implications is available

Funding for the research was provided by the National Science Foundation; HarvestPlus; Purdue University startup and Patterson Chair funds; the U.S. Department of Agriculture-Agricultural Research Service; Cornell University startup funds; a U.S. Department of Agriculture National Needs Fellowship; and a Borlaug Fellowship.

http://www.eurekalert.org/pub_releases/2014-10/m-snd100514.php

Study: New device can slow, reverse heart failure

Cuff around aorta pumps blood from the heart, proves effective in some severe cases

COLUMBUS, Ohio – A new, implantable device to control heart failure is showing promising results in the first trial to determine safety and effectiveness in patients, according to lead researcher Dr. William Abraham of The Ohio State University Wexner Medical Center. Results of the study are published in the Journal of American College of Cardiology Heart Failure.

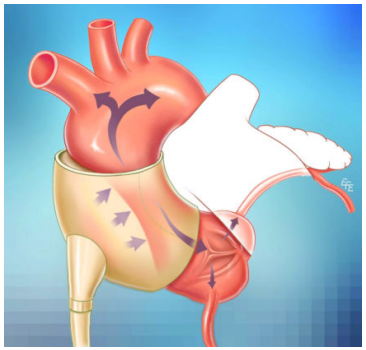
"Heart failure is one of the fastest growing forms of heart disease and it's one of the most common reasons people are hospitalized," said Abraham, director of the Division of Cardiovascular Medicine at Ohio State's Wexner Medical Center. "The optimal drug therapies we have today often aren't enough to manage this disease for some patients, so we are always looking for new types of therapies."

Abraham and other cardiovascular researchers at seven U.S. centers examined an extra-aortic counterpulsation system called C-Pulse, made by Sunshine Heart Inc. It's a cuff that wraps around the aorta and syncs with the patient's heartbeat, rapidly inflating and deflating a small balloon to help squeeze blood through the aorta to circulate throughout the body. It's powered through a wire that exits the abdomen and connects to an external driver worn by the patient. The driver can be plugged in or battery-powered.

In the pilot study, 20 patients with New York Heart Association (NYHA) functional class III or ambulatory functional class IV heart failure were implanted with the device. Patients were evaluated at six months and one year. At both times, 16 of the patients showed significant improvements in NYHA functional class.

"At the one year mark, three of the patients had mild or no symptoms of heart failure. They went from class III or IV down to a functional class I, effectively reversing their heart failure," Abraham said.

Additionally, patients were able to walk an average 100 feet farther during standardized measures and average quality of life scores improved nearly 30 points. "Drug and device therapies that are currently available for heart failure improve that same quality of life score by only five or 10 points. So, this is truly a significant improvement," Abraham said.



This graphic illustrates a potential breakthrough in the treatment of heart failure patients. The C-Pulse system utilizes a cuff that`s placed around the aorta and hooked via wires to an external power source. The system is synced with a patient`s pulse so that it quickly inflates after each heartbeat to help squeeze blood out of the heart. A new study led by researchers at The Ohio State University Wexner Medical Center shows that the device slowed or reversed symptoms in several heart failure patients during the first round of tests in the United States

Sunshine Heart Inc.

The most common adverse effect during the trial was infection of the exit site, experienced by 8 out of 20 participants. Researchers noted that stricter guidelines for exit site management, wound care and antibiotic therapy could reduce that risk in future studies.

There were no hospitalizations among the participants for stroke, thrombosis, sepsis or bleeding, which often occurs in patients using left ventricular assist devices (LVADs). The researchers said this is due to the device remaining outside the bloodstream. Another important difference is the C-Pulse device can be temporarily turned off and disconnected, allowing patients some conveniences that an LVAD doesn't permit.

Researchers are now conducting a randomized, controlled trial of this device at Ohio State's Ross Heart Hospital and 18 other academic medical centers across the country. For more information, go to clinicaltrials.gov. This study was funded by Sunshine Heart Inc., and Abraham has received consulting fees from the company.

http://www.eurekalert.org/pub_releases/2014-10/uocm-cmn100614.php

Cancer medicine: New, improved, expensive and exploited?

First nationally representative empirical evidence suggesting that the 340B program's original intent is being eroded by the actions of certain hospitals

Two studies published in the October 2014 issue of Health Affairs by a University of Chicago health economist examine spending on oral anti-cancer drugs as well as a federal program designed to help the poor, which researchers say instead helps hospitals boost profits.

The first study, by Rena M. Conti, PhD, and colleagues, examines recent trends in spending and use of oral cancer drugs. Their findings showed average spending on the 47 available oral oncolytics - cancer medication taken specifically by mouth - increased from $940 million in the first quarter of 2006 to $1.4 billion in the third quarter of 2011.

Conti's second study examined the federal 340B program, which provides deep discounts on outpatient drug purchases. She found hospitals and clinics that joined the program since 2004 currently serve more affluent and well-insured communities than those that qualified for the program in previous years.

"This study provides the first nationally representative empirical evidence suggesting that the program's original intent is being eroded by the actions of certain hospitals," Conti said.

In the first article, National trends in spending on and use of oral oncologics, first quarter 2006 through third quarter 2011, Conti, an assistant professor of pediatrics and population health sciences at the University of Chicago Medicine, and coauthors Adam Fein, PhD, president of Pembroke Consulting in Philadelphia, PA, and oncologist Sumita Bhatta, MD, a former oncology fellow at the University of Chicago Medicine, document the rapid growth in spending on new oral drugs for cancer care.

"This is an exciting time, an era of breakthrough cancer drugs," she said. "Some of these medications have extended the lives of many people with certain types of cancer. Other new drugs may provide cures for patients suffering now. However, spending on these brand-name oral oncologics is outstripping national spending on all pharmaceuticals and all medical care spending generally."

The increase in oncolytics spending during the study period was driven by brand-name, patent-protected drugs. Despite the hefty increase, the use of these drugs climbed a comparatively small amount. That suggests price increases are partially driving spending trends.

Despite the high and increasing costs, there is good news. First, many newer oral oncologics are targeted agents, a class of drugs that represent significant therapeutic advances with milder side effects than traditional chemotherapy. U.S. spending on such drugs increased from 35 percent of all oral cancer drugs in 2006 to nearly 60 percent in 2011.

Second, Conti and her colleagues discovered that when oncologic drugs of all types lose patent protection, patients and society benefit. Even though use of newly off-patent drugs increased by 16 percent, average quarterly spending on those drugs fell by 65 percent.

Findings from the second study are less heartening.

The article follows work by Conti and Peter B. Bach, director of the Center for Health Policy and Outcomes at Memorial Sloan Kettering Cancer Center, published last year in JAMA. That study explained how 340B-qualified hospital-affiliated clinics can boost profits thanks to discounts on the expensive, anti-cancer drugs. The facilities receive the discounts under the expectation that the savings will be passed on to poor patients.

"Hospitals qualify for the program based on the poverty of their inpatient census only," Conti said. "The affiliated clinics are the only 340B institutions not required to pass the discounts off to patients or their insurers. Nor do they have to report to the government exactly how these profits are used to serve the poor. Insurers' and their patients' payments for outpatient drug treatment don't reflect the discounts the hospital receives."

The 340B program, which began in 1992, was designed to help selected hospitals and their outpatient clinics serve low-income and uninsured patients by providing discounts of 30 to 50 percent on outpatient drugs. About a decade ago, however, enrollment in 340B began to explode. Now more than one-third of the 4,375 U.S. non-federal hospitals are 340B qualified. Recent Congressional and news reports suggest that for selected hospitals, profits off the 340B program can be significant.

For their new study, The 340B drug discount program: Hospitals generate profits by expanding to reach more affluent communities, Conti and Bach examined the populations served by hospitals and clinics qualifying for 340B before and after the decade-long growth spurt. They matched data for all hospitals and clinics registered with the 340B program with socioeconomic data from the U.S. Census Bureau. The results showed communities served by hospital-affiliated clinics joining the program in 2004 or later tended to have higher household incomes, much less unemployment and higher rates of health insurance.

"Our findings are consistent," the authors add, with recent complaints that the 340B program has been converted "from one that serves vulnerable communities to one that enriches participating hospitals and the clinics affiliating with them."

The National Cancer Institute funded both research projects.

http://www.eurekalert.org/pub_releases/2014-10/w-wty100314.php

What 20 years of research on cannabis use has taught us

Wayne Hall, WHO Expert Advisor on addiction, reviews cannabis research since 1993

In the past 20 years recreational cannabis use has grown tremendously, becoming almost as common as tobacco use among adolescents and young adults, and so has the research evidence. A major new review in the scientific journal Addiction sets out the latest information on the effects of cannabis use on mental and physical health.

The key conclusions are:

Adverse Effects of Acute Cannabis Use

Cannabis does not produce fatal overdoses.

Driving while cannabis-intoxicated doubles the risk of a car crash; this risk increases substantially if users are also alcohol-intoxicated.

Cannabis use during pregnancy slightly reduces birth weight of the baby.

Adverse Effects of Chronic Cannabis Use

Regular cannabis users can develop a dependence syndrome, the risks of which are around 1 in 10 of all cannabis users and 1 in 6 among those who start in adolescence.

Regular cannabis users double their risks of experiencing psychotic symptoms and disorders, especially if they have a personal or family history of psychotic disorders, and if they start using cannabis in their mid-teens.

Regular adolescent cannabis users have lower educational attainment than non-using peers but we don't know whether the link is causal.

Regular adolescent cannabis users are more likely to use other illicit drugs, but we don't know whether the link is causal.

Regular cannabis use that begins in adolescence and continues throughout young adulthood appears to produce intellectual impairment, but the mechanism and reversibility of the impairment is unclear.

Regular cannabis use in adolescence approximately doubles the risk of being diagnosed with schizophrenia or reporting psychotic symptoms in adulthood.

Regular cannabis smokers have a higher risk of developing chronic bronchitis.

Cannabis smoking by middle aged adults probably increases the risk of myocardial infarction.

http://bit.ly/1ygkbfG

Warning: USB Malware Code Unleashed

USB sticks have an unfixable security flaw that can allow malware to take over your entire PC, without you knowing it.

Sara Angeles, Business News Daily

Think malware can only come from the Web, malicious emails and corrupt files? If you depend on USB flash drives for your business, listen up about another threat: A new USB malware is on the loose. And it can cause ultimate digital destruction.

Back in July, security researchers Karsten Nohl and Jakob Lell revealed that USB sticks have an unfixable security flaw that can allow malware to take over your entire PC -- without you knowing it.

To demonstrate, Nohl and Lell created BadUSB, malware that lives in a USB's core. It rewrites the USB's firmware, staying undetected as it self-installs and

quietly wreaks havoc on devices and network systems the infected USB is connected to. Even worse, BadUSB remains imperceptible to antivirus software and mobile security apps, and lives on even after the contents of the drive and devices have been deleted and reformatted.

This week, Adam Caudill and Brandon Wilson, security researchers who reverse engineered and recreated BadUSB, did what is seemingly the unthinkable: They've released the code for the malware, allowing anyone to reproduce the malware and exploit all types of USB-capable devices, Wired reports.

If this doesn't scare you, it should. Connecting a USB drive infected by BadUSB and its variants will destroy any connected device and can spread to your entire network. Specifically, Wired reports that malware like BadUSB can also:

Alter files from thumb drives
Redirect Internet traffic
Tap and spy on USB-enabled smartphones
Hijack keyboards to type commands
Potentially inject malicious elements as files are being transferred

The malware can also be executed from any USB device, not just flash drives. This includes USB keyboards, mobile devices and more.

Caudill and Wilson made it clear, however, that they didn't release the malware to purposely exploit the flaw.

The pair said in a hacker conference that they published the code to force USB manufacturers to make a decision: fix the problem or leave the entire digital world vulnerable to USB malware attacks.

12 Easy-Peasy Passwords Designed To Foil Hackers

"The belief we have is that all of this should be public. It shouldn't be held back. So we're releasing everything we've got," Caudill told the audience.

"This was largely inspired by the fact that [Nohl and Lell] didn't release their material. If you're going to prove that there's a flaw, you need to release the material so people can defend against it."

So how can you protect your business from the scary USB monster now running loose the digital wild?

The bad news is that the security flaw is unpatchable and your antivirus can't detect it. Until USB companies change how USB drives are designed and how they function, there's currently no way to defend your devices 100 percent if you use these drives.

The good news is that you have alternatives. Instead of using USB flash drives to store and share files, consider using cloud and online collaboration services like DropBox, Box, OneDrive and Google Drive. Here's an extensive list of cloud storage solutions for small businesses.

http://bit.ly/1xxT907

Study Shows Coffee Drinking Habits Shaped by DNA Variations

Research Reveals Coffee Drinking Habits Shaped by Genetic Variations

The new genes explain about 1.3 percent of our coffee-drinking behavior, which is about the same as that reported for other habitual behaviors, such as smoking and alcohol consumption. Photo by Julius Schorzman/Creative Commons

A study by the international Coffee and Caffeine Genetics Consortium looked at DNA samples and data sets from the coffee-drinking habits of 120,000 people of European and African-American ancestry, providing insight on why caffeine affects people differently, and how these effects influence coffee-drinking behavior.

An international research team has found six new genes underlying our coffee-slurping ways.

The work, led by Marilyn Cornelis, a research associate at the Harvard T.H. Chan School of Public Health, found a total of eight genes, two of which had been identified in prior work by Cornelis and others. Two of the new genes were related to metabolism of caffeine and two were related to its psychoactive effects. The two remaining genes are related to lipid and glucose metabolism, but their role in coffee consumption is unclear. They present a possible avenue of investigation, Cornelis said.

The discoveries provide insight on why caffeine affects people differently, and how these effects influence coffee-drinking behavior, Cornelis said. One person, for example, may feel energized on a daily cup of coffee, while another might need four cups to feel the same effect. If the one-cup-a-day person consumes four cups, Cornelis said, he or she might feel jittery or experience digestive issues, discouraging that level of consumption going forward.

Though there has been disagreement over coffee's health effects in the past, Cornelis said evidence of its benefits has been mounting. In fact, Cornelis herself - who never liked coffee - has been persuaded to try to cultivate the habit.

"I'm not a coffee drinker; I hate the taste of it," Cornelis said. "If there were more people like me in the study we wouldn't have found those genes."

The new genes explain about 1.3 percent of our coffee-drinking behavior, Cornelis said. Though that may seem like a small amount, it is about the same as that reported for other habitual behaviors, such as smoking and alcohol consumption, she said.

Culture is a probably sizable influence, researchers said, but there's also a strong chance that additional genes remain to be found, perhaps many more. The findings were published Tuesday in the journal Molecular Psychiatry.

The work was conducted by the international Coffee and Caffeine Genetics Consortium, which was launched two years ago, Cornelis said, by investigators who had published parallel work on caffeine-related genes. The researchers joined forces and recruited additional investigators, with each team contributing DNA samples and data sets, including surveys of the coffee-drinking habits of 120,000 people of European and African-American ancestry.

The analysis involved searching for consumption patterns and single "letter" changes in the genetic code called single-nucleotide polymorphisms, or SNPs.

The study's senior author, Daniel Chasman, a professor of medicine at Harvard Medical School and the Harvard-affiliated Brigham and Women's Hospital, said in a statement that the work is an example of how genetics can influence habitual behaviors.

The genes found so far might represent only the tip of the iceberg on coffee consumption, Cornelis said. Not only may there be more genes involved in caffeine metabolism, coffee is rich in active compounds in addition to caffeine, some of which may also have physiological effects.

"The next question is who is benefiting most from coffee," Cornelis said. "If, for example, caffeine is protective, individuals might have very similar physiological exposure to caffeine, once you balance the metabolism. But if coffee has other potentially protective constituents, those levels are going to be higher if you consume more cups, so they might actually be benefitting from non-caffeine components of coffee. So it's a little bit complex."

Publication: The Coffee and Caffeine Genetics Consortium, "Genome-wide meta-analysis identifies six novel loci associated with habitual coffee consumption," Molecular Psychiatry, (7 October 2014); doi:10.1038/mp.2014.107

http://bit.ly/110aowG

Womb transplant: old uterus as good as a 20-year-old's

A woman has, for the first time, given birth to a healthy baby after receiving a uterus transplant.

11:43 07 October 2014 by Michael Slezak

And if all goes well, we will see two more such deliveries this year and more in 2015. There are many questions. The uterus donor was 61 – how is it that a 61-year-old transplanted womb is viable? Could this transplant operation become routine? Why doesn't the body reject the transplanted womb? New Scientist has the answers.

The 36-year-old woman was one of nine women to receive a donated uterus at the Sahlgrenska University Hospital in Gothenburg, Sweden, by a team of doctors led by Mats Brännström of the University of Gothenburg.

She received the uterus from a family friend who had previously given birth to two children. Twelve months after the operation, the recipient had an embryo implanted that had been fertilised in-vitro using her egg and her partner's sperm. She gave birth nine months later to a healthy baby boy (pictured).

A 61-year-old donor's uterus is perfect, says Ash Hanafy, a uterus-transplant obstetrician from Griffith University on the Gold Coast in Australia, who worked with Brännström's team. "We have evidence showing that a 70-year-old's uterus will function like a 20-year-old's," he says. "It's actually the eggs that matter."

The uterus is just like a house, Hanafy says. You can live in an old house or you can live in a new mansion – they both keep the rain off. "It's just an incubator basically. The uterus is an amazing organ. And it does function perfectly well – responding to hormones and so on."

Avoiding rejection

So how was the potential rejection of the transplanted uteruses dealt with? For the 12 months after the transplant, the recipients were given immunosuppressant drugs. And based on evidence from the transplants of other organs, the team knew that waiting a year before implanting the embryo would mean they could lower the immunosuppressant drugs during the pregnancy. What's more, says Hanafy, pregnancy itself is immunosuppressive, which prevents the mother from rejecting the fetus.

Of the eight other women who received donated uteruses, two rejected the organ, four are in the 12-month waiting period before pregnancy and two have received embryos and are progressing well. "They will deliver this year," Hanafy says.

Hanafy says we're decades away from this kind of treatment being routine. "I don't think this will be a routine operation in my lifetime," he says. "It is very lengthy and it is very expensive. And requires a massive skilled team to be working together." But somewhere down the track he expects it to be a viable option for women who have no uterus.

The birth is an impressive development in the history of both organ transplantation and fertility management, says Shaun Brennecke, a professor of obstetrics and gynaecology at the University of Melbourne, Australia. About 1 girl in 4500 is born without a uterus, and some women with uterine cancer have their uterus removed. There are about 8200 cases of uterine cancer diagnosed in the UK each year, and it is more commonly seen in women past the menopause.

"The clinical need for this type of treatment is likely to be quite rare, and it remains to be seen how cost-beneficial and safe – for the donor, recipient and eventual fetus – let alone ethically acceptable, this treatment option is, compared, for example, to surrogacy," says Brennecke.

Journal reference The Lancet, DOI: 10.1016/S0140-6736(14)61728-1

http://scitechdaily.com/nasa-data-show-earths-deep-ocean-warmed/

NASA Data Show Earth's Deep Ocean Has Not Warmed

NASA Shows Earths Ocean Abyss Has Not Warmed

Using 2005-2013 data from the Argo buoys, NASA's Jason-1 and Jason-2 satellites and GRACE satellites, scientists found that deep ocean warming contributed virtually nothing to sea level rise during this period.

The cold waters of Earth's deep ocean have not warmed measurably since 2005, according to a new NASA study, leaving unsolved the mystery of why global warming appears to have slowed in recent years.

Scientists at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, analyzed satellite and direct ocean temperature data from 2005 to 2013 and found the ocean abyss below 1.24 miles (1,995 meters) has not warmed measurably.

Study coauthor Josh Willis of JPL said these findings do not throw suspicion on climate change itself.

"The sea level is still rising," Willis noted. "We're just trying to understand the nitty-gritty details."

In the 21st century, greenhouse gases have continued to accumulate in the atmosphere, just as they did in the 20th century, but global average surface air temperatures have stopped rising in tandem with the gases.

The temperature of the top half of the world's oceans - above the 1.24-mile mark - is still climbing, but not fast enough to account for the stalled air temperatures.

Many processes on land, air and sea have been invoked to explain what is happening to the "missing" heat.

One of the most prominent ideas is that the bottom half of the ocean is taking up the slack, but supporting evidence is slim.

This latest study is the first to test the idea using satellite observations, as well as direct temperature measurements of the upper ocean. Scientists have been taking the temperature of the top half of the ocean directly since 2005, using a network of 3,000 floating temperature probes called the Argo array.

"The deep parts of the ocean are harder to measure," said JPL's William Llovel, lead author of the study published Sunday in the journal Nature Climate Change. "The combination of satellite and direct temperature data gives us a glimpse of how much sea level rise is due to deep warming. The answer is - not much."

The study took advantage of the fact that water expands as it gets warmer.

The sea level is rising because of this expansion and the water added by glacier and ice sheet melt.

To arrive at their conclusion, the JPL scientists did a straightforward subtraction calculation, using data for 2005-2013 from the Argo buoys, NASA's Jason-1 and Jason-2 satellites, and the agency's Gravity Recovery and Climate Experiment (GRACE) satellites. From the total amount of sea level rise, they subtracted the amount of rise from the expansion in the upper ocean, and the amount of rise that came from added meltwater. The remainder represented the amount of sea level rise caused by warming in the deep ocean.

The remainder was essentially zero. Deep ocean warming contributed virtually nothing to sea level rise during this period.

Coauthor Felix Landerer of JPL noted that during the same period warming in the top half of the ocean continued unabated, an unequivocal sign that our planet is heating up.

Some recent studies reporting deep-ocean warming were, in fact, referring to the warming in the upper half of the ocean but below the topmost layer, which ends about 0.4 mile (700 meters) down.

Landerer also is a coauthor of another paper in the same journal issue on 1970-2005 ocean warming in the Southern Hemisphere. Before Argo floats were deployed, temperature measurements in the Southern Ocean were spotty, at best.

Using satellite measurements and climate simulations of sea level changes around the world, the new study found the global ocean absorbed far more heat in those 35 years than previously thought - a whopping 24 to 58 percent more than early estimates.

Both papers result from the work of the newly formed NASA Sea Level Change Team, an interdisciplinary group tasked with using NASA satellite data to improve the accuracy and scale of current and future estimates of sea level change.

The Southern Hemisphere paper was led by three scientists at Lawrence Livermore National Laboratory in Livermore, California.

NASA monitors Earth's vital signs from land, air and space with a fleet of satellites and ambitious airborne and ground-based observation campaigns.

NASA develops new ways to observe and study Earth's interconnected natural systems with long-term data records and computer analysis tools to better see how our planet is changing.

The agency shares this unique knowledge with the global community and works with institutions in the United States and around the world that contribute to understanding and protecting our home planet.

Publications:

W. Llovel, et al., "Deep-ocean contribution to sea level and energy budget not detectable over the past decade," Nature Climate Change, 2014; doi:10.1038/nclimate2387

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http://www.eurekalert.org/pub_releases/2014-10/hfhs-ssd100714.php

Study: Stroke-fighting drug offers potential treatment for traumatic brain injury

The only drug currently approved for treatment of stroke's crippling effects shows promise, when administered as a nasal spray, to help heal similar damage in less severe forms of traumatic brain injury.

DETROIT - In the first examination of its kind, researchers Ye Xiong, Ph.D, Zhongwu Liu, Ph.D., and Michael Chopp, Ph.D., Scientific Director of the Henry Ford Neuroscience Institute, found in animal studies that the brain's limited ability to repair itself after trauma can be enhanced when treated with the drug tPA, or tissue plasminogen activator. "Using this novel procedure in our earlier stroke studies, we found significant improvement in neurological function," said Michael Chopp, Ph.D., scientific director of the Henry Ford Neuroscience Institute. "So we essentially repeated the experiment on lab rats with subacute traumatic brain injury, and with similar remarkable results.

"As in stroke treated intra-nasally with tPA, our subjects showed greatly improved functional outcome and rewiring of the cortical spinal tract." The new study was recently published in the Public Library of Science's peer-reviewed online journal PLOS ONE.

Commonly called a "clot-buster," tPA is the only FDA-approved treatment for acute ischemic stroke. Acute ischemic stroke occurs when oxygen-rich blood flow to the brain is blocked by a clot. Resulting damage to oxygen-starved brain cells can lead to physical impairment, mental disabilities and sometimes death.

In the case of traumatic brain injury, damage is due to a violent blow or other external assault.

It has been known for some time that stroke damage can be reduced if tPA is given intravenously within 4.5 hours. But tPA administered through the bloodstream also has potentially harmful side effects, including swelling of the brain and hemorrhage.

More recently, however, Henry Ford researchers found that the effective treatment window could be extended to as much as two weeks for lab rats dosed with tPA in a nasal spray, while avoiding the harmful side effects of intravenous injection.

Although scientists do not yet fully understand how it works, earlier research has shown that drugs administered through the nose directly target both the brain and spinal cord.

Traumatic brain injury is a leading cause of death and disability throughout the world. While the new Henry Ford study offers hope of a drug treatment, so far no effective pharmacological therapy is available.

These most recent findings suggest that tPA has the potential to be a noninvasive treatment for subacute traumatic brain injury, helping the brain restore function to damaged cells.

The researchers cautioned that further animal studies will be required to discover the best dose and the best time window for optimal intranasal treatment.

Funding: National Institute of Neurological Disorders and Stroke RO1 NS062002 (YX), and National Institute on Aging RO1 AG037506 (MC).

http://bit.ly/1qwWzKR

Study shows manure from cows not given antibiotics still causes increase in resistant bacteria in soil

Soil treated with manure from cows that never received antibiotics had more resistant bacteria than soil treated with nonorganic fertilizer

by Bob Yirka

Phys.org - A team of researchers working out of Yale University has found that soil treated with cow manure from cows that never received antibiotics, still had more resistant bacteria in it than soil treated with nonorganic fertilizer. In their paper published in Proceedings of the National Academy of Sciences, the team describes their study and offers some theories regarding their results.

Giving livestock antibiotics has allowed farmers to produce a huge amount of meat in relatively small areas, increasing production and profits. But, some contend, it's also contributed to the problem of bacteria becoming more resistant to drugs dedicated to fighting infections in people. Some have also suggested that using manure from cows given antibiotics as a fertilizer, very likely makes the problem even worse. In this new effort, the researchers sought to find out if that is true.

It was a simple exercise, the team fertilized one patch of ground with manure from cows that never were given antibiotics, and another patch with a nitrogen based inorganic fertilizer. Two weeks later they came back and tested the soil for bacteria levels. To their surprise they found that the soil that had been treated with the manure still had a lot more resistant bacteria (those with genes that caused the production of the enzyme β-lactamases) in it than the patch that had been inorganically treated. Further testing revealed that the increase in antibiotic resistant bacteria came from the soil, not the cows. Thus, there was something about the presence of the manure that caused living organisms in the soil to behave differently.

The researchers can't say for sure why the manure caused more resistant bacteria to show up in the soil but suggest it's possible that heavy metals from the manure or other nutrients could make the soil friendlier to the types of resistant bacteria that are naturally in soils. Such bacteria have naturally developed resistance to

antibacterial agents from fungi and even other bacteria. The researchers plan to continue their research to find out the true cause.

In the meantime, it's likely that those who have been suggesting that manure from cows given antibacterial agents causes problems, will suggest that because "clean" manure also causes an increase in the amount of resistant bacteria, its likely cows given antibiotics would make the problem even worse.

More information: Bloom of resident antibiotic-resistant bacteria in soil following manure fertilization, PNAS, DOI: 10.1073/pnas.1409836111

http://www.eurekalert.org/pub_releases/2014-10/p-ocf093014.php

Oral chelation for environmental lead toxicity

Treatment with DMSA linked to reductions in the amount of lead inchildren's blood

Treatment with dimercaptosuccinic acid (DMSA), an oral chelation agent, was linked to reductions in the amount of lead in blood in young children in Zamfara State, Nigeria following environmental lead contamination, according to a study by Jane Greig and colleagues from Médecins Sans Frontières (MSF) published in this week's PLOS Medicine.

The researchers report findings from an MSF program initiated in May 2010 to reduce lead poisoning in children following widespread environmental lead contamination due to gold mining in Zamfara State, Nigeria, leading to the death of an estimated 400 young children in the 3 months before chelation therapy was provided.

The analysis included 3180 courses of DSMA chelation therapy administered between 1 June 2010 and 30 June 2011 to 1,156 children ≤5 y of age who had measurements of venous blood lead levels before and after each course of DMSA. The researchers found that, on average, treatment with DSMA was associated with a reduction in venous blood lead levels to 74.5% of the level at the start of the DMSA course. Nine of these 1,156 children died during the period studied, with lead poisoning likely involved in three of these deaths. The researchers report that no clinically severe adverse effects related to DMSA were seen during the study period, and no laboratory findings were recorded that required treatment discontinuation.

While the findings cannot be used to reach any definitive conclusions about the effectiveness or safety of oral DMSA as a treatment for lead poisoning in young children, blood lead levels decreased and the number of deaths was substantially reduced after the program was initiated.

The authors say: "This experience with basic supportive care and chelation in a large paediatric cohort adds significantly to the evidence base for clinical management of epidemic lead poisoning, particularly in resource-poor settings."

Funding: This study was funded as part of MSF operations. Lundbeck donated some DMSA, but had no role in the treatment programme or in study design, data collection and analysis, decision to publish, or preparation of the manuscript. The findings and conclusions in this presentation have not been formally disseminated by the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry and should not be construed to represent any agency determination or policy.

Competing Interests: The authors have declared that no competing interests exist.

Citation: Thurtle N, Greig J, Cooney L, Amitai Y, Ariti C, et al. (2014) Description of 3,180 Courses of Chelation with Dimercaptosuccinic Acid in Children #5 y with Severe Lead Poisoning in Zamfara, Northern Nigeria: A Retrospective Analysis of Programme Data. PLoS Med 11(10): pmed.1001739. doi:10.1371/journal.pmed.1001739

http://www.eurekalert.org/pub_releases/2014-10/usmc-ri100714.php

Researchers identify 'Achilles heel' in metabolic pathway that could lead to new cancer treatment

Achilles heel"found in a metabolic pathway crucial to stopping the growth of lung cancer cells.

DALLAS - Researchers at UT Southwestern Medical Center have found an "Achilles heel" in a metabolic pathway crucial to stopping the growth of lung cancer cells.

At the heart of this pathway lies PPARγ (peroxisome proliferation-activated receptor gamma), a protein that regulates glucose and lipid metabolism in normal cells.

Researchers demonstrated that by activating PPARγ with antidiabetic drugs in lung cancer cells, they could stop these tumor cells from dividing.

"We found that activation of PPARγ causes a major metabolic change in cancer cells that impairs their ability to handle oxidative stress," said Dr. Ralf Kittler, Assistant Professor in the Eugene McDermott Center for Human Growth and Development, the Department of Pharmacology, the Harold C. Simmons Cancer Center and the Cecil H. and Ida Green Center for Reproductive Biology Sciences at UT Southwestern.

"The increased oxidative stress ultimately inhibits the growth of the tumor. We found that activation of PPARγ killed both cancer cells grown in a dish and tumors in mice, in which we observed near complete tumor growth inhibition," said Dr. Kittler, the John L. Roach Scholar in Biomedical Research of UT Southwestern's Endowed Scholars Program.

The study, published in the journal *Cell Metabolism*, builds on a large body of work showing that metabolism in cancer cells is altered when compared to normal cells. Changes in metabolism can make cancer cells more vulnerable to therapeutic agents, which make them a good target to investigate for cancer therapy.

The new research also extends earlier observations made by Dr. Steven Kliewer, Professor of Molecular Biology and Pharmacology, who first identified that thiazolidinediones target PPARγ. Dr. Kliewer holds the Nancy B. and Jake L. Hamon Distinguished Chair in Basic Cancer Research.

Dr. Kittler and his team determined that PPARγ activation triggers changes in glucose and lipid metabolism that cause an increase in the levels of reactive oxygen species (ROS). ROS are highly reactive oxygen-containing molecules that damage cells when present at high levels, a phenomenon known as oxidative stress.

It is this increase in ROS that eventually stops the cancer cells from dividing.

"The abnormal metabolism in cancer cells frequently causes increased oxidative stress, and any further increase can 'push' cancer cells over the cliff," said Dr. Kittler, UT Southwestern's first Cancer Prevention and Research Institute of Texas (CPRIT) Scholar in Cancer Research.

The findings suggest that targeting PPARγ could be a promising new therapeutic approach for lung cancer and potentially other cancers.

The researchers saw that activating PPARγ caused similar molecular changes in breast cancer cells.

"This is an important finding because the drugs that activate PPARγ include FDA-approved antidiabetic drugs that are relatively well tolerated compared to chemotherapy. Knowing their mechanism of action provides us with clues for selecting tumors that may be responsive to this treatment, for combining these drugs with anti-cancer drugs to make therapy more effective, and for developing markers to measure the response of tumors to these drugs in patients," said Dr. Kittler, Director of the McDermott Next-Generation Sequencing Core at UT Southwestern.

"Of course, further study will be required to determine the therapeutic effectiveness of PPARγ-activating drugs for lung cancer treatment," he added.

Other UT Southwestern researchers involved in the work include joint first authors Dr. Nishi Srivastava, postdoctoral researcher, and Rahul Kollipara, computational biologist; Dr. Dinesh Singh, research scientist; Jessica Sudderth, research associate; Dr. Zeping Hu, Assistant Professor at the Children's Research Institute at UT Southwestern; Dr. Hien Nguyen at the University of Massachusetts Medical School; Dr. Shan Wang, postdoctoral researcher; Caroline Humphries, senior research scientist; Ryan Carstens, student research assistant; Dr. Kenneth Huffman, research scientist; and Dr. Ralph DeBerardinis, Associate Professor with the Children's Medical Center Research Institute at UT Southwestern, the Eugene McDermott Center for Human Growth and Development, and the Department of Pediatrics, who holds the Joel B. Steinberg, M.D. Chair in Pediatrics and is the Sowell Family Scholar in Medical Research. The study was funded by the Cancer Prevention and Research Institute of Texas (CPRIT) and the National Cancer Institute (NCI).

http://www.eurekalert.org/pub_releases/2014-10/uouh-aue100714.php

A universal Ebola drug target

New study reports design, characterization of universally conserved drug target for current, future strains of virus

Salt Lake City - University of Utah biochemists have reported a new drug discovery tool against the Ebola virus. According to a study published in this week's online edition of Protein Science, they have produced a molecule, known as a peptide mimic, that displays a functionally critical region of the virus that is universally conserved in all known species of Ebola. This new tool can be used as a drug target in the discovery of anti-Ebola agents that are effective against all known strains and likely future strains.

The University of Utah (U of U) work, which was funded by the National Institutes of Health, was conducted by a large collaborative team led by Debra Eckert, Ph.D., (research assistant professor of biochemistry) and Michael Kay, M.D., Ph.D., (professor of biochemistry). Key contributions to this work were provided by Dr. John Dye's laboratory at the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), the lab of Christopher P. Hill, D.Phil., professor and co-chair of the U of U Department of Biochemistry, and a group led by Brett Welch, Ph.D. at Navigen, Inc., a Salt Lake City pharmaceutical discovery and development company. (Navigen has licensed exclusive rights to the technology from the U of U and is currently screening for drugs against the target.)

The Utah scientists designed peptide mimics of a highly conserved region in the Ebola protein that controls entry of the virus into the human host cell, initiating infection. Importantly, the researchers were able to demonstrate this peptide target is suitable for use in high-throughput drug screens. These kinds of screens allow rapid identification of potential new drugs from billions of possible candidates. Current experimental drugs generally target only one of Ebola's five species. "The current growing epidemic demonstrates the need for effective broad-range Ebola virus therapies," says Dr. Tracy R. Clinton, lead author on the study. "Importantly, viral sequence information from the epidemic reveals rapid changes in the viral genome, while our target sequence remains the same. Therefore, our target will enable the discovery of drugs with the potential to treat any future epidemic, even if new Ebola virus strains emerge."

Ebola is a lethal virus that causes severe hemorrhagic fever with a 50 percent to 90 percent mortality rate. There are five known species of the virus. Outbreaks have been occurring with increasing frequency in recent years, and an unprecedented and rapidly expanding Ebola outbreak is currently spreading through several countries in West Africa with devastating consequences. The

development of an effective anti-Ebola agent to protect against natural outbreaks and potential bioterror exposures is an urgent global health need. There are no approved anti-Ebola agents, but a number of promising experimental drugs are being aggressively advanced to clinical trials to address the current crisis.

Dr. Eckert notes, "Although the current push of clinical trials will hopefully lead to an effective treatment for the Zaire species causing the present epidemic, the same treatments are unlikely to be effective against future outbreaks of a different or new Ebola species. Development of a broadly acting therapy is an important long-term goal that would allow cost-effective stockpiling of a universal Ebola treatment."

Of particular interest, this target was shown to be suitable for the discovery of mirror-image peptide inhibitors (D-peptides), which are promising drug candidates. Unlike natural peptides, they are not digested by enzymes in the blood. D-peptides are also much simpler and less expensive to produce compared to the current most promising approach, antibodies. The Utah group has previously developed highly potent and broadly acting D-peptide inhibitors of HIV entry, currently in preclinical studies, and is now adapting this approach to Ebola using the mimics developed in this study. In collaboration with Navigen, several promising lead D-peptide inhibitors have already been identified. U of U and Navigen are now seeking additional funding to optimize these inhibitors and advance them into clinical trials in humans.

http://www.eurekalert.org/pub_releases/2014-10/ehs-hfv100714.php

H7N9 flu vaccine study shows adjuvant is essential for effective immune response

Immune response found in participants who received injections of low dose inactivated vaccine mixed with adjuvant

A large, NIH-sponsored clinical trial of an experimental H7N9 avian influenza vaccine found an immune response that was believed to be protective in 59 percent of study participants who received two injections of the inactivated vaccine at the lowest dosage tested when mixed with an adjuvant – a component that boosts the body's immune response and enhances the effectiveness of inactivated influenza vaccines.

Participants who received a vaccine without the adjuvant had a minimal immune response. The results are published in the Journal of the American Medical Association (JAMA).

The randomized, double-blinded clinical trial, sponsored by the National Institute of Allergy and Infectious Diseases (NIAID), enrolled 700 healthy adults ages 19 to 64 at four NIAID-sponsored Vaccine and Treatment Evaluation Units (VTEUs) in the United States. Enrollment began in Sept. 2013 and six-month followup was completed in May 2014.

The clinical trial was led by Mark Mulligan, MD, professor of medicine at Emory University School of Medicine and principal investigator of the Emory VTEU. The Emory study site included the Hope Clinic of the Emory Vaccine Center, the Emory Department of Pediatrics and Children's Healthcare of Atlanta. The paper's Emory co-authors were Evan Anderson, MD, Srilatha Edupuganti, MD, Nadine Rouphael, MD and Paul Spearman, MD.

The 700 volunteers were divided into groups receiving four different dosages of vaccine, with or without adjuvant (MF59), given at 0 and 21 days. Those receiving vaccine without adjuvant had minimal immune responses, even at the highest vaccine dose. Likely immune responses were assessed at 42 days after the first vaccination with a standard blood test called the hemagglutination (HAI) antibody assay. No serious adverse events were reported, and side effects were mild.

Antibody responses were not significantly different between participants who received the highest and the lowest dosages of vaccine along with two doses of adjuvant. But participants who received a dose of adjuvant with their first dose of vaccine had immune responses comparable to those who received two doses of adjuvant. This finding could be important in stretching supplies of vaccine and adjuvant during a pandemic. Participants who recently had received a seasonal flu vaccination or those who were older were less likely to have a strong immune response.

"This clinical trial gave us valuable information about the use of H7N9 flu vaccine combined with adjuvant and makes us better prepared for a potential pandemic," says Mulligan. "We must continue to test and improve vaccines for all flu strains, as these viruses have the ability to mutate and spread rapidly."

The first human H7N9 avian influenza cases occurred in China in early 2013. Most infected people have had contact with infected poultry. Although the virus does not sicken birds, approximately 67 percent of infected people have required hospitalization. As of Sept. 4, 2014, 452 cases and 166 deaths (37 percent) had been reported to the World Health Organization.

Other VTEUs participating in the clinical trial were at Cincinnati Children's Hospital and Medical Center; University of Iowa, Iowa City; and University of Texas Medical Branch, Galveston. The vaccine and adjuvant were supplied by the U.S. Department of Health and Human Services Biomedical Advanced Research and Development Authority (BARDA) from its National Pre-pandemic Influenza Vaccine Stockpile.

Reference: MJ Mulligan et al. Serological responses to an avian influenza A/H7N9 vaccine mixed at the point-of-use with MF59 adjuvant: a randomized clinical trial. JAMA 2014; 312(14):1409-1419. Doi:10.1001/jama 2014.12854

http://www.eurekalert.org/pub_releases/2014-10/uu-vlc100714.php

Very low concentrations of heavy metals and antibiotics contribute to resistance

Plasmids containing genes conferring antibiotic resistance enriched by very low concentrations of antibiotics and heavy metals

New Swedish research shows that plasmids containing genes that confer resistance to antibiotics can be enriched by very low concentrations of antibiotics and heavy metals. These results strengthen the suspicion that the antibiotic residues and heavy metals (such as arsenic, silver and copper) that are spread in the environment are contributing to the problems of resistance. These findings have now been published in the highly regarded journal *mBio*.

Antibiotic resistance is a growing medical problem that threatens human health worldwide. Why and how these resistant bacteria are selected is largely unknown, although it is known that the primary selection takes place in humans and animals treated with antibiotics. Another contributory factor is that roughly half of the antibiotics used in treating humans and animals are, in unchanged and active form, excreted in the urine.

Professor Dan I. Andersson, at Uppsala University, who headed the study, says: 'These antibiotics then disperse, usually in very low concentrations, through sewerage systems into water and soil, where they can remain active in the environment for a long period and so contribute to the enrichment of resistant bacteria.'

Besides antibiotics massive quantities of biocides and heavy metals are also present in the environment. This is due partly to various natural sources (such as heavy metals in groundwater), but also to contamination caused by human activities. Biocides and heavy metals are used mainly to prevent growth of various microorganisms in different contexts. For example, they promote growth in animal production (pigs and poultry), serve as ingredients in anti-fouling paint for boat hulls and as disinfectants for industrial, domestic and hospital use., and are found in products.

Plasmids (small extra fragments of DNA that can be transferred between bacteria) can contain not only antibiotic resistance genes but also genes conferring resistance to biocides and heavy metals, such as arsenic, copper, silver, lead and mercury.

'When these chemicals spread in the environment, bacteria with resistant plasmids will be selected. This indirectly results in antibiotic resistance increasing as well. What's more, in most environments there are complex mixtures of antibiotics, biocides and heavy metals that, together, have intensified combination effects,' Andersson continues.

In the study in question, the researchers performed very sensitive competition experiments in a laboratory environment. They allowed two different strains of bacteria, one susceptiblensitive to antibiotics and one resistant with a plasmid, to grow together in a culture with small amounts of antibiotics and heavy metals present. The results show that very low concentrations of both heavy metals (such as arsenic) and antibiotics, separately or in combination, were able to enrich the resistant plasmid-bearing bacteria.

'These results are worrying and suggest that substances other than antibiotics that are present in very small quantities in the environment can drive development of resistance as well. The results underline the importance of reducing the use of antibiotics, but also suggest that our high use of heavy metals and biocides in various contexts should decrease too,' says Andersson.

The study was funded by the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (Formas) and the Swedish Research Council. It forms part of a large research programme (INTERACT, http://interact.gu.se) with the aim of understanding how biocides and heavy metals, especially in combination, contribute to development of antibiotic resistance.

Reference: *Erik Gullberg et al. (2014) Selection of a Multidrug Resistance Plasmid by Sublethal Levels of Antibiotics and Heavy Metals. mBio. DOI:10.1128/mBio.01918-14.*

http://bit.ly/1uUc5XJ

Do We Doodle Because We Speak?

Scribbling and sketching aren't just practices to idle time away, but a more fundamental indication of our need for language

By Marissa Fessenden

A toddler with a crayon in hand is understood to be a menace to white walls. But instead of scolding the kid, we could instead examine the scribbles for messages. Is doodling, often born of boredom, actually something that we are driven to do by instinct?

Some researchers are now discussing the possibility that doodling may be a kind of language. In an article by David Robson for BBC Future, Neil Cohn, who studies graphic novels scientifically at the University of California, San Diego, points out that some symbols are repeated across a medium - for instance, stars spin around the head of dizzy characters in comics - and serve as a kind of vocabulary. A toddler's desire to scribble on anything and everything may actually be evidence of a fundamental need for a doodle language.

There are also some signs that these drawings are rudimentary attempts at communication – the size of the random squiggles seems to correspond to the size of nearby objects, for instance. In light of Cohn's work, this instinct could just be the

graphical equivalent of "babbling" – the cooing noises that all babies make as they make the first steps towards speech. Perhaps we are just hard-wired to communicate in as many ways as possible and our environment determines which path becomes more dominant.

Robson's piece also delves into the storytelling by the Arandic, the Waripiri and other indigenous cultures in Australia. There, stories are told with visual aids sketched in the desert ground. "In the old days, the women would take a stick from a tree and shape it into a flexible implement for drawing," Lizzie Ellis, a Western Desert storyteller, told the BBC. "But the girls now use wire, made with elaborate handles." The girls wear these 'story wires' around their neck so they can quickly draw at any time

Other facts also help elevate the humble doodle. Of course, artists doodle regularly (though we call it sketching). Early written languages look like they borrow heavily from and improve upon sketches of people and things. And doodling may even improve our ability to retain information. So next time your pen wanders to the margin of your page, know that you are engaging in a practice that is rich in history and just maybe hardwired in your brain.

http://www.bbc.com/news/science-environment-29522647

Garlic injection could tackle tree diseases

Injecting trees with a concentrated form of garlic might help save trees in the UK from deadly diseases.

By Claire Marshall BBC environment correspondent

Operating under an experimental government licence, a prototype piece of technology to administer the solution is being trialled on a woodland estate in Northamptonshire.

Widespread use of the injection process is impractical and expensive.

But it could potentially help save trees of historic or sentimental value.

Garlic is one of nature's most powerful antibacterial and antifungal agents.

It contains a compound called allicin, which scientists are interested in harnessing.

The experimental injection device is made up of a pressurised chamber and eight "octopus" tubes.

The pressure punches the solution through the tubes and through special injection units in to the tree's sap system. The needles are positioned in a way to get allicin evenly around the tree.

The moment the active agent starts to encounter the disease, it destroys it. The poison is organic and isn't rejected by the tree.

It is pulled up the trunk out along the branches and in to the leaves by the process of transpiration - the flow of water through a plant.

Tree consultant Jonathan Cocking is involved with the development and deployment of the treatment.

"Over the last four years we have treated 60 trees suffering badly with bleeding canker of horse chestnut. All of the trees were cured.

This result has been broadly backed up by 350 trees we have treated all over the country where we have had a 95% success rate."

Oak trees with acute oak decline - which eventually kills the tree - have improved after being treated. In laboratory conditions allicin kills the pathogen chalara which is responsible for ash dieback.

The solution is made by a company in Wales. "Organic cloves of garlic are crushed," said Mr Cocking, "and a patented method is used to amplify the volume of allicin and improve the quality of it so it is stable for up to one year. Allicin in the natural world only lasts for about 5-10 minutes.

If you go back to the tree the day after, and crush a leaf that is in the extremity of the crown, you can often smell the garlic."

The goal is to get a commercial licence by the beginning of next year.

According to Prof Stephen Woodward, a tree expert at Aberdeen University: "The antibacterial properties of allicin are well-known in the laboratory. I have not heard of it being used in trees before, but yes this is interesting. It could work."

However Mr Woodward cautioned about such methods of "biological control". "Despite being plant-based that doesn't mean it can't harm an ecosystem. For example cyanide is plant-based."

Many conservationists also caution against such drastic intervention. Dr Anne Edwards from the John Innes Centre was one of the first to identify ash dieback in a coppice wood in Norfolk.

She said that this treatment would not be effective for ash dieback: "In a woodland setting we really have to let nature take its course. It's very depressing," she explained.

The Woodland Trust also favours a different approach. The organization is investing £1.5m in a seed bank. The idea is to grow trees that are fully traceable and therefore free from foreign disease.

Austin Brady, director of conservation and external affairs, said: "Our native woodland needs to build its resilience to disease and pests. By starting from the beginning of the supply chain we can ensure that millions of trees will have the best possible chance of survival in the long term."

In recognition of the threat posed by current and future tree and plant biosecurity, Defra recently appointed a Chief Plant Health Officer, and has earmarked £4 million for research in to treatments.

http://bit.ly/1tNACcF

Cancer Spreads Through Our Bodies at Night

This could mean that therapies delivered after dark might be more effective

By Rachel Nuwer

Cancer therapies are typically administered during the daytime. But according to a new paper published in the journal *Nature Communications*, cancer's growth is actually suppressed by the body's natural hormones during the day. It's nighttime, the researchers think, when cancers do most of their growing, which means that changing the timing of treatments such as chemo could boost their efficacy.

Researchers from the Weizmann Institute of Science stumbled across this surprising finding while researching cell receptor proteins, including one that interacts with glucocorticoid, a chemical that plays a role in maintaining the body's alertness throughout the day, the researchers explained in a release. Glucocorticoid ensures we have enough energy to function while we're awake, and when we encounter stressful situations, it surges through our system to help us prepare for potential danger.

The authors of the study discovered that, when glucocorticoid binds to receptors on the outside of cells, it blocks the ability of another chemical, the epidermal growth factor receptor (EGFR), from doing so. This is significant because EGFR has been implicated in cancer, including in fueling the growth and migration of malignant cells, the researchers said.

The researchers confirmed in mice that EGFR is significantly more active at night than during the day, when glucocorticoid blocks its activity. When they gave breast cancer model mice a new drug designed to treat that disease, the animals responded differently to the treatment depending on the time of day that they received their dose. Those that took the meds at night developed significantly smaller tumors.

The researchers believe this finding could have relevance for human cancer patients. "Cancer treatments are often administered in the daytime, just when the patient's body is suppressing the spread of the cancer on its own," they said in the release. "What we propose is not a new treatment, but rather a new treatment schedule for some of the current drugs."

http://phys.org/news/2014-10-japan-nobel-winner-salaryman-bosses.html

Japan Nobel winner is salaryman who took on bosses

Japan celebrated three more Nobel prizes Wednesday, including for a scientist remembered as the salaryman who stood up to a corporation - and won.

Shuji Nakamura was one of a trio recognised for their pioneering work in the creation of the blue LED, a development that paved the way for energy-efficient lighting.

Nakamura was employed at Nichia Corp. when he carried out the research that led to his invention of the blue LED in 1993, with the patent registered under the company name.

His initial bonus from the company was only 20,000 yen (less than $200), despite the huge financial gains for the firm.

Nakamura later sued his employer, demanding 20 billion yen, a record at that time in a Japanese patent trial.

In a landmark ruling in 2004, the Tokyo District Court ordered the company to pay the sum demanded by Nakamura.

"Engineers have long been ignored," Nakamura said afterwards.

Nichia appealed, but settled on a payment of 844 million yen in 2005, more than $8 million.

The case was widely watched for its potential to set a precedent for how Japanese companies treat inventors on their payroll, who generally get a pittance in exchange for sometimes revolutionary and hugely profitable inventions.

After the Nobel Prize was announced on Tuesday, Nakamura said he had been driven to great heights of scientific achievement by anger at the way he was always treated like an outsider.

Nakamura, currently a professor at University of California, Santa Barbara, never lived in Tokyo and was not from an elite university or a giant well-known firm.

He once said students looked down on him when he was studying in the United States - where he had been sent by the company - as he did not have a PhD.

"My desire to get back at them led to the invention of the (blue) LED," he earlier said, according to the Nikkei business daily.

The outspoken scientist, who is now an American citizen, was recognised along with Isamu Akasaki and Hiroshi Amano.

"It's an honour getting a Nobel Prize, the greatest of all," said Amano, who is currently in France at the Minatec research centre in the Alpine city of Grenoble.

Describing the technology as "the greatest for energy saving", he said he would like to continue the research.

"I began the study in 1983 when I was a student. So I've started over 30 years ago," he added.

"I was stuck many times but I never gave up. I continued the experiments three times a day. It always failed but I got new ideas that pushed me to continue the experiments".

Japanese media effusively welcomed news of the triple win, with newspapers issuing special editions and television stations flashing the news.

Headlines ranged from "Miracle of Blue, Crystalisation of Passion" in the usually sober Nikkei to "Passion Invites Revolution" in the mass circulation Asahi daily.

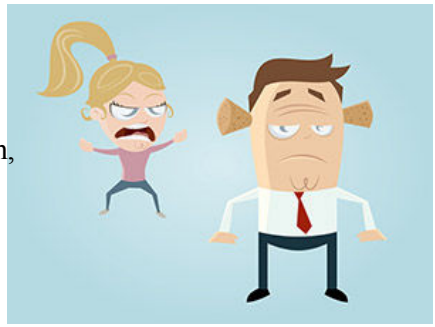
http://phys.org/news/2014-10-everyday-conversations.html

Complaining in everyday conversations

Complaining has become so pervasive that it creeps into conversations from the dinner table to the workplace.

by Robin Lally

When was the last time you went through an entire day either not complaining or hearing a friend, colleague or family member whining about one thing or another? More likely than not the answer is probably never.



"Complaining is just one of those very pervasive activities," says Jenny Mandelbaum, a professor in the in the Department of Communication in the School of Communication and Information at Rutgers. "No matter what people may say, everyone complains, it is part of human nature."

Complaining has become so pervasive that it creeps into conversations from the dinner table to the workplace.

Mandelbaum and her colleague Galina Bolden, an associate professor, investigate social interactions between individuals and co-teach a Byrne Seminar, "It's not Fair! Complaining in Everyday Conversation". Created for first-year students, the class examines the good, the bad and the ugly of the common kvetching that has become second nature to most of us.

Those in the small class of 10 students meet for three hours over a five-week period and have the opportunity at the beginning of each class to get whatever they want off their chest: Dorm rooms that are too hot. Noisy students congregating outside their rooms late at night. Broken down cars. Overwhelming academic and personal obligations. Whatever their complaint, these new college students have the opportunity to vent, often times, about the same topic.

"Many times when people start complaining, the complaint can all of a sudden become a topic of conversation and even lead to some new friends being made," says Bolden. "That's because complaints bring people together through a common experience."

Although social science research indicates that being a regular complainer – or hanging around them – is not good for your brain or overall physical condition and can wreak havoc on your personal life and career, the practice is so prevalent that it creeps into social interactions from the workplace to the dinner table, the professors say.

In the Rutgers Byrne seminar – which introduces incoming undergraduates to the basics of how to conduct academic research – students are encouraged to become careful observers and more aware not only of the complaining they do but also of the complaints that swirl around them every day.

Kara Monaco, 18, a first-semester student taking the one-credit course, said she hadn't thought about the topic much before. "But now, when I hear someone complaining, I think we really do complain a lot," she says.

Mandelbaum and Bolden work with students by analyzing video and audio recordings. From dinner party arguments over whether or not the baked potato is too hard to a friend complaining about a broken down car or someone making a customer service complaint, the messages in these naturally-occurring conversations provide students with a better understanding of the act, how we react when the complaint is lodged at us personally and what we think when we hear someone else complaining.

They say complaints are fraught with social complexities: Should you complain behind someone's back? What is the best way to make a direct complaint? Can complaining ever be positive? What is the person complaining looking to achieve?

"Sometimes all the person wants is to be understood," says Mandelbaum. "They just want someone to listen."

Understanding this is key, they say, because ignoring a complaint or complainer is practically impossible. It is better, they insist, to consider the implications and consequences of complaining and learn how to produce and react appropriately to these situations in both your personal and professional lives.

"This class has made it easier for me to understand that I can change the wording when I'm talking to friends so it won't sound like I'm complaining," says 18-year-old Allyson Wagner.

http://bit.ly/1qbGs6g

Could Multiple Sclerosis Begin in the Gut?

MS researchers are focusing on the content of the gut's microbiome as a possible contributor to the body's autoimmune attack on its nervous system

October 8, 2014 |By Bret Stetka

Multiple sclerosis (MS) is an electrical disorder, or rather one of impaired myelin, a fatty, insulating substance that better allows electric current to bolt down our neurons and release the neurotransmitters that help run our bodies and brains. Researchers have speculated for some time that the myelin degradation seen in MS is due, at least in part, to autoimmune activity against the nervous system. Recent work presented at the MS Boston 2014 Meeting suggests that this aberrant immune response begins in the gut.

Eighty percent of the human immune system resides in the gastrointestinal tract. Alongside it are the trillions of symbiotic bacteria, fungi and other single-celled organisms that make up our guts' microbiomes. Normally everyone wins: The microorganisms benefit from a home and a steady food supply; we enjoy the essential assistance they provide in various metabolic and digestive functions. Our microbiomes also help calibrate our immune systems, so our bodies recognize which co-inhabitants should be there and which should not. Yet mounting evidence suggests that when our resident biota are out of balance, they contribute to numerous diseases, including diabetes, rheumatoid arthritis, autism and, it appears, MS by inciting rogue immune activity that can spread throughout the body and brain.

One study presented at the conference, out of Brigham and Women's Hospital (BWH), reported a single-celled organism called methanobrevibacteriaceae that activates the immune system is enriched in the gastrointestinal tracts of MS patients whereas bacteria that suppress immune activity are depleted. Other work, which resulted from a collaboration among 10 academic researcher centers across the U.S. and Canada, reported significantly altered gut flora in pediatric MS patients while a group of Japanese researchers found that yeast consumption reduced the chances of mice developing an MS-like disease by altering gut flora. Sushrut Jangi, a staff physician at Beth Israel Deaconess Medical Center in Boston who co-authored the BWH study, thinks that regional dietary influences might even be at play. "The biomes of people living in different areas and who consume Western versus non-Western diets are demonstratively different," he says. "People who emigrate from non-Western countries, including India, where MS rates are low, consequently develop a high risk of disease in the U.S. One idea to explain this is that the biome may shift from an Indian biome to an American biome," although there is not yet data to support this theory.

The microbiome theory is gaining so much steam in academia that a coalition of four U.S. research centers called the MS Microbiome Consortium recently formed to investigate the role of gut microorganisms in the disease. The group presented data in Boston showing significantly different gastrointestinal bacterial populations in patients treated with the MS drug glatiramer acetate compared with untreated subjects. How exactly the drug suppresses MS activity is unknown but the findings suggest that perhaps it works in part by altering gut flora and, as a result, suppressing abnormal immune activity. "The gut is well-positioned for an important role in the development of autoimmune disease, including MS.," says Ilana Katz Sand, an assistant professor of neurology at Mount Sinai Medical Center in New York City and member of the MS Microbiome Consortium. "But important questions remain, such as how MS medications affect the microbiome, how an individual's microbiome may affect treatment responses, whether particular bacterial species are associated with more severe disease and ultimately whether we can manipulate the microbiome to benefit our patients."

Katz Sand says that dietary and probiotic approaches to treating MS are worth pursuing, as is a less palatable approach: fecal transplantation. Yet answers in science and medicine are rarely simple, she added, pointing out that in all likelihood MS arises from a complicated confluence of genetic and environmental influences that might ultimately trigger autoimmune activity. Beyond just our gut flora well over 100 genetic variants - many related to immune function - are now known to contribute to the disease as are external factors including vitamin D deficiency (MS is more common at higher latitudes), smoking and increased salt intake.

Further confounding our ability to pinpoint root causes is that our genetic code influences how our bodies and brains respond to these external factors. It could be that both genes and environmental stimuli lead to pathologic microbiomes or that some unfortunate combination of these factors leads to a common autoimmunologic pathway that ravages myelin. "We know the microbiome shapes our immune system and that MS is an immune-mediated disease. We also know that genes influence our microbiomes and immune systems," says David Hafler, professor of neurology and immunobiology at Yale University School of Medicine who was at the conference but not involved in the microbiome work presented. But there must be nongenetic factors contributing to the disease, too, given that the incidences of MS and other autoimmune disorders are increasing. "Maybe it's a lot of little factors like low vitamin D, increased body mass index and increased salt intake," Hafler says, "but I wouldn't be surprised if it was one big thing, much like how H. pylori was found to cause ulcers. No one's identified a clear bug that's driving MS but I think it's important we keep looking."

http://www.eurekalert.org/pub_releases/2014-10/dci-pdr100314.php

Patient's dramatic response and resistance to cancer drug traced to unsuspected mutations

DNA of woman whose lethal thyroid cancer "melted away" for 18 months has revealed new mechanisms of cancer response

BOSTON – The DNA of a woman whose lethal thyroid cancer unexpectedly "melted away" for 18 months has revealed new mechanisms of cancer response and resistance to the drug everolimus, said researchers from Dana-Farber Cancer Institute and the Broad Institute of MIT and Harvard.

The investigators discovered two previously unknown mutations in the cancer's DNA. One made the woman's cancer extraordinarily sensitive to everolimus,

accounting for the remarkably long-lasting response. The second mutation was found in the DNA of her tumor after it had evolved resistance to the drug 18 months after treatment started, according to the study published in the October 9 issue of the New England Journal of Medicine.

The single case study illustrates how repeatedly sequencing a patient's cancer DNA – first prior to treatment and again when the tumor shows signs of resistance – can identify unsuspected "response" and "resistance" mutations that may help guide treatment of other patients.

"This is personalized, precision medicine at its best," said Jochen Lorch, MD, a thyroid cancer specialist at the Head and Neck Treatment Center at Dana-Farber and senior author of the report.

Having identified the mutation – in a gene called TSC2 -- that caused the patient's dramatic response to everolimus, researchers at Dana-Farber have opened a clinical trial to test the drug's effectiveness in other patients with TSC2 mutations. This type of trial, sometimes called a "basket" trial, is becoming more common as studies of patients who are "exceptional responders" are revealing previously unknown response mutations to a variety of drugs. A basket trial pools patients with a particular response mutation, regardless of the type of cancer they have.

"The study of patients with extraordinary responses can yield critically important insights," said Nikhil Wagle, MD, first author of the report. "These studies could help us develop methods for matching patients to drugs, highlight effective uses for otherwise 'failed' therapies, and design new therapeutic strategies to fight cancer." Wagle is an oncologist at Dana-Farber and is also affiliated with Brigham and Women's Hospital and the Broad Institute of MIT and Harvard.

Everolimus, sold as Afinitor, is approved to treat tumors associated with Tuberous Sclerosis Complex (TSC), a rare genetic disorder causes by mutations in TSC1and TSC2 genes. It is also approved for use in brain tumors, pancreatic cancer, kidney cancer and advanced breast cancer. Everolimus targets a protein kinase, mTOR, that regulates important cell functions including growth and proliferation, and which is overactive in some cancers.

The patient whose stunning response to the drug prompted the hunt for mutations was a 56-year-old woman diagnosed in 2010 with anaplastic thyroid cancer. This form of thyroid cancer is almost always fatal within a few months. "No treatment has ever worked," said Lorch. The tumor spread to her lungs despite surgery, radiation and chemotherapy.

Lorch, who was leading a clinical trial of everolimus for a more treatable type of thyroid cancer, decided to include the woman and a handful of other anaplastic patients. To his surprise, after a few months the tumor shrank to a very small size. It remained that way for an unheard-of 18 months until it began to grow again.

Using whole-exome DNA sequencing, which scans the protein-coding regions of the genome, the investigators discovered a mutation in the TSC2 gene.

The TSC2 protein normally suppresses mTOR activity; when it is mutated, mTOR is overactivated – making it a prime target for everolimus. None of the other anaplastic patients were so fortunate, which explains their failure to benefit from the drug.

Specimens taken from the tumor after it grew again revealed a mutation in the mTOR protein – not present in the original biopsy sample – that blocked everolimus from binding to it. This mutation – not seen before in humans – explained how the cancer acquired resistance to the drug.

But that was not the end of the story. Laboratory experiments demonstrated that even the mutated, resistant cancer cells remained sensitive to a different type of mTOR inhibitor. A new drug of this type is about to enter clinical trials, and the patient described in the report, who is still alive four years after her diagnosis, is in line to receive the treatment, Lorch said.

He added that the case has broader implications, as the same mechanism of resistance to everolimus may be operating in other cancer types such as breast and kidney cancer, for which the drug is FDA-approved and frequently used.

"Because we could show that an mTOR inhibitor that is using a different mechanism could overcome resistance in anaplastic thyroid cancer, these findings could provide a rationale for treatment once resistance to everolimus occurs," Lorch said.

In addition to Lorch and Wagle, authors of the report are from Dana-Farber, Brigham and Women's Hospital, the Broad Institute, Harvard Medical School, the Whitehead Institute for Biomedical Research and the MIT Department of Biology.

Research support came from the Next Generation Fund at the Broad Institute, Novartis Pharmaceuticals, the Staff Cancer Consortium, and the National Cancer Institute.

http://www.eurekalert.org/pub_releases/2014-10/cuot-mpa100214.php

Mind-controlled prosthetic arms that work in daily life are now a reality

For the first time, robotic prostheses controlled via implanted neuromuscular interfaces have become a clinical reality. A novel osseointegrated (bone-anchored) implant system gives patients new opportunities in their daily life and professional activities.

In January 2013 a Swedish arm amputee was the first person in the world to receive a prosthesis with a direct connection to bone, nerves and muscles. An article about this achievement and its long-term stability will now be published in the Science Translational Medicine journal.

"Going beyond the lab to allow the patient to face real-world challenges is the main contribution of this work," says Max Ortiz Catalan, research scientist at Chalmers University of Technology and leading author of the publication.

"We have used osseointegration to create a long-term stable fusion between man and machine, where we have integrated them at different levels. The artificial arm is directly attached to the skeleton, thus providing mechanical stability. Then the human's biological control system, that is nerves and muscles, is also interfaced to the machine's control system via neuromuscular electrodes. This creates an intimate union between the body and the machine; between biology and mechatronics."

The direct skeletal attachment is created by what is known as osseointegration, a technology in limb prostheses pioneered by associate professor Rickard Brånemark and his colleagues at Sahlgrenska University Hospital. Rickard Brånemark led the surgical implantation and collaborated closely with Max Ortiz Catalan and Professor Bo Håkansson at Chalmers University of Technology on this project.

The patient's arm was amputated over ten years ago. Before the surgery, his prosthesis was controlled via electrodes placed over the skin. Robotic prostheses can be very advanced, but such a control system makes them unreliable and limits their functionality, and patients commonly reject them as a result.

Now, the patient has been given a control system that is directly connected to his own. He has a physically challenging job as a truck driver in northern Sweden, and since the surgery he has experienced that he can cope with all the situations he faces; everything from clamping his trailer load and operating machinery, to unpacking eggs and tying his children's skates, regardless of the environmental conditions (read more about the benefits of the new technology below).

The patient is also one of the first in the world to take part in an effort to achieve long-term sensation via the prosthesis. Because the implant is a bidirectional interface, it can also be used to send signals in the opposite direction – from the prosthetic arm to the brain. This is the researchers' next step, to clinically implement their findings on sensory feedback.

"Reliable communication between the prosthesis and the body has been the missing link for the clinical implementation of neural control and sensory feedback, and this is now in place," says Max Ortiz Catalan. "So far we have shown that the patient has a long-term stable ability to perceive touch in different locations in the missing hand. Intuitive sensory feedback and control are crucial for interacting with the environment, for example to reliably hold an object despite disturbances or uncertainty. Today, no patient walks around with a prosthesis that provides such information, but we are working towards changing that in the very short term."

The researchers plan to treat more patients with the novel technology later this year.

"We see this technology as an important step towards more natural control of artificial limbs," says Max Ortiz Catalan. "It is the missing link for allowing sophisticated neural interfaces to control sophisticated prostheses. So far, this has only been possible in short experiments within controlled environments."

The study "An osseointegrated human-machine gateway for long-term sensory feedback and motor control of artificial limbs" will be published by Science Translational Medicine on Wednesday, 8 October. It will be published at:
http://stm.sciencemag.org/lookup/doi/10.1126/scitranslmed.3008933

More about: How the technology works

The new technology is based on the OPRA treatment (osseointegrated prosthesis for the rehabilitation of amputees), where a titanium implant is surgically inserted into the bone and becomes fixated to it by a process known as osseointegration (Osseo = bone). A percutaneous component (abutment) is then attached to the titanium implant to serve as a metallic bone extension, where the prosthesis is then fixated. Electrodes are implanted in nerves and muscles as the interfaces to the biological control system. These electrodes record signals which are transmitted via the osseointegrated implant to the prostheses, where the signals are finally decoded and translated into motions.

More about: Benefits of the new technology, compared to socket prostheses

Direct skeletal attachment by osseointegration means:

Increased range of motion since there are no physical limitations by the socket – the patient can move the remaining joints freely

Elimination of sores and pain caused by the constant pressure from the socket

Stable and easy attachment/detachment

Increased sensory feedback due to the direct transmission of forces and vibrations to the bone (osseoperception)

The prosthesis can be worn all day, every day

No socket adjustments required (there is no socket)

Implanting electrodes in nerves and muscles means that:

Due to the intimate connection, the patients can control the prosthesis with less effort and more precisely, and can thus handle smaller and more delicate items.

The close proximity between source and electrode also prevents activity from other muscles from interfering (cross-talk), so that the patient can move the arm to any position and still maintain control of the prosthesis.

More motor signals can be obtained from muscles and nerves, so that more movements can be intuitively controlled in the prosthesis.

After the first fitting of the controller, little or no recalibration is required because there is no need to reposition the electrodes on every occasion the prosthesis is worn (as opposed to superficial electrodes).

Since the electrodes are implanted rather than placed over the skin, control is not affected by environmental conditions (cold and heat) that change the skin state, or by limb motions that displace the skin over the muscles. The control is also resilient to electromagnetic interference (noise from other electric devices or power lines) as the electrodes are shielded by the body itself.

Electrodes in the nerves can be used to send signals to the brain as sensations coming from the prostheses.

More about: The research

The novel osseointegrated system for prosthetic control and sensory feedback was developed in close collaboration between Chalmers University of Technology, Sahlgrenska University Hospital, the University of Gothenburg, and Integrum. The research was funded by Vinnova, Integrum, ALF (Region Västra Götaland), Conacyt, and Promobilia.

http://nyti.ms/1z1oNI6

Cave Paintings in Indonesia May Be Among the Oldest Known

Paintings of hands and animals in seven limestone caves on Sulawesi may be as old as the earliest European cave art

By JOHN NOBLE WILFORDOCT. 8, 2014

There is nothing like a blank stone surface to inspire a widely shared urge to make art. A team of researchers reported in the journal Nature on Wednesday that paintings of hands and animals in seven limestone caves on the Indonesian island of Sulawesi may be as old as the earliest European cave art.

Cave art found on the Indonesian island of Sulawesi is as old as the oldest cave art in Europe. This image of a babirusa--a type of pig native to Indonesia--is at least 34,500 years old. **Image: Kinez Riza**

The oldest cave painting known until now is a 40,800-year-old red disk from El Castillo, in northern Spain.

Other archaeologists of human origins said the new findings were spectacular and, in at least one sense, unexpected. Sulawesi's cave art, first described in the 1950s, had previously been dismissed as no more than 10,000 years old.

"Assuming that the dates are good," Nicholas Conard, an archaeologist at the University of Tübingen in Germany, said in an email, "this is good news, and the only surprising thing is not that analogous finds would exist elsewhere, but rather that it has been so hard to find them" until now.

Eric Delson, a paleoanthropologist at Lehman College of the City University of New York, agreed that the discovery "certainly makes sense." Recent genetic findings, he said, "support an early deployment of modern humans eastward to Southeast Asia and Australasia, and so having art of a similar age is reasonable as well."

The authors of the new study, a team from Australia and Indonesia, used a uranium decay technique to date the substance that encrusts the wall paintings - a mineral called calcite, created by water flowing through the limestone in the cave. The art beneath is presumably somewhat older than the crust.

Maxime Aubert and Adam Brumm, research fellows at Griffith University in Queensland, Australia, and the leaders of the study, examined 12 images of human hands and two figurative animal depictions at the cave sites.

The researchers said the earliest images, with a minimum age of 39,900 years, are the oldest known stenciled outlines of human hands in the world. Blowing or spraying pigment around a hand pressed against rock surfaces would become a common practice among cave artists down through the ages - and even some of the youngest schoolchildren to this day.

A painting of an animal known as a pig deer, of the species babirusa, was determined to be at least 35,400 years old. The team concluded that it was "among the earliest dated figurative depiction worldwide, if not the earliest one."

The closest in age from Western Europe is a painting of a rhinoceros from Chauvet Cave in France, dated at 35,000 years old, although some archaeologists have questioned that estimate. The most familiar rock art in the region of Sulawesi was created by the Aborigines of Australia, modern humans who arrived there 50,000 years ago. But none of the surviving rock art is older than 30,000 years.

The Sulawesi dates challenge the long-held view about the origins of cave art in an explosion of human creativity centered on Western Europe about 40,000 years ago, Dr. Aubert said, in an announcement issued by Griffith University.

Instead, he said, the creative brilliance required to produce the lifelike portrayals of horses and other animals much later at famous sites like Chauvet and Lascaux in France could have particularly deep roots within the human lineage.

But it is too soon to assess the discovery's deeper implications, Wil Roebroeks, a specialist in human origins studies at Leiden University in the Netherlands, wrote in a commentary accompanying the report. "Whether rock art was an integral part of the cultural repertoire of colonizing modern humans, from Western Europe to southeast and beyond, or whether such practices developed independently in various regions, is unknown," he wrote.

"But what is clear," Dr. Roebroeks continued, "is that no figurative art is known from before the time of the initial expansion of Homo sapiens into Asia and across Europe - neither from earlier H. sapiens in Africa nor from their contemporaries in western Eurasia, the Neanderthals."

Dr. Conard, of Tübingen University, said he had long argued for what he calls polycentric mosaic modernity, in which similar kinds of cultural innovations happened in different contexts as modern Homo sapiens spread across the world and displaced archaic hominins.

"I have never thought that complex symbolic behavior has a single point source and that cultural evolutions is like switching a light on,'" he said. "One would expect different regions to have distinctive signatures and to contribute to the story in their own way."

Dr. Delson, of CUNY, said he tended "to prefer the idea that art came as part of the 'baggage' of Homo sapiens as they spread into Eurasia, mainly as we know that so many of the cultural features once thought to have developed in western Eurasia in fact occurred far earlier in Africa."

He cited the examples of early use of pigments and engravings in Africa, as well as bodily adornment with shells and advanced stoneworking technology.

In their report, Dr. Aubert and Dr. Brumm took no sides in the debate. "It is possible that rock art emerged independently around the same time and at roughly both ends of the spatial distribution of early modern humans," they concluded. "An alternate scenario, however, is that cave painting was widely practiced by the first H. sapiens to leave Africa tens of thousands of years earlier."

If that is the case, the Australian-Indonesian research team predicted, "We can expect future discoveries of depictions of human hands, figurative art and other forms of image-making dating to the earliest period of the global dispersal of our species."

http://bit.ly/1C9khTV

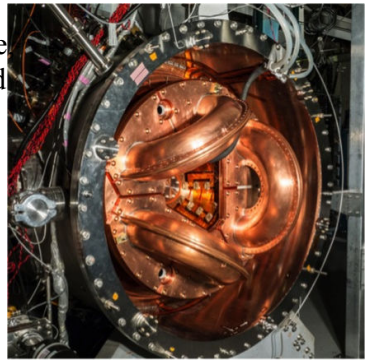
UW fusion reactor concept could be cheaper than coal

Fusion energy almost sounds too good to be true – zero greenhouse gas emissions, no long-lived radioactive waste, a nearly unlimited fuel supply.

Perhaps the biggest roadblock to adopting fusion energy is that the economics haven't penciled out. Fusion power designs aren't cheap enough to outperform systems that use fossil fuels such as coal and natural gas.

University of Washington engineers hope to change that. They have designed a concept for a fusion reactor that, when scaled up to the size of a large electrical power plant, would rival costs for a new coal-fired plant with similar electrical output.

The team published its reactor design and cost-analysis findings last spring and will present results Oct. 17 at the International Atomic Energy Agency's Fusion Energy Conference in St. Petersburg, Russia. "Right now, this design has the greatest potential of producing economical fusion power of any current concept," said Thomas Jarboe, a UW professor of aeronautics and astronautics and an adjunct professor in physics.



The UW's current fusion experiment, HIT-SI3. It is about one-tenth the size of the power-producing dynomak concept. **Credit: U of Washington**

The UW's reactor, called the dynomak, started as a class project taught by Jarboe two years ago. After the class ended, Jarboe and doctoral student Derek Sutherland – who previously worked on a reactor design at the Massachusetts Institute of Technology – continued to develop and refine the concept.

The design builds on existing technology and creates a magnetic field within a closed space to hold plasma in place long enough for fusion to occur, allowing the hot plasma to react and burn. The reactor itself would be largely self-sustaining, meaning it would continuously heat the plasma to maintain thermonuclear conditions. Heat generated from the reactor would heat up a coolant that is used to spin a turbine and generate electricity, similar to how a typical power reactor works.

"This is a much more elegant solution because the medium in which you generate fusion is the medium in which you're also driving all the current required to confine it," Sutherland said.

There are several ways to create a magnetic field, which is crucial to keeping a fusion reactor going. The UW's design is known as a spheromak, meaning it generates the majority of magnetic fields by driving electrical currents into the plasma itself. This reduces the amount of required materials and actually allows researchers to shrink the overall size of the reactor.

Other designs, such as the experimental fusion reactor project that's currently being built in France – called Iter – have to be much larger than the UW's because they rely on superconducting coils that circle around the outside of the device to provide a similar magnetic field. When compared with the fusion reactor concept in France, the UW's is much less expensive – roughly one-tenth the cost of Iter – while producing five times the amount of energy.

The UW researchers factored the cost of building a fusion reactor power plant using their design and compared that with building a coal power plant. They used

a metric called "overnight capital costs," which includes all costs, particularly startup infrastructure fees. A fusion power plant producing 1 gigawatt (1 billion watts) of power would cost $2.7 billion, while a coal plant of the same output would cost $2.8 billion, according to their analysis. "If we do invest in this type of fusion, we could be rewarded because the commercial reactor unit already looks economical," Sutherland said. "It's very exciting."

Right now, the UW's concept is about one-tenth the size and power output of a final product, which is still years away. The researchers have successfully tested the prototype's ability to sustain a plasma efficiently, and as they further develop and expand the size of the device they can ramp up to higher-temperature plasma and get significant fusion power output.

The team has filed patents on the reactor concept with the UW's Center for Commercialization and plans to continue developing and scaling up its prototypes.

http://bit.ly/1svtWnZ

Computer mind meld gives voice to man after a stroke

LOCKED in but not shut out: for the first time people who have lost the ability to move or talk because of a stroke may be able to communicate with their loved ones using a brain-computer interface.

Brain injuries can leave people aware but almost completely paralysed, a condition called locked-in syndrome. Brain-computer interfaces (BCIs) can help some people communicate by passing signals from electrodes attuned to their brain activity as they watch a screen displaying letters. Subtle changes in neural activity let researchers know when a person wishes to select a particular on-screen item, allowing them to spell out messages by thought alone.

Until now, BCIs have only been tested on healthy volunteers and people with amyotrophic lateral sclerosis, a neurodegenerative disease that leads to muscle wasting. But no one had tested whether the technology could help people locked in after a brain stem stroke.

Now Eric Sellers and his colleagues at East Tennessee State University in Johnson City have tested the technique on a 68-year-old man. After more than a year of training he learned to communicate reliably via the BCI. He took the opportunity to thank his wife for her hard work, and to give his thoughts on gift purchases for his children (Science Translational Medicine, DOI: 10.1126/scitranslmed.3007801).

Sellers says he can imagine a future where every hospital has a BCI. For that to happen the technology will need to become cheaper and more efficient. A device costs about $10,000, and a user can spell out a typical message in around an hour. However, scaling up the technology will only happen if larger trials are carried out – something that's not easy with a rare condition that is difficult to diagnose. "It's a supply and demand issue," says Sellers.

http://phys.org/news/2014-10-people-infection-meat.html

Why do people risk infection from bat meat?

Researchers investigate what drives consumption of bat bushmeat

Ebola, as with many emerging infections, is likely to have arisen due to man's interaction with wild animals – most likely the practice of hunting and eating wild meat known as 'bushmeat'. A team of researchers led by the University of Cambridge and the Zoological Society of London (ZSL) has surveyed almost six hundred people across southern Ghana to find out what drives consumption of bat bushmeat – and how people perceive the risks associated with the practice.

The Straw-Coloured Fruit Bat, Eidolon helvum, is widely hunted and eaten in Ghana, but carries a risk of infection with 'zoonotic' pathogens – diseases transmitted from animal to man. Hunting, butchering and consuming wild animals for food can potentially transmit these infections through bites, scratches, bodily fluids, tissue and excrement. Bats in particular appear to host more zoonotic viruses per species than any other group of mammals, yet very little is known about how humans and bats interact, how people perceive bats and their accompanying disease risk, or who is most at risk.

Dr Olivier Restif from the Department of Veterinary Medicine at the University of Cambridge explains: "Knowing who eats bush meat and why, as well as how they perceive the risks, is important for informing both disease and conservation management plans. This requires a close-knit collaboration between epidemiologists, ecologists and social anthropologists. That is why we have teamed up with the Zoological Society of London and the University of Ghana to develop this research programme."

Dr Alexandra Kamins, a Gates Cambridge scholar alumna working with Dr Restif, adds: "All too often, local community voices go unheard, despite representing those most at risk of spillover and often shouldering negative impacts arising from intervention measures. That is why it was important for us to listen to them."

Dr Kamins and colleagues interviewed 577 people across southern Ghana, including hunters, vendors and consumers of bat meat. Of these, the majority (551) were interviewed using a general survey whilst the rest were interviewed in-depth through focus groups.

The researchers found that hunters used a variety of means to capture bats, including shooting, netting and scavenging, and that all of the hunters reported handling live bats, coming into contact with bat blood and getting scratched or bitten. None of the hunters reported using protective measures, such as gloves. Scavenged bats were collected alive, usually when a branch broke and bats fell to the ground, but this too carried risks: four interviewees explained how people

would fight over the bats when a large branch fell, sometimes even lying down on top of bats to prevent others from taking them, often sustaining bites and scratches.
The bats were prepared and cooked in a number of ways, the most common methods being to smoke the bats before preparing food and using the bats in soup.
At odds with reports from other countries, the survey in South East Ghana revealed few uses of bat bushmeat associated with traditional beliefs or medical practices. In Ghana, bat bushmeat seems to function as both subsistence and luxury food. The large number of hunters who hunt for themselves or who keep some of their catch suggests that bats provide a readily available source of animal protein. At the same time, high taste ratings among consumers and relatively high prices suggest that bat meat is seen as a 'luxury food' in Ghana.
Hunters, vendors and consumers of bat meat all tended to be older than those people with no connection to the practice - on average seven to ten years older. The researchers believe this could imply a number of scenarios, the most likely being a decrease in youth interest in bat bushmeat.
They found a strong association between gender and roles in the bat-bushmeat commodity chain, with hunters primarily being male and vendors female, consistent with the cultural norms of rural Ghanaian society. This could mean that disease risk was also different between the sexes. The researchers also found that those people living in urban environments and those who were more educated were less likely to participate in bat bushmeat activities. Although this suggests that increased urbanisation and improvements in education could reduce the use of bats as bushmeat, it is possible that increased household income could lead to increased bushmeat consumption, particularly as the meat appears to be seen as a luxury item.
Using focus groups, the researchers carried out more in-depth interviews to understand participants' likely reactions to interventions regarding bat bushmeat. They found that regulations by themselves are not effective solutions: laws and fines alone are unlikely to induce change. While only some of our respondents would be willing to risk paying fines if they continued to earn enough from selling bat bushmeat, essentially no one knew of the existing hunting laws in Ghana, suggesting that enforcement is a major issue.
Possible health risks appeared to be more of a deterrent than fines; some respondents suggested that disease risk could motivate them to stop. However, the risk of disease from bat bushmeat was considered to be greatest by those who did not consume the meat and lowest by those who hunted or sold the bats. This finding supports previous research suggesting that people can readily perceive risk and even intellectually acknowledge desire to reduce that risk, but actual behaviour might not change.
Professor James Wood, who leads the research programme at the University of Cambridge, says: "Understanding both actual and perceived risk factors is vital. If a bat-borne zoonotic disease outbreak were to occur in Ghana, our information could prove invaluable in helping target those groups at greatest risk and in planning disease control measures."
Dr Marcus Rowcliffe from ZSL adds: "Unfortunately, there may not be a simple way to minimise the risks of zoonotic spillover from bats. For example, bat hunting is a highly seasonal occupation and, like all bushmeat hunting, can be started and dropped at will, whereas rearing domestic animals – one possible sustainable solution for reducing bushmeat hunting – requires continuous activity throughout the year on a daily basis.
"Although many programmes suggest economic opportunity as the major motivation behind livelihood choices and success of alternatives, it may not be enough on its own. We found people in Ghana to be responsive to education pieces about the disease risk from bushmeat but also the ecological role of bats in pollination and seed dispersal. Working with local communities to help them find effective and sustainable solutions in line with their economic needs must be a long-term commitment."
More information: A.O. Kamins, O. Restif, Y. Ntiamoa-Baidu, R. Suu-Ire, D.T.S. Hayman, A.A. Cunningham, J.L.N. Wood, J.M. Rowcliffe, "Uncovering the fruit bat bushmeat commodity chain and the true extent of fruit bat hunting in Ghana, West Africa," Biological Conservation, Volume 144, Issue 12, December 2011, Pages 3000-3008, ISSN 0006-3207, dx.doi.org/10.1016/j.biocon.2011.09.003.

http://bit.ly/1o6zjsT

Study shows teacher expectations match student success

A study of over 4000 students has revealed their success was influenced by the expectations of the people teaching them.

Zheng Li will graduate with a PhD next May after completing her study into teacher expectations at the University of Auckland's Faculty of Education.
She used 4617 students across 116 English language classes being taught by 50 teachers at two Universities in South China.
Zheng asked the teachers to complete surveys asking them to predict how good their students were going to be during the year, while the students were asked questions about classroom climate and their teacher's style.
The students were also interviewed about the classroom instruction and their socio-emotional environment.
Their scores were collected at the beginning and the end of the school year.
The teachers' survey results were collated to show if they were a high, medium or low expectation teacher.

At the end of the teaching year the teachers' results matched the success levels of their pupils.

"If a teacher held high expectations for one class, they appeared to hold similar expectations for other classes, and the results were the same for teachers who held low expectations," Zheng says. "This shows teacher expectations are pervasive."

Furthermore, teachers tended to develop their expectations as a result of their pedagogical beliefs and self-efficacy, and they were likely to cling to their expectation types throughout the whole school year despite latest student information (even contradictory evidence).

Teachers with different expectations also varied in the ways they instructed and interacted with students; their behaviours, depending on their expectations, led to different instructional and socio-emotional environments in classrooms.

Zheng says that's great for students who had a high expectation teacher, but not for the other students, because students with high expectation teachers were provided more frequent, more challenging and more rewarding learning opportunities and they were sharing a more friendly relationship with their teachers than students with low expectation teachers.

As a result students with high expectation teachers were more likely to participate willingly in learning and achieved higher than students with low expectation teachers.

So the students in low expectation classes had lower grades and less success than those with high expectation teachers.

"Low expectation teachers didn't have positive relationships with their students. They just believed the students couldn't achieve well.

"So the students are not so reliant on their teachers and they don't show much acceptance of their teachers. They are more reliant on their peers and class mates."

This thesis has provided more convincing evidence that teacher expectation effects are a function of teacher rather than student variables. The findings indicate that it is the teacher who makes a difference.

"It seems to me that student learning is largely dependent on which teacher they happen to be placed with, because different teachers may lead to diverse learning experiences and outcomes," Zheng says.

The thesis has been a four year project for Zheng, who was a university lecturer in China for 10 years before she chose to return to full time study.

She now hopes to continue her research both here and in China in the hope that all teachers will become high expectation teachers for the sake of all their students' success.

http://www.eurekalert.org/pub_releases/2014-10/msu-wja100914.php

When judging art, men and women stand apart

The sexes show stark differences in how they evaluate art, finds a new study co-authored by a Michigan State University marketing scholar.

EAST LANSING, MI - Men seem to focus more on the artist's background and authenticity, while women pay more attention to the art itself.

The study, which appears in the journal Psychology & Marketing, is the first to investigate how important an artist's "brand" is to average consumers when they appraise art. Turns out, that personal brand is very important, a finding that has implications for the $64 billion art market and other product industries such as food and fashion.

"All consumers in the study, but especially men, evaluated art with a strong emphasis on how motivated and passionate the artist was," said Stephanie Mangus, assistant professor in MSU's Broad College of Business. "So if you're an artist or if you're managing an artist, developing that human brand – getting the message across that you're authentic – becomes essential."

Mangus and her fellow researchers had 518 people look at two unfamiliar paintings with made-up biographies of the artist. Some participants read a bio that characterized the artist as authentic – in other words, a lifelong painter who creates unique work. Others read a bio that characterized the artist as an ordinary painter who took up the craft only recently.

When the artist was characterized as authentic, participants had a much more favorable impression of both the artist and the artwork. Participants indicated they were more willing to buy that artist's painting and to pay a higher price for it.

Men were much more likely to use the artist's brand as a deciding factor when evaluating art. Mangus said this jibes with past research that indicates men tend to use factors that are known to them (in this case, the artist's brand) when making a decision.

Women also took the artist's authenticity into account, but a bigger factor for them was the artwork itself. "Women are more willing to go through a complicated process of actually evaluating the artwork," Mangus said, "whereas men may say, 'This guy's a great artist, so I'll buy his art.'"

While the art market has grown steadily for the past 10 years – outperforming the equities market during that time – there's a dearth of research on how consumers are actually determining the worth of artwork, Mangus said.

Knowing that the artist's brand plays a major role in consumers' evaluation may help art dealers better set their prices. The findings can also help consumers make decisions on which art they buy.

"For the average person trying to purchase art, knowing something about the artist – and knowing that the artist is authentic – can reduce the risk of buying a worthless piece," Mangus said.

The findings likely extend to other product industries in which a creator is highly involved and visible. These include the clothing, shoe, jewelry and restaurant and food industries.

"While designers and chefs oftentimes operate in the background, this research suggests that more emphatically communicating their passion and commitment to their craft could significantly benefit that brand's image and sales," the study says.

Mangus's co-authors are Julie Guidry Moulard from Louisiana Tech University, Dan Hamilton Rice from Louisiana State University and Carolyn Popp Garrity from Birmingham-Southern College.

http://bit.ly/1uZ1Otk

Nobel Shocker: RCA Had the First Blue LED in 1972

Nearly 20 years before Japanese scientists finished work leading to their Nobel Prize, a young researcher at RCA ad already turned on an LED that glowed blue

By Neel V. Patel

The work of this year's winners of the Nobel Prize in Physics cannot be understated. As the Nobel Foundation said when they awarded the prize to Isamu Akasaki, Hiroshi Amano, and Shuji Nakamura—the three inventors for the blue light-emitting diode—"Incandescent light bulbs lit the 20th century; the 21st century will be lit by LED lamps."

But there's more to this story. "The background is kind of being swept under the rug," says Benjamin Gross, a research fellow at the Chemical Heritage Foundation in Philadelphia. "All three of these gentlemen deserve their prize, but there is a prehistory to the LED."

In fact, almost two decades before the Japanese scientists had finished the work that would lead to their Nobel Prize, a young twenty-something materials researcher at RCA named Herbert Paul Maruska had already turned on an LED that glowed blue.

In the 1950s and 60s, RCA was a television giant. David Sarnoff, founder and CEO of the company, was pushing for a technological replacement for the bulky picture tube in color TVs. An LED TV was naturally seen as the next step.

photo of journal entry Photo: David Sarnoff Library Maruska's Research Center notebook page from Nov. 22, 1968, confirming the single-crystal form of his GaN sample through the Laue method of x-ray diffraction.

At the time, the company was exploring the electronic properties of compound semiconductors, as opposed to elemental ones. "These had new, unexplored electrical and potentially optical properties," says Gross. Work on gallium arsenic (GaAs) and gallium phosphide (GaP) had already led to red and green LEDs, respectively. "Blue was the final piece of the puzzle" says Gross.

In May 1968, Maruska was a young scientist working in RCA's central research lab in Princeton, New Jersey. "I had already been growing GaAs and GaP." James Tietjen, the director of the lab, marched up to Maruska's desk and told him, "I got an idea. I think I know how we can make a blue LED. Why don't you figure out how to grow gallium nitride (GaN)? Then we can make a TV that we can hang on the wall."

Tietjen knew enough about these semiconductor compounds to know GaN was promising, Gross explains. Based on where gallium and nitrogen fall on the periodic table, it was thought an LED made of that substance would emit blue.

To grow these semiconductors, Tietjen and his lab used a technique called Halide Vapor Phase Epitaxy, an approach where hydrogen chloride is reacted at elevated temperatures with metal to produce gaseous metal chlorides, which are then reacted with ammonia to produce a metal compound that collects on a substrate as a thin layer.

"At this time," Maruska fondly remembers, "RCA had so much money that we didn't have to look at a budget or anything—we just went to work on it. It was wonderful time to work on this." Without financial barriers, Maruska used sapphire as the substrate to grow GaN.

According to Maruska, "we tried for about a year to get something to grow. All I would get was powders and junk. One day I simply thought 'Oh what the hell, why don't I just turn up the temperatures to GaAs temperatures—900 degrees?'"

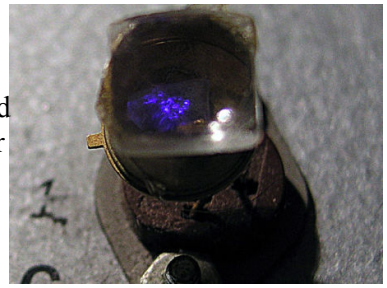
When Maruska pulled out the sapphire substrate, he saw nothing at first. A little closer, he noticed something transparent actually had grown—GaN. By November 1969, Maruska and Tietjen published a paper outlying how to grow GaN crystals.

"It caused a stir among the semiconductor industry," says Gross. "Other companies like Bell and Philips started to try to make their own GaN."

Maruska went on to earn his Ph.D at Stanford University, but remained an employee of RCA and continued to work on the project.

Other famed materials researchers like Jacques Pankove and Edward Miller joined the RCA lab to help with project's biggest obstacle: the scientists were able to easily grow n-type GaN, but not p-type, which was necessary for developing a PN junction. In 1971, without a solution, Tietjen and the lab set aside the PN architecture in favor of an approach that didn't need a p-type dopant.

This was the metal insulator semiconductor (MIS) arrangement. It's essentially a sandwich that, in this case, consisted of a n-type GaN semiconductor in the middle, a top layer of zinc-doped GaN, and a transparent layer of indium on the bottom. Pankove and Miller were able to make a green LED through this layering, albeit at a lower efficiency than a PN-architecture.



The first blue LED, developed by Maruska.

In order to generate a blue LED, Maruska changed the dopant from zinc to magnesium. In 1972, after some tinkering, he successfully created a blue LED. "It lit up and I came back and shined the blue light at everybody," Maruska says. "Everybody was very impressed."

Unfortunately, as Maruska recalls, "RCA was collapsing internally." Sarnoff had died, and his son, Robert, had just taken over. Among many poor decisions, Robert pursued an ill-fated endeavor to make RCA a leader in computers. Unfortunately, RCA was unable to compete with the king company of computers: IBM.

Every branch of RCA had their budgets slashed, and the blue LED project was officially dead by 1974. By that time, Maruska had already been let go. "I'm sure it wouldn't have been long before I would have gotten a bright blue LED right on the track," he says. "But once I got kicked out, I couldn't find another job doing that."

Meanwhile, Akasaki and Amano worked tirelessly to solve the problem that stumped Maruska and his colleagues: growing a p-type GaN that could lead to an efficient blue LED. "They wouldn't give up," says Maruska. "They found out what the problems were and they overcame them."

"One day," Maruska recalls, "I was in a hotel in 1990, and there's a knock on the door, and Akasaki is outside the door. He looks in, and he shines this blue LED in my eyes and says, 'look at this!' I say, 'holy shit! It's actually a bright blue LED!' He says, 'yes, it is.' And he just disappears down the hall." Nakamura, working independently, would figure out how to scale the whole process for efficient manufacturing.

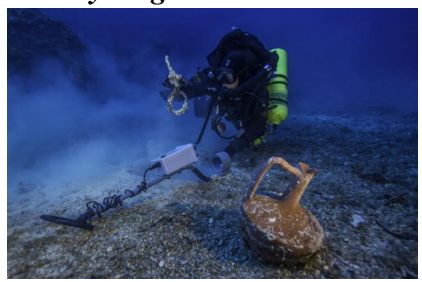
Maruska is happy to see his story getting a fresh look again, and there's no hard feelings on who the Nobel Prize went to. "These three guys really deserve the credit," he says. "It's like I say to people: they had been working on the steam engine for 100 years, but they never could make one that really worked, until James Watt showed up. It's the guy who makes it really work who deserves the Nobel Prize. They certainly deserve it."

http://www.eurekalert.org/pub_releases/2014-10/whoi-sff100914.php

Stunning finds from ancient Greek shipwreck

New Antikythera discoveries prove luxury cargo survives

A Greek and international team of divers and archaeologists has retrieved stunning new finds from an ancient Greek ship that sank more than 2,000 years ago off the remote island of Antikythera. The rescued antiquities include tableware, ship components, and a giant bronze spear that would have belonged to a life-sized warrior statue.



Greek technical diver Alexandros Sotiriou discovers an intact "lagynos" ceramic table jug and a bronze rigging ring on the Antikythera Shipwreck. **Brett Seymour, Copyright: Return to Antikythera 2014**

The Antikythera wreck was first discovered in 1900 by sponge divers who were blown off course by a storm. They subsequently recovered a spectacular haul of ancient treasure including bronze and marble statues, jewellery, furniture, luxury glassware, and the surprisingly complex Antikythera Mechanism. But they were forced to end their mission at the 55-meter-deep site after one diver died of the bends and two were paralyzed. Ever since, archaeologists have wondered if more treasure remains buried beneath the sea bed.

Now a team of international archaeologists including Brendan Foley of the Woods Hole Oceanographic Institution and Theotokis Theodoulou of the Hellenic Ephorate of Underwater Antiquities have returned to the treacherous site using state-of-the-art technology. During their first excavation season, from September 15 to October 7, 2014, the researchers have created a high-resolution, 3D map of the site using stereo cameras mounted on an autonomous underwater vehicle (AUV). Divers then recovered a series of finds which prove that much of the ship's cargo is indeed still preserved beneath the sediment.

Components of the ship, including multiple lead anchors over a metre long and a bronze rigging ring with fragments of wood still attached, prove that much of the ship survives. The finds are also scattered over a much larger area than the sponge divers realized, covering 300 meters of the seafloor. This together with the huge size of the anchors and recovered hull planks proves that the Antikythera ship was much larger than previously thought, perhaps up to 50 meters long.

"The evidence shows this is the largest ancient shipwreck ever discovered," says Foley. "It's the Titanic of the ancient world."

The archaeologists also recovered a beautiful intact table jug, part of an ornate bed leg, and most impressive of all, a 2-meter-long bronze spear buried just beneath

the surface of the sand. Too large and heavy to have been used as a weapon, it must have belonged to a giant statue, perhaps a warrior or the goddess Athena, says Foley. In 1901, four giant marble horses were discovered on the wreck by the sponge divers, so these could have formed part of a complex of statues involving a warrior in a chariot that was pulled by the four horses.

The shipwreck dates from 70 to 60 BC and is thought to have been carrying a luxury cargo of Greek treasures from the coast of Asia Minor west to Rome. Antikythera stands in the middle of this major shipping route and the ship probably sank when a violent storm smashed it against the island's sheer cliffs.

The wreck is too deep to dive safely using regular scuba equipment, so the divers had to use rebreather technology, in which carbon dioxide is scrubbed from the exhaled air while oxygen is introduced and recirculated. This allowed them to dive on the site for up to three hours at a time.

The archaeologists plan to return next year to excavate the site further and recover more of the ship's precious cargo. The finds, particularly the bronze spear, are "very promising," says Theodolou. "We have a lot of work to do at this site to uncover its secrets."

http://bit.ly/1tm8bIy

Remains of Alexander the Great's Father Confirmed Found

A team of Greek researchers has confirmed that bones found in a royal tomb indeed belong to the Macedonian King Philip II

A team of Greek researchers has confirmed that bones found in a two-chambered royal tomb at Vergina, a town some 100 miles away from Amphipolis's mysterious burial mound, indeed belong to the Macedonian King Philip II, Alexander the Great's father.

The anthropological investigation examined 350 bones and fragments found in two larnakes, or caskets, of the tomb. It uncovered pathologies, activity markers and trauma that helped identify the tomb's occupants.

Along with the cremated remains of Philip II, the burial, commonly known as Tomb II, also contained the bones of a woman warrior, possibly the daughter of the Skythian King Athea, Theodore Antikas, head of the Art-Anthropological research team of the Vergina excavation, told Discovery News.

The findings will be announced on Friday at the Archaeological Museum of Thessaloniki. Accompanied by 3,000 digital color photographs and supported by X-ray computed tomography, scanning electron microscopy, and X-ray fluorescence, the research aims to settle a decades-old debate over the cremated skeleton.

Scholars have argued over those bones ever since Greek archaeologist Manolis Andronikos discovered the tomb in 1977-78. He excavated a large mound -- the Great Tumulus -- at Vergina on the advice of the English classicist Nicholas Hammond.

Among the monuments found within the tumulus were three tombs. One, called Tomb I, had been looted, but contained a stunning wall painting of the Rape of Persephone, along with fragmentary human remains.

Tomb II remained undisturbed and contained the almost complete cremated remains of a male skeleton in the main chamber and the cremated remains of a female in the antechamber. Grave goods included silver and bronze vessels, gold wreaths, weapons, armor and two gold larnakes.

Tomb III was also found unlooted, with a silver funerary urn that contained the bones of a young male, and a number of silver vessels and ivory reliefs.

Most of the scholarly debate concentrated on the occupants of Tomb II, with experts arguing that the occupants were either Philip II and Cleopatra or Meda, both his wives, or Philip III Arrhidaeus, Alexander's half-brother, who assumed the throne after Alexander's death, with his wife Eurydice.

King Philip II was a powerful fourth-century B.C. military ruler from the Greek kingdom of Macedon who gained control of Greece and the Balkan peninsula through tactful use of warfare, diplomacy, and marriage alliances (the Macedonians practiced polygamy).

His efforts -- he reformed the Macedonian army and proposed the invasion of Persia -- later provided the basis for the achievements of his son and successor Alexander the Great, who went on to conquer most of the known world.

The overlord of an empire stretching from Greece and Egypt eastward across Asia to India, Alexander died in Babylon, now in central Iraq, in June of 323 B.C. - just before his 33rd birthday.

His elusive tomb is one of the great unsolved mysteries of the ancient world.

Analyzed by Antikas' team since 2009, the male and female bones in Philip II's tomb have revealed peculiarities not previously seen or recorded.

"The individual suffered from frontal and maxillary sinusitis that might have been caused by an old facial trauma," Antikas said.

Such trauma could be related to an arrow that hit and blinded Philip II's right eye at the siege of Methone in 354 B.C. The Macedonian king survived and ruled for another 18 years before he was assassinated at the celebration of his daughter's wedding.

The anthropologists found further bone evidence to support the identification with Philip II, who being a warrior, suffered many wounds, as historical accounts testify. "He had signs of chronic pathology on the visceral surface of several low thoracic ribs, indicating pleuritis," Antikas said.

He noted that the pathology may have been the effect of Philip's trauma when his right clavicle was shattered with a lance in 345 or 344 B.C. The anthropologist also found an old incised wound on Philip's left hand caused by a sharp-edged object, possibly a weapon. Degenerative lesions and markers pointed to a middle-aged man who rode a horse frequently.

Examination of the bones revealed a fully-fleshed cremation, further disproving the theory that the remains belong to Philip III Arrhidaeus, who was buried, exhumed, cremated and finally reburied.

"Features such as cracking, color, warping, twisting seen on the bones indicate pyre-induced morphological alterations," Antikas said. "A typical example is the 90-degree twisting of the left parietal bone of the man's cranium. This would never happen, if the skull were 'dry', coming from an ossuary," he added.

Additional composite material was also found on the bones. Dr. Yannis Maniatis, Head of the Archaeometry Lab at the "Demokritos" National Scientific Research Center in Athens, Antikas's team found traces of royal purple, huntite, textile, beeswax and clay belonging to an elaborately made object.

"It was placed on top of the bones after they were cleaned, wrapped and placed in the gold larnax. If they had been burned in the pyre, they would have dissappeared, as its temperature exceeded 800 degrees Celsius at times," Antikas said.

Ongoing investigations carried by Maniatis might reveal the nature and origins of the puzzling composite material. According to the researchers, further evidence for the dead being Philip II is the identity of the female buried in the antechamber, who died at 30 to 34. "Her age was determined by examining a pelvis bone fragment not seen or identified by previous researchers," Antikas said.

The finding proved extremely important in the complex identification process. "Basically her age excludes every other wife-concubine of Philip II and indirectly Arrhidaeus, whose wife was under 25," he said.

Morphological alterations in the bones indicate she was cremated just after her death, just like the deceased in the chamber, while equestrian activity indicators suggest she also rode for a long time.

A fracture in the upper end of her left leg caused shortening, atrophy, "and most probably disfiguration," according to Antikas. "This leads to the conclusion that the pair of mismatched greaves -- the left is shorter -- the Scynthian gorytus and weaponry found in the antechamber belonged to her," he said.

The finding reinforces the assumption made by Hammond as early as 1978 that the spears, arrows, quiver and greaves belonged to a warrior queen in Philip's royal household. Among the candidates proposed by Hammond were Meda, Cynna (the offspring of Philip and Audata, an Illyrian warrior princess) and an unknown daughter of the Scythian king Ateas, defeated by Philip in 339 B.C.

The Scythian theory also strengthens Philip II's identification.

"No Macedonian King other than Philip is known to have had 'relations' with a Scythian," Antikas said.

According to Adrienne Mayor, a research scholar at Stanford University's Departments of Classics and History of Science, the new bioarchaeological analysis of the bones in Tomb II "is a truly exciting discovery, confirming without a doubt that the weapons and mismatched greaves belonged to a horsewoman-archer close to Philip II."

The author of "The Amazons: Lives and Legends of Warrior Women across the Ancient World," Mayor, however, cautions about the Scynthian princess hypothesis. "Hammond speculated that Ateas might have sent a daughter to Philip during their negotiations. But their dealings were hostile, not friendly, ending in war and the defeat of Ateas in 339 B.C.," Mayor told Discovery News.

"Moreover, as Hammond acknowledged, there is no mention of a daughter of Ateas in any ancient sources that describe Philip's interactions with Ateas or list the names of his wives," she added.

Mayor proposes another possibility -- that the mystery woman could have been a wife selected by Philip from the 20,000 Scythian women he took as prisoners after the defeat of Ateas. The sources report that these women and their horses all escaped when another Scythian tribe attacked Philip's army on its way back to Macedonia.

"Perhaps one of these women, traveling with Philip's entourage, did not escape and remained in the royal house for three years until his death in 336 B.C. When the king was assassinated, a captive Scythian bride from Ateas' coalition may well have felt compelled to commit suicide," Mayor said.

On another finding, Antikas' team shed new light on the remains in Tomb I. His team found in an old storage place with wood cases containing plastics bags filled with never-studied bones from the tomb, which was thought to contain the remains of a male, a female and an infant. This led some scholars to believe Tomb I contained the remains of Philip, his wife Cleopatra, and their few-week-old child.

"From three recently found plastic bags containing over one hundred bone fragments of inhumed individuals, our team analyzed and identified 70 bones," Antikas told Discovery News.

Surprisingly, it emerged that Tomb I contained the remains of at least seven individuals: an adult male, a female, a child, four babies aged 8-10 lunar months and one fetus of 6.5 lunar months.

"This find automatically disproves every previous hypothesis of historians and archaeologista alike that Tomb I was intended for Philip II and his last wife," Antikas said.

http://www.eurekalert.org/pub_releases/2014-10/cru-rrl100614.php

Researchers reveal lung cancer can stay hidden for over 20 years

Lung cancers can lie dormant for over 20 years before suddenly turning into an aggressive form of the disease

CANCER RESEARCH UK scientists have discovered that lung cancers can lie dormant for over 20 years before suddenly turning into an aggressive form of the disease, according to a study published in Science* today (Thursday).

The team studied lung cancers from seven patients – including smokers, ex-smokers and never smokers. They found that after the first genetic mistakes that cause the cancer, it can exist undetected for many years until new, additional, faults trigger rapid growth of the disease.

During this expansion there is a surge of different genetic faults appearing in separate areas of the tumour. Each distinct section evolves down different paths – meaning that every part of the tumour is genetically unique.

This research – jointly funded by Cancer Research UK and the Rosetrees Trust – highlights the need for better ways to detect the disease earlier. Two-thirds of patients are diagnosed with advanced forms of the disease when treatments are less likely to be successful.

By revealing that lung cancers can lie dormant for many years the researchers hope this study will help improve early detection of the disease.

Study author Professor Charles Swanton, at Cancer Research UK's London Research Institute and the UCL Cancer Institute, said: "Survival from lung cancer remains devastatingly low with many new targeted treatments making a limited impact on the disease. By understanding how it develops we've opened up the disease's evolutionary rule book in the hope that we can start to predict its next steps."

The study also highlighted the role of smoking in the development of lung cancer. Many of the early genetic faults are caused by smoking. But as the disease evolved these became less important with the majority of faults now caused by a new process generating mutations within the tumour controlled by a protein called APOBEC.

The wide variety of faults found within lung cancers explains why targeted treatments have had limited success. Attacking a particular genetic mistake identified by a biopsy in lung cancer will only be effective against those parts of the tumour with that fault, leaving other areas to thrive and take over.

Over 40,000 people are diagnosed with lung cancer each year and, despite some positive steps being made against the disease it remains one of the biggest challenges in cancer research, with fewer than 10 per cent surviving for at least five years after diagnosis.

Building on this research will be a key priority for the recently established Cancer Research UK Lung Cancer Centre of Excellence at Manchester and UCL. The Centre – where Professor Swanton is joint centre lead – is a key part of Cancer Research UK's renewed focus to beat lung cancer; bringing together a unique range of internationally renowned scientists and clinicians to create an environment that catalyses imaginative and innovative lung cancer research.

Professor Nic Jones, Cancer Research UK's chief scientist, said: "This fascinating research highlights the need to find better ways to detect lung cancer earlier when it's still following just one evolutionary path. If we can nip the disease in the bud and treat it before it has started travelling down different evolutionary routes we could make a real difference in helping more people survive the disease.

"Building on this work Cancer Research UK is funding a study called TRACERx which is studying 100s of patient's lung cancers as they evolve over time to find out exactly how lung cancers mutate, adapt and become resistant to treatments "

**de Bruin, E.C. et al. Spatial and temporal diversity in genomic instability processes defines lung cancer evolution. Science (2014)*

http://bit.ly/1vZ4khk

More Americans Speak Arabic at Home Than Italian or Polish

21 percent of Americans speak another language at home

By Mary Beth Griggs

In the United States, 21 percent of people speak a language other than English at home. That's an increase of three percent since 2000, says the Pew Chairitable Trust's Stateline, which took a look at data from the U.S. Census and the American Community Survey. Pew also looked at which languages people were speaking and found that Italian and Polish - the languages of 20th century immigrants - had fallen from the top ten secondary languages, replaced by French Creole and Arabic.

Spanish is top on the list with over 38 million speakers; the next most spoken language, Chinese, has a relatively puny 3,029,042 speakers. Though there has been an increase in people speaking second languages, English is likely to remain dominant, Stateline writes:

Even as more Americans speak foreign languages at home, there is little risk that any one of them will crowd out English. History has shown that eventually, the American "melting pot" consumes them all, leading some linguists to call the U.S. a "cemetery of languages." Most of the children and grandchildren of immigrants who spoke Yiddish, German or Italian have long since abandoned those languages in daily discourse.

Italian and Polish weren't the only European languages that are in decline. Though they managed to stay on the top ten list, since 2000, the French and German speakers have declined by 24 percent and 29 percent, respectively.

European languages down; Arabic and Creole break into top 10 languages

21 percent of Americans now speak a foreign language at home, up from 18 percent in 2000. Among the fastest growing are Arabic and French Creole, both now in the top 10, displacing Italian and Polish as European languages wane.

Language	Speakers	Change since 2000	Rank in 2013	Rank in 2000
Spanish	38,417,235	37%	1	1
Chinese	3,029,042	50%	2	2
Tagalog	1,612,465	32%	3	5
Vietnamese	1,428,352	41%	4	6
French	1,251,815	-24%	5	3
Korean	1,100,881	23%	6	8
Arabic	1,052,938	71%	7	11
German	984,669	-29%	8	4
Russian	895,902	27%	9	9
French Creole	783,017	73%	10	14

Source: American Community Survey and U.S. Census, Stateline analysis

http://bit.ly/1uZih0n

A heroic family fight against paralysis

Ten years after the death of everyone's favourite Superman, Christopher Reeve, his son Matthew Reeve is pushing ahead with a spine-tingling clinical trial

- **12:46 10 October 2014 by Andy Coghlan**

You're planning a large study of a paralysis treatment that has already helped four young men. What will it entail?

This study will include 36 people with spinal cord injuries who will be treated with epidural stimulation – a technique in which a device is used to apply electrical current to the spinal cord. If we see the same results as we did in the first four, this therapy could have a profound impact on thousands of people living with paralysis. It has the potential to become as commonplace as the pacemaker is for cardiac patients.

How well has the treatment worked for the four men who have already received it?

Prior to epidural stimulation, they had all suffered chronic injuries caused by completely severed spinal cords. All four have seen dramatic improvements, including the ability to voluntarily move their toes, feet, ankles and legs, and even stand at times, when the device is on.

One unexpected bonus has been the return of autonomic function, such as bladder and bowel control and sexual function. From a quality-of-life point of view, this is the biggest improvement. Also unexpectedly, these autonomic functions continue in all four men even when the device is switched off, although they still need it to stand, move their legs and do exercises.

How does the device work?

It is a 16-electrode stimulator that is implanted in the same place on each patient's spine, irrespective of where their cord was severed. When the recipient operates the device, it applies a continuous electrical current – at varying frequencies and intensities – to specific regions in the lower spinal cord where there are dense bundles of nerves that control the hips, knees, ankles and toes. It mimics signals that would normally come from the brain to rekindle movement in those regions artificially.

Will anything be different in the larger trial?

The four people treated so far are all fit young men, so we want to try out the treatment in a wider range of individuals, including women and people of different ages, and with differing degrees and duration of injury. We're using the same device but are working to improve it, so it may be upgraded to allow for easier manipulation of the controls, for example.

When will the trial start?

We're aiming for next year, and it will run for five years. To fund it, we have to raise $15 million, and we already have $5 million of that. We're hoping people will each donate $36 – that's $1 for each patient. The faster we raise it, the sooner we start.

What would your father have made of the progress so far?

He would be proud of what we've achieved and learned, but would want to keep moving forward. His goal was a world of empty wheelchairs. And though it may end up being a combination of treatments, I can say that it's a question of when, not if, we will eventually succeed.

To learn more, or to get involved, visit reevebigidea.org

Profile

***Matthew Reeve** is on the board of the Christopher & Dana Reeve Foundation, which seeks new treatments for spinal injury. The late Christopher Reeve, who played Superman, became paralysed in 1995 after a horse-riding accident.*

http://bit.ly/1vZ9yd5

Instead of Growing Meat in a Lab, Why Not Make It Out of Plants?

"Plant blood" is the secret behind the I-can't-believe-it-isn't-meat company, Impossible Foods

By Rachel Nuwer

A startup called Impossible Food claims to have created a game-changing burger alternative—plant-based foods that both look like meat and taste just as good. Patrick Brown, a former Stanford University biochemistry professor, founded the company after stumbling across what he calls "plant blood," the Wall Street Journal reports. While working in his lab several years ago, he discovered that plants' heme—a compound found in hemoglobin—can take on strikingly meat-like flavors when combined with various amounts of sugars and amino acids. Brown's engineers have also figured out ways to mold plant tissue into the equivalent of animal fat, muscle and connective tissue, the Wall Street Journal adds.

The Impossible Burger smells and cooks like a normal hamburger would, but the Wall Street Journal notes that its taste isn't perfect—more akin to a turkey than a beef patty. A single patty also currently costs about $20 to produce, due to the large quantities of five plant species involved in its making. Brown thinks that improving the production process and scaling things up should lower that price, however.

The most obvious customers for a bloody, plant-based burger are vegetarians and vegans who give up meat for environmental and animal rights reasons—not because they do not like the taste. But, considering how energy intensive creating burgers and other meat products is, if a plant-based alternative can do the same culinary work at a lower carbon price, it might be a good option for the rest of us, too.

http://bit.ly/1qihORv

Researchers Uncover Molecular Process in the Brain that Transforms White Fat into Brown Fat

Yale scientists uncover how a molecular process in the brain that known to control eating transforms white fat into brown fat, impacting how much energy we burn and how much weight we can lose.

The results are published in the October 9 issue of the journal Cell.

Obesity is a rising global epidemic. Excess fatty tissue is a major risk factor for type 2 diabetes, cardiovascular disease, hypertension, neurological disorders, and cancer. People become overweight and obese when energy intake exceeds energy expenditure, and excess calories are stored in the adipose tissues. The adipose organ is made up of both white and brown fat. While white fat primarily stores energy as triglycerides, brown fat dissipates chemical energy as heat. The more brown fat you have, the more weight you can lose.

It has previously been shown that energy-storing white fat has the capacity to transform into energy-burning "brown-like" fat. In this new study, researchers from the Yale Program in Integrative Cell Signaling and Neurobiology of Metabolism, demonstrate that neurons controlling hunger and appetite in the brain control the "browning" of white fat.

Lead author Xiaoyong Yang, associate professor of comparative medicine and physiology at Yale School of Medicine, conducted the study with Tamas Horvath, professor and chair of comparative medicine, and professor of neurobiology and Obstetrics/gynecology at Yale School of Medicine, and their co-authors.

The team stimulated this browning process from the brain in mice and found that it protected the animals from becoming obese on a high-fat diet. The team then studied the molecular changes in hunger-promoting neurons in the hypothalamus and found that the attachment of a unique sugar called "O-GlcNAc" to potassium ion channels acts as a switch to control brain activity to burn fat.

"Our studies reveal white fat "browning" as a highly dynamic physiological process that the brain controls," said Yang. "This work indicates that behavioral modifications promoted by the brain could influence how the amount of food we eat and store in fat is burned."

Yang said hunger and cold exposure are two life-history variables during the development and evolution of mammals. "We observed that food deprivation dominates over cold exposure in neural control of white fat browning. This regulatory system may be evolutionarily important as it can reduce heat production to maintain energy balance when we are hungry. Modulating this brain-to-fat connection represents a potential novel strategy to combat obesity and associated illnesses."

Other authors on the study include Hai-Bin Ruan, Marcelo O. Dietrich, Zhong-Wu Liu, Marcelo R. Zimmer, Min-Dian Li, Jay Prakash Singh, Kaisi Zhang, Ruonan Yin, and Jing Wu.

The study was funded by the National Institutes of Health, American Diabetes Association, Ellison Medical Foundation, American Heart Association, and CNPq/Brazil.

Publication: Hai-Bin Ruan, et al., "O-GlcNAc Transferase Enables AgRP Neurons to Suppress Browning of White Fat," Cell, Volume 159, Issue 2, p306–317, 9 October 2014; doi:10.1016/j.cell.2014.09.010

http://nyti.ms/1szlzb9

Harvoni, a Hepatitis C Drug From Gilead, Wins F.D.A. Approval

The first complete treatment for hepatitis C that requires taking only a once-a-day pill won approval Friday from the Food and Drug Administration.

By ANDREW POLLACK OCT. 10, 2014

The drug, called Harvoni from Gilead Sciences, could shorten the duration of treatment and provide the first all-oral regimen for many patients.

The new drug also appears to be a bit less expensive for some patients than Gilead's existing blockbuster hepatitis C drug, Sovaldi, which has become the poster child for those complaining that the cost of medicines is out of control.

Sovaldi costs $1,000 a pill, or $84,000 for a typical 12-week course of treatment, but it must be used with other drugs. Harvoni is even more expensive at $1,125 a pill, or $94,500 for a 12-week course of treatment. But that is roughly in line with the total cost for Sovaldi and the drugs used with it. Many patients will be able to take Harvoni for only eight weeks, at a cost of about $63,000. This will probably not mollify insurance companies and Medicaid programs, many of which are restricting the use of Sovaldi to the most seriously ill patients.

Harvoni may shorten treatment for hepatitis C. **Credit Gilead Sciences**

"They are not prepared to cover the cost even at $63,000," said Dr. Steven Miller, the chief medical officer of Express Scripts, which manages pharmacy benefits for employers and insurance companies. "Their budgets just are not going to be able to tolerate it." He said the patients eligible for the shorter regimen are also the ones least in need of treatment.

But some patient advocates hope the pricing will persuade payers to relax their restrictions. "We're talking about a much lower cost to Medicaid for a substantial number of people, and to me that's a game changer," said Ryan Clary, executive director of the National Viral Hepatitis Roundtable, a coalition of organizations that receives some funding from drug companies.

Gilead defended the price. "We believe the price of Harvoni reflects the value of the medicine," it said in a statement. "Unlike long-term or indefinite treatments for other chronic diseases, Harvoni offers a cure at a price that will significantly reduce hepatitis C treatment costs now and deliver significant health care savings to the health care system over the long term."

Harvoni is a combination of sofosbuvir, the ingredient in Sovaldi, and a new medicine from Gilead called ledipasvir, which is not available as a stand-alone product. The two drugs attack the virus in different ways.

By combining drugs into a single pill, Gilead is repeating the strategy it used to become the leading supplier of drugs for H.I.V. Its drug Atripla, which combines three medicines, was the first once-a-day complete treatment for that disease.

Gilead estimates that over the long run as many as half of the patients might be able to receive only eight weeks of treatment.

Three million to four million Americans are infected with hepatitis C, which can gradually damage the liver. Harvoni's approval is only for the main subtype of hepatitis, called genotype 1, which accounts for about 70 percent of the cases in the United States. In clinical trials, more than 90 percent of the patients treated with Harvoni had no detectable virus in their blood 12 weeks after treatment ended. Doctors say that is considered an effective cure.

Sovaldi, which was approved in December, has already made a huge difference for patients, reducing the duration of treatment to 12 weeks from 24 or 48 weeks, increasing the cure rate and reducing side effects.

But Sovaldi is not supposed to be used by itself. Patients with genotype 1 are supposed to also take the older hepatitis C drugs, alpha interferon and ribavirin. Interferon in particular, which is given as a weekly injection, can have debilitating side effects such as flulike symptoms and depression.

In practice, many doctors this year have been avoiding the use of interferon by prescribing Sovaldi with another new pill, Johnson & Johnson's Olysio. That combination has not been approved by the F.D.A. and costs about $150,000. Compared with that off-label combination, Harvoni is far less expensive, which could mean lower sales for Johnson & Johnson's drug.

It is not so much the price per patient of Sovaldi but the total cost that has insurers and Medicaid programs worried. Sales of Sovaldi in the first half of the year were nearly $6 billion, almost all of it in the United States, shattering the record for first-year sales of any drug.

"Ironically, if this drug were not a breakthrough drug, people would not object to it because so many people would not be standing in line," said Ed Schoonveld, a principal at ZS Associates, a consultant to drug companies.

Caught off guard by the surge in demand, many insurers and state Medicaid programs have started to restrict the use of Sovaldi to patients who have more advanced liver disease. Some are requiring patients to demonstrate they have not abused alcohol or illicit drugs in a number of months.

Some advocacy groups, led by the National Viral Hepatitis Roundtable, sent a letter last month to Sylvia Mathews Burwell, the secretary of health and human

services, saying that such restrictions were "discriminatory and violate the spirit and the intent of the Affordable Care Act."

It can take 20 years or more for hepatitis C to cause noticeable cirrhosis or liver cancer. Many people infected with the virus never suffer noticeable liver damage. That is why in many cases it can be acceptable for patients without advanced liver damage to delay treatment. Many patients, on advice from their doctors, have been delaying treatment until Harvoni became available.

Gilead and some doctors make the case that even if liver damage is not serious, people with a chronic virus infection can have various other health problems, including an increased risk of heart attack. Treating the disease early is better, they argue, because it avoids liver damage to begin with.

"The sooner you cure them, the more likely you are to have better long-term outcomes for these patients," John F. Milligan, president and chief operating officer of Gilead, said at the Morgan Stanley health care conference last month.

Gilead recently agreed to allow several generic drug manufacturers in India to make and sell much less expensive copies of Sovaldi in about 90 poorer countries. That agreement also applies to Harvoni.

Analysts think the introduction of Harvoni will keep Gilead in the lead in the market for hepatitis C treatments. Just this week, Bristol-Myers Squibb said it would essentially give up for now on fielding its own combination treatment, a tacit acknowledgment that its regimen would not be competitive.

The competition for Gilead is expected from AbbVie, which could receive F.D.A. approval for its combination regimen by the end of this year. Insurers hope to play Gilead and AbbVie against each other to obtain lower prices, but it is not clear that will work.

http://nyti.ms/1qikmz6

Doctors Without Borders Evolves as It Forms the Vanguard in Ebola Fight

Doctors Without Borders remains the primary international medical aid group battling Ebola

By SHERI FINK ADAM NOSSITER and JAMES KANTER. OCT. 10, 2014

When the Ebola virus began relentlessly spreading in Sierra Leone months ago, government officials made an urgent plea to Doctors Without Borders, all that appeared to stand between the country and chaos.

"They asked us to be everywhere," recalled Walter Lorenzi, the medical charity's former coordinator in Sierra Leone. "They didn't know what to do."

Not long after, the group opened a treatment center in Kailahun, in eastern Sierra Leone, that was hacked out of the bush in just 12 days. Before opening another center three weeks ago in the southern city of Bo, the organization ran three shifts of workers, 24 hours a day, when daily rain and equipment breakdowns delayed construction.

The first to respond to the Ebola crisis in West Africa, Doctors Without Borders remains the primary international medical aid group battling the disease there. As local health systems have all but collapsed and most outside institutions, including the United States military, have yet to fulfill all their pledges of help, the charity has erected six treatment centers in West Africa, with plans for more. Its workers have treated the majority of patients, just as they have in previous Ebola outbreaks and some other epidemics in the developing world.

But it, too, has been overwhelmed by the scale of this disaster. In Sierra Leone, it has been strained by the caseload, though it was wary of a decision by other health and government officials on Friday to treat most patients at home because of a shortage of clinic beds. In Guinea the day before, it reported that its two treatment centers were stretched to the limit. In Liberia, the organization is trying to improve the quality of care at its Monrovia facility.

While also maintaining its outposts in war zones and other danger areas, the group has pushed in recent weeks to do more in the Ebola epidemic — tripling its staff on the ground, opening its training center in Brussels to outsiders for the first time and offering guidance to others joining the fight.

"We decided to scale up; we decided to do things we've never done before," said Dr. Joanne Liu, the international president of the group, which is also known as Médecins Sans Frontières, or M.S.F.

The group decided long ago that it could not depend on governments and other institutions, so it built a global infrastructure that sustains a robust supply chain to the field, like that of a far-flung army.

Its state-of-the-art supply depot in Brussels, for example, has sent hundreds of thousands of masks, protective suits, large tents and medical supplies to West Africa in recent months, getting them on the ground within 24 hours. To overcome obstacles, the Brussels logistics team is innovating — developing field tents rigged so workers do not get overheated, retrofitting body bags to absorb infectious fluids and seeking fast ways to dry wet boots that must be regularly disinfected.

To minimize risks, specialists in Brussels designed treatment centers that are precisely laid out: with single entry and exit points, strict separation of high risk and low risk areas, and space for health workers in a buddy system to watch over one another while removing contaminated protective gear. When a volunteer French nurse became sick last month, they resolved to make the safeguards tougher.

And the group has drawn on its legions of volunteers and billion-dollar base of donors who are attracted by its insistence on independence and record of providing care in places where often no one else dares to go.

Other aid organizations occasionally grumble about cockiness among Doctors Without Borders workers, safety protocols so rigorous they can seem like overkill and a focus on immediate help that does little to buttress local health systems over the long term.

But the organization, which won the Nobel Peace Prize in 1999, usually delivers. Even leaders of groups that have been criticized by Doctors Without Borders for a slow response to Ebola have praised its performance in the hot zone in recent months.

"Most people equate M.S.F. with courage, operating in conflicts," said Dr. Bruce Aylward, an assistant director general of the World Health Organization. "This is courage of an equal magnitude when you realize how few others responded."

A Simple Mandate

Doctors Without Borders calls itself a movement, and that sensibility infuses the operation. The group created a center, called Crash, devoted to self-criticism of its work. The culture is flinty — aid workers eschew the fancy hotels where government or United Nations workers sometimes stay — and volunteer doctors and top executives alike are paid considerably less than their counterparts at some other aid organizations.

Jean Pletinckx, 47, a chain-smoker who wears a battered black jacket over a gray hoodie and is a veteran of aid missions in Chechnya, Congo and Indonesia, presides over the logistics team in Brussels. He takes a dim view of consultants and rebuffs donations he considers more trouble than they are worth ("That's a joke for me," he said of a business that offered 10,000 free face masks to protect against Ebola when he needs 200,000 each month).

"Every single bit of money should be used as much as you can for results at the field level," he said.

The group emerged in the late 1960s, as Nigerian forces fought a secessionist struggle in Biafra. When the government refused to allow some young French Red Cross doctors to deliver food to the famine-stricken rebel territory, they revolted, breaking their Red Cross pledge of neutrality and silence.

They founded the group that would, in 1971, become Médecins Sans Frontières. Its first director, Dr. Bernard Kouchner, a media-savvy leftist who would become France's foreign minister, described the mission: "It's simple. Go where the patients are."

Medical teams would tend to people wherever they suffered, regardless of political or military boundaries, with or without permission. The group's workers would bear public witness to what they observed.

Today, Doctors Without Borders is the largest of the relatively few organizations devoted to providing urgent care in medical crises caused by armed conflict or natural disasters; many other groups offer aid but focus on building up health care systems. Most of its $1.3 billion in donations last year came from private individuals across the globe, according to financial reports; just 9 percent came from governmental agencies. The charity sent about 6,000 health, logistics and other experts to 67 countries last year, and hired 30,000 local workers. This year, those numbers are swelling.

Doctors Without Borders was already in West Africa when the Ebola outbreak was identified in Guinea in March. One of its teams was there battling malaria, a chronic killer; in neighboring Sierra Leone, workers were providing maternal and pediatric care.

The aid organization, which had developed expertise in epidemics by treating measles, meningitis, and cholera in refugee camps, and small outbreaks of Ebola in Central Africa since the 1980s, started efforts to halt the virus. A group of workers went to Monrovia, in April, setting up an Ebola treatment unit. As the cases multiplied across the region through the summer, the charity brought on more volunteers and local workers to try to keep pace.

Emily Veltus, a 29-year-old American volunteer who had been inspired to work in an Ebola outbreak since seeing news of one in the fourth grade, helped build community support in Sierra Leone. She hired 700 local workers in six weeks, significantly increasing the budget. "I had the freedom to do that," she said.

Although Ebola is new to the United States, the goal of contact tracing is the same in any disease: Track down those who could have been exposed.

Mary Jo Frawley, 59, an American nurse who also was posted in Sierra Leone and previously worked with Doctors Without Borders in various emergencies, credited local health workers for the aid group's effectiveness. "Nurses came to us and said, 'We want to work for you; you have the right stuff to be safe,' " she said. But as the human misery mounted in the West African countries, its leaders delivered dire warnings that catalyzed promises of action from other organizations and governments.

"That's what we try also to teach to our younger colleagues," said Dr. Jean-Hervé Bradol, director of studies at Crash. "It's not only to be operationally very dynamic, with good technical support structures, but also to understand when crises should have a bit more political attention."

One Crisis to the Next

Even though only 30 percent of volunteers return and the group had more vacancies this summer than ever before, the charity is highly selective for the Ebola mission, rejecting applications from qualified medical people who do not have experience in crises. But it has stepped up training of volunteers in Brussels and redeployed some of its experts on other missions to West Africa.

The logistics team has tapped additional suppliers and invented or adapted solutions to problems. The requests from the field attest to the grim labor: patient wristbands with bar codes that can withstand repeated dousing with chlorine, an industrial-strength vacuum cleaner to suck up contaminated fluids, a cart designed to move bodies in rough terrain.

The team has begun sending out computers with communications systems that work in the bush so patients can share final words with their families. And it is providing 70,000 disinfection kits to patients' families and others, including every taxi driver in Monrovia.

"Ebola is like having an earthquake that never stops," said Mr. Pletinckx, the logistics chief. "It is a constant emergency for the supply chain."

The group is deciding where to go next in Sierra Leone, Makeni or Freetown, or to expand at all. In Liberia, the worst-hit country, it is working to improve care at its 250-bed center in Monrovia, the largest it has ever run. Until last week, the center had stopped putting in intravenous lines for patients to combat dehydration because of safety risks for health workers. Admissions had briefly failed to rise despite the opening of new beds, officials with the group acknowledged, possibly because of another center opening, bottlenecks with ambulance transfers and rumors and criticism about the care.

"We're very aware of the kind of compromises we're having to make," said Christopher Stokes, general director of the organization's Belgium office, which oversees the Ebola response. "We're trying to put a boost on quality."

http://www.eurekalert.org/pub_releases/2014-10/tjnj-tcd100914.php

Treating C. diff infection with oral, frozen encapsulated fecal material

Treating C. diff by oral administration of frozen encapsulated fecal material from unrelated donors

A preliminary study has shown the potential of treating recurrent Clostridium difficile infection (a bacterium that is one of the most common causes of infection of the colon) with oral administration of frozen encapsulated fecal material from unrelated donors, which resulted in an overall rate of resolution of diarrhea of 90 percent, according to a study published in JAMA. The study is being released early online to coincide with its presentation at IDWeek 2014.

Recurrent Clostridium difficile infection (CDI) is a major cause of illness and death, with a recent increase in the number of adult and pediatric patients affected globally. Standard treatment with oral administration of the antibiotics metronidazole or vancomycin is increasingly associated with treatment failures. Fecal microbiota transplantation (FMT)—i.e., reconstitution of normal flora (gut bacteria) by a stool transplant from a healthy individual—has been shown to be effective in treating relapsing CDI. The majority of reported FMT procedures have been performed with fresh stool suspensions from related donors; however practical barriers and safety concerns have prevented its widespread use, according to background information from the article.

To address these barriers, the use of frozen fecal matter from carefully screened healthy donors has been used for FMT; nasogastric tube (a tube that is passed through the nasal passages and into the stomach) administration of the frozen product was comparable with colonoscopic delivery. Building on this work, the researchers generated a capsulized version of the frozen inoculum that can be administered orally and obviates the need for any gastrointestinal procedures.

Ilan Youngster, M.D., M.M.Sc., of Massachusetts General Hospital, Boston, and colleagues conducted a study to evaluate the safety and rate of diarrhea resolution associated with oral administration of frozen FMT capsules for patients with recurrent CDI. The study included 20 patients with at least three episodes of mild to moderate CDI and failure of a 6- to 8-week taper with oral vancomycin or at least 2 episodes of severe CDI requiring hospitalization. Healthy volunteers were screened as potential donors and FMT capsules were generated and frozen. Patients received 15 capsules on 2 consecutive days and were followed up for symptom resolution and adverse events for up to 6 months.

Among the 20 patients, 14 had clinical resolution of diarrhea after the first administration of capsules (70 percent) and remained symptom free at 8 weeks. All 6 non-responders were retreated at an average 7 days after the first procedure; 4 obtained resolution of diarrhea, resulting in an overall 90 percent rate of clinical resolution of diarrhea.

Daily number of bowel movements decreased from a median of 5 the day prior to administration to 2 at day 3 and 1 at 8 weeks. Self-reported health rating using a standardized questionnaire scale of l to 10 improved significantly over the study period, from a median of 5 for overall health and 4.5 for gastrointestinal health the day prior to FMT, to 8 for both ratings at 8 weeks after the administration.

No serious adverse events attributed to FMT were observed.

"If reproduced in future studies with active controls, these results may help make FMT accessible to a wider population of patients, in addition to potentially making the procedure safer. The use of frozen inocula allows for screening of

donors in advance. Furthermore, storage of frozen material allows retesting of donors for possible incubating viral infections prior to administration. The use of capsules obviates the need for invasive procedures for administration, further increasing the safety of FMT by avoiding procedure-associated complications and significantly reducing cost," the authors write.

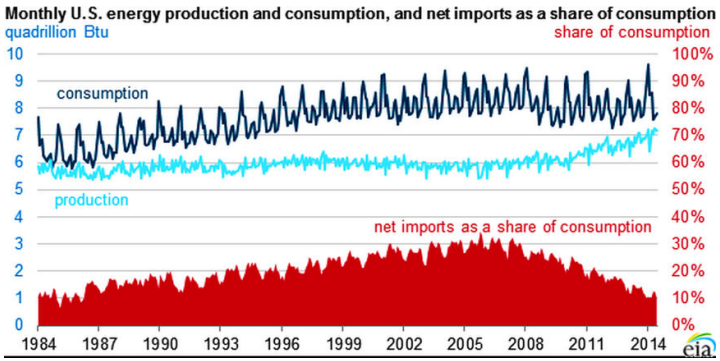
"Larger studies are needed to confirm these results and to evaluate long-term safety and effectiveness." (doi:10.1001/jama.2014.13875; Available pre-embargo to the media at http://media.jamanetwork.com)

http://bit.ly/1sFRcig

US edges closer to energy independence

Demand outstripped supply by the lowest level in 30 years.

by John Timmer - Oct 11 2014, 4:45am TST



The net energy consumption of the US has held fairly steady for nearly 20 years. Over the past decade, however, there's been a large increase in production of energy within the US. As a result, the US government's energy figures for the first half of this year show that the differences between production and consumption have dropped to the lowest level in 29 years. This represents a net drop in energy imports by 17 percent compared to the same period a year earlier.

According to the Energy Information Agency, the boost in energy production came from a variety of sources. Natural gas was the largest, accounting for just over half of the annual increase. Coal accounted for another quarter, renewable energy for 12 percent, and petroleum for eight. The EIA also notes that energy use this year was unusually high due to the intense cold that hit most of the nation in the first few months of 2014.

The vast majority of the country's imports come in the form of petroleum products and crude oil. These imports have been decreasing as new sources of oil are tapped and automotive efficiency standards are tightening. Refined petroleum products remain the largest US energy export; smaller quantities of coal and natural gas are also shipped overseas.

http://www.eurekalert.org/pub_releases/2014-10/wifb-bcf100914.php

Bioinspired coating for medical devices repels blood and bacteria

Developed using FDA-approved materials, the coating prevented flowing blood from clotting in a large animal efficacy study

From joint replacements to cardiac implants and dialysis machines, medical devices enhance or save lives on a daily basis. However, any device implanted in the body or in contact with flowing blood faces two critical challenges that can threaten the life of the patient the device is meant to help: blood clotting and bacterial infection.

A team of Harvard scientists and engineers may have a solution. They developed a new surface coating for medical devices using materials already approved by the Food and Drug Administration (FDA). The coating repelled blood from more than 20 medically relevant substrates the team tested – made of plastic to glass and metal – and also suppressed biofilm formation in a study reported in Nature Biotechnology. But that's not all.

The team implanted medical-grade tubing and catheters coated with the material in large blood vessels in pigs, and it prevented blood from clotting for at least eight hours without the use of blood thinners such as heparin. Heparin is notorious for causing potentially lethal side-effects like excessive bleeding but is often a necessary evil in medical treatments where clotting is a risk.

"Devising a way to prevent blood clotting without using anticoagulants is one of the holy grails in medicine," said Don Ingber, M.D., Ph.D., Founding Director of Harvard's Wyss Institute for Biologically Inspired Engineering and senior author of the study. Ingber is also the Judah Folkman Professor of Vascular Biology at Harvard Medical School and Boston Children's Hospital, as well as professor of bioengineering at Harvard School of Engineering and Applied Sciences (SEAS).

The idea for the coating evolved from SLIPS, a pioneering surface technology developed by coauthor Joanna Aizenberg, Ph.D., who is a Wyss Institute Core Faculty member and the Amy Smith Berylson Professor of Materials Science at Harvard SEAS. SLIPS stands for Slippery Liquid-Infused Porous Surfaces. Inspired by the slippery surface of the carnivorous pitcher plant, which enables the plant to capture insects, SLIPS repels nearly any material it contacts. The liquid layer on the surface provides a barrier to everything from ice to crude oil and blood.

"Traditional SLIPS uses porous, textured surface substrates to immobilize the liquid layer whereas medical surfaces are mostly flat and smooth – so we further adapted our approach by capitalizing on the natural roughness of chemically modified surfaces of medical devices," said Aizenberg, who leads the Wyss Institute's Adaptive Materials platform. "This is yet another incarnation of the

highly customizable SLIPS platform that can be designed to create slippery, non-adhesive surfaces on any material."

The Wyss team developed a super-repellent coating that can be adhered to existing, approved medical devices. In a two-step surface-coating process, they chemically attached a monolayer of perfluorocarbon, which is similar to Teflon. Then they added a layer of liquid perfluorocarbon, which is widely used in medicine for applications such as liquid ventilation for infants with breathing challenges, blood substitution, eye surgery, and more. The team calls the tethered perfluorocarbon plus the liquid layer a Tethered-Liquid Perfluorocarbon surface, or TLP for short.

In addition to working seamlessly when coated on more than 20 different medical surfaces and lasting for more than eight hours to prevent clots in a pig under relatively high blood flow rates without the use of heparin, the TLP coating achieved the following results:

TLP-treated medical tubing was stored for more than a year under normal temperature and humidity conditions and still prevented clot formation

The TLP surface remained stable under the full range of clinically relevant physiological shear stresses, or rates of blood flow seen in catheters and central lines, all the way up to dialysis machines

It repelled the components of blood that cause clotting (fibrin and platelets)

When bacteria called Pseudomonas aeruginosa were grown in TLP-coated medical tubing for more than six weeks, less than one in a billion bacteria were able to adhere. Central lines coated with TLP significantly reduce sepsis from Central-Line Mediated Bloodstream Infections (CLABSI). (Sepsis is a life-threatening blood infection caused by bacteria, and a significant risk for patients with implanted medical devices.)

Out of sheer curiosity, the researchers even tested a TLP-coated surface with a gecko – the superstar of sticking whose footpads contain many thousands of hairlike structures with tremendous adhesive strength. The gecko was unable to hold on.

"We were wonderfully surprised by how well the TLP coating worked, particularly in vivo without heparin," said one of the co-lead authors, Anna Waterhouse, Ph.D., a Wyss Institute Postdoctoral Fellow. "Usually the blood will start to clot within an hour in the extracorporeal circuit, so our experiments really demonstrate the clinical relevance of this new coating."

While most of the team's demonstrations were performed on medical devices such as catheters and perfusion tubing using relatively simple setups, they say there is a lot more on the horizon.

"We feel this is just the beginning of how we might test this for use in the clinic," said co-lead author Daniel Leslie, Ph.D., a Wyss Institute Staff Scientist, who aims to test it on more complex systems such as dialysis machines and ECMO, a machine used in the intensive care unit to help critically ill patients breathe.

Reflecting the strong collaborative model of the Wyss Institute, the cross-disciplinary team included researchers representing the Wyss Institute, SEAS, Harvard Medical School, and Boston Children's Hospital whose specialties range from hematology to immunology, surface chemistry and materials science.

"This really could only happen in a place like the Wyss Institute," Ingber said. "The magic happened when physicians and scientists in my group started brainstorming with the SLIPS engineering team who are experts in super-repellency. What emerged could become a new paradigm for implantable medical devices, extracorporeal circuits, and more."

The project was funded by the Defense Advanced Research Projects Agency (DARPA) and the Wyss Institute for Biologically Inspired Engineering at Harvard University.

http://bit.ly/1nj2loz

'IMPs' on moon point to recent lava flows

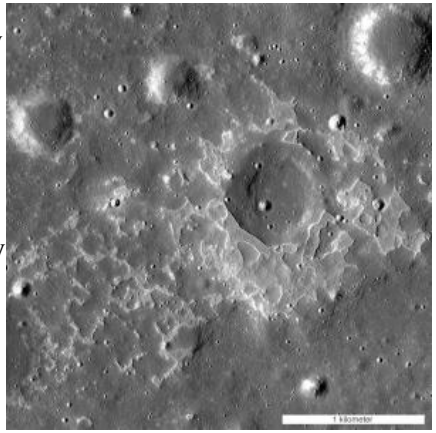
The man in the moon may still have some fire in his belly.

18:00 12 October 2014 by Maggie McKee

A new study argues that magma erupted onto the lunar surface less than 100 million years ago – nearly a billion years later than previously thought. If confirmed, the finding suggests that radioactive elements may be keeping the moon's innards toasty even today.

The moon is thought to have formed from the debris of a collision between Earth and a Mars-sized body about 4.5 billion years ago. Its fiery birth kept its surface molten for a few hundred million years. But even after its crust solidified, magma regularly erupted onto the moon's surface until about 3 billion years ago, creating vast basaltic plains known as maria. After that, the eruptions largely stopped, with the most recent volcanic features dating to about a billion years ago.

Now Sarah Braden at Arizona State University in Tempe and colleagues say that dozens of small rocky formations spotted by NASA's eagle-eyed Lunar Reconnaissance Orbiter were laid down by lava no more than 100 million years ago – a geological eye-blink.



Hot or not? Unusual features like the Maskelyne IMP suggest the moon still has some volcanic tricks up its sleeve **NASA/GSFC/Arizona State University**

The spacecraft, which has been orbiting the moon since 2009, can make out details as small as 50 centimetres across, providing the best orbital view yet of the moon's surface. Scouring the images, Braden and her team found 70 regions that stood out from their surroundings, most of which were new to science.

Called irregular mare patches, or IMPs, the features measure less than 5 kilometres across, and are sprinkled over the moon's near side within the larger maria. They have two-toned textures, with smooth, usually dark, rock lying over rougher, blockier rock. That may be because the first lava to emerge during an eruption formed a rough crust that was then overlaid by smoother flows, Braden says.

Fresh-faced IMPs

The IMPs appear relatively fresh-faced compared with their surroundings, suggesting they have experienced no more than 100 million years of impacts from space rocks, the team say. If so, "the moon was more active in recent history than previously thought possible", says Braden.

"Young volcanism indicates possibly more magma, or magma at higher temperatures, or magma at shallower depths, or all of the above," she says. The heat powering this activity may come from gravitational tugs from Earth or the decay of radioactive elements beneath the moon's surface.

"This paper demonstrates how much we don't know about the moon," says Peter Schultz at Brown University in Providence, Rhode Island, who wasn't involved with the work.

But he has another explanation: he believes magma lying deep within the moon produces gas that seeps up through cracks and occasionally bursts through the surface. In 2006, he suggested such bursts could explain the few IMPs known at the time. He also believes that this "degassing" has occurred even more recently than Braden's estimate for volcanism, with a 3-kilometre-wide IMP named Ina forming no more than 10 million years ago.

Both explanations suggest that "the moon isn't dead", he says. "We need to visit such sites to understand what happened – or could still be happening."

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