http://www.eurekalert.org/pub_releases/2013-02/nu-bmc021513.php

Bone marrow cells used in bladder regeneration

A new approach to bladder regeneration is capitalizing on the potential of two distinct cell populations harvested from a patient's healthy bone marrow, a new study reports.

The Northwestern Medicine® research, which will be published February 18 in the Proceedings of the National Academy of Sciences by lead author Arun K. Sharma, research assistant professor in urology at Northwestern University Feinberg School of Medicine and colleagues, is an alternative to contemporary tissue-engineering strategies. The bone marrow cells are being used to recreate the organ's smooth muscle, vasculature, and nerve tissue.

"We are manipulating a person's own disease-free cells for bladder tissue reformation," said Sharma, a member of the Institute for BioNanotechnology in Medicine and the Ann & Robert H. Lurie Children's Hospital of Chicago Research Center. "We have used the spina bifida patient population as a proof of concept model because those patients typically have bladder dysfunction. However, this regeneration approach could be used for people suffering from a variety of bladder issues where the bone marrow microenvironment is deemed normal."

In end-stage neurogenic bladder disease – an illness often associated with spinal cord diseases like spina bifida – the nerves which carry messages between the bladder and the brain do not work properly, causing an inability to pass urine. The most common surgical option, augmentation cystoplasty, involves placing a "patch" derived from an individual's bowel over a part of the diseased organ in order to increase its size. The current "gold standard," the procedure remains problematic because the bowel tissue introduces long-term complications like the development of electrolyte imbalance and bladder cancer.

Because Sharma's procedure does not use bowel tissue, it offers the benefits of augmentation without the association of long-term risks. His technique combines stem and progenitor cells from a patient's bone marrow with a synthetic scaffold created in the lab of Guillermo Ameer, ScD, professor of biomedical engineering at McCormick School of Engineering and Applied Science and of surgery at Feinberg. The scaffold takes the place of the traditional patch.

"We decided to use material that has the ability to be tailored to simulate mechanical properties of the bladder," said Sharma, director of pediatric urological regenerative medicine at Lurie Children's. "Using the elastomer created by Dr. Ameer and the bone marrow stem and progenitor cells, I believe that we have developed a technique that can potentially be used in lieu of current bladder augmentation procedures. However, further study is needed."

Sharma's initial research was supported in part by an Excellence in Academic Medicine grant funded by the Illinois Department of Healthcare and Family Services.

http://bit.ly/VO0eLW

Origins of alcohol consumption traced to ape ancestor

Eating fermented fruit off the ground may have paved way for ability to digest ethanol

By Erin Wayman

BOSTON — The taste for alcohol may be an ancient craving. The ability to metabolize ethanol — the alcohol in beer, wine and spirits — might have originated in the common ancestor of chimpanzees, gorillas and humans roughly 10 million years ago, perhaps when this ancestor became more terrestrial and started eating fruits fermenting on the ground.

Chemist Steven Benner of the Foundation for Applied Molecular Evolution in Gainesville, Fla., reached that conclusion by “resurrecting” the alcohol-metabolizing enzymes of extinct primates. Benner and his colleagues estimated the enzymes’ genetic code, built the enzymes in the lab and then analyzed how they work to understand how they changed over time.

“It’s like a courtroom re-enactment,” said biochemist Romas Kazlauskas of the University of Minnesota in Minneapolis. Benner “can re-enact what happened in evolution.” Benner proposed the idea February 15 at the annual meeting of the American Association for the Advancement of Science.

Today, humans rely on an enzyme called alcohol dehydrogenase 4, or ADH4, to break down ethanol. The enzyme is common throughout the esophagus, stomach and intestines, and is the first alcohol-metabolizing enzyme that comes into contact with what a person drinks. Among primates, not all ADH4s are the same — some can’t effectively metabolize ethanol.

To see how ADH4 evolved, Benner’s team read the stretches of DNA that make ADH4 in 27 modern primate species, including lemurs, monkeys, apes and humans. Then they mapped the DNA sequences on a primate family tree and inferred what the genes might have looked like long ago at points on the tree where evolutionary branches separated. The branching points represent extinct primate ancestors.

Most primate ancestors wouldn't have been able to metabolize ethanol, the results showed. But at the branching point leading to gorillas, chimps and humans — which represents an ancestor that lived roughly 10 million years ago — the enzyme becomes a powerful alcohol digester. Compared with earlier enzymes, this one was 50 times as efficient, Benner reported, and was nearly capable of breaking down the level of ethanol found in modern alcoholic beverages.

Because gorillas, chimps and humans all spend at least some time on the ground, Benner thinks a terrestrial lifestyle arose in these primates' common ancestor around 10 million years ago. Being on the ground, the ancestor would have come across fruit that had fallen from trees. With a damaged husk or skin, yeast could have invaded the fruit and fermented its sugars into ethanol. Thus, individuals who could digest ethanol would have survived better than those who couldn't. This would also explain why the ability to metabolize ethanol didn't evolve in tree-dwelling primates like orangutans that rarely encounter fermented fruit.

But it may be too soon to link metabolizing ethanol with living on the ground, said Jeremy DeSilva, a biological anthropologist at Boston University. "There's very little fossil evidence from the general time period when humans, gorillas and chimpanzees last shared a common ancestor." Scientists still debate whether this ancestor was strictly arboreal or split its time between the ground and the trees. "This is cool work," he said. "We'll be able to evaluate it with better evidence as we find more fossils from that time period."

S. Benner. Paleogenetics and the history of alcohol in primates. American Association for the Advancement of Science annual meeting. Presented February 15, 2013.

http://bit.ly/13lFfO6

Traces of life on Mars may have been bleached away

Any clues to past life on Mars probably lie somewhat deeper down

16:10 18 February 2013 by Lisa Grossman, Boston, Massachusetts

A Martian meteorite that has been frozen in Antarctic ice hints that the surface of the Red Planet is riddled with chemicals related to those used in household bleach. That increases the likelihood that carbon-bearing compounds – strong indicators of life – may have been broken down by chemical reactions, suggesting that we need to dig deeper into Mars to search for traces of any past inhabitants.

"We're speculating that you perhaps cannot find organics on the surface of Mars," says Sam Kounaves of Tufts University in Medford, Massachusetts. "You have to be below the surface or inside sedimentary rocks."

Kounaves and colleagues studied a Martian meteorite called EETA 79001, collected in 1979 in Antartica where it fell 12,000 years ago. Its long stay means its outer layers were probably contaminated with earthly material, so the team cut it open to study the stuff inside.

They found a white substance nestled in the meteorite that turned out to contain a form of nitrate, a chemical that some earthly bacteria use as fuel. By comparing the ratio of isotopes found in it with those on Earth, the team determined it is not a contaminant.

"It's clear to us it's Martian," Kounaves told New Scientist at a meeting of the American Association for the Advancement of Science in Boston, Massachusetts, last week.

Chloride traces

The team also found small amounts of chloride minerals in the rock, and are confident these are from Mars. Previously, the Phoenix Mars lander had found related compounds called perchlorates, which can also be fuel for microorganisms, in Martian soil..

Chemical reactions can produce perchlorates from chlorides, but an intermediate step is the formation of oxychlorines – a class of highly oxidising chemicals that includes household bleach. What's more, ultraviolet light from the sun and cosmic rays can convert perchlorates back into oxychlorines. When these bleaching agents meet even a little bit of water, they will break down any organic compounds present.

That would seem to spell trouble for NASA's Curiosity rover, exploring the surface of Mars for traces of past life. The rover is in a crater that we think was once a large lake, and has already found strong evidence for flowing water on Mars's surface.

So it's a good thing Curiosity brought along a drill. Although it can only get 6.4 centimetres deep, that may be enough to find any organics preserved in rocks below, shielded from the oxychlorine-forming processes.

"If organics were present under several inches of soil or in a sedimentary rock, they could be protected from radiation," Kounaves says. "Assuming they somehow got there from an earlier epoch, they would have a greater chance of surviving." But at such small depths, it's also possible that the soil layer above blew in from elsewhere and has been exposed to damaging radiation along the way.

"The odds of rolling up to a rock on Mars and finding organics are vanishingly small," says rover project scientist John Grotzinger of the California Institute of Technology in Pasadena. "But we're still going to try."

http://nyti.ms/1571c69

The Average American Knows How Many People?

The average American knows about 600 people. How do we know this?

By ANDREW GELMAN

Researchers led by my Columbia colleague Tian Zheng posed a series of questions to a representative sample of 1,500 Americans: How many people do you know named Kevin? How many named Karen? How many named Shawn or Sean, Brenda, Keith or Rachel?

After adjusting for various factors (for example, the names are not evenly distributed in age across the population), we determined that participants knew an average of 8.4 people with those names. Social Security records suggest that 1.4 percent of the population has one of the names, and 8.4 divided by 1.4 percent is 600 people.

Using this clever method of estimating social networks can be tricky. Indeed, the method's inventors, H. Russell Bernard and Peter Killworth, estimated from an earlier survey that the average American knew only 290 people.

Why was their estimate so low? Perhaps because the names they used were common ones, like Michael and Robert; research shows that people with common names are harder to recall than those with slightly more exotic ones, like Sean and Rachel.

Our team also estimates that most Americans know just 10 to 25 people well enough to say they trust them.

http://www.sciencedaily.com/releases/2013/02/130218164130.htm

Ancient Fossilized Sea Creatures Yield Oldest Biomolecules Isolated Directly from a Fossil

Scientists have long believed that complex organic molecules couldn't survive fossilization

Though scientists have long believed that complex organic molecules couldn't survive fossilization, some 350-million-year-old remains of aquatic sea creatures uncovered in Ohio, Indiana, and Iowa have challenged that assumption.

The spindly animals with feathery arms -- called crinoids, but better known today by the plant-like name "sea lily" -- appear to have been buried alive in storms during the Carboniferous Period, when North America was covered with vast inland seas. Buried quickly and isolated from the water above by layers of fine-grained sediment, their porous skeletons gradually filled with minerals, but some of the pores containing organic molecules were sealed intact.

Different species of the sea animals known as crinoids display different colors in these 350-million-year-old fossils. Ohio State University researchers have found organic compounds sealed within the pores of these fossilized animals' skeletons. **(Credit: William Ausich, courtesy of Ohio State University)**

That's the conclusion of Ohio State University geologists, who extracted the molecules directly from individual crinoid fossils in the laboratory, and determined that different species of crinoid contained different molecules. The results will appear in the March issue of the journal Geology. William Ausich, professor in the School of Earth Sciences at Ohio State and co-author of the paper, explained why the organic molecules are special.

"There are lots of fragmented biological molecules -- we call them biomarkers -- scattered in the rock everywhere. They're the remains of ancient plant and animal life, all broken up and mixed together," he said. "But this is the oldest example where anyone has found biomarkers inside a particular complete fossil. We can say with confidence that these organic molecules came from the individual animals whose remains we tested."

The molecules appear to be aromatic compounds called quinones, which are found in modern crinoids and other animals. Quinones sometimes function as pigments or as toxins to discourage predators.

Lead author Christina O'Malley, who completed this work to earn her doctoral degree, first began the study when she noticed something strange about some crinoids that had perished side by side and become preserved in the same piece of rock: the different species were preserved in different colors.

In one rock sample used in the study, one crinoid species appears a light bluish-gray, while another appears dark gray and yet another more of a creamy white. All stand out from the color of the rock they were buried in. The researchers have since found similar fossil deposits from around the Midwest.

"People noticed the color differences 100 years ago, but no one ever investigated it," O'Malley said. "The analytical tools were not available to do this kind of work as they are today."

O'Malley isolated the molecules by grinding up small bits of fossil and dissolving them into a solution. Then she injected a tiny sample of the solution into a machine called a gas chromatograph mass spectrometer. The

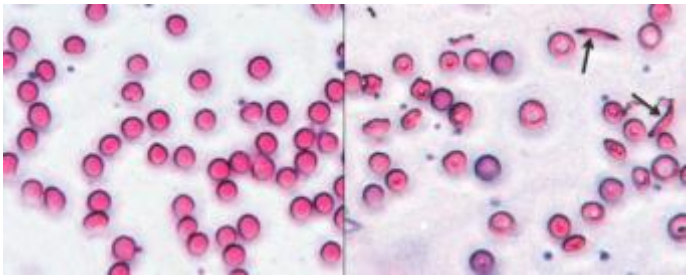
machine vaporized the solution so that a magnet could separate individual molecules based on electric charge and mass. Computer software identified the molecules as similar to quinones.
Then, with study co-author and Ohio State geochemist Yu-Ping Chin, she compared the organic molecules from the fossils with the molecules that are common in living crinoids today. Just as the researchers suspected, quinone-like molecules occur in both living crinoids and their fossilized ancestors.
Though different colored fossils contained different quinones, the researchers cautioned that there's no way to tell whether the quinones functioned as pigments, or that the preserved colors as they appear today were similar to the colors that the crinoids had in life.
Part of why the crinoids were so well preserved has to do with the structure of their skeletons, the researchers said. Like sand dollars, crinoids have skin on top of a hard calcite shell. In the case of crinoids, their long bodies are made up of thousands of stacked calcite rings, and each ring is a single large calcite crystal that contains pores filled with living tissue. When a crinoid dies, the tissue will start to decay, but calcite will precipitate into the pores, and calcite is stable over geologic time. Thus, organic matter may become sealed whole within the rock.
"We think that rock fills in the skeleton according to how the crystals are oriented. So it's possible to find large crystals filled in such a way that they have organic matter still trapped inside," Ausich said.
The location of the fossils was also key to their preservation. In the flat American Midwest, the rocks weren't pushed up into mountain chains or heated by volcanism, so from the Ohio State geologists' perspective, they are pristine.
Their next challenge is to identify the exact type of quinone molecules they found, and determine how much information about individual species can be gleaned from them. "These molecules are not DNA, and they'll never be as good as DNA as a means to define evolutionary relationships, but they could still be useful," Ausich said. "We suspect that there's some kind of biological signal there -- we just need to figure out how specific it is before we can use it as a means to track different species."
This research was sponsored by the National Science Foundation and the Geological Society of America.
C. E. O'Malley, W. I. Ausich, Y.-P. Chin. Isolation and characterization of the earliest taxon-specific organic molecules (Mississippian, Crinoidea). Geology, 2013; DOI: 10.1130/G33792.1

http://www.sciencedaily.com/releases/2013/02/130218173215.htm

Could an Old Antidepressant Treat Sickle Cell Disease?

Antidepressant used since 1960s may hold promise for treating sickle cell disease

An antidepressant drug used since the 1960s may also hold promise for treating sickle cell disease, according to a surprising new finding made in mice and human red blood cells by a team from the University of Michigan Medical School. The discovery that tranylcypromine, or TCP, can essentially reverse the effects of sickle cell disease was made by U-M scientists who have spent more than three decades studying the basic biology of the condition, with funding from the National Institutes of Health.
Their findings, published in Nature Medicine, pave the way for a clinical trial now being planned for adult patients who have the life-threatening condition. The discovery may also lead to other treatments for the disease, which leads misshapen red blood cells to cause vascular damage and premature death.



Blood smears from normal (left) and sickle cell disease (right). Note the rigid extended cells (arrows) indicative of sickling. **(Credit: Image courtesy of University of Michigan Health System)**

But the researchers caution it is too soon for the drug to be used in routine treatment of sickle cell anemia, an inherited genetic disease that affects tens of thousands of Americans and millions of others worldwide.
The climax of a decade of discovery In the new paper, the researchers describe a painstaking effort to test TCP's effect on the body's production of a particular form of hemoglobin -- the key protein that allows red blood cells to carry oxygen. The drug acts on a molecule inside red blood cells called LSD1, which is involved in blocking the production of the fetal form of hemoglobin. The U-M team zeroed in on the importance of LSD1 as a drug target after many years of research. Then, they literally did a Google search to find drugs that act on LSD1. That's how they found TCP, which since 1960 has been used to treat severe depression.
In the new paper, they describe how TCP blocked LSD1 and boosted the production of fetal hemoglobin -- offsetting the devastating impact of the abnormal "adult" form of hemoglobin that sickle cell patients make.
"This is the first time that fetal hemoglobin synthesis was re-activated both in human blood cells and in mice to such a high level using a drug, and it demonstrates that once you understand the basic biological mechanism

underlying a disease, you can develop drugs to treat it," says Doug Engel, Ph.D., senior author of the study and chair of U-M's Department of Cell & Developmental Biology. "This grew out of an effort to discover the details of how hemoglobin is made during development, not with an immediate focus on curing sickle cell anemia, but just toward understanding it."

Engel credits the dedication and persistence of his team, including a former research assistant professor, Osamu Tanabe, M.D., Ph.D., now at Japan's Tohoku University, U-M postdoctoral fellow, Lihong Shi, Ph.D., first author of the study, and research instructor Shuaiying Cui, Ph.D.. Together, they have identified LSD1's crucial role, and its epigenetic interaction with two nuclear receptors in the nuclei of red blood cell precursors called TR2 and TR4. Working in tandem, they repress the expression of the gene that makes fetal hemoglobin -- an effect called gene silencing. So, interfering with this repression allows the fetal hemoglobin subunits to be made.

Treatment with TCP caused fetal hemoglobin to be produced at such high abundance that it made up 30 percent of all hemoglobin in cultured human blood cells -- a finding Engel called "startling." TCP is FDA-approved, though patients taking it need to follow strict dietary guidelines to avoid drug interactions with certain naturally occurring chemicals in some foods.

Boosting healthy hemoglobin

Sickle cell disease occurs when a person or animal inherits two defective copies of a gene that governs the production of the "adult" form of hemoglobin. James Neel, the first chair of the U-M Department of Human Genetics, co-discovered the genetic basis for the disease in the late 1940s. People with just one copy of the mutated gene normally do not get sick, but if they have a child with another person who carries the same trait, there is a one in four chance the child will develop the disease. An estimated 2.5 million Americans -- including one in every 12 African Americans and one in every 100 Latinos -- carry one copy of the mutated globin gene.

In sickle cell disease, the body makes a form of adult hemoglobin that can aggregate to cause red blood cells to become C-shaped or "sickle" shaped, and stiff and sticky. Those cells clog small blood vessels in the limbs and internal organs, causing organ damage, pain, and raising the risk of infection. Life expectancy in these patients is greatly shortened. In a very small number of sickle cell patients, the 'fetal' form of hemoglobin -- which is usually only made in the womb and the first couple of months of life -- keeps being produced throughout life. These patients have symptoms that are either far less severe or nonexistent.

The most common current sickle cell treatment, oral hydroxyurea, aims to boost fetal hemoglobin production. Others, including transfusions and stem cell (bone marrow) transplants from unrelated donors, aim to exchange the source of the overall red blood cell supply.

More study needed

Andrew Campbell, M.D., who directs the Pediatric Comprehensive Sickle Cell program at U-M's C.S. Mott Children's Hospital and has worked with Engel on previous research, finds the new findings are very exciting news for sickle cell patients, since there are not enough treatment options. But, he notes, more clinical research is needed to determine if the findings from mice and cultured human red cell precursors will translate to humans for TCP or even other drugs that inactivate LSD1.

The first such clinical trial is now being planned with the sickle cell team at Wayne State University in Detroit. Further information will be available later this year if it receives approval to go forward. At the same time, U-M is exploring other possible drug candidates targeting the same pathway.

Engel is working with U-M psychiatrist Juan Lopez, M.D., to study the effect of TCP -- and other antidepressants in the class known as monoamine oxidase inhibitors -- on hemoglobin production in adults. The study is still seeking volunteers who are already taking these drugs to treat major depression.

The study was funded by NIH grants DK086956 and HL24415 and an American Heart Association postdoctoral fellowship, as well as NCI and Medical School support to the Vector, Flow Cytometry, DNA sequencing and Microarray Cores. U-M has filed for a patent on the discovery.

Lihong Shi, Shuaiying Cui, James D Engel, Osamu Tanabe. Lysine-specific demethylase 1 is a therapeutic target for fetal hemoglobin induction. Nature Medicine, 2013; DOI: 10.1038/nm.3101

http://www.bbc.co.uk/nature/21459520

Carnivorous plant species glow blue to lure prey

Some carnivorous plants act as blue "fluorescent lamps" to lure prey, according to scientists in India.

By Michelle Warwicker BBC Nature

The research team discovered blue fluorescent emissions from the plants' "capture spots" when tested in ultraviolet (UV) light. Carnivorous plants are known to attract insects with nectar, colours and smells.

But the alluring blue glow reveals a new prey capture mechanism in some species, according to the findings.

The study, published in the journal Plant Biology, was carried out by scientists from Jawaharlal Nehru Tropical Botanic Garden and Research Institute in Thiruvananthapuram, Kerala, India.

"These distinct blue emissions were so far not known in carnivorous prey traps," said research team member Dr Sabulal Baby. "To the best of our knowledge, this is the first study reporting such strong and distinct fluorescence emissions in the plant kingdom."

Significant signals

The team found the blue emissions, caused by molecular mechanisms, in "prey traps" of pitcher plants Nepenthes and Sarracenia and in Venus flytraps (Dionaea muscipula).

The blue glow was revealed on the inner sides of Venus flytraps when scanned at UV 366nm. And distinct blue fluorescence appeared on the lids, interior pitcher tubes and peristomes (upper rims) of pitcher plants.

Most insects and other arthropods can perceive UV regions of the electromagnetic spectrum.

The peristomes of Nepenthes gracilis appear like attractive landing pads for prey

To potential prey, the blue fluorescent rings emitting from the pitcher plants' peristomes may make attractive landing pads. These fluorescent emissions would also be perceptible in low-light conditions, meaning they could also attract nocturnal prey. The glow may also attract visits from small mammals such as rats, bats and tree shrews.

To test the significance of blue fluorescence as a prey-attracting device, the team "masked" the blue rings of Indian pitcher plants (Nepenthes khasiana) growing in the botanic gardens by coating them with a non-fluorescent extract.

The plants' prey capture success reduced drastically over the 10-day period when their blue emissions were hidden. This indicates that blue fluorescence acts as a "very significant signal" in attracting prey, Dr Baby explained.

Invaluable insights

Found in low-nutrient soil, carnivorous plants have evolved to gather nutrients from elsewhere.

The plants use biological traps such as pitfall traps, snap traps and flypaper traps to snare animals before digesting nutrients from the prey. For example, the Venus flytrap snaps shut around insects with one of the quickest movements in the plant kingdom, while pitcher plants have slippery edges causing prey to fall to their deaths into a pitcher of digestive fluid.

According to the study, the discovery of the plants' blue fluorescence in UV light conditions provides "a new understanding to prey capture in carnivorous plants and also [of] plant-animal interactions."

http://blogs.scientificamerican.com/guest-blog/2013/02/19/how-to-instill-false-memories/

How to Instill False Memories

Everyone enjoys the occasional practical joke – assuming the gag isn't mean-spirited or overly perilous, even the prank's poor victim can appreciate the punch line!

By Steven Ross Pomeroy | February 19, 2013

I'm sure you have your favorites: gluing dollars to sidewalks, filling your co-worker's office with balloons, moving your roommate's bed to the basement… while he's sleeping in it.

More typical stunts may employ whoopee cushions, fake vomit, and hand buzzers, but honestly, those are a tad sophomoric and overdone. Thus, in an effort to elevate the standard of stunts, I'd like to present a gag that makes use not of stink bombs, but of science.

How to implant false memories in your friends, in four steps:

In The Demon-Haunted World, Carl Sagan argued that implanting false memories in people is not only possible, but is actually pretty easy when attempted in the proper settings with a gullible subject, He cited as examples people who, at the urging of therapists or hypnotists, genuinely start to believe that they'd been abducted by UFOs or falsely remember being abused as a child. For these people, the distinction between memory and imagination becomes blurred, and events that never actually took place become sewn into their memories as real events. They can even describe these false remembrances incredibly vividly – as if they actually happened!

"Memory can be contaminated," Sagan wrote. "False memories can be implanted even in minds that do not consider themselves vulnerable and uncritical."

Sagan's insight provides a segue into step one of our plot to implant a memory, which is made possible by a frank fact: your friends — while undoubtedly honest, funny, supportive, and intelligent — probably don't all possess invulnerable and critical minds. Thus, the first step is to select one of your mates who, in your estimation, is "prone to suggestion." Please note that you should be acquainted with this friend for at least five

years, and have shared experiences with him or her. This will enhance your believability, and thus your odds of success.

Once you've got your target singled out, the next, and possibly the most critical step, is to fabricate a memory. The false memory should have "taken place" at least a year in the past, not be unduly intricate, and not be something that might engender strong feelings of emotion.

Studies have shown that it's easy to make people falsely recall small details about events, but as the fake memories grow in complexity and specificity, implantation grows progressively harder, though not impossible. After three interviews, researchers at Western Washington University succeeded in getting subjects to recall details about accidentally spilling a bowl of punch on the parents of the bride at a wedding reception. As described by University of Washington psychologist Elizabeth Loftus in a 1997 article for Scientific American:

During the first interview one participant, when asked about the fictitious wedding event, stated, "I have no clue. I have never heard that one before." In the second interview the participant said: "It was an outdoor wedding and I think we were running around and knocked something over like the punch bowl or something and um made a big mess and of course got yelled at for it."

Emotions tend to make people remember associated events more vividly. (You probably can recall where you were and what you were doing around the time of traumatic events, for example.) Thus, your target might not be as apt to accept a false memory if you told him or her that they experienced something highly emotional. In 1999, researchers at the University of British Columbia did succeed in convincing 26% of their subjects that they had been victims of a vicious animal attack in their childhood, but the research team's sophisticated methods probably won't apply in a practical joke setting.

Choosing a childhood memory will give you the best odds of success. You'll have an easier time implanting something that supposedly occurred far in the past. Since this is meant to be a practical joke, I recommend creating a false memory that's comical and not potentially life-scarring.

If you want more of a challenge, try to implant a memory that supposedly occurred more recently. For example, you could concoct a scene at a bar in which you purchased your friend a plethora of drinks and he or she never paid you back. That way, should you succeed, you'll get some money out of the deal (…which you will, of course, give back once you reveal your playful deception).

With the memory and target selected, your third task is to prepare. You're going to need a couple things if the prank will have any chance of success. First off, you'll need to formulate some narrative details surrounding the false memory. Be as specific as possible. What outfit was your friend wearing? What were the circumstances that led to the event? What was the setting like? Who was there?

If you're skilled at editing images, you could also try doctoring a photo. In 2002, psychologists exposed twenty subjects to a false childhood event using a fake photograph. Over three interviews, subjects were instructed to think about the photo, which showed them on a hot air balloon, and were made to recall the event with guided-imagery exercises. At the study's conclusion, fifty percent of subjects ended up concocting complete or partial false memories!

You'll also need corroborators; the more the better. The power of corroboration in instilling false memories was demonstrated in the 1990s by researchers at Williams College. In their study, participants were falsely accused of causing a computer to crash by pressing a wrong key. According to Loftus:

"The innocent participants initially denied the charge, but when a confederate said that she had seen them perform the action, many participants signed a confession, internalized guilt for the act and went on to confabulate details that were consistent with that belief."

Now you're ready to set your plan in motion. When you commence, be persistent. The memory may not stick right away; you'll probably have to bring it up multiple times over a span of days or even weeks. Additionally, don't be afraid to use peer pressure. You and your compatriots should utilize phrases like the following:

"Really? You don't remember that?"

"Seriously? You were there!"

"Your memory is awful!"

Memory isn't static. It's fickle, ever changing, and easily tampered with; a patchwork quilt that can be ripped, torn, and remade.

"Perhaps what we actually remember," says Carl Sagan, "is a set of memory fragments stitched onto a fabric of our own devising. If we sew cleverly enough, we have made ourselves a memorable story easy to recall."

Still, implanting a false memory in a person, and having them fully believe it, takes some doing. Even in the lab, researchers succeed less than half of the time…

…but it can be done. So sew away, my friends. Sew away.

http://www.eurekalert.org/pub_releases/2013-02/nu-rda021413.php

Researchers discover a biological marker of dyslexia

Ability to consistently encode sound undergirds the reading process

EVANSTON, Ill. - Though learning to read proceeds smoothly for most children, as many as one in 10 is estimated to suffer from dyslexia, a constellation of impairments unrelated to intelligence, hearing or vision that make learning to read a struggle. Now, Northwestern University researchers report they have found a biological mechanism that appears to play an important role in the reading process.

"We discovered a systematic relationship between reading ability and the consistency with which the brain encodes sounds," says Nina Kraus, Hugh Knowles Professor of Neurobiology, Physiology and Communication. "Unstable Representation of Sound: A Biological Marker of Dyslexia," co-authored by Jane Hornickel, will appear in the Feb. 20 issue of The Journal of Neuroscience.

Recording the automatic brain wave responses of 100 school-aged children to speech sounds, the Northwestern researchers found that the very best readers encoded the sound most consistently while the poorest readers encoded it with the greatest inconsistency. Presumably, the brain's response to sound stabilizes when children learn to successfully connect sounds with their meanings.

Happily biology is not destiny. In prior work in Northwestern's Auditory Neuroscience Laboratory, Kraus and her colleagues found that the inconsistency with which the poorest readers encode sound could be "fixed" through training.

In that study, children with reading impairments were fitted for a year with assistive listening devices that transmitted their teacher's voice directly into their ears. After a year, the children showed improvement not only in reading but also in the consistency with which their brains encoded speech sounds, particularly consonants.

"Use of the devices focused youngsters' brains on the "meaningful" sounds coming from their teacher, diminishing other, extraneous distractions," said Kraus. "After a year of use, the students had honed their auditory systems and no longer required the assistive devices to keep their reading and encoding advantage."

People rarely have difficulty encoding vowel sounds, which are relatively simple and long, according to Kraus. It is consonant sounds -- sounds which are shorter and more acoustically complex -- that are most likely to be incorrectly categorized by the brain.

"Understanding the biological mechanisms of reading puts us in a better position to both understand how normal reading works and to ameliorate it where it goes awry," says Kraus.

"Our results suggest that good readers profit from a stable neural representation of sound, and that children with inconsistent neural responses are likely at a disadvantage when learning to read," Kraus adds. "The good news is that response consistency can be improved with auditory training."

Decades of research from laboratories worldwide have shown that reading ability is associated with auditory skills, including auditory memory and attention, the ability to rhyme sounds and the ability to categorize rapidly occurring sounds.

http://www.eurekalert.org/pub_releases/2013-02/uobc-eod021213.php

Evolution of diversity surprisingly predictable

Similar -- or even identical -- mutations can occur during diversification in completely separate populations of E. coli evolving over more than 1,000 generations

Similar—or even identical—mutations can occur during diversification in completely separate populations of E. coli evolving over more than 1,000 generations, according to researchers at the University of British Columbia and the University of Montana.

The findings by UBC zoologist and mathematician Michael Doebeli and Matthew Herron, a postdoctoral researcher at the University of Montana, will be published next week in the open access journal PLOS Biology.

The researchers allowed three populations of E. coli, each consisting of generalist bacteria competing for two food sources (glucose and acetate), to evolve independently. After 1,200 generations all three populations had evolved into two coexisting types, each with a specialized physiology adapted to one of the foods.

Herron and Doebeli sequenced the genomes of populations of bacteria frozen at 16 different points during their evolution, and discovered a surprising amount of similarity between independently evolving populations.

"Understanding the intricacies of diversification is important for understanding why there are so many species on Earth," says Doebeli.

"Not only did similar genetic changes occur, but the temporal sequence in which the changes occur over evolutionary time was also similar between the different evolving populations. This 'parallelism' implies that diversification is a deterministic process driven by natural selection."

Herron and Doebeli argue that a particular form of selection—negative frequency dependence—plays an important role in driving diversification. When bacteria are either glucose specialists or acetate specialists, a higher density of one type will mean fewer resources for that type, so bacteria specializing on the alternative resource will be at an advantage.
Recent advances in sequencing technology allowed Doebeli and Herron to sequence large numbers of whole bacterial genomes. As technology advances, they believe similar experiments in larger organisms will be possible.

http://www.eurekalert.org/pub_releases/2013-02/iu-irr021913.php

IU research: Rock-paper-scissors a parable for cycles in finance, fashion, politics and more

Using a grown-up version of the rock-paper-scissors game, scientists offer a new theory of the group dynamics that arise in varied situations

BLOOMINGTON, Ind. -- Using a grown-up version of the rock-paper-scissors game, Indiana University cognitive scientists offer a new theory of the group dynamics that arise in situations as varied as cycles of fashion, fluctuations of financial markets, eBay bidding wars and political campaign strategies.
In a study written about this week in PLOS ONE, the researchers analyzed situations in which each person's decision depends on what they think other people will decide, looking at the riddle of "what you think I think you think I think."
What they found, said Seth Frey, doctoral candidate in the Department of Psychological and Brain Sciences in the IU College of Arts and Sciences, is that "people playing this kind of game subtly influence each other, converging on similar ways of reasoning over time. The natural analogy for the process is to a flock of birds veering in concert."
"Anticipation," he said, "may be the motor that keeps fads running in circles. It could be a source of the violent swings that we see in financial markets. Anyone in a bidding war on eBay may have been caught in this dynamic. If the bidders are tweaking their increasing bids based on the tweaks of others, then the whole group may converge in price and determine how those prices rise. The process isn't governed by the intrinsic value of that mint-condition Star Wars lunch box, but on the collective dynamics of people trying to reason through each other's thoughts."
Robert Goldstone, professor in the Department of Psychological and Brain Sciences, said they wanted "an elegant parable in a laboratory context" of the kind of real-world situations when people are trying to assess what other people are deciding. The researchers are interested in what the entire group looks like when everybody is trying to second guess everybody else. "At a core level," he said, "people's guesses do converge, and that's interesting because dominant models suggest otherwise."
Nash equilibrium, for example -- the influential theory of John Nash, a mathematician portrayed in several films and the book "A Beautiful Mind" -- would predict that everyone will end up at random places with equal probability for each round. It's a theory, Goldstone said, "that assumes full rationality, full ability to reason about what you know I know you know I know." Instead, "we are getting this systematic behavior, which is not random," he said. "Even though people are trying to beat each other out, they end up in synchrony."
Whether looking at benign social habits or mass panics, Frey and Goldstone conclude, social theorists have always treated group behavior as though it resulted from a kind of mindlessness. But this lesson from rock-paper-scissors suggests that the most sophisticated reasoning can be caught up in the subtleties of social interaction. The study, "Cyclic Game Dynamics Driven by Iterated Reasoning," is available online at PLOS ONE. This three-minute video explains the concept.

Rock-paper-scissors revisited

In the experiment, Frey and Goldstone introduce a version of rock-paper-scissors they call "the mod game." In each round, they gave small groups of five or six IU psychology undergraduates a choice of numbers from 1 and 24. Participants earned money for picking a number exactly one greater than a number chosen by someone else, with the choices wrapped around in a circle so that 1 beat 24.
Each student had to anticipate what others were going to pick, and pick the next number up, keeping in mind that everyone else was thinking the same thing. In this game of one-upmanship, the best performers aren't the ones who think the most steps ahead, but the ones who think just the right number of steps ahead -- about two, as it turned out in the experiment.
Experimental economists predict that sufficiently experienced people will continually increase the number of steps by which they think ahead. But this did not happen in the mod game. Instead, when participants were shown each previous round's results, they tended to cluster in one part of the circle of choices and start

bounding around it in sync. Groups produced a compelling periodic orbit around the choices, reminiscent of the cultural pendulum swinging back and forth, bringing, say, mustaches in and out of fashion.
The cycling behavior consistently got faster with time. With more experience, people learned to think further ahead, so the economic prediction was partly correct. But the increase was much less dramatic than economists might have thought: After 200 rounds of the mod game, the average number of thinking steps increased by only half a step, from 2 to 2.5. Moreover, the synchronicity that occurs in this game turned out to benefit everyone; a tighter grouping of choices meant a higher density of money to be earned in each round.
Robert Goldstone, Chancellor's Professor of Psychological and Brain Sciences, directs the Percepts and Concepts Laboratory in the Department of Psychological and Brain Sciences at IU Bloomington. Seth Frey is a graduate student in the lab.

http://www.eurekalert.org/pub_releases/2013-02/cumc-inj021913.php

It's not just amyloid: White matter hyperintensities and Alzheimer's disease

New findings by Columbia researchers suggest that along with amyloid deposits, white matter hyperintensities (WMHs) may be a second necessary factor for the development of Alzheimer's disease.

New York, NY - Most current approaches to Alzheimer's disease focus on the accumulation of amyloid plaque in the brain. The researchers at the Taub Institute for Research on Alzheimer's Disease and the Aging Brain, led by Adam M. Brickman, PhD, assistant professor of neuropsychology, examined the additional contribution of small-vessel cerebrovascular disease, which they visualized as white matter hyperintensities (WMHs).
The study included 20 subjects with clinically defined Alzheimer's disease, 59 subjects with mild cognitive impairment, and 21 normal control subjects. Using data from the Alzheimer's Disease Neuroimaging Initiative public database, the researchers found that amyloid and WHMs were equally associated with an Alzheimer's diagnosis. Amyloid and WMHs were also equally predictive of which subjects with mildcognitive impairment would go on to develop Alzheimer's. Among those with significant amyloid, WMHs were more prevalent in those with Alzheimer's than in normal control subjects.
Because the risk factors for WMHs—which are mainly vascular—can be controlled, the findings suggest potential ways to prevent the development of Alzheimer's in those with amyloid deposits.
"White Matter Hyperintensities and Cerebral Amyloidosis" was published online today in JAMA Neurology.
The other authors are Frank A. Provenzano, MS (CUMC and Fu Foundation School of Engineering and Applied Sciences); Jordan Muraskin, MS (CUMC and Fu Foundation School of Engineering and Applied Sciences); Guiseppe Tosto, MD (CUMC); Atul Narkhede, MS (CUMC); Ben T. Wasserman, AB (CUMC); Erica Y Griffith, BS (CUMC); Vanessa A. Guzman, BA (CUMC); Irene B. Meier, MSc (CUMC); and Molly E. Zimmerman, PhD (Albert Einstein College of Medicine, NY, NY).
The research was supported by NIH (U01 AG024904, P30 AG010129, K01 AG030514, AG029949, and AG034189).
The authors report no financial or other conflict of interest.

http://www.sciencedaily.com/releases/2013/02/130219121606.htm

In Fight Against Cancer, a Closer Look at Nuclear Blebbing

Misshapen cell nuclei are frequently observed in the cells of people with cancer and other diseases, but what causes the abnormality -- and why it is associated with certain disorders -- has remained unclear.

Researchers at Northwestern University have recently developed a mathematical model that sheds light on the defect by clarifying the mechanisms that cause bulges known as "blebs" in cells' nuclear membranes. The research -- a collaboration between experts at the McCormick School of Engineering and Applied Science and the Feinberg School of Medicine -- could be a step toward bleb prevention, which may ultimately provide potential therapies for related diseases.
A paper describing the research, titled "Mechanical Model of Blebbing in Nuclear Lamin Meshworks," was published Feb. 11 in the Proceedings of the National Academy of Sciences USA (PNAS).
"Changes in the shape of the nucleus are indicative of a range of pathologies, including the premature aging disorder Hutchinson-Gilford progeria syndrome, Emery-Dreifuss muscular dystrophy and some cancers," said Monica Olvera de la Cruz, the corresponding author of the paper. "Our research suggests that blebbing may be the result of an imbalance between the various proteins that constitute the nuclear lamina."
She is a Lawyer Taylor Professor, professor of materials science and engineering in the McCormick School and professor of chemistry in the Weinberg College of Arts and Sciences.
The nucleus -- the control center of the cell, the keeper of genetic material and overseer of cell growth and reproduction -- is covered by a nuclear envelope consisting of a double membrane and an underlying structure called the nuclear lamina that surrounds the surface of the nucleus and gives it shape. In addition to its mechanical support, the lamina helps regulate cell division and organize genetic material.

In the majority of healthy cells, the nucleus appears smooth and maintains an overall spherical shape, but abnormal nuclear shapes characterized by blebs have been observed in the cells of people suffering from some forms of cancer and other diseases.
In mammals, the lamin meshworks that make up the nuclear lamina consist of mainly two types of lamin proteins, known as types A and B, which are wrapped like two nets around the nucleus. Under normal conditions, the A-type and B-type lamins co-exist throughout the sphere, creating a healthy lamina of approximately even thickness throughout.
But when one of the B-type lamins is depleted, researchers found the A-type and B-type lamins begin to segregate from one another, resulting in an uneven mesh layer with altered mechanical properties. In some regions, the lamina's fibers begin to gap and separate, giving rise to nuclear blebs, bulges in the cell's nuclear envelope.
The nuclear lamins, especially the A-type lamins, are now considered to be major building blocks of nuclear architecture and are thus involved in numerous important nuclear functions. Much of the recent information on the functions of the nuclear lamins comes from findings demonstrating that many different human diseases are caused by hundreds of mutations in the nuclear lamin A gene. Many of these diseases are accompanied by changes in nuclear shape and altered lamin organization.
"This study helps us to begin to understand how these abnormal shapes are formed," said Robert D. Goldman, the Stephen Walter Ranson Professor of Cell and Molecular Biology, chair of the department of cell and molecular biology at the Feinberg School, and one of the paper's authors. "Collaborations between physicists and cell biologists are beginning to reveal new insights into these normal and abnormal cells."
Enabling some of those new insights, the Northwestern researchers designed an energy-minimizing continuum elastic model that enabled them to produce structures with comparable shapes and patterns as those found in naturally occurring pathological nuclei.
C. M. Funkhouser, R. Sknepnek, T. Shimi, A. E. Goldman, R. D. Goldman, M. Olvera de la Cruz. Mechanical model of blebbing in nuclear lamin meshworks. Proceedings of the National Academy of Sciences, 2013; DOI: 10.1073/pnas.1300215110

http://www.sciencedaily.com/releases/2013/02/130219140716.htm?

Diet of Resistant Starch Helps the Body Resist Colorectal Cancer

Effects of resistant starch promote the growth of good bugs while keeping bad bugs at bay

Garth Sundem.

As the name suggests, you can't digest resistant starch so it ends up in the bowel in pretty much the same form it entered your mouth. As unlovely as that seems, once in the bowel this resistant starch does some important things, including decreasing bowel pH and transit time, and increasing the production of short-chain fatty acids. These effects promote the growth of good bugs while keeping bad bugs at bay.
A University of Colorado Cancer Center review published in this month's issue of the journal Current Opinion in Gastroenterology shows that resistant starch also helps the body resist colorectal cancer through mechanisms including killing pre-cancerous cells and reducing inflammation that can otherwise promote cancer.
"Resistant starch is found in peas, beans and other legumes, green bananas, and also in cooked and cooled starchy products like sushi rice and pasta salad. You have to consume it at room temperate or below -- as soon as you heat it, the resistant starch is gone. But consumed correctly, it appears to kill pre-cancerous cells in the bowel," says Janine Higgins, PhD, CU Cancer Center investigator and associate professor of Pediatrics at the University of Colorado School of Medicine.
Higgins describes studies showing that rats fed resistant starch show decreased numbers and sizes of lesions due to colorectal cancer, and an increased number of cells that express the protein IL-10, which acts to regulate the body's inflammatory response.
"Resistant starch may also have implications for the prevention of breast cancer," Higgins says. "For example, if you let rats get obese, get them to lose the weight, and then feed half of the rats a diet high in resistant starch -- these rats don't gain back the weight as fast as rats fed a regular, digestible starch diet. This effect on obesity may help to reduce breast cancer risk as well as having implications for the treatment of colorectal cancer."
"There are a lot of things that feed into the same model of resistant starch as a cancer-protective agent," Higgins says. "Much of this information currently comes from rodent models and small clinical trials but the evidence is encouraging." On the table now is a menu of benefits and while it's just now being studied which benefits, exactly, will pan out as mechanisms of cancer prevention, one thing is clear: resistant starch should be on the menu.
Janine A. Higgins, Ian L. Brown. Resistant starch. Current Opinion in Gastroenterology, 2013; 29 (2): 190 DOI: 10.1097/MOG.0b013e32835b9aa3

http://www.eurekalert.org/pub_releases/2013-02/acs-asp022013.php

A self-healing protective coating for concrete

Scientists are reporting development of what they describe as the first self-healing protective coating for cracks in concrete, the world's most widely used building material.

Their study on the material — which is inexpensive and environmentally friendly — appears in the journal ACS Applied Materials & Interfaces.

Chan-Moon Chung and colleagues explain that protecting concrete roads, bridges and other structures from developing tiny cracks has been a major technological challenge. Cracks allow water, salt used for deicing and air to enter the concrete. During winter weather, water in the cracks freezes, expands and the cracks get bigger, with road salt speeding concrete's deterioration. "Although several reports of self-healing anticorrosive coatings for metal protection have appeared, there have been no reports on self-healing protective coating for concrete," say the scientists.

They describe development of such a coating, one that contains microcapsules loaded with a material that seals cracks. Cracking ruptures the microcapsules, releasing the healing agent. Sunlight shining onto the concrete activates and solidifies the sealant. "Our self-healing coating is the first example of capsule-type photo-induced self-healing system, and offers the advantages of catalyst-free, environment-friendly, inexpensive, practical healing," the report states.

The authors acknowledge research supported by Korea Institute of Construction & Transportation Technology Evaluation and Planning Grant funded by Ministry of Land, Transport and Maritime Affairs and by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology.

http://www.sciencedaily.com/releases/2013/02/130220084436.htm

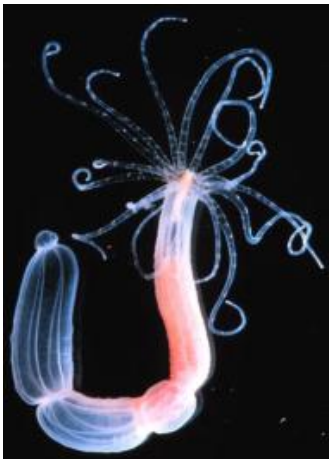
Where Does Our Head Come From?

Brainless Sea Anemone Sheds New Light On the Evolutionary Origin of the Head

A research group at the Sars Centre in Norway has shed new light on the evolutionary origin of the head. In a study published in the journal PLoS Biology they show that in a simple, brainless sea anemone, the same genes that control head development in higher animals regulate the development of the front end of the swimming larvae.

In many animals, the brain is located in a specific structure, the head, together with sensory organs and often together with the mouth. However, there are even more distantly related animals, which have a nervous system, but no brain, like sea anemones and corals.

In this study a research group led by Fabian Rentzsch used the sea anemone Nematostella vectensis to find out if one of the ends of the sea anemone corresponds to the head of higher animals. To do this they studied the function of genes that control head development in higher animals during the embryonic development of the starlet sea anemone.



Adult Nematostella polyp. **(Credit: Timm Nuechter & Thomas Holstein)**

"Despite looking completely different, it has become clear over the last decade, that all animals have a similar repertoire of genes, including those that are required to make the head of higher animals" , says first author and PhD-student Chiara Sinigaglia.

Stands on its head When the sea anemone is in the larval stage it swims. As adults, the sea anemone stands with one end on the sea floor and uses long tentacles on its upper end to catch small animals which they stuff into the only body opening in the middle of the ring of tentacles. "Based on the appearance of the adult animals, the lower end of these animals has traditionally been called the foot and the upper end the head," explains Rentzsch. What the research group found out was that in the sea anemone the "head gene" function is located at the end that corresponds to the "foot" of the adult animals. The key was to study the larvae of the sea anemones when theystill move around. "The larvae swims with the "foot" end forward and this end carries their main sense organ, so at this stage it looks more like this might be their head," says Rentzsch. And indeed, the "head genes" function on this side of the animals.

Sea anemones and all higher animals, including humans, share a common brainless ancestor which lived between 600 and 700 million years ago. "By revealing the function of "head genes" in Nematostella, we now understand better how and from where the head and brain of higher animals evolved," Sinigaglia and Rentzsch explain.

Chiara Sinigaglia, Henriette Busengdal, Lucas Leclère, Ulrich Technau, Fabian Rentzsch. The Bilaterian Head Patterning Gene six3/6 Controls Aboral Domain Development in a Cnidarian. PLoS Biology, 2013; 11 (2): e1001488 DOI: 10.1371/journal.pbio.1001488

http://io9.com/5985311/nanocapsules-could-take-you-from-sloshed-to-sober-in-a-matter-of-minutes

Nanocapsules Take You from Sloshed to Sober

Enzymes packed into tiny spheres have been shown to quickly and dramatically reduce blood alcohol levels in intoxicated mice.

Annie Engel/Corbis

Ever been drunk? So drunk you couldn't drive/speak without slurring/be trusted with a cell phone? Sure you have. Ever wished you could just sober up on the spot, without resorting to such humiliating (not to mention mythbusted) techniques as chugging coffee or splashing icewater on your face? Of course. But you can't. No such sober pill exists. But one day -- and soon -- it might.

A team of researchers led by UCLA bimolecular engineer Yunfeng Lu and USC biochemist Cheng Ji have packaged enzymes inside a nontoxic, nanoscale polymer shell that mimic the body's natural alcohol-processing activities. The "biomimetic enzyme nanocomplexes," have been shown to quickly and dramatically reduce blood alcohol levels in intoxicated mice, and show promise as "antidotes and preventive measures for alcohol intoxication."

Technology Review's Mike Orcutt has more:

To demonstrate the efficacy of the delivery method, the researchers injected the mice with capsules containing two enzymes. One of them, oxidase, produces hydrogen peroxide, so it has to work in concert with another enzyme that decomposes this potentially harmful by-product. The researchers report that the mice receiving the enzyme treatment saw their blood alcohol content fall quickly and significantly compared with controls.

The advance could open the door to a new class of enzyme drugs, says Lu. Down the road, for example, he envisions an alcohol prophylactic or antidote that could be taken orally. Since alcohol metabolism naturally occurs in the liver, it would "almost be like having millions of liver cell units inside your stomach or in your intestine, helping you to digest alcohol," he says.

We're wondering what sort of social, behavioral and biological consequences might come with the introduction of an "alcohol antidote" that allows you to sober up at an accelerated rate. On one hand, it could help you get a better night's sleep; crawling into bed with a blood alcohol content in the range of 0.06 to 0.08 tends to exact a serious toll on your body during the second half of your normal sleep period, during what's called a "rebound effect." A sober pill, taken shortly before bedtime, could reduce the recommended 4-hour time window between your last drink and hitting the hay.

But it's also worth considering what effect such an alcohol antiserum might have on people's behavior. If sobriety were a pill and a short wait away, how might it affect your drinking habits? The potential for abuse is glaringly obvious.

The nanocapsule technique has applications beyond alcohol prophylactics. Mimicking the function of the body's organelles (cellular sub-compartments that contain many functionally complementary enzymes) has been a longstanding challenge for synthetic biologists; but Lu and Ji appear to have found an effective solution. We're interested in seeing where this work heads next.

Lu and Ji's findings are published in the latest issue of Nature Nanotechnology.

http://www.eurekalert.org/pub_releases/2013-02/bmj-dps021913.php

Digital processing system avoids 17.4 million drug errors in US in 1 year

But potential to avoid more than 50 million if more widely adopted in hospitals

Processing a prescription through an electronic ordering system can halve the likelihood of a drug error, and avert more than 17 million such incidents in US hospitals in one year alone, indicates research published online in the Journal of the American Medical Informatics Association. And if much more widely adopted than at present, the system has the potential to cut out 50 million drug errors a year, calculate the researchers.

The US Institute of Medicine estimates that, on average, at least one mistake will be made with a hospital patient's medication every day.

Computerised provider order entry systems, or CPOE for short, process prescriptions or test requests electronically, sending them directly to the relevant individual/department. They aim to improve quality and safety by avoiding the need to rely on handwritten instructions, and by providing inbuilt checks on doses and potentially harmful interactions with other medications, so cutting down on the risk of mistakes.

The researchers systematically analysed the published evidence on the impact of CPOE on hospital drug errors and combined this with data on the adoption of CPOE by hospitals and the volume of medication orders processed, using several reliable sources.

These included the 2006 American Society of Health System Pharmacists Annual Survey, the 2007 American Hospital Association (AHA) Annual Survey (4701 hospitals in total), and the Association's own data on uptake of electronic health records.
The final analysis calculated the estimated reduction in drug errors for 2008. It showed that CPOE halves the likelihood of a drug error. And when put in the context of the number of US hospitals that had adopted the system by 2008, the authors calculated that it cut these errors by 12.5% nationally.
That equates to around 17.4 million drug errors avoided in 2008 alone, they say.
Yet the AHA survey indicated that only one in three acute care hospitals had adopted CPOE by 2008. Larger, urban, and teaching hospitals were significantly more likely to have done so. Those hospitals that had adopted the system were enthusiasts, with almost four out of 10 respondents saying that they processed 90% of their orders this way. But a significant proportion (42%) said they used it less than half the time, equating to around a quarter of all medication orders processed by CPOE across the board, say the authors.
"Despite CPOE systems' effectiveness at preventing medication errors, adoption and use in US hospitals remains modest," write the authors, adding that "great potential" remains to cut the tally of drug errors still further. "If all US hospitals adopted CPOE, assuming constant implementation levels of around 60%, 51 million medication errors per year could be averted compared with what would have been expected without CPOE," they say.
Reduction in medication errors in hospitals due to adoption of computerized provider order entry systems Online First doi 10.1136/amiajnl-2012-001241

http://www.sciencedaily.com/releases/2013/02/130220184943.htm

Fish Oil Component Reduces Brain Damage in Newborns, Mouse Study Suggests

Novel use of a component of fish oil reduced brain trauma in newborn mice

Research conducted by a team of scientists from Columbia University College of Physicians and Surgeons and Dr. Nicolas Bazan, Boyd Professor and Director of the Neuroscience Center of Excellence at LSU Health Sciences Center New Orleans, found the novel use of a component of fish oil reduced brain trauma in newborn mice. The study reports that neonatal brain damage decreased by about 50% when a triglyceride lipid emulsion containing docosahexaenoic acid (DHA) was injected within two hours of the onset of ischemic stroke.
The study compared the effectiveness of emulsions with two omega-3 fatty acids -- DHA and eicosapentaenoic acid (EPA) -- as well as optimal doses and therapeutic window. The researchers found that DHA provided protection while EPA did not. The therapeutic window ranged from 90 minutes prior to several hours after with the optimal window for treatment 0 -- 2 hours. There was no protective effect at hour 4.
DHA is an essential omega-3-fatty acid and is vital for proper brain function. It is also necessary for the development of the nervous system, including vision. Moreover, omega-3 fatty acids, found in cold water fatty fish, including salmon, tuna, mackerel, sardines, shellfish, and herring, are part of a healthy diet that helps lower the risk of heart disease. DHA has potent anti-inflammatory effects. Since inflammation is at the root of many chronic diseases, DHA treatment has been widely demonstrated to have beneficial effects in patients with coronary heart disease, asthma, rheumatoid arthritis, osteoporosis, sepsis, cancer, dry eye disease, and age-related macular degeneration. Its potential benefit in stroke is now being documented.
EPA is also an omega-3 fatty acid found in coldwater fish. EPA can prevent the blood from clotting easily. Often paired with DHA in fish oil supplements, these fatty acids are known to reduce pain and swelling.
Ischemic strokes, representing about 87% of strokes, result from loss of blood flow to an area of the brain due to a blockage such as a clot or atherosclerosis. The damage includes an irreversibly injured core of tissue at the site of the blockage. The area of tissue surrounding the core, called the penumbra, is also damaged but potentially salvageable. The penumbra has a limited life span and appears to undergo irreversible damage within a few hours unless blood flow is reestablished and neuroprotective therapy is administered. A cascade of chemicals floods the tissue along with restored blood flow, including damaging free radicals and pro-inflammatory enzymes which can cause further damage and cell death.
Administering clot-busting drugs (thrombolysis) is currently the only treatment for ischemic stroke. But due to a narrow therapeutic window and complexity of administration, only 3-5% of patients typically benefit from thrombolysis.
Dr. Bazan's group at the LSU Health Sciences Center New Orleans Neuroscience Center of Excellence has increasingly shown that DHA is a potentially powerful treatment for stroke for nearly ten years. His study published in 2011 found DHA triggered production of Neuroprotectin D1 (NPD1), a naturally occurring neuroprotective molecule in the brain derived from DHA and discovered by Dr. Bazan. Not only did DHA treatment salvage stroke-damaged brain tissue that would have died, its repair mechanisms rendered some areas indistinguishable from normal tissue by 7 days.

"Stroke is a brain attack that each year kills 130,000 Americans," notes Dr. Bazan. "Strokes can occur at any age, including in newborns, with long-term and devastating consequences. DHA is already widely consumed as a dietary supplement in the US, and from a therapeutic point of view, we can now see a light at the end of the tunnel."

The researchers conclude that the findings suggest a need for further studies to determine if acute injection of these emulsions could be neuroprotective after stroke injury in humans. They also suggest that the emulsion rich in DHA will prove to be a novel and important therapy to treat stroke and could decrease mortality and increase long-term functional recovery after stroke in humans of different ages. The paper's senior author is Richard Deckelbaum, MD, director of the Institute of Human Nutrition at Columbia's College of Physicians & Surgeons.

According to the Centers for Disease Control and Prevention, 795,000 Americans have a stroke each year, and stroke causes 1 in every 18 deaths. Stroke is also a leading cause of long-term disability. Louisiana is among the states with the highest prevalence of stroke. It has been estimated that the direct and indirect costs of stroke in the United States totaled nearly $74 billion in 2010. In addition, with an estimated incidence of 1 in 2300 to 5000 births, stroke is more likely to occur in the perinatal period than at other times in childhood. Ischemic stroke in newborns is a disorder associated with significant long-term neurologic impairment. Twenty to 60% of survivors exhibit long-term detrimental neuropsychological consequences which include mental retardation, cerebral palsy, and behavioral disorders.

Jill J. Williams, Korapat Mayurasakorn, Susan J. Vannucci, Christopher Mastropietro, Nicolas G. Bazan, Vadim S. Ten, Richard J. Deckelbaum. N-3 Fatty Acid Rich Triglyceride Emulsions Are Neuroprotective after Cerebral Hypoxic-Ischemic Injury in Neonatal Mice. PLoS ONE, 2013; 8 (2): e56233 DOI: 10.1371/journal.pone.0056233

http://www.eurekalert.org/pub_releases/2013-02/bmj-sd021913.php

Scrap 'unwinnable' drugs war and divert funds into curbing global antibiotic misuse

Antibiotic resistance poses far more serious threat to human health, claims ethicist

Governments around the world should stop squandering resources fighting an "unwinnable war" against illegal drugs, such as cocaine and heroin. Instead, they should use the cash to curb antibiotic misuse, which poses a far more serious threat to human health, claims a leading ethicist in the Journal of Medical Ethics.

Dr Jonny Anomaly, of Duke University, Durham in North Carolina, USA, says that concerted collective action is needed to tackle the excessive and casual prescribing of antibiotics, which has led to a worrying rise in resistance to these medicines. "Government action is both more appropriate and more likely to be effective in regulating antibiotics than it is in criminalising narcotics," he writes.

Dr Anomaly says the arguments put forward for continuing to plough resources into the war on illegal drugs, such as the need to curb the related violence and social harms, should, of course, be taken seriously.

But he contends that "most of the violence and crime associated with narcotics is caused by laws that prohibit drug use, rather than drug use itself." And the argument that stimulant drugs increase violent tendencies is not based on strong evidence, he says.

He accepts that a drug habit takes its toll on friends and family, but argues that this does not justify treating this behaviour as a crime. And while supporters of tough action on illegal drugs fear that the absence of harsh penalties will simply make it easier to get hold of them, Dr Anomaly points to the evidence in Portugal—the only country that has decriminalised recreational drug use.

This "suggests that consumption has not significantly increased for most drugs, and has actually declined for some…greater accessibility does not necessarily lead to more drug use by either adults or children," he writes.

At the very least antibiotic resistant infections have the power to harm others and make illness more costly to treat, and they can often kill, he warns.

"This feature gives antimicrobial drugs a fundamentally different moral status from recreational drugs, and it suggests that current policy priorities are based on moral confusion, scientific ignorance, or both," he suggests.

He puts forward several possible ways of tackling antibiotic resistance.

These include phasing out the use of these drugs in farming, along with factory farming; cash incentives for pharmaceutical companies to conserve existing drugs; banning over the counter sales of antibiotics in developing nations; and global surveillance of resistant bacteria, spearheaded by the world's wealthy nations.

In addition to this, a flat user fee should be levied on courses of antibiotics, the monies from which could be used to fund antibiotic research, he suggests.

"A user fee would not be a panacea. But it could be a crucial part of a multidimensional approach to the problem of resistance. User fees are especially attractive because of their fairness and simplicity," he says.

Collective action and individual choice: rethinking how we regulate narcotics and antibiotics Online First doi: 10.1136/medethics-2012-101160

http://bit.ly/XoXWRo

Three Radical New Brain-Mapping Tools Scientists Want Obama to Deliver

Three future technologies that are being considered for mapping the human brain

By Greg Miller

The Obama administration wants to make a huge investment in mapping the human brain, according to The New York Times. How can they get the most bang for their buck? We have details on three future technologies that are being eyed by the scientists behind the bold proposal.

The U.S. already has one big brain-mapping effort under way, the Human Connectome Project, which aims to map the connections between regions of the human brain. The new project would go beyond this static depiction and map the activity of individual neurons in real time.

"All the really interesting features of the brain — language, perception, cognition, the mind — emerge from collections of neurons interacting with each other in ways we don't understand," said neuroscientist John Donoghue of Brown University, one of the architects of the proposed project. It's those interactions, the electrochemical blips coursing through networks of interconnected neurons, that the new Brain Activity Map project aims to capture.

The Connectome project focuses mostly on static images of the brain. Although it does include some measures of brain activity, the fMRI scans it will use provide a view that's something like that of a city seen from an airplane window. What the scientists behind the proposed Brain Activity Map want instead are detailed street maps with real-time traffic info. Ideally, they want to record every blip of every neuron in a network of thousands, or even millions.

The scientists hope they'll get as much as $3 billion over the next decade to build a new set of dream tools for studying how the human brain works when it's healthy and what goes wrong in disorders like epilepsy and Alzheimer's disease. Here are three ideas they've discussed, all in various stages of development.

"Sure, they sound far-fetched," Donoghue said. "But we're on the cusp of being able to do them."

Neuro-nanotech

For decades, the workhorse method for recording the activity of individual neurons has been hair-thin metal electrodes. Not only are they invasive — like sticking a toothpick into a bowl of Jello — but they only record from one neuron at a time. More recently, scientists have built grids with dozens of electrodes. Donoghue's team, for example, has shown that signals from just 100 neurons or so are enough to allow a paralyzed person to operate a robotic arm.

But even that may start to look crude by comparison. Harvard physicist Hongkun Park is one of several scientists trying to pack hundreds of thousands of nanowire electrodes into flexible sheets that conform to the surface of the brain and can eavesdrop on neurons with minimal tissue damage. "I didn't know we could make such things," says Donoghue, who saw Park talk about his work at an early planning meeting for the brain-mapping project.

Optobiology

Optical methods have already revolutionized neuroscience in the past decade, providing new ways to record and manipulate the activity of neurons with light. But that's just a start, says Rafael Yuste, a neuroscientist at Columbia University and one of the scientists behind the proposed mapping project. "We've just seen an appetizer of what optics can do in the brain," Yuste said.

Imagine that your brain is a giant TV with 100 billion pixels and it's playing a movie. "Each pixel is a neuron and that movie is your mind," Yuste said. With a conventional electrode, a neuroscientist can watch one pixel/neuron at a time, and she'd have no clue what the movie is about. Today's state-of-the-art optical recording methods can capture 100 neurons or more, but there's a time lag that blurs the picture. To even begin to be able to follow the plot, researchers need to follow 100,000 neurons with no time delay, Yuste says. That will require better chemical sensors for visualizing electrical activity, as well as better optical hardware.

Another huge obstacle is peering deeper into the brain. "For hundreds of years people have designed microscopes to focus on a single plane," Yuste said. "We have to redesign the microscope to focus on all the planes at the same time so we can see in 3-D." That will require help from physicists and engineers, which are exactly the kind of collaborations Yuste and others hope the new mapping project will inspire. "There's enough ideas in the hopper to make me confident that major progress will happen," he said.

Synthetic biology sensors

DNA can store vast amounts of data in a tiny space. Harvard molecular technologist George Church famously used it to store his book, and now Church says DNA also could be used to record neural activity. He estimates that the 3 billion base pairs of the human genome have enough storage capacity to record everything a neuron does for a week, or at least every electrical spike, assuming it fires 100 times per second.

One strategy for doing this, which his team described last year in PLoS ONE, involves enzymes called DNA polymerases, whose job it is to make exact copies of a DNA sequence. But some of these enzymes have a tendency to mess up in the presence of positive ions, which happen to be exactly what floods into a neuron when it fires. The mistakes made by the polymerase create a record of the neuron's firing that could be read out later in the sequence of the copied DNA.
It's a long way from being practical, but Church is already thinking about how to get the DNA recorders into the brain (smuggle them inside synthetic immune cells, perhaps) and how to recover the ticker-tape record of neural firing once it's made (possibly reading it out with still-to-be invented optical methods that could even identify which neuron it came from).

http://nyti.ms/XtjIk2

Nanotubes Seen as Alternative When Silicon Chips Hit Their Limits

In the next decade or so, the circuits etched on silicon-based computer chips are expected to shrink as small as they can physically become, prompting a search for alternative materials to take their place.

By JOHN MARKOFF

SAN FRANCISCO - Some researchers are putting high hopes on carbon nanotubes, and on Monday a group of researchers at Stanford successfully demonstrated a simple microelectronic circuit composed of 44 transistors fabricated entirely from the threadlike fibers.
The development, which was presented both as a paper and a working demonstration at a technical conference here, is the most striking evidence yet that carbon nanotubes may prove to be the material of the future when today's silicon-based chips reach their fundamental physical limits.
I.B.M., which is one of the biggest proponents of nanotubes for microelectronic applications, has made clear its hope that carbon nanotube technology will be ready a decade from now, when semiconductors are expected to shrink to minimum dimensions of just 5 nanometers. But until now, researchers at universities and chip makers have succeeded in making only individual devices, like transistors, from carbon nanotubes.
The Stanford development is the first time a complete working circuit has been created and publicly demonstrated, suggesting that the material may indeed live up to its promise.
Silicon, a plentiful natural element that functions both as a conductor and an insulator, has already lasted decades longer than computer engineers originally expected, as generations of increasingly smaller transistors have been perfected. It is used by the computer chip industry to etch circuits much finer than the wave length of light, and engineers and scientists say they believe that the material will continue to scale down, at least until the end of the decade.
But sooner or later the shrinking of circuits made from the material will stop, ending the microelectronic era that has been defined by Moore's Law, the 1965 observation by the Intel co-founder Gordon Moore that the number of transistors that could be placed on a silicon chip doubled at regular intervals.
The Stanford advance seems to hold promise for the belief that whenever the silicon era stalls, the scaling-down process will continue, and permit designers to increase power and capacity of computers far into the future.
The Stanford demonstration came during a session at the International Solid State Circuits Conference, held here annually. A graduate student, Max Shulaker, chose a wooden, human-size hand, connected to a simple motor and gear arrangement on a makeshift stand. Onstage, he threw a switch and the hand shook vigorously.
It was a simple demonstration, but the research group said its goal was to build an entire microprocessor from carbon nanotubes to confirm the potential of the material.
Besides their small size, carbon nanotubes use much less power and switch faster than today's silicon transistors. "The bottom line is you can expect an order of magnitude in power saving at the system level," said Subhasish Mitra, an associate professor of electrical engineering at Stanford and director of the Robust Systems Group. That offers tremendous promise for effectively increasing the battery life in mobile consumer devices in the future, he said.
Other new materials and variations of silicon-based transistors are also being studied to see if they will shrink to smaller sizes. Intel, for example, last year began using a three-dimensional transistor called a FinFET. By turning the device on its side, the chip maker was able to pack transistors more densely on the surface of a chip.
"I'm not saying there is nothing else around," said H.-S. Philip Wong, a Stanford electrical engineering professor. "It's just a matter of who wins when you scale down to really, really small dimensions."
The challenge of carbon nanotubes in their type state is that they form a giant "hairball" of interwoven molecules. However, by chemically growing them on a quartz surface, the researchers are able to align them closely and in regularly spaced rows. They then transfer them to a silicon wafer, where they used conventional photolithographic techniques to make working circuits.

The technological hurdle has been to make reliable circuits even when a small percentage of the wires are misaligned. The Stanford group stated it had perfected a circuit technique that made use of redundancy to work around the imperfectly formed wires.
Dr. Mitra said that "99.5 percent looks very nice on a PowerPoint slide. But when you're talking about 10 billion things, .5 percent of 10 billion is a really large number, and that completely messes things up."
Beyond microelectronics, carbon nanotubes are showing promise in commercial applications like rechargeable batteries, bicycle frames, ship hulls, solar cells and water filters, according to an article in the Feb. 1 issue of the journal Science.

http://www.eurekalert.org/pub_releases/2013-02/isu-ksh022013.php

Kepler spacecraft helps astronomers find tiny planet beyond our solar system

The Kepler spacecraft finds planets beyond our solar system by detecting changes in star brightness when a planet passes in front of a star.

AMES, Iowa – An international team of astronomers has used nearly three years of high precision data from NASA's Kepler spacecraft to make the first observations of a planet outside our solar system that's smaller than Mercury, the smallest planet orbiting our sun. The planet is about the size of the Earth's moon. It is one of three planets orbiting a star designated Kepler-37 in the Cygnus-Lyra region of the Milky Way.
The findings are published were published online on Feb. 20 by the journal Nature. The lead authors are Thomas Barclay of the NASA Ames Research Center in California and the Bay Area Environmental Research Institute and Jason Rowe of NASA Ames and the SETI Institute in California.
Steve Kawaler, an Iowa State University professor of physics and astronomy, was part of a team of researchers who studied the oscillations of Kepler-37 to determine its size. "That's basically listening to the star by measuring sound waves," Kawaler said. "The bigger the star, the lower the frequency, or 'pitch' of its song."
The team determined Kepler-37's mass is about 80 percent the mass of our sun. That's the lowest mass star astronomers have been able to measure using oscillation data for an ordinary star. Those measurements also allowed the main research team to more accurately measure the three planets orbiting Kepler-37, including the tiny Kepler-37b.
"Owing to its extremely small size, similar to that of the Earth's moon, and highly irradiated surface, Kepler-37b is very likely a rocky planet with no atmosphere or water, similar to Mercury," the astronomers wrote in a summary of their findings. "The detection of such a small planet shows for the first time that stellar systems host planets much smaller as well as much larger than anything we see in our own Solar System."
Kawaler said the discovery is exciting because of what it says about the Kepler Mission's capabilities to discover new planetary systems around other stars.
Kepler launched March 6, 2009, from Florida's Cape Canaveral Air Force Station. The spacecraft is orbiting the sun carrying a photometer, or light meter, to measure changes in the brightness of thousands of stars. Its primary job is to detect tiny variations in the brightness of the stars within its view to indicate planets passing in front of the star. Astronomers with the Kepler team are looking for earth-like planets that might be able to support life.
The Kepler Asteroseismic Investigation is also using data from that photometer to study stars. The investigation is led by a four-member steering committee: Kawaler, Chair Ron Gilliland of the Space Telescope Science Institute based in Baltimore, Jorgen Christensen-Dalsgaard and Hans Kjeldsen, both of Aarhus University in Denmark.
Kawaler said Kepler is sending astronomers photometry data that's "probably the best we'll see in our lifetimes." This latest discovery shows astronomers "we have a proven technology for finding small planets around other stars." That could have implications for some big-picture discoveries: "While a sample of only one planet is too small to use for determination of occurrence rates," the astronomers write in the Nature paper, "it does lend weight to the belief that planet occurrence increases exponentially with decreasing planet size."

http://www.eurekalert.org/pub_releases/2013-02/bcfq-smo022113.php

Scientists make older adults less forgetful in memory tests

Finding could impact how older adults remember appointments and manage busy daily schedules

Toronto, Canada – Scientists at Baycrest Health Sciences' Rotman Research Institute (RRI) and the University of Toronto's Psychology Department have found compelling evidence that older adults can eliminate forgetfulness and perform as well as younger adults on memory tests. Scientists used a distraction learning strategy to help older adults overcome age-related forgetting and boost their performance to that of younger adults. Distraction learning sounds like an oxymoron, but a growing body of science is showing that older brains are adept at

processing irrelevant and relevant information in the environment, without conscious effort, to aid memory performance.
"Older brains may be be doing something very adaptive with distraction to compensate for weakening memory," said Renée Biss, lead investigator and PhD student. "In our study we asked whether distraction can be used to foster memory-boosting rehearsal for older adults. The answer is yes!"
"To eliminate age-related forgetfulness across three consecutive memory experiments and help older adults perform like younger adults is dramatic and to our knowledge a totally unique finding," said Lynn Hasher, senior scientist on the study and a leading authority in attention and inhibitory functioning in younger and older adults. "Poor regulation of attention by older adults may actually have some benefits for memory."
The findings, published online yesterday in Psychological Science, ahead of print publication, have intriguing implications for designing learning strategies for the mature, older student and equipping senior-housing with relevant visual distraction cues throughout the living environment that would serve as rehearsal opportunities to remember things like an upcoming appointment or medications to take, even if the cues aren't consciously paid attention to.

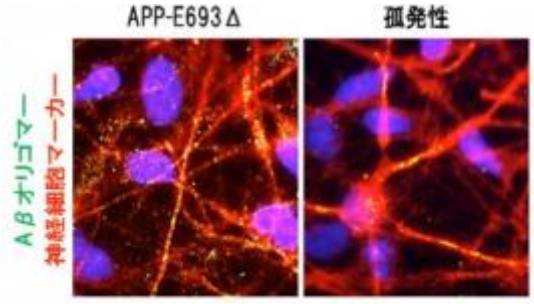
The study

In three experiments, healthy younger adults recruited from the University of Toronto (aged 17– 27) and healthy older adults from the community (aged 60 – 78) were asked to study and recall a list of words after a short delay and again, on a surprise test, after a 15-minute delay. During the delay period, half of the studied words occurred again as distraction while people were doing a very simple attention task on pictures. Although repeating words as distracters had no impact on the memory performance of young adults, it boosted older adults' memory for those words by 30% relative to words that had not repeated as distraction.
"Our findings point to exciting possibilities for using strategically-placed relevant distraction as memory aids for older adults – whether it's in classroom, at home or in a long term care environment," said Biss.
While older adults are watching television or playing a game on a tablet, boosting memory for goals (such as remembering to make a phone call or send a holiday card) could be accomplished by something as simple as running a stream of target information across the bottom of their tablet or TV.
The study was supported by a grant from the Canadian Institutes of Health Research and the Natural Sciences and Engineering Research Council of Canada.

http://www.eurekalert.org/pub_releases/2013-02/cfic-mad022013.php

Modeling Alzheimer's disease using iPSCs

Study reveals stress phenotypes associated with intracellular amyloid beta and differential drug responsiveness



Kyoto, Japan – Working with a group from Nagasaki University, a research group at the Center for iPS Cell Research and Application (CiRA) at Japan's Kyoto University has announced in the Feb. 21 online publication of Cell Stem Cell has successfully modeled Alzheimer's disease (AD) using both familial and sporadic patient-derived induced pluripotent stem cells (iPSCs), and revealed stress phenotypes and differential drug responsiveness associated with intracellular amyloid beta oligomers in AD neurons and astrocytes.

***This shows amyloid beta oligomers in neurons from a familial AD (APP-E693 delta) (left) and from a sporadic AD patient (right).*Credit: Courtesy of Dr. Haruhisa Inoue's laboratory**

In a study published online in Cell Stem Cell, Associate Professor Haruhisa Inoue and his team at CiRA and a research group led by Professor Nobuhisa Iwata of Nagasaki University generated cortical neurons and astrocytes from iPSCs derived from two familial AD patients with mutations in amyloid precursor protein (APP), and two sporadic AD patients. The neural cells from one of the familial and one of the sporadic patients showed endoplasmic reticulum (ER)-stress and oxidative-stress phenotypes associated with intracellular amyloid beta oligomers. The team also found that these stress phenotypes were attenuated with docosahexaenoic acid (DHA) treatment. These findings may help explain the variable clinical results obtained using DHA treatment, and suggest that DHA may in fact be effective only for a subset of patients.
Using both familial and sporadic AD iPSCs, the researchers discovered that pathogenesis differed between individual AD patients. For example, secreted amyloid beta 42 levels were depressed in familial AD with APP E693 delta mutation, elevated in familial AD with APP V717L mutation, but normal in sporadic AD.
``This shows that patient classification by iPSC technology may contribute to a preemptive therapeutic approach toward AD," said Inoue, a principal investigator at CiRA who is also a research director for the

CREST research program funded by the Japan Science and Technology Agency. ``Further advances in iPSC technology will be required before large-scale analysis of AD patient-specific iPSCs is possible."
Kondo et al. "Modeling Alzheimer's disease using iPSCs reveals stress phenotypes associated with intracellular amyloid beta and differential drug responsiveness."

http://www.eurekalert.org/pub_releases/2013-02/miot-hhl022113.php

How human language could have evolved from birdsong

Darwin speculated language might have had its origins in singing. He was likely on the right path.

Peter Dizikes, MIT News Office

CAMBRIDGE, MA -- "The sounds uttered by birds offer in several respects the nearest analogy to language," Charles Darwin wrote in "The Descent of Man" (1871), while contemplating how humans learned to speak. Language, he speculated, might have had its origins in singing, which "might have given rise to words expressive of various complex emotions."

Now researchers from MIT, along with a scholar from the University of Tokyo, say that Darwin was on the right path. The balance of evidence, they believe, suggests that human language is a grafting of two communication forms found elsewhere in the animal kingdom: first, the elaborate songs of birds, and second, the more utilitarian, information-bearing types of expression seen in a diversity of other animals.

"It's this adventitious combination that triggered human language," says Shigeru Miyagawa, a professor of linguistics in MIT's Department of Linguistics and Philosophy, and co-author of a new paper published in the journal Frontiers in Psychology.

The idea builds upon Miyagawa's conclusion, detailed in his previous work, that there are two "layers" in all human languages: an "expression" layer, which involves the changeable organization of sentences, and a "lexical" layer, which relates to the core content of a sentence. His conclusion is based on earlier work by linguists including Noam Chomsky, Kenneth Hale and Samuel Jay Keyser.

Based on an analysis of animal communication, and using Miyagawa's framework, the authors say that birdsong closely resembles the expression layer of human sentences — whereas the communicative waggles of bees, or the short, audible messages of primates, are more like the lexical layer. At some point, between 50,000 and 80,000 years ago, humans may have merged these two types of expression into a uniquely sophisticated form of language.

"There were these two pre-existing systems," Miyagawa says, "like apples and oranges that just happened to be put together."

These kinds of adaptations of existing structures are common in natural history, notes Robert Berwick, a professor of computational linguistics at MIT who is also an author of the paper.

"When something new evolves, it is often built out of old parts," Berwick says. "We see this over and over again in evolution. Old structures can change just a little bit, and acquire radically new functions."

A new chapter in the songbook

The new paper, "The Emergence of Hierarchical Structure in Human Language," was co-written by Miyagawa, Berwick and Kazuo Okanoya, a biopsychologist at the University of Tokyo who is an expert on animal communication.

To consider the difference between the expression layer and the lexical layer, take a simple sentence: "Todd saw a condor." We can easily create variations of this, such as, "When did Todd see a condor?" This rearranging of elements takes place in the expression layer and allows us to add complexity and ask questions. But the lexical layer remains the same, since it involves the same core elements: the subject, "Todd," the verb, "to see," and the object, "condor."

Birdsong lacks a lexical structure. Instead, birds sing learned melodies with what Berwick calls a "holistic" structure; the entire song has one meaning, whether about mating, territory or other things. The Bengalese finch, as the authors note, can loop back to parts of previous melodies, allowing for greater variation and communication of more things; a nightingale may be able to recite from 100 to 200 different melodies.

By contrast, other types of animals have bare-bones modes of expression without the same melodic capacity. Bees communicate visually, using precise waggles to indicate sources of foods to their peers; other primates can make a range of sounds, comprising warnings about predators and other messages.

Humans, according to Miyagawa, Berwick and Okanoya, fruitfully combined these systems. We can communicate essential information, like bees or primates — but like birds, we also have a melodic capacity and an ability to recombine parts of our uttered language. For this reason, our finite vocabularies can generate a seemingly infinite string of words. Indeed, the researchers suggest that humans first had the ability to sing, as Darwin conjectured, and then managed to integrate specific lexical elements into those songs.

"It's not a very long step to say that what got joined together was the ability to construct these complex patterns, like a song, but with words," Berwick says.
As they note in the paper, some of the "striking parallels" between language acquisition in birds and humans include the phase of life when each is best at picking up languages, and the part of the brain used for language. Another similarity, Berwick notes, relates to an insight of celebrated MIT professor emeritus of linguistics Morris Halle, who, as Berwick puts it, observed that "all human languages have a finite number of stress patterns, a certain number of beat patterns. Well, in birdsong, there is also this limited number of beat patterns."

Birds, bees — and dolphins?

The researchers acknowledge that further empirical studies on the subject would be desirable.
"It's just a hypothesis," Berwick says. "But it's a way to make explicit what Darwin was talking about very vaguely, because we know more about language now."
Miyagawa, for his part, asserts it is a viable idea in part because it could be subject to more scrutiny, as the communication patterns of other species are examined in further detail. "If this is right, then human language has a precursor in nature, in evolution, that we can actually test today," he says, adding that bees, birds and other primates could all be sources of further research insight.
MIT-based research in linguistics has largely been characterized by the search for universal aspects of all human languages. With this paper, Miyagawa, Berwick and Okanoya hope to spur others to think of the universality of language in evolutionary terms. It is not just a random cultural construct, they say, but based in part on capacities humans share with other species. At the same time, Miyagawa notes, human language is unique, in that two independent systems in nature merged, in our species, to allow us to generate unbounded linguistic possibilities, albeit within a constrained system.
"Human language is not just freeform, but it is rule-based," Miyagawa says. "If we are right, human language has a very heavy constraint on what it can and cannot do, based on its antecedents in nature."

http://www.eurekalert.org/pub_releases/2013-02/plos-apn021913.php

A promising new method for next-generation live-attenuated viral vaccines against Chikungunya virus

Engineered virus is a new vaccine candidate for this emerging viral disease

Researchers have successfully applied a novel method of vaccine creation for Chikungunya virus (CHIKV) using a technique called large scale random codon re-encoding. Using this approach, a group from the UMR_D 190, Emerging viruses Department in Marseille, France in collaboration with the University of Sydney, Australia, demonstrated that the engineered viruses exhibit a stable phenotype with a significantly decreased viral fitness (i.e., replication capacity), making it a new vaccine candidate for this emerging viral disease. This new report publishes on February 21 in the Open Access journal, PLOS Pathogens.
There is an immense need for the development of vaccines targeting many emerging viral pathogens. CHIKV has been responsible for several million human cases over the last decade and represents a striking example of a re-emerging, arthropod-borne, human pathogen for which no licensed vaccine exists. Worryingly, one of the vectors of CHIKV, the mosquito Aedes albopictus, has dispersed into new regions (including temperate areas) resulting in outbreaks of this disease where they had never been previously observed, for example in Italy.
Using the large-scale codon re-encoding method, Antoine Nougairede and colleagues were able to synthetically modify the nucleic acid composition of the virus without modifying the encoded viral proteins. When this method was applied to poliovirus and Influenza A virus, it resulted in a live but attenuated virus that had significant reduction of viral fitness. In contrast with previous studies, which employed a targeted approach of codon re-encoding, this new study demonstrates that a random approach reduced the replicative fitness of CHIKV in both primate and arthropod cells. The employed strategy also prevented the reversion of the attenuated phenotype by mutation or recombination, thus reducing the possibility that the newly created virus strain could evolve back to the pathogenic version.
The findings by Nougairede et al. suggest that large-scale codon re-encoding can provide a strong basis for the rapid design of next-generation viral vaccines against emerging viral pathogens, as soon as their genome sequence has been determined. It represents an exciting route to vaccine development because it intrinsically alleviates the likelihood of novel pathogenic properties of the designed live vaccine, and allows modulation of the amount of reduced fitness by altering the terms and degree of the genetic re-encoding. Thus, this strategy potentially allows for the generic development of live attenuated vaccines against many new viral pathogens, with reduced costs and the potential single dose induction of long-term immunity.
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http://dx.plos.org/10.1371/journal.ppat.1003172 (link will go live upon embargo lift)
CITATION: Nougairede A, De Fabritus L, Aubry F, Gould EA, Holmes EC, et al. (2013) Random Codon Re-encoding Induces Stable Reduction of Replicative Fitness of Chikungunya Virus in Primate and Mosquito Cells. PLoS Pathog 9(2): e1003172. doi:10.1371/journal.ppat.1003172

http://www.eurekalert.org/pub_releases/2013-02/uof-rsm021913.php

Research suggests malaria can be defeated without a globally led eradication program

Malaria does not have to be eradicated globally for individual countries to succeed at maintaining elimination of the disease

GAINESVILLE, Fla. --- Malaria does not have to be eradicated globally for individual countries to succeed at maintaining elimination of the disease, according to research from the University of Florida's Emerging Pathogens Institute and department of geography, to be published in the journal Science Feb. 22.

Researchers Andrew Tatem and Christina Chiyaka found that those countries that have eliminated malaria have maintained their malaria-free states with remarkable stability, going against traditional theory. Between 1945 and 2010, 79 countries eliminated malaria and 75, or 95 percent, remained malaria-free, shrinking the geographic range of the disease, the researchers said.

For the 99 countries with endemic malaria today, the research by Tatem and his colleagues has important implications for tackling the problem. The elimination of malaria may be less costly to achieve and maintain than previously thought, Tatem said.

"Traditional theory suggests that we have to get rid of malaria completely, all across the world, all at around the same time, to keep new cases from being imported and starting outbreaks in elimination countries all over again," said Tatem, who conducted the research at UF and now is a professor at the University of Southampton in the United Kingdom. Chiyaka also has moved to the United Kingdom with her family.

The researchers found, however, that malaria elimination may be a 'sticky state,' meaning that once elimination is achieved, resurgence becomes a rare event.

"For instance, the United States imports 1,500 cases of malaria per year but has seen very few local outbreaks resulting from these, despite still having mosquitoes capable of spreading malaria," Tatem said. "The United States doesn't have active control measures in place, but does have a well-functioning detection system in place to take care of it."

Tatem said that many factors, working in combination, have likely contributed to the stability of malaria elimination seen in many countries. These include urbanization, which creates environments that are unfavorable for malaria-spreading mosquitoes; improvements in surveillance within health systems to ensure that imported cases are treated promptly and any local outbreaks are controlled early; and travel patterns, with travelers who bring in infections from elsewhere rarely ending up in rural areas where mosquito densities are highest, thus reducing the likelihood of onward spread.

Malaria has long been a global health issue. In 1955, the World Health Organization launched an eradication campaign that eliminated the disease in many temperate and subtropical regions but did not achieve worldwide eradication. The program was scrapped after less than two decades in favor of controlling malaria. However, WHO attributed about 660,000 deaths to the disease in 2010, mostly African children.

http://bit.ly/VT9hLy

Hydrogen Fuel Made with Sunlight and Zinc

Erik Koepf may have found a way to make hydrogen fuel cheaply, using only sunlight, zinc oxide and water.

Jesse Emspak

Hydrogen is the most abundant element on Earth. And it's potential as a fuel could revolutionize the energy market because using it doesn't produce any emissions. Zero. Unfortunately, it's lightweight gas and rises into the atmosphere, which means its rarely found in its pure form. And making making it produces emissions.

Erik Koepf, a mechanical engineering PhD student at the University of Delaware, may have found a way to make hydrogen fuel cheaply, using only sunlight, zinc oxide and water.

He built a device that has a mirror and chamber, which holds the zinc oxide. The mirror concentrates the sunlight into the chamber holding the zinc oxide. The concentrated light is so intense, with temperatures hitting up to 3,500 degrees Fahrenheit, that when it hits the zinc oxide the heat separates the zinc and oxygen, and the zinc becomes a vapor.

In a large facility, the zinc vapor would be added to water, which reacts with it and turns into zinc oxide again, releasing the hydrogen. Koepf's apparatus doesn't perform that second step, which is actually simpler.

It's the first step that's more challenging, "because it requires very high temperatures," said Ajay Prasad, a professor of mechanical engineering at the University of Delaware and Koepf's PhD adviser.

Since the product is zinc oxide, the same chemical the reaction started with, it can be used over and over again. The only waste produced is oxygen. Since the power source is sunlight, it eliminates the problem of the vast amounts of electricity needed in other hydrogen-producing reactions, such as electrolyzing water.
The device is being tested at the Swiss Federal Institute of Technology, and there are still questions about whether it can be scaled up. Thus far the amounts of hydrogen and zinc produced have been small, and the reaction chamber Koepf designed only takes care of the first step, making the zinc vapor. The next stage will be setting up the water-zinc reaction to more efficiently produce the hydrogen.
Koepf will also be testing a reflector designed to concentrate the sunlight. Initially he used an existing mirror at the Institute to concentrate the sunlight, but to run this next set of tests he'll be using a water-cooled version of his own design to reach the temperatures necessary to drive the reaction.

http://www.sciencedaily.com/releases/2013/02/130221141250.htm

Aspirin and Omega-3 Fatty Acids Work Together to Fight Inflammation

Researchers show that aspirin helps trigger the production of molecules naturally made by the body that shut off the inflammation

This shows key molecules (DHA, aspirin, AT-RvD3) and cells undergoing actions promoted by AT-RvD3 (i.e. macrophages phagocytosing apoptotic cells). **(Credit: Chemistry & Biology, Dalli et al.)**

Experts tout the health benefits of low-dose aspirin and omega-3 fatty acids found in foods like flax seeds and salmon, but the detailed mechanisms involved in their effects are not fully known. Now researchers reporting in the February 21 issue of the Cell Press journal Chemistry & Biology show that aspirin helps trigger the production of molecules called resolvins that are naturally made by the body from omega-3 fatty acids. These resolvins shut off, or "resolve," the inflammation that underlies destructive conditions such as inflammatory lung disease, heart disease, and arthritis.
"In this report, we found that one resolvin, termed resolvin D3 from the omega-3 fatty acid DHA, persists longer at sites of inflammation than either resolvin D1 or resolvin D2 in the natural resolution of inflammation in mice," explains senior author Dr. Charles Serhan of Brigham and Women's Hospital and Harvard Medical School. "This finding suggests that this late resolution phase resolvin D3 might display unique properties in fighting uncontrolled inflammation."
The researchers also confirmed that aspirin treatment triggered the production of a longer acting form of resolvin D3 through a different pathway. "Aspirin is able to modify an inflammatory enzyme to stop forming molecules that propagate inflammation and instead produce molecules from omega-3 fatty acids, like resolvin D3, that help inflammation to end," explains coauthor Dr. Nicos Petasis of the University of Southern California.
The team went on to reveal detailed information about resolvin D3. "We were able to produce by chemical synthesis both resolvin D3 and aspirin-triggered resolvin D3 in pure form, which allowed us to establish their complete structures and biological activities," says Dr. Petasis. When administered to human cells, both of these resolvins demonstrated potent anti-inflammatory actions. When given to mice, the compounds also stimulated the resolution of inflammation in the body.
"We also identified the human receptor that is activated by resolvin D3, which is critical in understanding how resolvin D3 works in the body to resolve inflammation," says Dr. Serhan. "With this new information, investigators will now also be able to study the pro-resolving and anti-inflammatory actions of resolvin D3 in other systems." In addition, researchers will be interested in determining which inflammation-associated diseases might be treated with this newly identified resolvin.
Jesmond Dalli, Jeremy W. Winkler, Romain A. Colas, Hildur Arnardottir, Chien-Yee C. Cheng, Nan Chiang, Nicos A. Petasis, Charles N. Serhan. Resolvin D3 and Aspirin-Triggered Resolvin D3 Are Potent Immunoresolvents. Chemistry & Biology, 2013; 20 (2): 188 DOI: 10.1016/j.chembiol.2012.11.010

http://bit.ly/YqPpyl

Newt Finding Might Set Back Efforts to Regrow Human Limbs

Unique proteins in these amphibians cast doubt on the existence of any latent potential for limb regeneration

By Zoe Cormier and Nature magazine

The ability of some animals to regenerate tissue is generally considered to be an ancient quality of all multicellular animals. A genetic analysis of newts, however, now suggests that it evolved much more recently. Tiny and delicate it may be, but the red spotted newt (Notophthalmus viridescens) has tissue-engineering skills that far surpass the most advanced biotechnology labs. The newt can regenerate lost tissue, including heart muscle, components of its central nervous system and even the lens of its eye.

Doctors hope that this skill relies on a basic genetic program that is common — albeit often in latent form — to all animals, including mammals, so that they can harness it in regenerative medicine. Mice, for instance, are able to generate new heart cells after myocardial injury.
The newt study, by Thomas Braun at the Max Planck Institute for Heart and Lung Research in Bad Nauheim, Germany, and his colleagues, suggest that it might not be so simple.
Attempts to analyze the genetics of newts in the same way as for humans, mice and flies have so far been hampered by the enormous size of the newt genome, which is ten times larger than our own. Braun and his colleagues therefore looked at the RNA produced when genes are expressed — known as the transcriptome — and used three analytical techniques to compile their data.
The team compiled the first catalogue of all the RNA transcripts expressed in N. viridescens, looking at both primary and regenerated tissue in the heart, limbs and eyes of both embryos and larvae.
The researchers found more than 120,000 RNA transcripts, of which they estimate 15,000 code for proteins. Of those, 826 were unique to the newt. What is more, several of those sequences were expressed at different levels in regenerated tissue than in primary tissue. Their results are published in Genome Biology.

Modern or ancestral?

The findings add to existing evidence that the ability evolved recently, says Jeremy Brockes of University College London, whose research provided the first evidence that regenerating tissue in salamanders express proteins that are not found in other vertebrates. “I no longer believe that there is an ancestral program that is waiting to be reawakened,” Brockes says. “However, I absolutely do believe it’s possible to coax mammal tissues into regenerating to a greater degree with the lessons we learn from newts.”
But saying that the trait is either ancestral or recent is probably too “black and white”, says Elly Tanaka of the Center for Regenerative Therapies in Dresden, Germany. The truth, she says, could be somewhere in the middle. “It may in fact be that regeneration is ancestral, but that newts have species-specific adaptations that allow it to have such spectacular regenerative capacities compared with other vertebrates.”
Moreover, Tanaka adds, scientists would do well to look for more grey zones in the potential for harnessing the regenerative capacities of newts (and of other animals, such as fish). Rather than focusing on spectacular, but perhaps unlikely, scenarios in which amputees could regrow entire limbs, researchers should instead focus on more plausible options, such as improving the healing of scars and burns or increasing the speed of organ regeneration.

http://bit.ly/ZwT93s

India to Launch Mission to Mars This Year, says President

India will launch its first mission to Mars this year, President Pranab Mukherjee said on Thursday, as the emerging Asian nation looks to play catch up in the global space race alongside the United States, Russia and its giant neighbor China.

NEW DELHI - "Several space missions are planned for 2013, including India's first mission to Mars and the launch of our first navigational satellite," Mukherjee told parliament.
India will send a satellite in October via an unmanned spacecraft to orbit the red planet, blasting off from the southeastern coast in a mission expected to cost about $83 million, scientists who are part of the mission say.
The spacecraft, which will be made in India, will take nine months to reach Mars and then launch itself in an elliptical orbit about 500 km (310 miles) from the planet. "The mission is ready to roll," Deviprasad Karnik, a scientist from the India Space Research Organisation (ISRO), said by phone from the city of Bangalore.
India's mission to Mars has drawn criticism in a country suffering from high levels of malnutrition and power shortages, and currently experiencing its worst slowdown in growth in ten years. But India has long argued that technology developed in its space programme has practical applications to everyday life.
India's space exploration programme began in 1962. Five years ago, its Chandrayaan satellite found evidence of water on the moon. India is now looking at landing a wheeled rover on the moon in 2014.

http://www.sciencedaily.com/releases/2013/02/130221104155.htm

Drugs to Treat Fibromyalgia Just as Likely to Harm as Help, Review Finds

Among fibromyalgia patients taking either of two commonly prescribed drugs to reduce pain, 22 percent report substantial improvement while 21 percent had to quit the regimen due to unpleasant side effects, according to a new review in The Cochrane Library.

People with fibromyalgia suffer from chronic widespread pain, sleep problems and fatigue. The illness affects more than 5 million Americans, 80 percent of whom are women. The cause of fibromyalgia is unknown and currently there is no cure. Using a Quality of Life (QOL) scale for fibromyalgia, the studies reviewed reported QOL ratings lower than 15 on a scale of 0 to 100 even among patients on medications. The two medications

often prescribed to treat fibromalgia are duloxetine, known by the brand name Cymbalta or milnacipran, commonly known as Savella.
"A frank discussion between the physician and patient about the potential benefits and harms of both drugs should occur," noted the reviewers, led by Winfried Häuser, M.D. of Technische Universität München.
The authors reviewed 10 high-quality studies comprising more than 6,000 adults who received either duloxetine, milnacipran, or a placebo for up to six months. A substantial majority of study participants were middle-aged, white women.
"This is a very important study," says Fred Wolfe, M.D. of the National Data Bank for Rheumatic Diseases. "There's an enormous amount of advertising suggesting that these drugs really help, whereas the research data show that the improvement is really minimal."
Treatment with drugs alone "should be discouraged," the reviewers added. Instead, the review authors recommend a multi-faceted treatment approach including medications for those who find them helpful, exercises to improve mobility and psychological counseling to improve coping skills.
"The medical field does poorly with the treatment of fibromyalgia in general," says Brian Walitt, M.D., M.P.H., a co-author of the review and an expert in pain syndromes at Washington Hospital Center in Washington, D.C. "Chasing [a cure] with medicine doesn't seem to work.The people who seem to me to do best sort of figure it out on their own by thinking about things, getting to know themselves, and making changes in their lives to accommodate who they've become," concludes Walitt.
The only other medication approved for fibromyalgia treatment in the U.S. is the anti-convulsant pregabalin, known by the brand name Lyrica. The Cochrane Library plans to publish a review of its effectiveness later this year.
Intensive neuroscientific research is needed to reveal the underlying causes of fibromyalgia and other pain syndromes, say the researchers. In the meantime, combinations of various medications as well as combinations of drug and non-drug treatments may offer better symptom control for sufferers.
Winfried Häuser, Gerard Urrútia, Sera Tort, Nurcan Üçeyler, Brian Walitt. Serotonin and noradrenaline reuptake inhibitors (SNRIs) for fibromyalgia syndrome. Cochrane Database of Systematic Reviews, 2013, Issue 1. Art. No.: CD010292 DOI: 10.1002/14651858.CD010292

http://www.wired.com/business/2013/02/smart-scheduling/

Predicting No-Shows to Put an End to Waiting at the Doctor's Office

When you're stuck waiting an hour past your appointment time at the doctor's office you can thank those patients who decided to never show up at all.

By Sarah Mitroff

That's because when too many people are no-shows one day, doctor's offices often overbook another day. But just as with overbooked flights, that strategy often backfires, causing too many people to show up on the overbooked day. In the scheduling business it's called "naive booking." While a fitting term, it's little comfort as you cool your heels with hopelessly outdated magazines while your now overwhelmed doctor tries to get to everyone.
Enter stealth startup Smart Scheduling. At MIT's H@cking Medicine conference last winter, Smart Scheduling CEO Christopher Moses met his future co-founders Andrea Ippolito and Gabriel Belfort. Belfort, a M.D. and Ph.D. himself, told Moses about the scheduling woes his wife faced at her pediatrics practice. It was the whole no-shows leading to overbookings, leading to long waits scenario in spades.
But what if you could predict which patients would show up and which ones wouldn't, based on their past behavior? Naive booking could become downright smart booking, Moses (right), Ippolito, and Belfort reasoned.
To test out their idea, the three joined the Healthbox Accelerator in August 2012 to try and develop on an algorithm that could make those predictions. While there, the trio was introduced to Athenahealth, the public-traded medical cloud services company founded by former President George W. Bush's cousin Jonathan Bush.
It was through Athenahealth that Smart Scheduling got its hands on the data it needed to test and tune its algorithm. Athenahealth gave Smart Scheduling three years' worth of patient scheduling data from 12 clinics to get started. Of the more than 700,000 appointments they looked through, there were 30,000 no-shows. "After looking at the data, we've been building prediction models to show who's going to miss their appointment and why they're going to miss it, (either because they're likely to cancel last-minute or tend to fail to show up without warning)," says Moses.
Smart Scheduling's first web application running the algorithm is being used in a pilot program with Boston-based medical group Steward Health, which uses Athenahealth software to run its medical practices. The web app shows an office's existing Athenahealth schedule and Smart Scheduling's suggestions for when they should book patients and when they shouldn't. When the office has to schedule a historically flaky patient, Smart

Scheduling will suggest the best time slot so that if they don't show up, it won't burden the office. The thinking is that if Smart Scheduling's tools can warn the person making the schedule of potential no-shows and the ideal overbook slots, it will help the medical practice make better scheduling decisions that ultimately affect how long you'll be stuck in the waiting room.

Rich Fernandez, the COO of Steward Health, jumped at the opportunity to participate in the pilot. For him, no-shows cost his medical group revenue, but also disrupt patient experience. "It's a revenue thing, but it's also about providing better quality and service," Fernandez says. "A struggle for a large medical group like ours is when patients don't show up. What we were impressed by with Smart Scheduling was their innovative way of helping us predict who's really going to show up so we can provide great access to our patients and keep our providers in our offices running as smooth as possible."

Moses says that during Smart Scheduling's private alpha in a few medical offices, the algorithm was 95 percent accurate at predicting the total volume of patients that would show up to a medical office on any particular day, accounting for no-shows and last-minute cancellations. "That allows us to tell medical offices how many patients they should be booking each day to hit their optimal number of patients," Moses says.

You can imagine applying the same Smart Scheduling approach to all kinds of waiting-room rich scenarios, from mechanics to barber shops. And indeed, Moses has been approached by people who want to use his technology for their hair salons or spas. But Smart Scheduling is focusing on medical offices for now, Moses says, with an eye toward branching out to dental offices next. The goal, of course, is to have Smart Scheduling running in every stripe of physician's office, Moses says. For the sake of our dental, physical, and mental health, here's hoping they get there – and fast.

http://www.bbc.co.uk/news/world-asia-china-21545868

China acknowledges 'cancer villages'

China's environment ministry appears to have acknowledged the existence of so-called "cancer villages" after years of public speculation about the impact of pollution in certain areas.

For years campaigners have said cancer rates in some villages near factories and polluted waterways have shot up. But the term "cancer village" has no technical definition and the ministry's report did not elaborate on it.

There have been many calls for China to be more transparent on pollution.

The latest report from the environment ministry is entitled "Guard against and control risks presented by chemicals to the environment during the 12th Five-Year period (2011-2015)".

It says that the widespread production and consumption of harmful chemicals forbidden in many developed nations are still found in China.

"The toxic chemicals have caused many environmental emergencies linked to water and air pollution," it said.

The report goes on to acknowledge that such chemicals could pose a long-term risk to human health, making a direct link to the so-called "cancer villages".

"There are even some serious cases of health and social problems like the emergence of cancer villages in individual regions," it said.

Beijing smog

The BBC's Martin Patience in Beijing says that as China has experienced rapid development, stories about so-called cancer villages have become more frequent.

And China has witnessed growing public anger over air pollution and industrial waste caused by industrial development.

Media coverage of conditions in these so-called "cancer villages" has been widespread. In 2009, one Chinese journalist published a map identifying dozens of apparently affected villages.

In 2007 the BBC visited the small hamlet of Shangba in southern China where one scientist was studying the cause and effects of pollution on the village.

He found high levels of poisonous heavy metals in the water and believed there was a direct connection between incidences of cancer and mining in the area.

Until now, there has been little comment from the government on such allegations.

Environmental lawyer Wang Canfa, who runs a pollution aid centre in Beijing, told the AFP news agency that it was the first time the "cancer village" phrase had appeared in a ministry document.

Last month - Beijing - and several other cities - were blanketed in smog that soared past levels considered hazardous by the World Health Organisation.

The choking pollution provoked a public outcry and led to a highly charged debate about the costs of the country's rapid economic development, our correspondent says.

http://www.eurekalert.org/pub_releases/2013-02/haoq-lfs022213.php

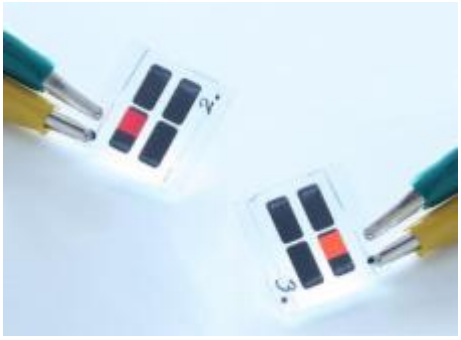
Light from silicon nanocrystal LEDs

Silicon nanocrystals have a size of a few nanometers and possess a high luminous potential.

This press release is available in German.

Scientists of KIT and the University of Toronto/Canada have now succeeded in manufacturing silicon-based light-emitting diodes (SiLEDs). They are free of heavy metals and can emit light in various colors. The team of chemists, materials researchers, nanoscientists, and opto-electronic experts presents its development in the "Nano Letters" journal (DOI: 10.1021/nl3038689).

Silicon dominates in microelectronics and photovoltaics industry, but has been considered unsuitable for light-emitting diodes for a long time. However, this is not true for nanoscopic dimensions: Minute silicon nanocrystals can produce light. These nanocrystals consist of a few hundred to thousand atoms and have a considerable potential as highly efficient light emitters, as was demonstrated by the team of Professor Uli Lemmer and Professor Annie K. Powell from KIT as well as Professor Geoffrey A. Ozin from the University of Toronto. In a joint project, the scientists have now succeeded in manufacturing highly efficient light-emitting diodes from the silicon nanocrystals.



Liquid-processed SiLEDs: By changing the size of the silicon nanocrystals, color of the light emitted can be varied. **(Photo: F. Maier-Flaig, KIT/LTI)**

So far, manufacture of silicon light-emitting diodes has been limited to the red visible spectral range and the near infrared. As regards the efficiency of silicon diodes emitting red light, researchers from Karlsruhe are already top in the world. "Controlled manufacture of diodes emitting multicolor light, however, is an absolutely novelty," explains Florian Maier-Flaig, scientist of the Light Technology Institute (LTI) of KIT and doctoral student of the Karlsruhe School of Optics and Photonics (KSOP). KIT scientists specifically adjust the color of the light emitted by the diodes by separating nanoparticles depending on their size. "Moreover, our light-emitting diodes have a surprising long-term stability that has not been reached before," Maier-Flaig reports. The increased service life of the components in operation is due to the use of nanoparticles of one size only. This enhances the stability of the sensitive thin-film components. Short circuits due to oversized particles are excluded.

The development made by the researchers from Karlsruhe and Toronto is also characterized by an impressing homogeneity of the luminous areas. The KIT researchers are among the few teams in the world that know how to manufacture such devices. "With the liquid-processed silicon LEDs that may potentially be produced on large areas as well as at low costs, the nanoparticle community enters new territory, the associated potentials of which can hardly be estimated today. But presumably, textbooks about semiconductor components have to be rewritten," says Geoffrey A. Ozin, who is presently working as a KIT distinguished research fellow at KIT's Center for Functional Nanostructures (CFN).

The SiLEDs also have the advantage that they do not contain any heavy metals. In contrast to cadmium selenide, cadmium sulfide or lead sulfide used by other groups of researchers, the silicon used by this group for the light-emitting nanoparticles is not toxic. Moreover, it is available at low costs and highly abundant on earth. Due to their many advantages, the SiLEDs will be developed further in cooperation with other partners.

Florian Maier-Flaig, Julia Rinck, Moritz Stephan, Tobias Bocksrocker, Michael Bruns, Christian Kübel, Annie K. Powell, Georey A. Ozin, and Uli Lemmer: Multicolor Silicon Light-Emitting Diodes (SiLEDs). In: Nano Letters. DOI: 10.1021/nl3038689

http://bit.ly/VYLA4E

Rusty rocks reveal ancient origin of photosynthesis

Oldest sedimentary rocks suggest early form of photosynthesis almost 3.8 billion years ago

22 February 2013 by Jeff Hecht

SUN-WORSHIP began even earlier than we thought. The world's oldest sedimentary rocks suggest an early form of photosynthesis may have evolved almost 3.8 billion years ago, not long after life appeared on Earth.

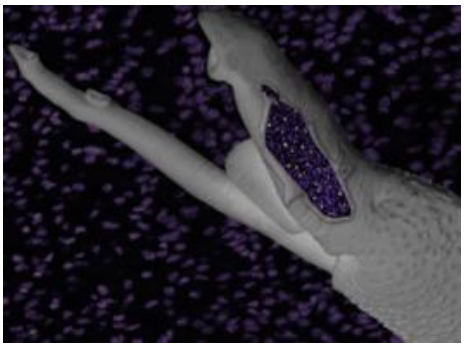
A hallmark of photosynthesis in plants is that the process splits water and produces oxygen gas. But some groups of bacteria oxidise substances like iron instead – a form of photosynthesis that doesn't generate oxygen. Evolutionary biologists think these non-oxygen-generating forms of photosynthesis evolved first, giving rise to oxygen-generating photosynthesis sometime before the Earth's atmosphere gained oxygen 2.4 billion years ago (New Scientist, 8 December 2012, p 12).

But when did non-oxygen-generating photosynthesis evolve? Fossilised microbial mats that formed in shallow water 3.4 billion years ago in what is now South Africa show the chemical fingerprints of the process. However, geologists have long wondered whether even earlier evidence exists.
The world's oldest sedimentary rocks – a class of rock that can preserve evidence of life – are a logical place to look, says Andrew Czaja of the University of Cincinnati in Ohio. These rocks, which are found in Greenland and date back almost 3.8 billion years, contain vast deposits of iron oxide that are a puzzle. "What could have formed these giant masses of oxidised iron?" asks Czaja.
To investigate, he analysed the isotopic composition of samples taken from the oxidised iron. He found that some isotopes of iron were more common than they would be if oxygen gas was indiscriminately oxidising the metal. Moreover, the exact isotopic balance varied subtly from point to point in the rock.
Both findings make sense if photosynthetic bacteria were responsible for the iron oxide, says Czaja. That's because these microbes preferentially oxidise only a small fraction of the dissolved iron, and the iron isotopes they prefer vary slightly as environmental conditions change (Earth and Planetary Science Letters, doi.org/kh5).
His findings suggest that this form of photosynthesis appeared about 370 million years earlier than we thought.
It is "the best current working hypothesis for the origin of these deposits", says Mike Tice of Texas A&M University in College Station – one of the team who analysed the 3.4-billion-year-old microbial mats from South Africa.
William Martin at the University of Düsseldorf, Germany, agrees. "Anoxygenic photosynthesis is a good candidate for the isotope evidence they see," he says. "Had these fascinating results been collected on Mars, the verdict of the jury would surely remain open," says Martin Brasier at the University of Oxford. "But [on Earth] opinion seems to be swinging in the direction of non-oxygen-generating photosynthesis during the interval from 3.8 to 2.9 billion years ago."

http://www.sciencedaily.com/releases/2013/02/130222143142.htm

Stash of Stem Cells Found in a Human Parasite

Stem cells inside schistosomiasis can regenerate worn-down organs



The parasites that cause schistosomiasis, one of the most common parasitic infections in the world, are notoriously long-lived. Researchers have now found stem cells inside the parasite that can regenerate worn-down organs, which may help explain how they can live for years or even decades inside their host.
Schistosomiasis is acquired when people come into contact with water infested with the larval form of the parasitic worm Schistosoma, known as schistosomes. Schistosomes mature in the body and lay eggs that cause inflammation and chronic illness. Schistosomes typically live for five to six years, but there have been reports of patients who still harbor parasites decades after infection.

A composite image of a scanning electron micrograph of a pair of male and female Schistosoma mansoni with the outer tegument (skin) of the male worm "peeled back" (digitally) to reveal the stem cells (orange) underneath. **Jim Collins, Ana Vieira and Phillip Newmark, Howard Hughes Medical Institute and University of Illinois at Urbana-Champaign**

According to new research from Howard Hughes Medical Institute (HHMI) investigator Phillip Newmark, collections of stem cells that can help repair the worms' bodies as they age could explain how the worms survive for so many years. The new findings were published online on February 20, 2013, in the journal Nature.
The stem cells that Newmark's team found closely resemble stem cells in planaria, free-living relatives of the parasitic worms. Planaria rely on these cells, called neoblasts, to regenerate lost body parts. Whereas most adult stem cells in mammals have a limited set of possible fates—blood stem cells can give rise only to various types of blood cells, for example —planarian neoblasts can turn into any cell in the worm's body under the right circumstances.
Newmark's lab at the University of Illinois at Urbana-Champaign has spent years focused on planaria, so they knew many details about planarian neoblasts —what they look like, what genes they express, and how they proliferate. They also knew that in uninjured planarians, neoblasts maintain tissues that undergo normal wear and tear over the worm's lifetime.
"We began to wonder whether schistosomes have equivalent cells and whether such cells could be partially responsible for their longevity," says Newmark.
Following this hunch, and using what they knew about planarian neoblasts, post-doctoral fellow Jim Collins, Newmark, and their colleagues hunted for similar cells in Schistosoma mansoni, the most widespread species of human-infecting schistosomes.

Their first step was to look for actively dividing cells in the parasites. To do this, they grew worms in culture and added tags that would label newly replicated DNA as cells prepare to divide; this label could later be visualized by fluorescence. Following this fluorescent tag, they saw a collection of proliferating cells inside the worm's body, separate from any organs.

The researchers isolated those cells from the schistosomes and studied them individually. They looked like typical stem cells, filled with a large nucleus and a small amount of cytoplasm that left little room for any cell-type-specific functionality. Newmark's lab observed the cells and found that they often divided to give rise to two different cells: one cell that continued dividing, and another cell that did not.

"One feature of stem cells," says Newmark, "is that they make more stem cells; furthermore, many stem cells undergo asymmetric division." The schistosomes cells were behaving like stem cells in these respects. The other characteristic of stem cells is that they can differentiate into other cell types.

To find out whether the schistosome cells could give rise to multiple types of cells, Newmark's team added the label for dividing cells to mice infected with schistosomes, waited a week, and then harvested the parasites to see where the tag ended up. They could detect labeled cells in the intestines and muscles of the schistosomes, suggesting that stem cells incorporating the labels had developed into both intestinal and muscle cells.

Years of previous study on planarians by many groups paved the way for this type of work on schistosomes, Newmark says.

"The cells we found in the schistosome look remarkably like planarian neoblasts. They aren't associated with any one organ, but can give rise to multiple cell types. People often wonder why we study the 'lowly' planarian, but this work provides an example of how basic biology can lead you, in unanticipated and exciting ways, to findings that are directly relevant to important public health problems."

Newmark says the stem cells aren't necessarily the sole reason schistosome parasites survive for so many years, but their ability to replenish multiple cell types likely plays a role. More research is needed to find out how the cells truly affect lifespan, as well as what factors in the mouse or human host spur the parasite's stem cells to divide, and whether the parasites maintain similar stem cells during other stages of their life cycle.

The researchers hope that with more work, scientists will be able to pinpoint a way to kill off the schistosome stem cells, potentially shortening the worm's lifespan and treating schistosome infections in people.

James J. Collins III, Bo Wang, Bramwell G. Lambrus, Marla E. Tharp, Harini Iyer, Phillip A. Newmark. Adult somatic stem cells in the human parasite Schistosoma mansoni. Nature, 2013; DOI: 10.1038/nature11924

http://www.bbc.co.uk/news/science-environment-21551149

http://www.eurekalert.org/pub_releases/2013-02/haog-foc022213.php

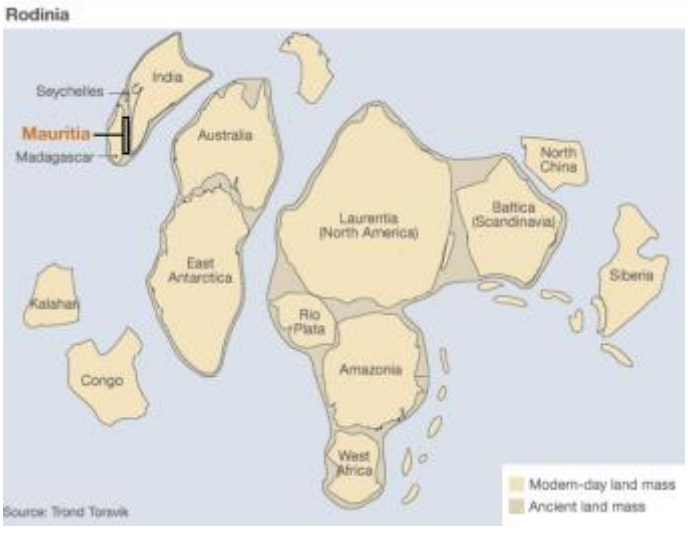
Fragments of ancient continent buried under Indian Ocean

Fragments of an ancient continent are buried beneath the floor of the Indian Ocean, a study suggests.

By Rebecca Morelle Science reporter, BBC World Service

The islands Reunion and Mauritius, both well-known tourist destinations, are hiding a micro-continent, which has now been discovered. The continent fragment known as Mauritia detached about 60 million years ago while Madagascar and India drifted apart, and had been hidden under huge masses of lava. Such micro-continents in the oceans seem to occur more frequently than previously thought, says a study in the latest issue of Nature Geoscience ("A Precambrian microcontinent in the Indian Ocean," Nature Geoscience, Vol 6, doi: 10.1038/NGEO1736).

Researchers have found evidence for a landmass that would have existed between 2,000 and 85 million years ago. The strip of land, which scientists have called Mauritia, eventually fragmented and vanished beneath the waves as the modern world started to take shape. The study is published in the journal Nature Geoscience.



Land on Earth was once gathered together in a supercontinent known as Rodinia, shown here as it was during its break-up 750 million years ago. Now scientists believe they have found a fragment of it buried under the Indian Ocean

Supercontinent

Until about 750 million years ago, the Earth's landmass was gathered into a vast single continent called Rodinia. And although they are now separated by thousands of kilometres of ocean, India was once located next to Madagascar. Now researchers believe they have found evidence of a sliver of continent - known as a microcontinent - that was once tucked between the two.

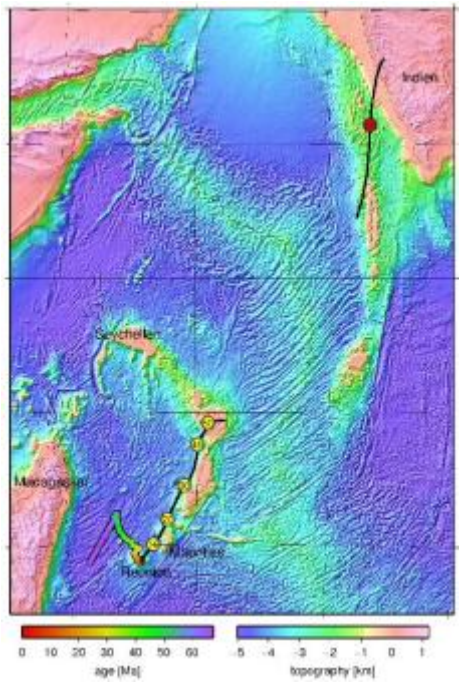
The break-up of continents is often associated with mantle plumes: These giant bubbles of hot rock rise from the deep mantle and soften the tectonic plates from below, until the plates break apart at the hotspots. This is how Eastern Gondwana broke apart about 170 million years ago. At first, one part was separated, which in turn fragmented into Madagascar, India, Australia and Antarctica, which then migrated to their present position. Plumes currently situated underneath the islands Marion and Reunion appear to have played a role in the emergence of the Indian Ocean. If the zone of the rupture lies at the edge of a land mass (in this case Madagascar / India), fragments of this land mass may be separated off. The Seychelles are a well-known example of such a continental fragment.

The team came to this conclusion after studying grains of sand from the beaches of Mauritius. While the grains dated back to a volcanic eruption that happened about nine million years ago, they contained minerals that were much older.

Professor Trond Torsvik, from the University of Oslo, Norway, said: "We found zircons that we extracted from the beach sands, and these are something you typically find in a continental crust. They are very old in age."

The zircon dated to between 1,970 and 600 million years ago, and the team concluded that they were remnants of ancient land that had been dragged up to the surface of the island during a volcanic eruption.

This dating method was supplemented by a recalculation of plate tectonics, which explains exactly how and where the fragments ended up in the Indian Ocean. Dr. Bernhard Steinberger of the GFZ German Research Centre for Geosciences and Dr. Pavel Doubrovine of Oslo University calculated the hotspot trail: "On the one hand, it shows the position of the plates relative to the two hotspots at the time of the rupture, which points towards a causal relation," says Steinberger. "On the other hand, we were able to show that the continent fragments continued to wander almost exactly over the Reunion plume, which explains how they were covered by volcanic rock." So what was previously interpreted only as the trail of the Reunion hotspot, are continental fragments which were previously not recognized as such because they were covered by the volcanic rocks of the Reunion plume. It therefore appears that such micro-continents in the ocean occur more frequently than previously thought.



The coloured track (left colour scale) west of Reunion is the calculated movement of the Reunion hotspot. The black lines with yellow circles and the red circle indicate the corresponding calculated track on the African plate and the Indian plate, respectively. The numbers in the circles are ages in millions of years. The areas with topography just below the sea surface are now regarded as continental fragments. **© GFZ/Steinberger**

Prof Torsvik said that he believed pieces of Mauritia could be found about 10km down beneath Mauritius and under a swathe of the Indian Ocean. It would have spanned millions years of history, from the Precambrian Era when land was barren and devoid of life to the age when dinosaurs roamed the Earth. But about 85m years ago, as India started to drift away from Madagascar towards its current location, the microcontinent would have broken up, eventually disappearing beneath the waves. However, a small part could have survived.

"At the moment the Seychelles is a piece of granite, or continental crust, which is sitting practically in the middle of the Indian Ocean," explained Prof Torsvik. "But once upon a time, it was sitting north of Madagascar. And what we are saying is that maybe this was much bigger, and there are many of these continental fragments that are spread around in the ocean." Further research is needed to fully investigate what remains of this lost region. Prof Torsvik explained: "We need seismic data which can image the structure... this would be the ultimate proof. Or you can drill deep, but that would cost a lot of money."

Torsvik, T.H., Amundsen, H., Hartz, E.H., Corfu, F., Kusznir, N., Gaina, C., Doubrovine, P.V., Steinberger B., Ashwal, L.D. & Jamtveit, B., „A Precambrian microcontinent in the Indian Ocean", Nature Geoscience, Vol. 6, doi:10.1038/NGEO1736.

http://www.sciencedaily.com/releases/2013/02/130224124635.htm

The Ultimate Chimp Challenge: Chimps Do Challenging Puzzles for the Fun of It

A study, published by the Zoological Society of London (ZSL), shows that just like humans love getting stuck into a crossword, chimpanzees get the same feeling of satisfaction from completing tricky puzzles.

Scientists set up a challenge for six chimpanzees at ZSL Whipsnade Zoo using plumbing pipes from a DIY store. The challenge involved moving red dice through a network of pipes until they fell into an exit chamber. This could only be achieved by the chimps prodding sticks into holes in the pipes to change the direction of the

dice. The same task was also carried out with Brazil nuts, but the exit chamber removed so that the nuts fell out as a tasty treat for the chimps. The paper was published February 24 in the American Journal of Primatology.
ZSL researcher Fay Clark says: "We noticed that the chimps were keen to complete the puzzle regardless of whether or not they received a food reward. This strongly suggests they get similar feelings of satisfaction to humans who often complete brain games for a feel-good reward."
The adult family group of chimpanzees at ZSL Whipsnade Zoo consist of two females and four males, three of which are half-brothers: Phil, Grant and Elvis. This study allowed them to solve a novel cognitive problem in their normal social grouping, by choice. In addition, the chimpanzees were not trained on how to use the device.
"For chimps in the wild, this task is a little bit like foraging for insects or honey inside a tree stump or a termite mound; except more challenging because the dice do not stick to the tool," Fay added.
The challenge, which only cost about £40 to make, was made more intricate by connecting many pipes together, and the level further increased by making pipes opaque so chimpanzees could only see the dice or nuts through small holes.
The chimps took part in the cognitive challenge as part of their normal daily routine and doing the brain teaser was completely voluntarily. As part of the Zoo's enrichment programme, they also receive tasty treats hidden in boxes, as well as pillows and blankets every night to make up their own beds. Chimps build their own nests every night in the wild, and this enrichment encourages the animals' natural behaviours.
This study suggests that like humans, chimpanzees are motivated to solve a puzzle when there is no food reward. They do so for the sake of the challenge itself. It also suggests that chimpanzee cognition can be measured on social groups under more naturalistic conditions.
Fay E. Clark, Lauren J. Smith. Effect of a Cognitive Challenge Device Containing Food and Non-Food Rewards on Chimpanzee Well-Being. American Journal of Primatology, 2013; DOI: 10.1002/ajp.22141

http://www.bbc.co.uk/news/health-21547508

Brain's 'stroke shielding' cracked

A part of the brain's ability to shield itself from the destructive damage caused by a stroke has been explained by researchers.

By James Gallagher Health and science reporter, BBC News

It has been known for more than 85 years that some brain cells could withstand being starved of oxygen.
Scientists, writing in the journal Nature Medicine, have shown how these cells switch into survival mode.
They hope to one-day find a drug which uses the same trick to protect the whole brain.
Treating a stroke is a race against time. Clots that block the blood supply prevent the flow of oxygen and sugar to brain cells, which then rapidly die. But in 1926, it was noticed that some cells in the hippocampus, the part of the brain involved in memory, did not follow this rule.
"They're staying alive when the prediction would say that they should die," said Prof Alastair Buchan from Oxford University who has investigated how they survive.

I'm a survivor

Experiments on rats showed that these surviving-cells started producing a protein called hamartin - which forces cells to conserve energy. They stop producing new proteins and break down existing ones to access the raw materials. When the researchers prevented the cells from producing hamartin, they died just like other cells.
Prof Buchan said: "We have shown for the first time that the brain has mechanisms that it can use to protect itself and keep brain cells alive."
Their aim is to develop a drug that can produce the same effect, which could be given when an ambulance arrived. This would buy the brain time until clot-busting drugs could be given in hospital.
The researchers do not know why these cells have this defence, but other nearby cells in the hippocampus do not. There are differences in function. The cells that die are known as CA1 cells which are very plastic and are involved in laying down memories whereas the surviving, or CA3, cells are less adaptable.
Speaking to BBC News online, Prof Buchan said the focus of this research was on "ways to keep brain cells alive" which could have impacts beyond stroke - such as in Alzheimer's disease and spinal cord injuries.
Commenting on the study, Dr Clare Walton from the Stroke Association said: "Previous research has shown that some brain cells are naturally more resilient than others, and this study has identified a particular protein in the cells that is responsible.
"In the future, researchers could try to turn on this protein in other, less resilient brain cells to reduce the brain damage caused by stroke. "The findings of this research are exciting, but we are still a long way off from developing a new stroke treatment."