http://bit.ly/1s2tiKB

200-Year-Old Alcohol Found in Shipwreck Is Still Drinkable

Researchers found the liquid, originally thought to be mineral water, was actually over-aged booze

By Mary Beth Griggs

Earlier this summer, researchers discovered a 200-year-old bottle of liquid while excavating a shipwreck off the coast of Poland. Based on the mark on the neck of the bottle, the archaeologists assumed that the stoneware bottle was full of mineral water from Seltsers, Germany. But preliminary test results have shown that the bottle actually contains alcohol - probably a form of vodka or the gin-like jenever. Still more surprising is the find that the alcohol is drinkable - although maybe not enjoyable - as Livescience reports:

Apparently, the alcohol is drinkable, the archaeologists involved told the news site of Poland's Ministry of Science and Science Education. "This means it would not cause poisoning. Apparently, however, it does not smell particularly good," Bednarz said, according to the Ministry.

Though finding intact bottles with liquid still in them is unusual, this isn't the first time that a bottle of alcohol has been recovered from an archaeological dig. io9 lists several different bottle of drinks that have been brought up from their resting places, including a few that - like this most recent find - date to the 1800s.

Go back further than a few centuries, though, and the examples of preserved liquids get fewer and further between, though archaeologists in 1867 were able to recover a glass bottle of wine from the 4th century A.D. Understandably, it has not been opened.

It's highly unlikely that you'll ever get the chance to taste the contents of one of these ancient bottles, but you might be able to come close. Making replicas of ancient drinks is pretty common in today's home-brewed world. Researchers and enthusiasts have recreated beer from ancient Egypt, the whisky carried to Antarctica by Shackleton, Mayan ale and many other drinks.

http://bit.ly/1tjEPYB

Bacteria battle cancer cells to shrink human tumours

Your enemy's enemy could be your friend. Disease-causing bacteria in soil could become an anti-cancer therapy. The microbes shrink tumours in dogs – and seem able to do it in humans too.

- **19:23 18 August 2014 by Philippa Skett**

Clostridium novyi bacteria thrive in oxygen-poor conditions, where the enzymes they release can puncture and kill mammalian cells. Saurabh Saha of BioMed Valley Discoveries in Kansas City, Missouri, and his colleagues wondered whether they could use the bacteria to selectively kill mammalian cells within cancerous tumours, which often have a poor blood, and thus oxygen, supply.

The team genetically modified *C. novyi* bacteria into a form that wouldn't pose a serious health risk, and injected them into the tumours of 16 dogs. Three weeks later, the tumours had shrunk or disappeared in nine of the dogs.

The group has now also tested the bacteria on a 53-year-old woman with tumours in her liver, lungs and the soft tissue in her right shoulder that didn't respond to standard treatment. They injected the bacteria into the tumour in her shoulder. One month later, it had shrunk.

Symptoms of infection

The bacteria left healthy, oxygen-rich tissue around the tumour intact. In fact, under a microscope, the researchers could see a precise border between the bacterially infected tumour cells and the non-cancerous healthy cells.

The bacteria did induce symptoms commonly seen in bacterial infection, such as fever and nausea, but these were controlled by antibiotics after the tumour size reduced. "This is the first study to look at the eradication of tumours in humans using bacteria, and the results were promising," says Saha.

"This is an elegant study," says Vikas Sukhatme at Harvard Medical School and Beth Israel Deaconess Medical Center in Boston. It could work well on localised tumours, he says – but more research may be needed to demonstrate that the approach can work against cancers that have metastasised.

Saha stresses that the bacteria are not a silver bullet to treat cancer, but used in conjunction with other therapies they may provide another tool in our anticancer armoury. The method is drastically different to conventional chemotherapies, radiation therapies and even personalised cancer treatments, Saha says.

Journal reference: Science Translational Medicine, DOI: 10.1126/scitranslmed.3008982

http://bit.ly/1q1SHVj

How the human brain folds itself up

Figuring out how the brain works is enough to make your head spin. But now we seem to have a handle on how it gets its folded shape.

20:00 18 August 2014 by Clare Wilson

The surface layer of the brain, or cortex, is also referred to as our grey matter. Mammals with larger brains have a more folded cortex, and the human brain is the most wrinkled of all, cramming as much grey matter into our skulls as possible.

L. Mahadevan at Harvard University and his colleagues physically modelled how the brain develops in the embryo, using a layer of gel to stand in for the grey matter. This gel adhered to the top of a solid hemisphere of gel representing the white matter beneath.

In the embryo, grey matter grows as neurons are created or others migrate to the cortex from the brain's centre. By adding a solvent to make the grey matter gel expand, the team mimicked how the cortex might grow in the developing brain. They didn't model what effect, if any, the skull would have had.

Video: ***Gel brain reveals how the brain gets its folds***

Hills and valleys

The team varied factors such as the stiffness of the gels and the depth of the upper layer to find a combination that led to similarly shaped wrinkles as those of the human brain, with smooth "hills" and sharply cusped "valleys".

There are several theories about how the brain's folds form. These include the possibility that more neurons migrate to the hills, making them rise above the valleys, or that the valleys are pulled down by the axons – fibres that connect neurons to each other – linking highly interconnected parts of the brain together.

Mahadevan's model shows that, as long as the cortex is attached to the white matter beneath, the only thing needed is expansion of the cortex, and it will physically buckle."Once you have that, everything else follows," says Mahadevan. "It's an extremely simple mechanism."

Knowing how the cortex folds will help us understand disorders where people are born with brains whose surface is smooth and unwrinkled or with too many folds, says Mahadevan.

Journal reference: *PNAS, DOI: 10.1073/pnas.1406015111*

http://www.eurekalert.org/pub_releases/2014-08/nifm-tao081814.php

The ABC's of animal speech: Not so random after all

The calls of many animals, from whales to wolves, might contain more language-like structure than previously thought, according to study that raises new questions about the evolutionary origins of human language.

KNOXVILLE - The study, published today in the journal Proceedings of the Royal Society B, analyzed the vocal sequences of seven different species of birds and mammals and found that the vocal sequences produced by the animals appear to be generated by complex statistical processes, more akin to human language.

Many species of animals produce complex vocalizations – consider the mockingbird, for example, which can mimic over 100 distinct song types of different species, or the rock hyrax, whose long string of wails, chucks and snorts signify male territory. But while the vocalizations suggest language-like characteristics, scientists have found it difficult to define and identify the complexity.

Typically, scientists have assumed that the sequence of animal calls is generated by a simple random process, called a "Markov process." Using the Markov process to examine animal vocalization means that the sequence of variables - in this case, the vocal elements - is dependent only on a finite number of preceding vocal elements, making the process fairly random and far different from the complexity inherent in human language.

Yet, assuming a Markov process exists raises questions about the evolutionary path of animal language to human language - if animal vocal sequences are Markovian, how did human language evolve so quickly from its animal origins?

Indeed, the study found no evidence for a Markovian process. The researchers used mathematical models to analyze the vocal sequences of chickadees, finches, bats, orangutans, killer whales, pilot whales and hyraxes, and found most of the vocal sequences were more consistent with statistical models that are more complex than Markov processes and more language-like.

Human language uses what's called "context-free grammars," whereby certain grammatical rules apply regardless of the context, whereas animal language uses simple or "regular" grammar, which is much more restrictive. The Markov process is the most common model used to examine animal vocal sequences, which assumes that a future occurrence of a vocal element is entirely determined by a finite number of past vocal occurrences.

The findings suggests there may be an intermediate step on the evolutionary path between the regular grammar of animal communication and the context-free grammar of human language that has not yet been identified and explored.

"Language is the biggest difference that separates humans from animals evolutionarily, but multiple studies are finding more and more stepping stones that seem to bridge this gap. Uncovering the process underlying vocal sequence generation in animals may be critical to our understanding of the origin of language," said lead author Arik Kershenbaum, a postdoctoral fellow at the National Institute for Mathematical and Biological Synthesis.

Kershenbaum A, Bowles A, Freeburg T, Dezhe J, Lameira A, Bohn K. 2014. Animal vocal sequences: Not the Markov chains we thought they were. Proceedings of the Royal Society B.

http://www.eurekalert.org/pub_releases/2014-08/uol-ye081914.php

'Tickling' your ear could be good for your heart

Stimulating nerves in your ear could improve the health of your heart, researchers have discovered.

A team at the University of Leeds used a standard TENS machine like those designed to relieve labour pains to apply electrical pulses to the tragus, the small raised flap at the front of the ear immediately in front of the ear canal.

The stimulation changed the influence of the nervous system on the heart by reducing the nervous signals that can drive failing hearts too hard.

Professor Jim Deuchars, Professor of Systems Neuroscience in the University of Leeds' Faculty of Biological Sciences, said: "You feel a bit of a tickling sensation in your ear when the TENS machine is on, but it is painless. It is early days - so far we have been testing this on healthy subjects - but we think it does have potential to improve the health of the heart and might even become part of the treatment for heart failure."

The researchers applied electrodes to the ears of 34 healthy people and switched on the TENS (Transcutaneous Electrical Nerve Stimulation) machines for 15-minute sessions. They monitored the variability of subjects' heartbeats and the activity of the part of the nervous system that drives the heart. Monitoring continued for 15 minutes after the TENS machine was switched off.

Lead researcher Dr Jennifer Clancy, of the University of Leeds' School of Biomedical Sciences, said: "The first positive effect we observed was increased variability in subjects' heartbeats. A healthy heart does not beat like a metronome. It is continually interacting with its environment - getting a little bit faster or a bit slower depending on the demands on it. An unhealthy heart is more like a machine constantly banging out the same beat. We found that when you stimulate this nerve you get about a 20% increase in heart rate variability."

The second positive effect was in suppressing the sympathetic nervous system, which drives heart activity using adrenaline.

Dr Clancy said: "We measured the nerve activity directly and found that it reduced by about 50% when we stimulated the ear. This is important because if you have heart disease or heart failure, you tend to have increased sympathetic activity. This drives your heart to work hard, constricts your arteries and causes damage. A lot of treatments for heart failure try to stop that sympathetic activity - beta-blockers, for instance, block the action of the hormones that implement these signals. Using the TENS, we saw a reduction of the nervous activity itself."

The researchers found significant residual effects, with neither heart rate variability or sympathetic nerve activity returning to the baseline 15 minutes after the TENS machine had been switched off.

The technique works by stimulating a major nerve called the vagus, which has an important role in regulating vital organs such as the heart. There is a sensory branch of the vagus in the outer ear and, by sending electrical current down the nerves and into the brain, researchers were able to influence outflows from the brain that regulate the heart. Vagal nerve stimulation has previously been used to treat conditions including epilepsy.

Professor Deuchars said: "We now need to understand how big and how lasting the residual effect on the heart is and whether this can help patients with heart problems, probably alongside their usual treatments. The next stage will be to conduct a pre-clinical study in heart failure patients."

The research is published today in the journal Brain Stimulation and was funded by the University of Leeds.

The full paper: Jennifer A. Clancy et al., 'Non-invasive vagus nerve stimulation in healthy humans reduces sympathetic nerve activity' is published in Brain Stimulation (DOI 10.1016/j.brs.2014.07.031). Copies of the paper are available on request to members of the media from the University of Leeds press office.

Images of the device in use and other content is available at: https://drive.google.com/folderview?id=0B_5idc3rcKskODI0VWlzQ1VZMG8&usp=sharing

http://www.eurekalert.org/pub_releases/2014-08/msu-set081914.php

Solar energy that doesn't block the view

A team of researchers at Michigan State University has developed a new type of solar concentrator that when placed over a window creates solar energy while allowing people to actually see through the window

A team of researchers at Michigan State University has developed a new type of solar concentrator that when placed over a window creates solar energy while allowing people to actually see through the window.

It is called a transparent luminescent solar concentrator and can be used on buildings, cell phones and any other device that has a flat, clear surface. And, according to Richard Lunt of MSU's College of Engineering, the key word is "transparent."

Research in the production of energy from solar cells placed around luminescent plastic-like materials is not new. These past efforts, however, have yielded poor results – the energy production was inefficient and the materials were highly colored.

"No one wants to sit behind colored glass," said Lunt, an assistant professor of chemical engineering and materials science. "It makes for a very colorful environment, like working in a disco. We take an approach where we actually make the luminescent active layer itself transparent."

The solar harvesting system uses small organic molecules developed by Lunt and his team to absorb specific nonvisible wavelengths of sunlight.

"We can tune these materials to pick up just the ultraviolet and the near infrared wavelengths that then 'glow' at another wavelength in the infrared," he said.

The "glowing" infrared light is guided to the edge of the plastic where it is converted to electricity by thin strips of photovoltaic solar cells.

"Because the materials do not absorb or emit light in the visible spectrum, they look exceptionally transparent to the human eye," Lunt said.

One of the benefits of this new development is its flexibility. While the technology is at an early stage, it has the potential to be scaled to commercial or industrial applications with an affordable cost.

"It opens a lot of area to deploy solar energy in a non-intrusive way," Lunt said. "It can be used on tall buildings with lots of windows or any kind of mobile device that demands high aesthetic quality like a phone or e-reader. Ultimately we want to make solar harvesting surfaces that you do not even know are there."

Lunt said more work is needed in order to improve its energy-producing efficiency.

Currently it is able to produce a solar conversion efficiency close to 1 percent, but noted they aim to reach efficiencies beyond 5 percent when fully optimized. The best colored LSC has an efficiency of around 7 percent.

The research was featured on the cover of a recent issue of the journal Advanced Optical Materials.

Other members of the research team include Yimu Zhao, an MSU doctoral student in chemical engineering and materials science; Benjamin Levine, assistant professor of chemistry; and Garrett Meek, doctoral student in chemistry.

http://scitechdaily.com/research-reveals-tumor-cells-move-throughout-body/

Research Reveals How Tumor Cells Move Throughout the Body

Using a microscopic obstacle course, researchers at Brown University observe cancer cells directly as they break away from a tumor mass and move.

Providence, Rhode Island (Brown University) - Using a microengineered device that acts as an obstacle course for cells, researchers have shed new light on a cellular metamorphosis thought to play a role in tumor cell invasion throughout the body.

The epithelial-mesenchymal transition (EMT) is a process in which epithelial cells, which tend to stick together within a tissue, change into mesenchymal cells, which can disperse and migrate individually.

EMT is a beneficial process in developing embryos, allowing cells to travel throughout the embryo and establish specialized tissues.

But recently it has been suggested that EMT might also play a role in cancer metastasis, allowing cancer cells to escape from tumor masses and colonize distant organs.

For this study, published in the journal Nature Materials, the researchers were able to image cancer cells that had undergone EMT as they migrated across a device that mimics the tissue surrounding a tumor.

"People are really interested in how EMT works and how it might be associated with tumor spread, but nobody has been able to see how it happens," said lead author Ian Y. Wong, assistant professor in the Brown School of Engineering and the Center for Biomedical Engineering, who performed the research as a postdoctoral fellow at Massachusetts General Hospital.

"We've been able to image these cells in a biomimetic system and carefully measure how they move."

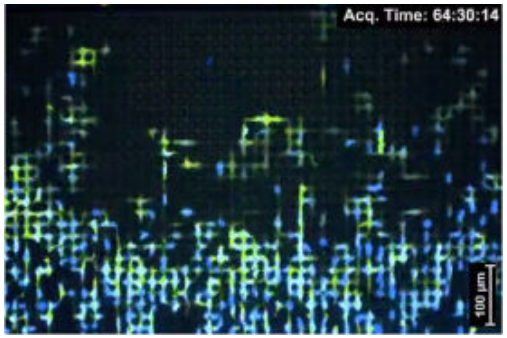
The experiments showed that the cells displayed two modes of motion. A majority plod along together in a collectively advancing group, while a few cells break off from the front, covering larger distances more quickly.

"In the context of cell migration, EMT upgrades cancer cells from an economy model to a fast sports car," Wong said.

"Our technology enabled us to track the motion of thousands of 'cars' simultaneously, revealing that many sports cars get stuck in traffic jams with the economy cars, but that some sports cars break out of traffic and make their way aggressively to distant locations."

Armed with an understanding of how EMT cancer cells migrate, the researchers hope they can use this same device for preliminary testing of drugs aimed at inhibiting that migration.

The work is part of a larger effort to understand the underpinnings of cancer metastasis, which is responsible for nine out of 10 cancer-related deaths.



***Tumor cells on the move*: Time-lapse microphotography shows a portion of the cancer cells making more rapid progress through the cellular obstacle course. Researchers were surprised to observe that cells remaining with the group began reverting to a less invasive cell type.**

'Obstacle course for cells'

To get this new view of how cancer cells move, the researchers borrowed microelectronics processing techniques to pattern miniaturized features on silicon wafers, which were then replicated in a rubber-like plastic called PDMS. The

device consists of a small plate, about a half-millimeter square, covered in an array of microscopic pillars. The pillars, each about 10 micrometers in diameter and spaced about 10 micrometers apart, leave just enough space for the cells to weave their way through. Using microscopes and time-lapse photography, the researchers can watch cells as they travel across the plate.

"It's basically an obstacle course for cells," Wong said. "We can track individual cells, and because the size and spacing of these pillars is highly controlled, we can start to do statistical analysis and categorize these cells based on how they move."

For their experiments, the researchers started with a line of benign cancer cells that were epithelial, as identified by specific proteins they express.

They then applied a chemical that induced the cells to become malignant and mesenchymal. The transition was confirmed by looking for proteins associated with the mesenchymal cell type. Once all the cells had converted, they were set free on the obstacle course.

The study showed that about 84 percent of the cells stayed together and slowly advanced across the plate. The other 16 percent sped off the front and quickly made it all the way across the device.

To the researchers' surprise, they found that the cells that stayed with the group started to once again express the epithelial proteins, indicating that they had reverted back to the epithelial cell type.

"That was a remarkable result," Wong said. "Based on these results, an interesting therapeutic strategy might be to develop drugs that downgrade mesenchymal sports cars back to epithelial economy models in order to keep them stuck in traffic, rather than aggressively invading surrounding tissues."

As for the technology that made these findings possible, the researchers are hopeful that it can be used for further research and drug testing.

"We envision that this technology will be widely applicable for preclinical testing of anti-migration drugs against many different cancer cell lines or patient samples," Wong said.

Other authors on the paper are Elisabeth A. Wong (no relation), now a medical student at the Alpert Medical School of Brown University, as well as Sarah Javaid, Sinem Perk, Daniel A. Haber, Mehmet Toner, and Daniel Irimia of Massachusetts General Hospital. The work was supported by the Damon Runyon Cancer Research Foundation (DRG-2065-10), the Howard Hughes Medical Institute and the National Institute of Health under (CA129933, EB002503, CA135601, GM092804).

Publication: Ian Y. Wong, et al., "Collective and individual migration following the epithelial–mesenchymal transition," Nature Materials, 2014; doi:10.1038/nmat4062

http://www.bbc.com/news/health-28850993

'Nurse ratio' at weekends key to stroke survival for patients

The number of nurses available at weekends - but not the frequency of doctors' ward rounds - affects chances of survival after stroke, a study says.

By Smitha Mundasad Health reporter, BBC News

Researchers found patients admitted to stroke units with the lowest ratio of nurses were most likely to die in the month after a stroke. But weekend ward rounds led by senior doctors did not appear to make a difference to the death rate. The PLoS Medicine study analysed data from more than 100 English hospitals.

Weekend deaths

A growing body of research suggests patients admitted to hospitals at weekends do not recover as well as those arriving during the week.

Scientists analysed data from 103 hospitals, noting the ratio of nurses to patients present in stroke units at weekends.

They also charted whether senior doctors carried out ward rounds on Saturdays and Sundays.

Wards with an average of 1.5 nurses caring for 10 patients had higher death rates than wards with three nurses to every 10 patients.

And researchers calculated if nurse ratios were doubled to three per 10 patients, one extra death could be prevented for every 25 admissions.

They found most wards had senior doctors conducting ward rounds five days a week and almost half provided consultant rounds seven days a week.

But there was no difference in death rates between the two groups.

Nutrition and hydration

The paper does not look at the reasons behind these trends but researchers speculate aspects of nursing care - such as attention to nutrition and hydration have a major impact on surviving after stroke.

Dr Benjamin Bray of King's College London, who led the research, told the BBC: "I would suggest the role of stroke doctors is still very important but the risk of death is the wrong thing to measure when considering their impact.

"Doctors play a vital role in speeding up recovery and helping people return home quickly. But we would need to carry out a different study to measure this."

He suggested hospitals may take this type of study into account when considering staffing levels.

But further work looking more specifically at the number of times patients were seen by doctors and nurses would provide more details on the complexities behind this, he said.

Dr Peter Carter of the Royal College of Nursing, said: "It is unacceptable that stroke patient mortality rates are higher at weekends when staffing levels tend to

be lower. "Driving up standards of patient care in the NHS requires commitment to investing in the nursing workforce. "We're worried that this isn't happening and that there remains much more work to do in providing safe staffing levels for every health setting."

http://www.eurekalert.org/pub_releases/2014-08/asu-nrs081914.php

New research shows seals and sea lions likely spread tuberculosis to humans

Tuberculosis is one of the most persistent and deadliest infectious diseases in the world

Tuberculosis is one of the most persistent and deadliest infectious diseases in the world, killing one to two million people each year.

Scientists who study tuberculosis have long debated its origins. New research shows that tuberculosis likely spread from humans in Africa to seals and sea lions that brought the disease to South America and transmitted it to Native people there before Europeans landed on the continent.

The paper, "Pre-Columbian Mycobacterial Genomes Reveal Seals as a Source of New World Human Tuberculosis," was published in Nature.

"We found that the tuberculosis strains were most closely related to strains in pinnipeds, which are seals and sea lions," said researcher Anne Stone, Arizona State University School of Human Evolution and Social Change professor. Stone and Johannes Krause of the University of Tubingen in Germany are co-principal investigators on the project. Research teams from the Wellcome Trust Sanger Institute in the United Kingdom and the Swiss Institute for Tropical and Public Health were collaborators on the study.

"What we found was really surprising. The ancient strains are distinct from any known human-adapted tuberculosis strain," Stone added.

Modern strains of tuberculosis currently circulating are most closely related to those found in Europe, and there was a complete replacement of the older strains when European disease reached the Americas during the age of exploration.

Researchers found that genomes from humans in Peru dating from about 1,000 year ago provide unequivocal evidence that a member of the tuberculosis strain caused disease in South America before Europeans arrived, so the question among the scientists was, "What types of tuberculosis strains were present before contact?"

"The age of exploration is a time when people are moving really long distances around the world and coming into contact with others. It's a time when a lot of disease spread," Stone said. "This opens up a lot of new questions. It fits the bioarcheological evidence that shows the oldest evidence for tuberculosis in South America."

"The connection to seals and sea lions is important to explain how a mammalian-adapted pathogen that evolved in Africa around 6,000 years ago could have reached Peru 5,000 years later," Krause said.

In the study, researchers collected genetic samples from throughout the world and tested those for tuberculosis DNA while utilizing advances in technology during the past five years that enable more accurate genome capture from ancient samples. Of 76 DNA samples from New World pre- and post-contact sites, three from Peru around 750 to 1350 AD had tuberculosis DNA that could be used. The researchers then focused on these three samples and used array-based capture to obtain and map the complete genome.

These were compared against a larger dataset of modern genomes and animal strains. Research results showed the clear relationship to animal lineages, specifically seals and sea lions.

"Our results show unequivocal evidence of human infection caused by pinnipeds (sea lions and seals) in pre-Columbian South America. Within the past 2,500 years, the marine animals likely contracted the disease from an African host species and carried it across the ocean to coastal people in South America," Stone said.

Africa has the most diversity among tuberculosis strains, implying that the pathogen likely originated from the continent and spread. After tuberculosis was established in South America, it may have moved north and infected people in North America before European settlers brought new strains in.

"We hypothesize that when the more virulent European strains came, they quickly replaced the pinniped strains," Stone said.

"It was a surprise for all of us to find that tuberculosis, formerly believed to have spread around the world with ancient human migration events, is in fact a relatively young disease," said Kelly Harkins, one of the study's first authors and recent doctoral graduate from ASU's Center for Bioarchaeological Research.

"A compelling prospect for future research will be to determine the relationship of these older forms to those currently circulating, and those isolated from other ancient remains," said Kirsten Bos, postdoctoral fellow at the University of Tuebingen and another first author on the study.

Study implications include a greater understanding of the speed and process of adaptation when a disease changes hosts. This is especially of interest when considering diseases that are transmitted between species - MERS, SARS and HIV - and how these are spread, Stone added.

"Tuberculosis is a disease that is on the rise again worldwide. This study and further research will help us understand how the disease is transmitted and how the disease may evolve," said Jane Buikstra, a collaborator on the study who identified tuberculosis in most of the cases utilized in the research. Buikstra is an ASU Regents' Professor and Director of the Center for Bioarchaeological Research.

http://www.eurekalert.org/pub_releases/2014-08/uota-uot081514.php

University of Tennessee research uncovers subglacial life beneath Antarctic ice sheet

University of Tennessee, Knoxville, research finds life can persist in a cold, dark world

University of Tennessee, Knoxville, research finds life can persist in a cold, dark world.

A UT microbiology assistant professor was part of a team that examined waters and sediments from a shallow lake deep beneath the Antarctic ice sheet and found the extreme environment supports microbial ecosystems.

The National Science Foundation-funded research by Jill Mikucki and her colleagues has implications for life in other extreme environments, both on Earth and in the solar system. The findings are published in the current edition of the science journal Nature.

Analysis of samples taken from Subglacial Lake Whillans, which is under 800 meters of ice, shows that the lake "supports a metabolically active and…diverse ecosystem that functions in the dark at subzero temperatures," according to the authors.

The NSF project, called Whillans Ice Stream Subglacial Access Research Drilling, or WISSARD, made scientific and engineering history in late January 2013 when the researchers retrieved water and sediment samples from Subglacial Lake Whillans that had been isolated from direct contact with the atmosphere for at least many thousands of years.

Previous research at Subglacial Lake Vostok, the largest subglacial lake in Antarctica, has been called into question due to potential contamination, primarily from hydrocarbon-based drilling fluid.

To avoid contamination concerns, the team used a novel clean hot-water drill technology to directly obtain samples from the waters and sediments that were uncontaminated by the drilling itself.

"Because Antarctica is basically a microbial continent, exploring below its thick ice sheet can help us understand how life has evolved to survive in cold darkness. I hope our findings motivate new research on the role of these extreme microorganisms in the function of our planet and other icy worlds in our solar system," said Mikucki.

Subglacial Lake Whillans is part of a network of major reservoirs under the Whillans Ice Stream.

The researchers say their data shows that through this network's connections to the waters surrounding Antarctica, the microbial ecosystems influence the chemical and biological composition of the Southern Ocean which encircles the continent.

"Given the prevalence of subglacial water in Antarctica, our data…lead us to believe that aquatic microbial systems are common features of the subsurface environment that exists beneath the…Antarctic Ice Sheet," wrote the authors.

Co-authors on the paper include researchers from Montana State University, the University of Venice in Italy, the Scripps Institution of Oceanography, St. Olaf College in Minnesota and Aberystwyth University in the United Kingdom. Mikucki will return to the Whillans Ice Stream with UT graduate student Alicia Purcell this December.

NASA's Cryospheric Sciences Program, the National Oceanic and Atmospheric Administration, and the private Gordon and Betty Moore Foundation also provided support for the project.

http://www.eurekalert.org/pub_releases/2014-08/nuos-tgc081514.php

Treating gastric cancer -- with Botox

Cutting the signals sent to cancer stem cells suppressed their growth

Researchers have found a novel approach to treating cancer - using Botox.

A study presented in the 20 August edition of Science Translational Medicine shows that cancer growth could be suppressed by eliminating the signals sent by nerves that are linked to cancer stem cells.

The approach thus treated the cancer. The use of Botox made the treatment cheap, safe and efficient. The researchers have thus far tested the procedure on mice, and will soon start testing on humans.

The nervous system is crucial in regulating many organs. Researchers from the Norwegian University of Science and Technology (NTNU), Columbia University and MIT, along with researchers from Japan and Germany have now shown that the vagal nerve contributes to the growth of gastric tumors, so that stopping the nerve signal to the tumor will stop its growth.

"This study shows that nerves control cancer stem cells," say NTNU Professor Duan Chen and Columbia Professor Timothy Wang, the co-corresponding authors of the study published in this week's edition Science Translational Medicine.

"We found that by removing the effect of the nerve, the stem cells in the cancer tumor are suppressed, leading to cancer treatment and prevention," Chen said.

This study found that nerves promote tumor growth through the release of a neurotransmitter.

The researchers tried four methods to cut the connection between the nerves and the tumor: surgically by cutting the gastric vagus nerve (vagotomy), by local injection of Botox to block the release of neurotransmitter from the vagus nerve, by giving a drug to block the receptor of the neurotransmitter, and by knocking out of the receptor gene. All procedures suppressed the tumor growth.

"But we found that the anti-cancer effects were remarkable, especially with local vagotomy or by injecting Botox. It actually surprised us. The finding that Botox was highly effective was particularly exciting," Chen said.

Botox is well known to the public as a beauty treatment, but it is also used for different medical indications.

"We believe this treatment is a good treatment because it can be used locally and it targets the cancer stem cells. The Botox can be injected through gastroscopy and it only requires the patient to stay in the hospital for a few hours," says Chen.

He added that the procedure is also less toxic than most standard cancer treatments, less expensive and has hardly any side effects.

"However, for most patients, we are suggesting that denervation works best in combination with traditional chemotherapy, since loss of nervous input appears to make cancer cells more vulnerable to chemotherapy, which makes the chemotherapy more efficient as well," Wang said.

The promising results from this study have led to an initiation of a phase II clinical trial for patients with stomach cancer in Norway.

The Botox treatment can be an additional treatment for patients who have inoperable stomach cancer, or patients who have received chemotherapy but no longer respond to such therapy.

It can also be considered in patients who, due to toxicity of chemotherapy, cannot be offered chemotherapy treatment or who, after meticulous information about chemotherapy, still do not want such treatment.

"The nerve-tumor growth connection is likely to be true in other solid tumors, such as in prostate cancer, but the precise nerves that are involved are likely to vary from organ to organ and tumor to tumor. Further studies are needed," both Chen and Wang added.

This work was supported by grants from the Research Council of Norway, the Joint Programme of the NTNU Medical Faculty and St. Olavs University Hospital, and the US National Institutes of Health.

The article "Denervation suppresses gastric tumorigenesis" by Zhao, Chun-Mei et al. is published in the 20 August edition of Science Translational Medicine.

http://www.eurekalert.org/pub_releases/2014-08/giot-ebi081914.php

Early bottlenecks in developing biopharmaceutical products delay commercialization

An analysis of patented university inventions licensed to biotechnology firms has revealed early bottlenecks on the path to commercialization.

To open these roadblocks, the researchers suggest that better communication of basic research results during the discovery stage could lead to faster commercialization down the road.

Biopharmaceutical drugs are frequently derived from discoveries made in university laboratories and licensed to biotechnology firms. Bottlenecks are well known during clinical trials, which have a high failure rate.

But a new study pinpoints how much time is lost earlier in the pathway, when biotech companies give up on an invention and transfer the technology to other biotech firms for repurposing in a new disease category.

Companies rarely share their basic research on an invention, which highlights what the researchers consider to be an underappreciated cost of commercialization as basic science research is then repeated, postponed, or never performed.

"The timeline for commercialization is much longer than most people think. There is so much turmoil and churn within the process," said co-author Jerry Thursby, a professor and the Ernest Scheller, Jr. Chair in Innovation, Entrepreneurship, and Commercialization at the Scheller College of Business at the Georgia Institute of Technology.

The study was sponsored by the National Institutes of Health (NIH) and was published August 20 in the journal Science Translational Medicine.

The standard path to the marketplace for biotechnology is for universities to do most of the basic research and then license a discovery to a small biotechnology firm that advances the research.

The small biotech firm will then sublicense the discovery to a large biotechnology firm that can afford to run clinical trials.

The study found that basic research rarely proceeds in this straightforward path to commercialization, often zigzagging across biotech firms and research areas before a drug is finally developed.

"What these data reveal is that there's a lot of bench to bench translational research. It's not linear," said Marie Thursby, a study co-author and the Hal and John Smith Chair in Entrepreneurship at the Scheller College of Business.

Matthew Higgins, an associate professor of strategic management, was also a co-author of the study.

For the study, the researchers built a database of 835 patents in 342 university licenses with biotech firms.

The researchers then traced the path of patents to document whether they were subsequently sublicensed to another firm for testing in a new disease category or whether the sublicense was to a large firm for clinical trials or marketing.

Sublicensing often resets the development timeline in what the authors refer to as bench-to-bench translational research.

"A very large fraction of the time, an invention pops out as something else and the timeline for the discovery stage starts all over again," said Jerry Thursby.

Of the 835 inventions studied, 27 percent appeared in a second license.

The average time between invention and first license was five and a half years, and the average time between first- and second-license was three and a half years.

This time span for the upstream phase of the translation process is substantial, the study says, given that the average time from discovery to approval of new drugs (including biologics) by the U.S. Food and Drug Administration (FDA) is 13 years.

Of the first-licenses that list a stage of development, 92 percent were either at the discovery or lead molecule stages (the earliest two stages, respectively), with only 6 percent listed in clinical trials. Among the second-licenses, only 22 percent were in clinical trials or beyond.

"Nobody knew the magnitude of how much licensing changes and the stages at which they change," said Marie Thursby.

"The biotechnology industry is quite fragmented, and there are all sorts of informational problems."

This analysis of early-stage biomedical translation suggests that stakeholders need to design policies and initiatives that enhance early translation by more efficiently driving more inventions into multiple disease pipelines.

One option might be the formation of an open-source translational research database that complements clinicaltrials.gov, where patents and licenses for fundamental biomedical research believed to be destined for eventual therapeutic use initially would be logged and shared.

"What might be a failure to a biotech firm could be a success to society as a whole," Jerry Thursby said.

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Marie Thursby, et al., "Bench-to-Bench Bottlenecks in Translation." (Science Translational Medicine, August 2014).

http://bit.ly/1kZWwv7

Magnesium surgical implants can be designed to biodegrade, promote bone growth

Ask anyone who has a surgical pin in their body, and they likely will tell you they wish it would just go away.

Phys.org - In the future, it just might, with help from research by Michele Manuel, an associate professor of materials science and engineering at the University of Florida. Manuel has developed a surgical pin made from magnesium and is working to control the rate at which the pin degrades in the body. In laboratory tests, the pin offers several advantages over the plastic and stainless steel or titanium pins currently used.

"We don't always want to put in a metal implant and leave it there forever," Manuel said. "The idea with this pin is that it would dissolve over time, and after it's finished, your body is basically in the same state it was before you had an injury.

"Everybody knows someone who has an implant in their body that they wish wasn't there," Manuel said. "Surgical pins don't have to become permanent fixtures in the body." The pin not only biodegrades but also aids healing. Magnesium builds bone, so it can function both as a pin and as a nutrient.

"You have to have magnesium to live, and many people take magnesium supplements," Manuel said. "So this is a good orthopedic application. It's not only an implant that serves a medical need in terms of fixing bones, it's also serving a nutritional need as well, so that's why you see a lot of activity in the surrounding tissue."

The use of magnesium isn't new, Manuel said. In the early 1800s, physicians experimented with magnesium implants but ran into problems because magnesium produces hydrogen as it breaks down, which creates hydrogen gas bubbles under the skin that are clearly visible. Doctors of the era tried to remove the hydrogen gas with syringes but eventually gave up until new, improved metals were developed.

The trick to using magnesium, Manuel said, is controlling the rate at which it breaks down to give the body time to absorb the hydrogen.

"Your body can handle the hydrogen, just not in large doses, so pockets form," Manuel said. "So if we can slow down how fast the magnesium degrades so it releases hydrogen more slowly, the body would take up the hydrogen the way it would take up any other gas and release it."

In lab tests, Manuel has compared the magnesium pin with clinical implant materials. Surgical pins are shaped like screws, so in addition to controlling the

rate at which the magnesium breaks down, Manuel is trying to determine how much torque can be applied before the screw is stripped.

In lab tests, the magnesium pin has been inserted into the tibia of rats. X-rays show the rate at which the magnesium pins dissolve, and at six weeks the new bone is indistinguishable from the bone before the break. Another use of the magnesium could be as a coating for an implant to promote bone growth.

As Manuel's research continues, entrepreneurs at UF's Innovation Hub are keeping watch, with an eye toward bringing the technology to market. "People who have sensitivity to metal or inflammation from a foreign material in the body could benefit from this," Manuel said. "There are a lot of different applications that could be possible."

http://www.bbc.com/news/health-28858511

Student's heart research finding 'could be lifesaving'

An 18-year-old student has made a scientific breakthrough that could help save the lives of black athletes with undiagnosed heart problems.

By James Gallagher Health editor, BBC News website

Hypertrophic cardiomyopathy can lead to the heart suddenly stopping. Henry Roth, from Hampshire, proved different tests for the condition were needed for black and white athletes - which do not currently take place. A cardiologist who worked with Henry on the project said he was "astonished" by the teenager's findings.

Henry was inspired to investigate the condition after the death of his uncle at the age of 21. A research project emerged from a conversation with a cardiologist at St George's Hospital in London during tests on Henry's own heart. They discussed how black athletes were at higher risk and the aspiring doctor resolved to find a better way of testing.

Thicker heart

Hypertrophic cardiomyopathy is an inherited disease where the heart muscle becomes thickened, increasing the risk of the heart suddenly stopping. Screening does take place, but intense exercise can also lead to a thicker heart - so some athletes might not be aware they have the condition.

Bolton footballer Fabrice Muamba collapsed on the pitch in 2012 when his heart stopped, despite being described as one of the fittest players at the club. Marc-Vivien Foe, the Cameroon footballer, died during an international match in 2003.

An alternative way of testing involves looking at the maximum amount of oxygen the body can use up at the limits of physical exercise. Those with hypertrophic cardiomyopathy cannot reach the same peak.

Henry's study on elite athletes found differences between black and white athletes, but these were not accounted for during screening. It meant black athletes were less likely to be diagnosed.

Henry, who studied at Guildford's Royal Grammar School, said he could not believe the difference had not been identified already. He told the BBC: "I was quite frankly shocked, but it takes people who are shocked to do something about it, make something happen and not sit back and accept normal practice."

Huge potential

Prof Sanjay Sharma, the medical director of the London Marathon and the charity Cardiac Risk in the Young, said: "Henry has a thirst for researching the heart, driven by his own family's experience of sudden cardiac death.

"He wants to make sure other families don't go through what he has experienced, and I have been really excited, and quite astonished, by the research he undertook with me and my colleagues at St George's Hospital. "Henry's work has the potential to change the way we test athletes for hypertrophic cardiomyopathy."

Around one in 500 people in the UK has the condition, although it will not affect the lives of the majority of patients.

Henry explains: "An aeroplane on the ground with a mechanical fault is not dangerous, but as soon as you take it into the air it's dangerous. "As soon as they go on to the field it leads to the possibility of arrhythmias (irregular heartbeat)."

Henry was also a finalist in the National Science and Engineering Competition. He will be returning to St George's to continue the research before travelling during a gap year and then pursuing a career in medicine.

http://www.medscape.com/viewarticle/830140

Infection Prevention and Control of Ebola Virus Disease in US Hospitals

What healthcare facilities can do to prepare for a patient with Ebola virus disease and the infection control procedures that need to be in place

David T. Kuhar, MD

Hello. I'm Dr. David Kuhar, a medical officer at the Centers for Disease Control and Prevention (CDC). I'm pleased to be speaking with you today as part of the CDC Expert Video Commentary series on Medscape. Today I want to discuss what healthcare facilities can do to prepare for a patient with Ebola virus disease and the infection control procedures that need to be in place in US hospitals.

The recent Ebola virus disease outbreak in West Africa has increased the possibility of patients traveling from the affected countries to the United States. Furthermore, 2 American citizens with Ebola were medically evacuated to the United States to receive care at a hospital.

Any US hospital that is following CDC's infection control recommendations, and can isolate a patient in a private room, is capable of safely managing a patient with Ebola virus disease.

Early recognition is *critical* for infection control. Any suspected case needs to be isolated until the diagnosis is confirmed or ruled out.

Healthcare providers should consider Ebola as a diagnosis when patients have traveled to affected areas within the past 3 weeks and report such symptoms as fever, joint or muscle aches, diarrhea, vomiting, weakness, stomach pain, or lack of appetite.

Patients should be isolated in a single-patient room containing a private bathroom, with the door to the hallway closed. Limit the number of persons entering the patient's room to those essential for care, and maintain a log of all persons entering the patient's room.

Anyone entering the room should wear at least gloves, a gown that is fluid resistant, eye protection such as goggles or a face shield, and a face mask.

Additional personal protective equipment (PPE) might be required in certain situations, such as when there may be copious amounts of blood or other body fluids present in the environment. For these situations, additional PPE could include, but is not limited to, double gloving, disposable shoe covers, and leg coverings. Upon exit from the care area, it is very important that PPE be carefully removed and discarded without contaminating the wearer's eyes, mucous membranes, or clothing with potentially infectious materials. Reusable PPE -- such as some types of goggles -- should be cleaned and disinfected according to the manufacturer's reprocessing instructions and hospital policies.

When caring for the patient, dedicated and disposable medical equipment is preferable, when possible. All nondedicated, nondisposable medical equipment used for patient care should be cleaned and disinfected according to the manufacturer's instructions and hospital policies.

Limit the use of needles and other sharps as much as possible. Phlebotomy procedures and lab testing should be limited to the minimum necessary for essential diagnostic evaluation and medical care. Also, all needles and sharps should be handled with extreme care and disposed of in puncture-proof, sealed containers.

We recommend avoiding aerosol-generating procedures for patients infected with Ebola virus disease. If these procedures are performed, you should follow CDC's detailed infection control recommendations, which can be found in the resources section on this page.

Diligent environmental cleaning and disinfection and safe handling of potentially contaminated materials are paramount, because blood, sweat, emesis, feces, and other body secretions represent potential infectious materials. Healthcare personnel performing environmental cleaning and disinfection should wear recommended PPE and consider use of additional barriers such as shoe or leg coverings.

The duration of precautions should be determined on a case-by-case basis, in conjunction with local, state, and federal health authorities.

I have described our minimum recommendations. If hospitals decide to add additional precautions, they should have staff practice the procedures and practice using the PPE in advance. Changing to unfamiliar equipment may lead to breaches in safe practices and may increase a person's risk of contaminating their clothes, mouth, or eyes, especially when removing the equipment. So, practice these protocols in advance.

As this outbreak continues to evolve, CDC will regularly update our Ebola Website and will continue to release additional resources for US healthcare facilities. Please continue to check back to stay up-to-date on the evolving situation or to view the additional resources available on this page.

Web Resources

Information for Health Care Workers

Infection Prevention and Control Recommendations for Hospitalized Patients with Known or Suspected Ebola Hemorrhagic Fever in US Hospitals

FAQ on Safe Management of Patients with Ebola Virus Disease (EVD) in U.S. Hospitals

Case Definition for Ebola Virus Disease (EVD)

Interim Guidance for Specimen Collection, Transport, Testing, and Submission for Patients with Suspected Infection with Ebola Virus Disease

2014 Ebola Outbreak in West Africa (The Latest, Highlights, Cases by Country)

http://bit.ly/1p1s8eJ

Crowd-control policing in the US is stuck in riot mode

The way a protest is marshalled has a greater influence on whether it ends peacefully or violently

- **16:34 20 August 2014 by Michael Bond**

Recent scenes in Ferguson, Missouri, could have come straight from the streets of Cairo or Bahrain: police carrying shields and in full body armour firing tear gas and pointing their weapons at largely unarmed protestors. The fact that this was the US makes it seem all the more shocking.

The St Louis suburb has at times resembled a war zone following the shooting and killing of unarmed 18-year-old resident Michael Brown by a police officer on 9 August. The large demonstrations that followed Brown's death were met with a harsh response from the authorities, a response that has been criticised by US president Barack Obama, among others.

One of the most worrying aspects of this drama is what it reveals about US crowd-control methods. In Europe, many police forces have started to accept that the traditional model of public-order policing, which treats all crowds as potentially dangerous, often makes things worse.

This model dates back to the French Revolution, which seeded the idea that crowds turn people into primitive, dysfunctional automata, and that the only way to deal with protestors is to attack, disperse or "kettle" them – a draconian form of containment.

Such tactics are slowly being abandoned in Europe because social psychologists have demonstrated time and again that they can have a dramatic and often catastrophic effect on how people in crowds behave. They have found that the way a protest is marshalled has a greater influence on whether it ends peacefully or violently than the actions of any hooligan minority within the crowd. This puts the police in a powerful position, even before they take aim with rubber bullets or tear gas.

Overly robust

A good example of how overly robust policing can change the dynamics of a crowd for the worse is the protest against the poll tax in London on 31 March 1990. The 250,000 who turned out that day came from diverse backgrounds and interest groups, united by their opposition to the government's plans for a community charge levied on all, with little regard to income.

Despite the presence of thugs and opportunistic trouble-makers, the vast majority were peaceful, right up to the point when police tried to disperse them with baton charges. Finding themselves the target of what they considered to be indiscriminate police violence, they began to view the police as the enemy and to fight back. The ensuing riot did not end until 3am the next morning.

Clifford Stott, a social psychologist and criminologist now at the University of Leeds, UK, was in the crowd that day. He typifies a new breed of crowd researchers who prefer to study group dynamics from the inside, notebook and recorder in hand.

Stott, Stephen Reicher at the University of St Andrews, John Drury at the University of Sussex, and others, have overturned the old idea that crowds are always "mad and bad".

Their research shows that rather than lose their minds, people in crowds are instead tuned into the shared interest of those around them, whether that be opposition to the poll tax, support for a particular football team, love for a band they're watching, or, in the case of an emergency, fear of what could be about to happen.

As a result, says Reicher, crowds are highly cooperative places. From the outside, "they look incredibly dangerous, as if your life would be under threat". But from the inside, he says, "they seem carnivalesque and friendly. People are in many ways much more sociable than they would otherwise be." This also makes them responsive. If those policing the event become aggressive, then everyone in the crowd is likely to feel threatened together.

Social identity

This "social identity" model of crowd behaviour appears to fit with most cases where relevant data has been collected, starting with the Bristol riots in the UK in 1980, and including numerous football matches monitored by Stott in Europe. It also tallies with the conclusions of the Kerner Commission into race riots in Detroit, Chicago, Los Angeles and other US cities between 1965 and 1967.

In Europe, this message has got through to authorities, and in many places the way major football matches and other public events are policed has changed dramatically – a standout example of academic research influencing public policy. The new approach involves establishing communication between police and the crowd, and targeting only genuine troublemakers. In the UK, police forces in London, Sussex and elsewhere field liaison officers in blue bibs at public events, whose job is to interact with protestors and build rapport.

In the US, however, police appear still to cling to the old "riot squad" methods. They are wedded to the idea that large protest groups are inherently dangerous and that force is the best way to deal with them. The so-called "war on drugs" and fears of terrorism post-9/11 have encouraged US authorities to equip their law enforcement agencies with military-style weapons and other high-octane hardware. Containment takes precedence over negotiation every time.

Hyper-aggressive tactics

A report by the American Civil Liberties Union, published in June, noted that "American policing has become unnecessarily and dangerously militarized, in large part through federal programs that have armed state and local law enforcement agencies with the weapons and tactics of war… The use of hyper-aggressive tools and tactics results in tragedy for civilians and police officers, escalates the risk of needless violence, destroys property, and undermines individual liberties."

The lesson of the protests in Ferguson is that a new approach is needed. US authorities have only to look across the Atlantic to find it. They have been here before: after the 1960s riots in the US, the Kerner Commission found that in Detroit the disorder was reduced where soldiers established contact and built up a rapport with residents.

The authorities didn't listen then. Will they listen now?

http://bit.ly/1trxaGV

Young blood to be used in ultimate rejuvenation trial

In California, people with Alzheimer's will be given transfusions of young blood to see if improves their cognition – there's good reason to hope it might

- **20 August 2014 by Helen Thomson**

IT SOUNDS like the dark plot of a vampire movie. In October, people with Alzheimer's disease will be injected with the blood of young people in the hope that it will reverse some of the damage caused by the condition.

The scientists behind the experiment have evidence on their side. Work in animals has shown that a transfusion of young mouse blood can improve cognition and the health of several organs in older mice. It could even make those animals look younger. The ramifications for the cosmetics and pharmaceutical industries could be huge if the same thing happens in people.

Disregarding vampire legends, the idea of refreshing old blood with new harks back to the 1950s, when Clive McCay of Cornell University in Ithaca, New York, stitched together the circulatory systems of an old and young mouse – a technique called heterochronic parabiosis. He found that the cartilage of the old mice soon appeared younger than would be expected.

It wasn't until recently, however, that the mechanisms behind this experiment were more clearly understood. In 2005, Thomas Rando at Stanford University in California and his team found that young blood returned the liver and skeletal stem cells of old mice to a more youthful state during heterochronic parabiosis. The old mice were also able to repair injured muscles as well as young mice (*Nature*, doi.org/d4fkt5).

Spooky things seemed to happen in the opposite direction, too: young mice that received old blood appeared to age prematurely. In some cases, injured muscles did not heal as fast as would be expected.

Several other experiments have shown similar effects. In 2012, Amy Wagers at Harvard University showed that young blood can reverse heart decline in old mice. Her team paired healthy young mice with old mice that had cardiac hypertrophy – a condition which swells the size of their heart – and connected their circulatory systems. After four weeks, the old mouse's heart had shrunk to the same size as its younger partner. In this experiment, the young mouse was seemingly unaffected by the old blood, its heart not changing in size.

Once the researchers had ruled out the effect of reduced blood pressure on the older mice, they identified a protein in the blood plasma called growth differentiation factor 11 (GDF11) that appeared to fall with age. To see if it was linked to the rejuvenating effects, the team gave old mice with enlarged hearts daily injections of GDF11 for 30 days. Their hearts decreased in size almost as much as they had in the parabiosis experiments (*Cell*, doi.org/q2f).

A year later, the same team showed in mice that daily injections of GDF11 also increases the number of blood vessels and the number of stem cells in the brain – both factors known to improve brain function. A separate team led by Tony Wyss-Coray at Stanford performed similar experiments. His team injected blood plasma from young mice into old mice and showed an improvement in the old mice's physical endurance and cognitive function (*Nature Medicine*, DOI: 10.1038/nm.3569).

In both mice and humans, GDF11 falls with age. We don't know why it declines, but we know it is involved in several mechanisms that control growth. It is also thought to mediate some age-related effects on the brain, in part by activation of another protein that is involved in neuronal growth and long-term memory.

So the billion-dollar question is: would a GDF11 boost have the same effect in humans? Wyss-Coray thinks it will, having taken the next step of injecting young human blood plasma into old mice. His preliminary results suggest that human blood has similar rejuvenating benefits for old mice as young mouse blood does. "We saw these astounding effects," he says. "The human blood had beneficial effects on every organ we've studied so far."

Now, the final step – giving young human blood plasma to older people with a medical condition – is about to begin. Getting approval to perform the experiment in humans has been relatively simple, says Wyss-Coray, thanks to the long safety record of blood transfusions. He warns against swapping blood at home because transfusions need to be screened for disease, matched for blood type and the plasma needs to be separated out. "Certainly you can't drink the blood," he says. "Although obviously we haven't tried that experiment."

So in early October, a team at Stanford School of Medicine will give a transfusion of blood plasma donated by people under 30 to older volunteers with mild to moderate Alzheimer's.

Following the impressive results in animal experiments, the team hopes to see immediate improvements in cognition, but Wyss-Coray cautions that it is still very experimental. "We will assess cognitive function immediately before and for several days after the transfusion, as well as tracking each person for a few months to see if any of their family or carers report any positive effects," he says. "The effects might be transient, but even if it's just for a day it is a proof of concept that is worth pursuing."

All researchers involved in the work agree that GDF11 is unlikely to be the only factor that keeps organs youthful. "It's too optimistic to think there would be just one factor," says Francesco Loffredo, who studies the effects of young blood in

old animals at Harvard University. "It's much more likely to be several factors that exert these effects in combination."

Loffredo says the approach of testing the effects of young blood in people with Alzheimer's is fascinating, but reckons in the long-term it is best to continue to strive to identify the individual factors that are exerting the rejuvenating effects so that they can be translated to humans more easily. "Imagine if you had to be transfused with young blood all the time – it's hard to imagine as a therapy. Who is going to be donating all this blood?" he asks.

Wyss-Coray agrees. "It would be great if we could identify several factors that we could boost in older people," he says. "Then we might be able to make a drug that does the same thing. We also want to know what organ in the body produces these factors. If we knew that, maybe we could stimulate that tissue in older people."

Chemotherapy aid

Alessandro Laviano at the Sapienza University of Rome in Italy says that the research on diseases of ageing certainly holds promise, but he is more interested in the potential use of young blood in chronic disease. People with cancer who resist muscle loss have better chances of survival, he says. "So I'd like to consider the possibility of using these youthful factors in young blood to reduce the muscle wasting that occurs during chemotherapy."

Before moving to clinical trials in people with cancer we need to learn more about the dynamics of the beneficial factors in blood, says Laviano, such as when they are at their peak. Do we reach a peak at 5 or 35 years? "We just don't know," he says. He would also like to investigate what happens when you give "too much" GDF11 – does it result in extra benefit or a negative outcome?

Laviano is currently looking at the effect of GDF11 on tumours in animals to see if it inhibits their growth, but he would also like to start an observational trial in humans. It would be very simple, he says, to find the age of the blood given to people receiving transfusions and test whether it has any effect. "I certainly think that this therapy might be beneficial in a number of different conditions," says Wyss-Coray. "Blood might contain the fountain of youth after all. And it is within us all – that's the crazy thing. It just loses its power as we age."

http://bit.ly/1nhLbSt

Silicon Valley Goes Long on Nuclear Fusion

An experimental nuclear fusion company recently raised $1.5 million in venture capital this month, in what is turning out to be a banner year for unconventional fusion fundraising.

(As IEEE Spectrum noted last month, another firm, Lawrenceville Plasma Physics recently wrapped a $180,000 IndieGogo campaign to fund an experimental reactor that the company predicts could fuse protons with boron nuclei to generate low-radiation nuclear energy.)

San Francisco-based Mithril Capital Management covered $1.25 million of the total raised by Helion Energy of Redmond, Wash. Ajay Royan, the VC firm's co-founder says his fund is always on the lookout for what he calls “state-shift companies,” firms that force a sea-change in their industry. Helion, he says, offers the promise of being that rare company.

Of course, to date no one - not warehouse-sized reactors like the National Ignition Facility, and not smaller prototypes being developed by Helion and Lawrenceville - have yet produced a reactor that can sustain nuclear fusion in which the energy generated exceeds the energy consumed. Royan says, however, that Helion proved its attractiveness in part through its methodical approach: reactor technologies that are already in the marketplace or will soon be coming into the marketplace, such as fast electrical switches and high-performance capacitors; goals it had already achieved; and a timetable for its future milestones.

As Royan put it, he and his co-founder Peter Thiel wanted to see a fusion company whose challenges were engineering problems, rather than problems involving unknown or untested fundamental physics.

“My criteria is we should have no miracle physics, we should have minimal or no neutron discharge - so that we’re not coming up on the same regulatory and safety concerns associated with traditional fission or even other fusion approaches,” he says. “And if successful, the design should scale to be competitive with fracked natural gas as a source of electric power. That’s a tall order. And [Helion has] shown for our diligence efforts how they can rationally get there.”

As Helion’s website explains, the reactor turns two blobs of deuterium fuel into plasma and uses a pulsed magnetic field to slam them together. A strong magnetic field compresses the merged plasma, heating it to the point where the deuterium fuses with helium nuclei left over in the chamber from previous burn cycles. Helion projects that this reaction can be harnessed to create a 50 megawatt reactor no bigger than a shipping container.

The $1.5 million the company raised - from Mithril and Y Combinator - does not represent the final phase of Helion’s fundraising. Royan says another, bigger chunk of funding will be needed to ultimately produce the full, working prototype of Helion’s reactor design.

“They’re talking about it as building a product beta, a working, pre-commercial prototype that would then go into a power plant,” Royan says. “That is expected to happen over the course of the next half-decade, and it’s expected to take on the order of $30 to $50 million by the company’s estimates.”

Certainly, any company that could achieve sustained, low-or-no radiation nuclear fusion energy would have earned the right to call themselves - as a June blog post from Helion's famous hometown denizen Bill Gates put it - an "energy miracle." Royan says any miraculous projections in Helion's technology come down to cutting-edge new materials and electronics. "A lot of what Helion is planning to do would have not been possible five years ago," he says. "There are a lot of advances in power electronics and semiconductors associated with the smart grid and software associated with these devices, and with capacitor technology, that make it possible for Helion to do what they're planning on doing. … I don't think we'd have funded this company the way it's currently set up three to five years ago. But we are glad to do so now."

http://nyti.ms/1pZoabE

Neanderthals in Europe Died Out Thousands of Years Sooner Than Some Thought, Study Says

Neanderthals, our heavy-browed relatives, spread out across Europe and Asia about 200,000 years ago. But when did they die out, giving way to modern humans?

By KENNETH CHANG AUG. 20, 2014

A new analysis of Neanderthal sites from Spain to Russia provides the most definitive answer yet: about 40,000 years ago, at least in Europe.

That is thousands of years earlier than some scientists have suggested, and it narrows the period that Neanderthals and modern humans overlapped in Europe.

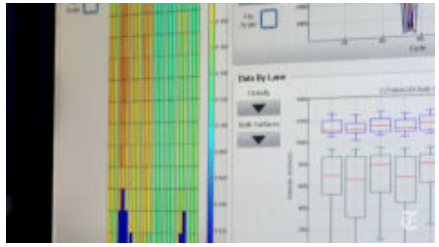
"After that, we don't think there are any Neanderthals on the continent anymore," said Thomas Higham, the deputy director of the radiocarbon accelerator unit at the University of Oxford in England.

On the other hand, the dating also argues against the view that modern humans overwhelmed the Neanderthals as soon they arrived in Europe. While modern humans and Neanderthals do not appear to have intermingled in the same locales, the findings suggest they co-existed in neighboring regions for up to several thousand years.

The findings, reported Wednesday in the journal Nature, run counter to claims that pockets of Neanderthals persisted in Portugal, Spain and Gibraltar until just 30,000 years ago, even as modern humans spread outward.

"This is a very strong compilation," said Chris Stringer, who leads research on human origins at the Natural History Museum in London and who was not involved in the research. "I think it kind of replaces the picture we had before."

In 1995, researchers including Jean-Jacques Hublin, now at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, announced fossil evidence of Neanderthals living 30,000 years ago in a cave near the southern Spanish city of Málaga.



Dr. Hublin said he had changed his mind as better radiocarbon dates became available. "To me, I'm ready to buy the new date," he said.

The Neanderthal inside us ***Svante Paabo is a Swedish biologist who studies evolutionary genetics.*** **Video Credit By Erik Olsen on Publish Date June 23, 2014. Image CreditDavid Reich/Nature**

Modern humans migrated out of Africa at least 60,000 years ago, and anthropologists have been trying to figure out what happened when the two groups encountered each other. One of the reasons some researchers think Neanderthals survived longer on the Iberian peninsula is that there are no signs of modern humans living there at that time.

A recent analysis of Neanderthal DNA shows that Neanderthals and modern humans not only crossed paths, but interbred. For non-African people living today, 1 to 4 percent of their genome has Neanderthal origins. The genetics suggest that interbreeding occurred about 50,000 to 60,000 years ago, somewhere in western Asia.

"You've kind of got two parts of the story," Dr. Stringer said. "There must have been a western Asia coexistence, which included interbreeding. Then there was a later coexistence in Europe, for which we have no evidence of interbreeding but possible evidence of some cultural contact between the groups."

Dr. Higham, the lead author of the Nature paper, and his colleagues took advantage of advances in radiocarbon dating in testing samples of bone, charcoal and shell from 40 sites, mostly in Western Europe. The dating method takes advantage of unstable, radioactive carbon 14 atoms produced from the bombardment of the atmosphere by cosmic rays from outer space. The radioactive carbon combines with oxygen atoms to form carbon dioxide, and plants and animals take up some of it as long as they are alive.

But when they die, they absorb no additional radioactive carbon, and the carbon 14 disappears over time. The ratio of carbon 14 to carbon 12, which is stable, thus tells the age and can be used to date bones and artifacts up to about 50,000 years ago.

Contaminants containing younger organic molecules can distort the dating. Dr. Higham said just 1 percent of modern carbon infiltrating a 50,000-year-old fossil would make it look 7,000 to 8,000 years younger. The researchers prepared samples that would extract collagen in the bone and remove the contaminants.

"What we find is often the dates get older," Dr. Higham said. "We've managed to chip away at these erroneous younger Neanderthal dates to come up with a more refined, and we think accurate, estimate for when Neanderthals disappeared."
Dr. Higham said his team would like to expand the research to Neanderthal sites in Eastern Europe and across Russia to Siberia. It is possible that Neanderthals survived later in those areas.
Some of the conclusions are tentative because many of the sites do not have bones of the actual inhabitants, and paleontologists are still debating whether it was Neanderthals or modern humans who made the tools found at some sites.
"This gives us a framework, basically, which allows us to ask more interesting questions," said William Davies of the University of Southampton in England, who wrote an accompanying commentary in Nature. "About what the tools might mean, how they were used, what they tell us about Neanderthal interactions."
The findings so far indicate that Neanderthals did not disappear all at once.
"I think we'll see patchy disappearance prior to extinction," Dr. Higham said.

http://slate.me/1trDbmY

What Makes People Look Like Their Pets?

The eyes are a window to the ego.

By Jesse Bering

If ever you overhear someone comparing you to a dog, chances are it's not a compliment. Yes, there's the famous loyalty of dogs, their unbridled enthusiasm for life, their boundless love and devotion, their fierce protectiveness - qualities that any of us would be lucky to possess at even a modicum of their standard manifestation in the canine. Typically, though, it's meant as a slight and a reference to some especially animalistic aspect of our four-legged friends. That assertive woman people call a "bitch," for instance (a term that has always struck me as being dubious; some of my kindest, gentlest companions in this world have been female dogs), or the lowlife "cur" who cheated you in that game of poker the other night.

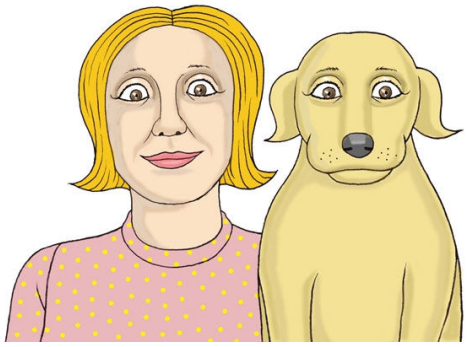


Illustration by Mark Alan Stamaty

As much as we might quibble over the virtues and vices of *Canis domesticus*, however, and over whether human nature is any better or worse than dog nature, even dog fanciers don't usually want to *look* like a dog. The hair of a poodle, the jowls of a bulldog, the bug eyes of a pug, the wrinkles of a Shar-Pei, the profile of a collie, the street-sweeping udders of a lactating mongrel … none of these traits are considered beautiful when incarnated in our own species. Still, if we look in the mirror, each of us can expect to find a certain doggy *je ne sais quoi* staring back at us. Those of us who own a dog, anyway. And we don't resemble just any old dog, either. Rather, we look somehow, in a can't-quite-put-your-finger-on-it kind of way, like our own dogs.
It's one of those curious observations that's had scientists scratching their heads for decades. When shown a photo lineup of random people and random dogs, people are able to match the pets with their owners at a rate greater than chance. At first, researchers thought there must be something obvious going on here, something that boils down to a simple, perhaps implicit, heuristic. Maybe men are more likely than women to own large breeds, for example, and women to own toy breeds. Or women with long hair are more likely to own dogs with floppy ears rather than perky ears. Or perhaps obese people overfeed their dogs, and thus we'd expect fat owners to have fat dogs (a correlation that does, in fact, exist). Yet the ability to match strangers with their own dogs holds up even when these more obvious superficial characteristics are carefully ruled out by the research design. So what is it, exactly, that enables us to correctly link owners and their dogs? That's the mystery that Sadahiko Nakajima, a psychologist from Kwansei Gakuin University in Japan, set out to solve in a recent study published in the journal *Anthrozoös*. This wasn't Nakajima's first stab at it. In prior research, he and his colleagues had shown that research participants could match photos of owners and their dogs by facial appearance alone. People could also recognize that photos of dogs and owners that the investigators had arbitrarily coupled were fake pairs. Impressive! Still, that just told him that people are surprisingly adept at knowing which pooch goes with which person on the basis of their facial appearance. So in this latest study, Nakajima teased apart the various possibilities to find out which facial features people use to make their bizarrely accurate judgments.
Here's how it worked. The researcher presented 502 Japanese undergrads with two test sheets. Each sheet included 20 photo sets of dog-human pairs, showing their faces together side-by-side. To eliminate extraneous factors, the photos were very basic color headshots cropped at the shoulders and shown against a plain white background. Nakajima writes that the portraits were taken earlier at a "dog-lovers' field festival" and that the pet owners were instructed to look straight at the camera and smile slightly. Presumably these instructions worked for the dogs as well - the photos show them with the same Mona Lisa grins as their masters. These resulting 40 human faces and 40 dog faces were digitally rendered equal in size (11 to 12 millimeters "from the vertex [highest point of the forehead] to the chin"). The photos were then randomly assigned to one of those two test sheets.

On one test sheet, the images included a set of 20 real-life dog-owner pairs; the other sheet featured 20 randomly matched pairs. These photo sets included an equal number of female and male human owners.

It's not entirely clear to me why mutts weren't included (perhaps there was a bit of snobbery at that dog-lovers' fest), but nonetheless there was still a healthy variety of breeds represented in the portraits, everything from the relatively rare Belgian tervuren to that popular pint-sized terror, the Yorkshire terrier, to papillons and golden retrievers.

The judges' task was simple: "Choose the set of dog-owner pairs that physically resemble each other," they were told, "Set A or Set B." Ah, but there was more to it than that. The participants had also been randomly assigned to one of five different "masking" photo conditions. The fundamental difference among these conditions was the way in which the photo sets were presented to the judges on the two sheets: *no-mask* (in which the participant saw the full unobstructed faces of humans and dogs); *eye-mask* (the humans' eyes were covered by black rectangular bars … just think crime-scene photos); *mouth-mask* (the humans' mouths were covered in this same way); *dog-eye-mask* (now it's the dogs' eyes that are covered by the creepy black bar); or *eye-only* (only the thin rectangular slices of the eye regions for both human and dog are shown).

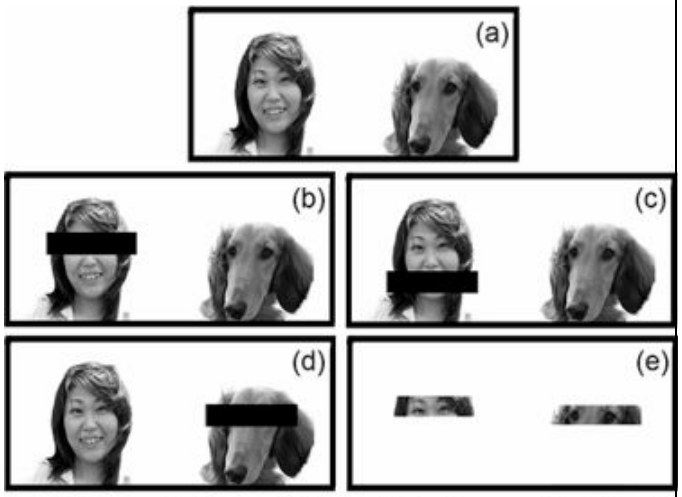


Figure 1. Examples of headshots used in the no-mask (panel a), eye-mask (panel b), mouth-mask (panel c), dog-eye-mask (panel d), and eye-only (panel e) conditions.

Courtesy of Sadahiko Nakajima

Just as in Nakajima's earlier study, the people in the no-mask condition - that's to say, those who saw the full faces of both the dogs and the owners - were strikingly good at sniffing out the fake domestic bonds. It's rather amazing, actually, to think that being asked to make a forced choice on "physical resemblance" resulted in 49 of the 61 judges (80 percent) selecting the set of images showing the real-life pairs. Those who saw the same photo sets but with the owners' mouths concealed (mouth-mask) were only slightly less impressive (73 percent correct). By contrast, simply covering the eyes of either the humans or dogs made the judges' performance fall to statistically chance levels. So it's all in the eyes, it turns out.

It's not about hairstyles, obesity, gender, height, or even eye color.

The most striking finding from Nakajima's experiment comes from the performance of those participants assigned to the eye-only condition. These judges, you'll recall, were shown just those thin slices of the human and dog eye regions. Nothing else.

Yet 40 of these 54 students (74 percent) still chose the set of true pairs. Nakajima was so surprised by their ability to do this by seeing just the eye regions that he tested a new batch of subjects on the eyes-only condition, just to be sure that the findings weren't some strange fluke.

But this fresh group of judges nailed it, too. This time, 42 of the 55 judges (76 percent) picked the image set with the real-life dog-human pairs.

One value of this study is its ability to tell us which physical cues people *aren't* using to correctly match dogs with their human owners. It's not about hairstyles, obesity, gender, height, or even eye color.

As Nakajima points out, since all of the human models were Asian dog-owners, they all had similarly dark-colored eyes. Instead, it's clearly something that's being conveyed in the shared look about the eyes of dogs and their people. I'd add something romantic here about the eyes being the window to the soul, and therefore how this all makes sense given that our pets are of course - of course! - our soulmates, except I'm afraid that I don't believe in souls of either the human or canine variety.

More likely is a logical scientific explanation about our apparently superhuman (or at least subconscious) ability to extract meaningful psychological cues from eyes. Nakajima is just as stumped as the rest of us about the underlying mechanism. And similar riddles exist, too.

The psychologist Nicholas Rule and his colleagues, for instance, have found that naive judges can discern the sexual orientation of strangers from their eyes alone. How they're going about this remains unclear, however, even to the judges themselves.

The good news is that we've narrowed it down to the eyes. What it is about the eyes is anyone's guess at this point. I'm sure you can come up with your own hypotheses.

And while you do that, I'm going to take my border terrier, Gulliver, who's now begun to shove his head under my hand to keep me from finishing this piece, out for a nice walk. By the way, Gulliver, has anyone ever told you you have the most beautiful eyes?

http://www.eurekalert.org/pub_releases/2014-08/ip-sad082114.php

Smartphone-loss anxiety disorder

Smart phones have changed our behavior for better or worse

The smart phone has changed our behavior, sometimes for the better as we are now able to connect and engage with many more people than ever before, sometimes for the worse in that we may have become over-reliant on the connectivity with the outside world that these devices afford us. Either way, there is no going back for the majority of users who can almost instantaneously connect with hundreds if not thousands of people through the various social media and other applications available on such devices and not least through the humble phone call.

However, our dependence brings anxiety. The loss of one's smart phone not only represents an immediate disconnection from one's online contacts but is also a potential privacy and security risk should the lost phone wend its way into the hands of a malicious third party. Writing in the International Journal of Mobile Communications, a Canadian team outlines the possible coping mechanisms that might be needed following loss or theft and the security problems that the user might face. The researchers point out that the same anxieties apply equally to lost or stolen laptops, tablet computers and other digital devices.

Zhiling Tu, Yufei Yuan and Norm Archer of McMaster University in Hamilton, Ontario, explain that the convenience of mobility, wireless communication and the information processing power of smart phones and other portable digital devices has led to more and more people carrying with them valuable data assets wherever they go. These assets may include personal and business contacts, private pictures and videos, meeting and lecture notes and the like, banking details, utility statements, company spreadsheets and much more. All such assets are potentially sensitive to abuse by third parties.

The researchers add that as many companies now have a BYOD (bring-your-own-device) policy rather than dispensing a standard corporate device to all employees there are additional security issues that arise from their being centralized control of the data on a given device. The value of lost hardware might be negligible when compared to the loss of sensitive or proprietary data. Perhaps more troubling is that while there are various countermeasures that can be used to cope with mobile device loss and theft, users are either unaware of their existence or unwilling to use them. The cost and convenience of security countermeasures also need to be weighed up.

The team has investigated how general mobile phone users might not cope with the threat of losing their device. They found that a few active and security-conscious users were aware of countermeasures but many users were either not aware of "time bomb" data deletion settings and remote device locks and such or were simply in denial of the risk of their losing their phone. Their findings suggest that an awareness campaign might be needed to encourage general users to make their devices more secure and that organizations must enforce certain features on their employees and members to protect sensitive data that might be on those devices beyond their direct control.

Tu, Z.L., Yuan, Y.F. and Archer, N. (2014) 'Understanding user behaviour in coping with security threats of mobile device loss and theft', Int. J. Mobile Communications, Vol. 12, No. 6, pp.603.

http://bit.ly/1tykmgZ

U.S. Wind Power Growth Stalled in 2013 as Prices Drop to All-Time Lows

A Department of Energy report on wind energy technologies and market status highlights dramatic cost reductions amidst a tenuous and uncertain future for the renewable energy source.

Installations of wind power in the United States in 2013 didn't come close to matching the previous few years, and federal policy uncertainty points to a shaky outlook for continued growth.

The industry added 1087 megawatts of new wind capacity in 2013 in the United States, which is amazingly only eight percent of that added in 2012. By the end of 2013 the total installed capacity had reached about 61 gigawatts. It was a down by another measure as well: wind power made up seven percent of all new electricity generating additions, compared with a six-year run before 2013 where that number ranged between 25 and 43 percent.

As 2013 came to a close, wind energy proponents mourned the death of the production tax credit, the primary federal support mechanism to help spur growth in the industry. The details of that death, however, suggest that the next few years will actually see amazing amounts of wind energy installed: the credit was available for any project that began construction by the end of 2013, meaning that everyone tried to jump into that pool instead of waiting until this year when it had dried up. The Energy Department's report highlights this, noting that an astonishing 114 gigawatts of wind is now officially in interconnection queues; not all of that will get built, but it does mean a big pile of turbines is on its way over the next two to three years.

Those projects are getting moving at the same that the industry is seeing wind power prices dropping to "all-time lows" according to the Energy Department. Power purchase agreements for wind energy peaked at almost US $70 per megawatt-hour in 2009, but those signed in 2013 averaged about $25/MWh. The report acknowledges that the price data is based on a limited sample size of

projects that are largely in lower-cost areas of the country, but even when compared to other generation sources wind power is proving to be cost competitive.

That being said, policy-based market drivers are probably still necessary to spur continued growth. With the federal tax credit now gone, it is state-based renewable energy portfolio requirements that will be the primary driver according to the report:

From 1999 through 2013, 69% of the wind power capacity built in the United States was located in states with RPS policies... In 2013, this proportion was 93%. But unless those requirements are ramped up in big ways, or new states add them (we've been sitting on 29 plus Washington D.C. for some time now), they may prove insufficient to really drive much new capacity at all.

All in all, the picture is a muddled combination of rosy and bleak. The report concludes:

Despite the lower price of wind energy and the potential for further technological improvements and cost reductions, federal policy uncertainty - in concert with continued low natural gas prices, modest electricity demand growth, and the aforementioned slack in existing state policies - may put a damper on growth.

http://bit.ly/1oY89Uo

ITAR-TASS claims Russian cosmonauts have found sea plankton on outside of International Space Station

Russian cosmonauts have found sea plankton on the outside of the International Space Station

The Russian news agency ITAR-TASS is claiming that Russian officials have confirmed that Russian cosmonauts have found sea plankton on the outside of the International Space Station. The news agency reports that the cosmonauts have also found traces of other organisms on the outside of the station as well. To date, no other news group has been able to confirm the report and thus far it appears no other agency, including NASA has been able to confirm the claims made by the Russians.

Finding sea plankton on the outside of the ISS would be remarkable, as the outside of the station is of course exposed to space - a hostile environment, to say the least. NASA officials reported that they were aware that Russian cosmonauts were conducting experiments on the exterior of the space station (primarily on windows known as illuminators), but were unaware of what they entailed. They note that cosmonauts have conducted such experiments as recently as this past week. The same officials report that they have not heard the results of any findings regarding the experiments from the Russian scientists directly, and thus, cannot comment on what the Russians are claiming. One scientist with NASA, Lynn Rothschild, suggested that if the claims turn out to be true, the plankton likely made its way to the ISS aboard a space station module.

Reports of the sea plankton findings have come, ITAR-TASS reports, from Vladimir Solovyev, chief of the Russian ISS orbital mission - he's also reporting that the type of plankton found is not native to the parts of Russia where spacecraft are launched - he theorizes that air currents could have pushed the plankton to the station (plankton is known to make its way into the atmosphere).

The findings, he continues, confirm that organisms can live on the outer surface of the space station, something Russian scientists have apparently been studying for over a year - though he didn't actually come right out and say that the specimens found were still alive. He also reports that the outside of the space station is covered with material from spacecraft engines that is emitted as they come and go. Of concern are the illuminators, which now need to be polished.

http://www.eurekalert.org/pub_releases/2014-08/cp-vtd081414.php

Viruses take down massive algal blooms, with big implications for climate

Algae might seem easy to ignore, but they are the ultimate source of all organic matter that marine animals depend upon.

Humans are increasingly dependent on algae, too, to suck up climate-warming carbon dioxide from the atmosphere and sink it to the bottom of the ocean. Now, by using a combination of satellite imagery and laboratory experiments, researchers have evidence showing that viruses infecting those algae are driving the life-and-death dynamics of the algae's blooms, even when all else stays essentially the same, and this has important implications for our climate.

According to results reported in the Cell Press journal Current Biology on August 21, a single North Atlantic algal bloom, about 30 kilometers in radius, converted 24,000 tons of carbon dioxide from the atmosphere into organic carbon via a process known as carbon fixation. Two-thirds of that carbon turned over within a week as that bloom grew at a very rapid rate and then quickly met its demise. A closer look at those algae revealed high levels of specific viruses infecting their cells.

To put it in perspective, Assaf Vardi of the Weizmann Institute of Science in Israel says that this patch of ocean fixes about as much carbon as an equivalent patch of rainforest and then almost immediately turns much of it over.

"This is, of course, only one patch out of numerous co-occurring patches in other parts of the Atlantic Ocean," adds Ilan Koren, also of the Weizmann Institute, not to mention those algal blooms that appear in other seasons and ecosystems.

"While the impact that viruses have on the entire ecosystem was previously

estimated to be very large, we provide the first approach to quantify their immense impact on open ocean blooms."

Important questions remain about the ultimate fate of all that carbon taken in by algal blooms, the researchers say. Much of it is probably recycled back to the atmosphere by bacteria. But it's also possible that the virus-infected algae release sticky sugars and lipids, leading their cells and the carbon within them to sink faster to the ocean floor.

"If the latter scenario is true, it will have a profound impact [on] the efficiency of carbon dioxide 'pumping' from the atmosphere to the deep ocean," Vardi says. "This carbon will then have a better chance [of being] buried in the ocean sediment."

The findings will improve models that predict the future of algal blooms and their impact on climate. They also serve as a reminder that sometimes it really is the little things that matter.

"These interactions begin when one virus infects one cell, but they end up causing the collapse of massive blooms that span thousands of kilometers," Koren says. "These life-and-death interactions on the micro scale have huge importance on the large scale and vice versa."

Current Biology, Lehahn et al.: "Decoupling physical from biological processes to assess the impact of viruses on a mesoscale algal bloom."

http://www.eurekalert.org/pub_releases/2014-08/uor-amo082014.php

Alternate mechanism of species formation picks up support, thanks to a South American ant

A newly-discovered species of ant supports a controversial theory of species formation.

The ant, only found in a single patch of eucalyptus trees on the São Paulo State University campus in Brazil, branched off from its original species while living in the same colony, something thought rare in current models of evolutionary development.

“Most new species come about in geographic isolation,” said Christian Rabeling, assistant professor of biology at the University of Rochester. “We now have evidence that speciation can take place within a single colony.”

The findings by Rabeling and the research team were published today in the journal Current Biology.

In discovering the parasitic Mycocepurus castrator, Rabeling and his colleagues uncovered an example of a still-controversial theory known as sympatric speciation, which occurs when a new species develops while sharing the same geographic area with its parent species, yet reproducing on its own.“While sympatric speciation is more difficult to prove,” said Rabeling, “we believe we are in the process of actually documenting a particular kind of evolution-in-progress.”

New species are formed when its members are no longer able to reproduce with members of the parent species. The commonly-accepted mechanism is called allopatric speciation, in which geographic barriers - such as mountains - separate members of a group, causing them to evolve independently.

“Since Darwin’s Origin of Species, evolutionary biologists have long debated whether two species can evolve from a common ancestor without being geographically isolated from each other,” said Ted Schultz, curator of ants at the Smithsonian’s National Museum of Natural History and co-author of the study. “With this study, we offer a compelling case for sympatric evolution that will open new conversations in the debate about speciation in these ants, social insects and evolutionary biology more generally.”

with - and off of - its host, Mycocepurus goeldii. The host is a fungus-growing ant that cultivates fungus for its nutritional value, both for itself and, indirectly, for its parasite, which does not participate in the work of growing the fungus garden.

That led the researchers to study the genetic relationships of all fungus-growing ants in South America, including all five known and six newly discovered species of the genus Mycocepurus, to determine whether the parasite did evolve from its presumed host. They found that the parasitic ants were, indeed, genetically very close to M. goeldii, but not to the other ant species.

They also determined that the parasitic ants were no longer reproductively compatible with the host ants - making them a unique species - and had stopped reproducing with their host a mere 37,000 years ago - a very short period on the evolutionary scale.

A big clue for the research team was found by comparing the ants’ genes, both in the cell's nucleus as well as in the mitochondria - the energy-producing structures in the cells. Genes are made of units called nucleotides, and Rabeling found that the sequencing of those nucleotides in the mitochondria is beginning to look different from what is found in the host ants, but that the genes in the nucleus still have traces of the relationship between host and parasite, leading him to conclude that M. castrator has begun to evolve away from its host.

Rabeling explained that just comparing some nuclear and mitochondrial genes may not be enough to demonstrate that the parasitic ants are a completely new species. “We are now sequencing the entire mitochondrial and nuclear genomes of these parasitic ants and their host in an effort to confirm speciation and the underlying genetic mechanism.”

The parasitic ants need to exercise discretion because taking advantage of the host species is considered taboo in ant society. Offending ants have been known to be

killed by worker mobs. As a result, the parasitic queen of the new species has evolved into a smaller size, making them difficult to distinguish from a host worker.

Host queens and males reproduce in an aerial ceremony, in the wet tropics only during a particular season when it begins to rain. Rabeling found that the parasitic queens and males, needing to be more discreet about their reproductive activities, diverge from the host's mating pattern. By needing to hide their parasitic identity, M. castrator males and females lost their special adaptations that allowed them to reproduce in flight, and mate inside the host nest, making it impossible for them to sexually interact with their host species.

The research team included Ted Schultz of the Smithsonian Institution's National Museum of Natural History, Naomi Pierce of Harvard University, and Maurício Bacci, Jr of the Center for the Study of Social Insects (São State University, Rio Claro, Brazil).

http://www.eurekalert.org/pub_releases/2014-08/uoc--hgw082114.php

Hacking Gmail with 92 percent success

UC Riverside assistant professor is among group that develops novel method to attack apps on Android, and likely other, operating systems

RIVERSIDE, Calif. - A team of researchers, including an assistant professor at the University of California, Riverside Bourns College of Engineering, have identified a weakness believed to exist in Android, Windows and iOS mobile operating systems that could be used to obtain personal information from unsuspecting users. They demonstrated the hack in an Android phone.

The researchers tested the method and found it was successful between 82 percent and 92 percent of the time on six of the seven popular apps they tested. Among the apps they easily hacked were Gmail, CHASE Bank and H&R Block. Amazon, with a 48 percent success rate, was the only app they tested that was difficult to penetrate.

The paper, "Peeking into Your App without Actually Seeing It: UI State Inference and Novel Android Attacks," will be presented Friday, Aug. 22 at the 23rd USENIX Security Symposium in San Diego. Authors of the paper are Zhiyun Qian, of the Computer Science and Engineering Department at UC Riverside; Z. Morley Mao, an associate professor at the University of Michigan; and Qi Alfred Chen, a Ph.D. student working with Mao.

The researchers believe their method will work on other operating systems because they share a key feature researchers exploited in the Android system. However, they haven't tested the program using the other systems.

The researchers started working on the method because they believed there was a security risk with so many apps being created by some many developers. Once a user downloads a bunch of apps to his or her smart phone they are all running on the same shared infrastructure, or operating system.

"The assumption has always been that these apps can't interfere with each other easily," Qian said. "We show that assumption is not correct and one app can in fact significantly impact another and result in harmful consequences for the user."

The attack works by getting a user to download a seemingly benign, but actually malicious, app, such as one for background wallpaper on a phone. Once that app is installed, the researchers are able to exploit a newly discovered public side channel - the shared memory statistics of a process, which can be accessed without any privileges. (Shared memory is a common operating system feature to efficiently allow processes share data.)

The researchers monitor changes in shared memory and are able to correlate changes to what they call an "activity transition event," which includes such things as a user logging into Gmail or H&R Block or a user taking a picture of a check so it can be deposited online, without going to a physical CHASE Bank.

Augmented with a few other side channels, the authors show that it is possible to fairly accurately track in real time which activity a victim app is in.

There are two keys to the attack. One, the attack needs to take place at the exact moment the user is logging into the app or taking the picture. Two, the attack needs to be done in an inconspicuous way. The researchers did this by carefully calculating the attack timing.

"By design, Android allows apps to be preempted or hijacked," Qian said. "But the thing is you have to do it at the right time so the user doesn't notice. We do that and that's what makes our attack unique."

The researchers created three short videos that show how the attacks work. They can be viewed here: http://bit.ly/1ByiCd3.

Here is a list of the seven apps the researchers attempted to attack and their success rates: Gmail (92 percent), H&R Block (92 percent), Newegg (86 percent), WebMD (85 percent), CHASE Bank (83 percent), Hotels.com (83 percent) and Amazon (48 percent).

Amazon was more difficult to attack because its app allows one activity to transition to almost any other activity, increasing the difficulty of guessing which activity it is currently in.

Asked what a smart phone user can do about this situation, Qian said, "Don't install untrusted apps." On the operating system design, a more careful tradeoff between security and functionality needs to be made in the future, he said. For example, side channels need to be eliminated or more explicitly regulated.

http://bit.ly/1pty8Cp

US Ebola Patients Make Full Recovery

An American doctor and an aid worker who both contracted Ebola treating patients in Liberia are fully recovered from the disease, said officials from Emory Hospital in Atlanta.

Aug 21, 2014 11:30 AM ET // by Paul Heltzel

Dr. Kent Brantly was released Thursday, and aid worker Nancy Writebol left the hospital Tuesday, officials said.

Brantley made comments at a press conference today at Emory Hospital.

"As a medical missionary I never expected to find myself in this position," Brantly said. "Ebola was not on our radar."

After Ebola made its way to Liberia, Brantly said he sent his family back to the United States and poured himself into his work treating patients with the virus.

"We took every precaution to protect ourselves from this dreaded disease," Brantly said. "I woke up three days later feeling under the weather" and was later diagnosed with the deadly virus.

Brantly thanked the hospital workers who cared for him in Atlanta and administered the experimental serum that cured him. "Above all I am grateful to God for sparing my life," Brantly said.

The Ebola virus has killed more than 1,300 people in West Africa, reports the World Health Organization, which recently issued a warning that the outbreak was vastly underreported.

http://phys.org/news/2014-08-ethics-driverless-cars.html

The ethics of driverless cars

There are a number of ethical problems that need to be tackled before driverless cars go mainstream

Jason Millar, a PhD Candidate in the Department of Philosophy, spends a lot of time thinking about driverless cars. Though you aren't likely to be able to buy them for 10 years, he says there are a number of ethical problems that need to be tackled before they go mainstream.

"This isn't an issue for the next generation, it's happening right now. Driverless cars are on the road in certain jurisdictions as they're being prepared for a mass market," says Millar, whose dissertation focuses on robot ethics and the implications of increasingly autonomous machinery. "These cars promise safety benefits, but I'm interested in what happens to the cars in a difficult situation, one where lives are on the line."

To explore this problem he created a thought experiment, called the Tunnel Problem, which attracted hundreds of thousands of readers and commenters online. The Tunnel Problem reworks ethical philosophy's Trolley Problem.

The setup is this: You are driving in an autonomous car along a narrow road, headed towards a one-lane tunnel when a child errantly runs on to the road and trips. The car cannot brake fast enough to avoid hitting the child and so it must decide whether to swerve off the road, effectively harming you, or remain driving straight, harming the child.

"This is a problem with only bad outcomes that even a human driver cannot easily solve," says Mr. Millar. "What's particularly useful about this situation is that it focuses our attention on a design question, as the car will be programmed to respond a certain way - I want to ask who should make the decision about the car's response."

After initially posting his article on Robohub.org, the site ran a poll to gauge readers' responses and rationales as to who should render the judgement.

"A near majority responded that the passenger in the car should have the right to make the decision about whether to swerve or not, and only about 12 per cent suggested it should be up to the car's designers," he says. A full third of respondents said it should be left up to lawmakers and legislators to make the call.

"That so many people were willing to trust a life and death situation to politicians and lawmakers really surprised me," Mr. Millar says. "Many of them said they wanted a standard behaviour so that people would know what to expect in that situation, while others simply wanted someone else to make the decision and take it off their hands."

The Tunnel Problem is one of just a series of problems that Millar foresees being an issue with driverless cars. "There's also the problem of who's culpable when a car crashes. If we maintain current standards of product liability, then the fault will tend to lie with the manufacturer, but we may also shift to a system where we consider the robot at fault," he says.

It's a possibility, but Millar says the future of driverless cars is far from certain. "Holding the robot responsible may be less satisfying for those with a mind for punitive justice."

http://bit.ly/1t4bClW

Life boils down to five 'rules' … or so says the Madingley Model

It may sound overly simple, but just five processes can define us as animals: eating, metabolism, reproduction, dispersal and death.

They might not seem like much, but, thanks to a mathematical model from scientists at Microsoft Research, we know that these five processes are the key to all ecosystems.

It's called the Madingley Model, and is the first time scientists have simulated ecosystems across the globe using a single set of biological rules.

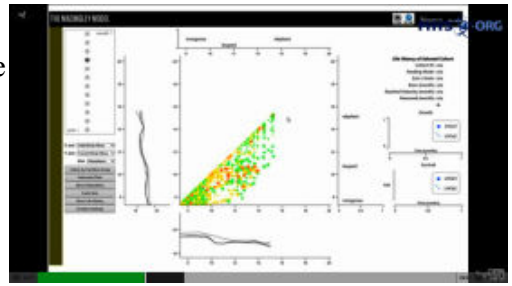
When these rules are combined with your body mass at birth and your body mass at maturity, they are enough to define your role in an ecosystem. In fact, they are enough to define any organism's role (for plants, substitute "eating" with "photosynthesis").

The Madingley Model is a global ecosystem model (GEM). While it is not the only ecosystem model around (we've been able to simulate ecosystems in terrestrial and marine environments for a while), the Madingley Model is the first to go global – linking land and sea – which is kind of a big deal.

The first iteration of the Madingley Model was made available this year, and it works basically like this:

- ***pick a spot on the Earth (currently about 200km square)***
- ***specify if it's ocean or land***
- ***tell the model the physical conditions (such as temperature and precipitation)***
- ***fill it with organisms (such as small herbivores and large carnivores)***
- ***repeat for every spot on Earth***
- ***click "go" – the model does the rest.***

Based on the five key processes of life, these virtual organisms will interact, feed, move and die, and gradually create stable networks of organisms; everywhere from the desert to the rainforest to the ocean. It is a beautiful thing – and according to the authors, this version of the Madingley Model recreates the big picture of life rather well.



A visualisation of the Madingley Model.

Sounds good, but why bother?

The Madingley Model can tell us how much life lives where, how stable it is and what might happen to it due to impacts such as climate change, habitat loss and human harvest.

It could identify the effect of a shrinking biodiversity on ecosystem services, show us what Earth would look like without humans, or even simulate what would happen if we brought back the dinosaurs (apart from all the running).

Its most impressive feature may be the model itself. Creating a single model for all organisms reveals which biological processes are most important for sustaining life. The model can identify ecosystem traits (such as the ratio of herbivores to plant material) that should be monitored as indicators of ecosystem health.

GEMs can also reveal things we're missing. The first version of the Madingley Model predicted that there should be more fish in the sea than we currently know about. Lo and behold, a study this year found that we may have been underestimating fish biomass all along.

The Madingley Model also predicted the same mismatch on land – have we made the same mistake counting our terrestrial animals? Or have humans altered terrestrial ecosystems more than we thought? The Madingley Model would suggest so.

The rules that drive this model are so universal that there is very little distinguishing different organisms. What makes a human different to, say, an octopus? As far as the Madingley Model goes, not much.

The model needs to know that you live on land, the octopus in the ocean; and that you're endothermic (warm-blooded), the octopus ectothermic (cold-blooded). But that's about it (who knew you were so octopus-like?).

This really does highlight that all life is driven by the same needs and processes. While this has been clear for a long time, expressing it mathematically is a great achievement.

The Madingley Model may eventually tell us how much of life is predictable. At the moment, life is only predictable at coarse spatial, temporal and biological resolutions. At the planetary scale, for example, you can predict with great accuracy where life exists (wait for it … it's Earth).

But as the scale shrinks, things get less accurate. Our most complicated models of the ocean can't tell you when a wave will smack you in the face, but they can tell you how cold the water will be.

Likewise, a GEM can't tell you how many black cockatoos you'll have in your backyard next Tuesday, but can tell you how many feathered fruit eaters can live in your bioregion.

Complexity from a general view

This issue of scale is one of the major criticisms of GEMs; that is, they tend to oversimplify the patterns. But the authors of the Madingley Model believe much can still be learnt from such a general model, and I agree – it is often when we strive to explain complex ideas simply that we learn the most about them.

Could the Madingley Model be made more realistic? Absolutely, and there is a wish list of things to add to the model to make it so (such as including freshwater environments).

But there are limits to this realism, at least for the moment. The Madingley Model cannot include every organism on planet Earth (even if we ignore the microbes, which most people do).

It would take billions of years to run a GEM that tracked every organism on the planet. And even if we could run it, there would probably be so many divergent paths, so many outcomes, that the fine-scale results would be meaningless.

More than any other models, GEMs are also limited by our understanding of the environment. Just as climate models need equations for how heat is transferred between sea and sky, GEMs need equations for how energy is transferred between organisms. This means evaluating and condensing hundreds of years of ecological research, and needs the skill to see the gaps in our knowledge of environments.

There is yet another limit to model complexity – our ability to extract answers from models. Complex models can be so great at spewing out data and uncertainty that it's difficult to make decisions based on their results.

There are signs that we are already reaching "peak model", and have to reduce their complexity to better communicate and apply their findings. This has led to the term "models of intermediate complexity" as a focus when using ecosystem models for decision making.

Despite the issues applying to complex models, they continue to get bigger. The global circulation models used to predict our warming climate are continuously advancing, and there is a push for "big data" network models incorporating just about everything, from traffic congestion and tweets to forest cover and stock prices.

Moving any of these models forward requires not only great empirical science, but also the infrastructure for collecting and storing environmental data, such as NASA's planetary skin.

There may be a time when global circulation models are linked with the biota of models such as the Madingley Model to create truly a "model of everything". We don't have the computer power or the knowledge to create such a model yet, but it's only a matter of time. Until then, enjoy the fact that, no matter how complicated your life feels, you're really just looking for the same things an octopus is.

http://wrd.cm/1mDXTLk

How to Solve Google's Crazy Open-Ended Interview Questions

One of the most important tools in critical thinking about numbers is to grant yourself permission to generate wrong answers to mathematical problems you encounter. Deliberately wrong answers!

By Daniel Levitin

Engineers and scientists do it all the time, so there's no reason we shouldn't all be let in on their little secret: the art of approximating, or the "back of the napkin" calculation. As the British writer Saki wrote, "a little bit of inaccuracy saves a great deal of explanation."

For over a decade, when Google conducted job interviews, they'd ask their applicants questions that have no answers. Google is a company whose very existence depends on innovation - on inventing things that are new and didn't exist before, and on refining existing ideas and technologies to allow consumers to do things they couldn't do before.

Contrast this with how most companies conduct job interviews: In the skills portion of the interview, the company wants to know if you can actually do the things that they need doing.

But Google doesn't even know what skills they need new employees to have. What they need to know is whether an employee can think his way through a problem.

Of Piano Tuners and Skyscrapers

Consider the following question that has been asked at actual Google job interviews: How much does the Empire State Building weigh?

Now, there is no correct answer to this question in any practical sense because no one knows the answer. Google isn't interested in the answer, though; they're interested in the process. They want to see a reasoned, rational way of approaching the problem to give them insight into how an applicant's mind works, how organized a thinker she is.

There are four common responses to the problem. People throw up their hands and say "that's impossible" or they try to look up the answer somewhere.

The third response? Asking for more information. By "weight of the Empire State Building," do you mean with or without furniture? Do I count the people in it?

But questions like this are a distraction. They don't bring you any closer to solving the problem; they only postpone being able to start it.

The fourth response is the correct one, using approximating, or what some people call guesstimating. These types of problems are also called estimation problems or Fermi problems, after the physicist Enrico Fermi, who was famous for being able to make estimates with little or no actual data, for questions that seemed impossible to answer. Approximating involves making a series of educated guesses systematically by partitioning the problem into manageable chunks, identifying assumptions, and then using your general knowledge of the world to fill in the blanks.

How would you solve the Fermi problem of "How many piano tuners are there in Chicago?"

Where to begin? As with many Fermi problems, it's often helpful to estimate some intermediate quantity, not the one you're being asked to estimate, but something that will help you get where you want to go. In this case, it might be

easier to start with the number of pianos that you think are in Chicago and then figure out how many tuners it would take to keep them in tune.

There is an infinity of ways one might solve the problem, but the final number is not the point - the thought process, the set of assumptions and deliberations, is the answer.

In any Fermi problem, we first lay out what it is we need to know, then list some assumptions:

1. How often pianos are tuned
2. How long it takes to tune a piano
3. How many hours a year the average piano tuner works
4. The number of pianos in Chicago

Knowing these will help you arrive at an answer. If you know how often pianos are tuned and how long it takes to tune a piano, you know how many hours are spent tuning one piano. Then you multiply that by the number of pianos in Chicago to find out how many hours are spent every year tuning Chicago's pianos. Divide this by the number of hours each tuner works, and you have the number of tuners.

Assumption 1: The average piano owner tunes his piano once a year.

Where did this number come from? I made it up! But that's what you do when you're approximating. It's certainly within an order of magnitude: The average piano owner isn't tuning only one time every ten years, nor ten times a year. One time a year seems like a reasonable guesstimate.

Assumption 2: It takes 2 hours to tune a piano. A guess. Maybe it's only 1 hour, but 2 is within an order of magnitude, so it's good enough.

Assumption 3: How many hours a year does the average piano tuner work? Let's assume 40 hours a week, and that the tuner takes 2 weeks' vacation every year: 40 hours a week x 50 weeks is a 2,000-hour work year. Piano tuners travel to their jobs - people don't bring their pianos in - so the piano tuner may spend 10 percent–20 percent of his or her time getting from house to house. Keep this in mind and take it off the estimate at the end.

Assumption 4: To estimate the number of pianos in Chicago, you might guess that 1 out of 100 people have a piano - again, a wild guess, but probably within an order of magnitude. In addition, there are schools and other institutions with pianos, many of them with multiple pianos. This estimate is trickier to base on facts, but assume that when these are factored in, they roughly equal the number of private pianos, for a total of 2 pianos for every 100 people.

Now to estimate the number of people in Chicago. If you don't know the answer to this, you might know that it is the third-largest city in the United States after New York (8 million) and Los Angeles (4 million). You might guess 2.5 million, meaning that 25,000 people have pianos. We decided to double this number to account for institutional pianos, so the result is 50,000 pianos.

So, here are the various estimates:

1. There are 2.5 million people in Chicago.
2. There are 2 pianos for every 100 people.
3. There are 50,000 pianos in Chicago.
4. Pianos are tuned once a year.
5. It takes 2 hours to tune a piano.
6. Piano tuners work 2,000 hours a year.
7. In one year, a piano tuner can tune 1,000 pianos (2,000 hours per year ÷ 2 hours per piano).
8. It would take 50 tuners to tune 50,000 pianos (50,000 pianos ÷ 1,000 pianos tuned by each piano tuner).
9. Add 15 percent to that number to account for travel time, meaning that there are approximately 58 piano tuners in Chicago.

What is the real answer? The Yellow Pages for Chicago lists 83. This includes some duplicates (businesses with more than one phone number are listed twice), and the category includes piano and organ technicians who are not tuners. Deduct 25 for these anomalies, and an estimate of 58 appears to be very close.

But Wait, What About the Empire State Building?

Back to the Google interview and the Empire State Building question. If you were sitting in that interview chair, your interviewer would ask you to think out loud and walk her through your reasoning. There is an infinity of ways one might solve the problem, but to give you a flavor of how a bright, creative, and systematic thinker might do it, here is one possible "answer." And remember, the final number is not the point - the thought process, the set of assumptions and deliberations, is the answer.

Let's see. One way to start would be to estimate its size, and then estimate the weight based on that. I'll begin with some assumptions. I'm going to calculate the weight of the building empty - with no human occupants, no furnishings, appliances, or fixtures. I'm going to assume that the building has a square base and straight sides with no taper at the top, just to simplify the calculations.

For size I need to know height, length, and width. I don't know how tall the Empire State Building is, but I know that it is definitely more than 20 stories tall and probably less than 200 stories.

I don't know how tall one story is, but I know from other office buildings I've been in that the ceiling is at least 8 feet inside each floor and that there are typically false ceilings to hide electrical wires, conduits, heating ducts, and so on. I'll guess that these are probably 2 feet. So I'll approximate 10–15 feet per story.

I'm going to refine my height estimate to say that the building is probably more than 50 stories high. I've been in lots of buildings that are 30–35 stories high. My boundary conditions are that it is between 50 and 100 stories; 50 stories work out to being 500–750 feet tall (10–15 feet per story), and 100 stories work out to be 1,000–1,500 feet tall. So my height estimate is between 500 and 1,500 feet. To make the calculations easier, I'll take the average, 1,000 feet.

Now for its footprint. I don't know how large its base is, but it isn't larger than a city block, and I remember learning once that there are typically 10 city blocks to a mile.

How many uses can you come up with for a broomstick? A lemon? These are skills that can be nurtured beginning at a young age. Most jobs require some degree of creativity and flexible thinking.

A mile is 5,280 feet, so a city block is 1/10 of that, or 528 feet. I'll call it 500 to make calculating easier. I'm going to guess that the Empire State Building is about half of a city block, or about 265 feet on each side. If the building is square, it is 265 x 265 feet in its length x width. I can't do that in my head, but I know how to calculate 250 x 250 (that is, 25 x 25 = 625, and I add two zeros to get 62,500). I'll round this total to 60,000, an easier number to work with moving forward.

Now we've got the size. There are several ways to go from here. All rely on the fact that most of the building is empty - that is, it is hollow. The weight of the building is mostly in the walls and floors and ceilings. I imagine that the building is made of steel (for the walls) and some combination of steel and concrete for the floors.

The volume of the building is its footprint times its height. My footprint estimate above was 60,000 square feet. My height estimate was 1,000 feet. So 60,000 x 1,000 = 60,000,000 cubic feet. I'm not accounting for the fact that it tapers as it goes up.

I could estimate the thickness of the walls and floors and estimate how much a cubic foot of the materials weighs and come up then with an estimate of the weight per story. Alternatively, I could set boundary conditions for the volume of the building. That is, I can say that it weighs more than an equivalent volume of solid air and less than an equivalent volume of solid steel (because it is mostly empty). The former seems like a lot of work. The latter isn't satisfying because it generates numbers that are likely to be very far apart. Here's a hybrid option: I'll assume that on any given floor, 95 percent of the volume is air, and 5 percent is steel.

I'm just pulling this estimate out of the air, really, but it seems reasonable. If the width of a floor is about 265 feet, 5 percent of 265 ≈ 13 feet. That means that the walls on each side, and any interior supporting walls, total 13 feet. As an order of magnitude estimate, that checks out - the total walls can't be a mere 1.3 feet (one order of magnitude smaller) and they're not 130 feet (one order of magnitude larger).

I happen to remember from school that a cubic foot of air weights 0.08 pounds. I'll round that up to 0.1. Obviously, the building is not all air, but a lot of it is - virtually the entire interior space - and so this sets minimum boundary for the weight. The volume times the weight of air gives an estimate of 60,000,000 cubic feet x 0.1 pounds = 6,000,000 pounds.

I don't know what a cubic foot of steel weighs. But I can estimate that, based on some comparisons. It seems to me that 1 cubic foot of steel must certainly weigh more than a cubic foot of wood. I don't know what a cubic foot of wood weighs either, but when I stack firewood, I know that an armful weighs about as much as a 50-pound bag of dog food. So I'm going to guess that a cubic foot of wood is about 50 pounds and that steel is about 10 times heavier than that. If the entire Empire State Building were steel, it would weigh 60,000,000 cubic feet x 500 pounds = 30,000,000,000 pounds.

This gives me two boundary conditions: 6 million pounds if the building were all air, and 30 billion pounds if it were solid steel. But as I said, I'm going to assume a mix of 5 percent steel and 95 percent air.

5% x 30 billion = 1,500,000,000
+ 95% x 6 million = 5,700,000

_____
1,505,700,000 pounds

or roughly 1.5 billion pounds. Converting to tons, 1 ton = 2,000 pounds, so 1.5 billion pounds/2,000 = 750,000 tons.

This hypothetical interviewee stated her assumptions at each stage, established boundary conditions, and then concluded with a point estimate at the end, of 750,000 tons. Nicely done!

Now Do It With Cars

Another job interviewee might approach the problem much more parsimoniously. Using the same assumptions about the size of the building, and assumptions about its being empty, a concise protocol might come down to this.

Skyscrapers are constructed from steel. Imagine that the Empire State Building is filled up with cars. Cars also have a lot of air in them, they're also made of steel, so they could be a good proxy. I know that a car weighs about 2 tons and it is about 15 feet long, 5 feet wide, and 5 feet high. The floors, as estimated above, are about 265 x 265 feet each. If I stacked the cars side by side on the floor, I

could get 265/15 = 18 cars in one row, which I'll round to 20 (one of the beauties of guesstimating).

How many rows will fit? Cars are about 5 feet wide, and the building is 265 feet wide, so 265/5 = 53, which I'll round to 50. That's 20 cars x 50 rows = 1,000 cars on each floor. Each floor is 10 feet high and the cars are 5 feet high, so I can fit 2 cars up to the ceiling. 2 x 1,000 = 2,000 cars per floor. And 2,000 cars per floor x 100 floors = 200,000 cars. Add in their weight, 200,000 cars x 4,000 pounds = 800,000,000 pounds, or in tons, 400,000 tons.

These two methods produced estimates that are relatively close - one is a bit less than twice the other - so they help us to perform an important sanity check. Because this has become a somewhat famous problem (and a frequent Google search), the New York State Department of Transportation has taken to giving their estimate of the weight, and it comes in at 365,000 tons. So we find that both guesstimates brought us within an order of magnitude of the official estimate, which is just what was required.

These so-called back-of-the-envelope problems are just one window into assessing creativity. Another test that gets at both creativity and flexible thinking without relying on quantitative skills is the "name as many uses" test.

For example, how many uses can you come up with for a broomstick? A lemon? These are skills that can be nurtured beginning at a young age. Most jobs require some degree of creativity and flexible thinking.

As an admissions test for flight school for commercial airline pilots, the name-as-many-uses test was used because pilots need to be able to react quickly in an emergency, to be able to think of alternative approaches when systems fail. How would you put out a fire in the cabin if the fire extinguisher doesn't work? How do you control the elevators if the hydraulic system fails?

Exercising this part of your brain involves harnessing the power of free association - the brain's daydreaming mode - in the service of problem solving, and you want pilots who can do this in a pinch. This type of thinking can be taught and practiced, and can be nurtured in children as young as five years old. It is an increasingly important skill in a technology-driven world with untold unknowns.

There are no right answers, just opportunities to exercise ingenuity, find new connections, and to allow whimsy and experimentation to become a normal and habitual part of our thinking, which will lead to better problem solving.

http://www.eurekalert.org/pub_releases/2014-08/uoh-rut082214.php

Research underway to create pomegranate drug to stem Alzheimer's and Parkinson's

Dr. Olumayokun Olajide's research will now look to produce compound derivatives of punicalagin for a drug that would treat neuro-inflammation

THE onset of Alzheimer's disease can be slowed and some of its symptoms curbed by a natural compound that is found in pomegranate. Also, the painful inflammation that accompanies illnesses such as rheumatoid arthritis and Parkinson's disease could be reduced, according to the findings of a two-year project headed by University of Huddersfield scientist Dr Olumayokun Olajide, who specialises in the anti-inflammatory properties of natural products.

Now, a new phase of research can explore the development of drugs that will stem the development of dementias such as Alzheimer's, which affects some 800,000 people in the UK, with 163,000 new cases a year being diagnosed. Globally, there are at least 44.4 million dementia sufferers, with the numbers expected to soar.

The key breakthrough by Dr Olajide and his co-researchers is to demonstrate that punicalagin, which is a polyphenol – a form of chemical compound – found in pomegranate fruit, can inhibit inflammation in specialised brain cells known as micrologia. This inflammation leads to the destruction of more and more brain cells, making the condition of Alzheimer's sufferers progressively worse.

There is still no cure for the disease, but the punicalagin in pomegranate could prevent it or slow down its development.

Dr Olajide worked with co-researchers – including four PhD students – in the University of Huddersfield's Department of Pharmacy and with scientists at the University of Freiburg in Germany. The team used brain cells isolated from rats in order to test their findings. Now the research is published in the latest edition of the journal Molecular Nutrition & Food Research and Dr Olajide will start to disseminate his findings at academic conferences.

He is still working on the amounts of pomegranate that are required, in order to be effective.

"But we do know that regular intake and regular consumption of pomegranate has a lot of health benefits – including prevention of neuro-inflammation related to dementia," he says, recommending juice products that are 100 per cent pomegranate, meaning that approximately 3.4 per cent will be punicalagin, the compound that slows down the progression of dementia.

Dr Olajide states that most of the anti-oxidant compounds are found in the outer skin of the pomegranate, not in the soft part of the fruit. And he adds that although this has yet to be scientifically evaluated, pomegranate will be useful in any

condition for which inflammation – not just neuro-inflammation – is a factor, such as rheumatoid arthritis, Parkinson's and cancer.

The research continues and now Dr Olajide is collaborating with his University of Huddersfield colleague, the organic chemist Dr Karl Hemming. They will attempt to produce compound derivatives of punicalagin that could the basis of new, orally administered drugs that would treat neuro-inflammation.

Dr Olajide has been a Senior Lecturer at the University of Huddersfield for four years. His academic career includes a post as a Humboldt Postdoctoral Research Fellow at the Centre for Drug Research at the University of Munich. His PhD was awarded from the University of Ibadan in his native Nigeria, after an investigation of the anti-inflammatory properties of natural products.

He attributes this area of research to his upbringing. "African mothers normally treat sick children with natural substances such as herbs. My mum certainly used a lot of those substances. And then I went on to study pharmacology!"

The article "Punicalagin inhibits neuroinflammation in LPS-activated rat primary microglia", by A. Olumayokun A. Olajide, Asit Kumar, Ravikanth Velagapudi, Uchechukwu P. Okorji and Bernd L. Fiebich is published by Molecular Nutrition & Food Research.

http://www.eurekalert.org/pub_releases/2014-08/uoa-net082214.php

New enzyme targets for selective cancer therapies

Thanks to important discoveries in basic and clinical research and technological advances, the fight against cancer has mobilized into a complex offensive spanning multiple fronts.

Edmonton - Work happening in a University of Alberta chemistry lab could help find new and more selective therapies for cancer. Researchers have developed a compound that targets a specific enzyme overexpressed in certain cancers - and they have tested its activity in cells from brain tumours.

Chemistry professor Christopher Cairo and his team synthesized a first-of-its-kind inhibitor that prevents the activity of an enzyme called neuraminidase. Although flu viruses use enzymes with the same mechanism as part of the process of infection, human cells use their own forms of the enzyme in many biological processes.

Cairo's group collaborated with a group in Milan, Italy, that has shown that neuraminidases are found in excess amounts in glioblastoma cells, a form of brain cancer.

In a new study, a team from the National Cancer Institute tested Cairo's enzyme inhibitor and found that it turned glioblastoma cancer stem cells - found within a tumour and believed to drive cancer growth - into normal cells. The compound also caused the cells to stop growing, suggesting that this mechanism could be important for therapeutics. Results of their efforts were published Aug. 22 in the Nature journal Cell Death & Disease.

Cairo said these findings establish that an inhibitor of this enzyme could work therapeutically and should open the door for future research.

"This is the first proof-of-concept showing a selective neuraminidase inhibitor can have a real effect in human cancer cells," he said. "It isn't a drug yet, but it establishes a new target that we think can be used for creating new, more selective drugs."

Long road from proof of concept to drug

Proving the compound can successfully inhibit the neuraminidase enzyme in cancer cells is just the first step in determining its potential as a therapy.

In its current form, the compound could not be used as a drug, Cairo explained, largely because it wasn't designed to breach the blood-brain barrier making it difficult to reach the target cells. The team in Milan had to use the compound in very high concentrations, he added.

The research advances our understanding of how important carbohydrates are to the function of cells. Although most of us think of glucose (blood sugar) as the only important sugar in biology, there is an entire area of research known as glycobiology that seeks to understand the function of complex carbohydrate structures in cells. Carbohydrate structures cover the surface of cells, and affect how cells interact with each other and with pathogens.

Scientists have known for decades that the carbohydrates found on cancer cells are very different from those on normal cells. For example, many cancers have different amounts of specific residues like sialic acid, or may have different arrangements of the same residues.

"The carbohydrates on the cell surface determine how it interacts with other cells, which makes them important in cancer and other diseases. So, if we can design compounds that change these structures in a defined way, we can affect those interactions," Cairo explained. "Finding new enzyme targets is essential to that process, and our work shows that we can selectively target this neuraminidase enzyme."

Although there has been a lot of work on targeting viral neuraminidase enzymes, Cairo's team has found inhibitors of the human enzymes. "The challenge in human cells is that there are four different isoenzymes. While we might want to target one for its role in cancer, hitting the wrong one could have harmful side-effects," he said.

The U of A team reached out to their colleagues in Milan who were studying the role of a specific neuraminidase isoenzyme in cancer cells isolated from patients. Cairo approached them about testing a compound his team identified last year,

which was selective for the same isoenzyme. "I expected it would do something, but I didn't know it would be that striking. It came out beautifully," Cairo said.

The U of A team is already working on improving the compound, and developing and testing new and existing inhibitors using a panel of in vitro assays they developed. "We've been working on these enzymes for about five years. Validation of our strategy - design of a selective neuraminidase inhibitor and application in a cell that overexpresses that enzyme - is an achievement for us."

The U of A's team was funded by the Alberta Glycomics Centre, the Cancer Research Society and the Natural Sciences and Engineering Research Council.

http://bit.ly/1t4k44y

Skype's Real-Time Translator Learns How to Speak From Social Media

The quirky cant of Twitter and Facebook helped Microsoft build the tools for its real-time translator

By Teresa Chong

Think you have trouble deciphering social media slang? Try translating it. Microsoft researchers have been studying how to translate social media, and in their efforts they came across a way to teach the company's upcoming Skype Translator how to speak more like us.

Some researchers think social media could be key to getting computers to better understand humans. Social media experiments are "important examples of a new line of research in computational social science, showing that subtle social meaning can be automatically extracted from speech and text in a complex natural task," says Dan Jurafsky, an expert in computational linguistics at Stanford, who recently led work on teaching computers about human interactions by listening to speed dating.

The Skype Translator app, set for beta release later this year, translates multilingual conversations over the service as they're happening. In May, Gurdeep Singh Pall, corporate vice president of Skype and Lync at Microsoft, and a German-speaking colleague demoed the app at the Code Conference, in Rancho Palos Verdes, Calif. As Pall spoke in English, both German and English subtitles scrolled along the bottom of the screen while real-time audio translation accompanied the subtitles.

The software system is a synthesis of several technologies, including speech recognition, machine translation, and speech synthesis. But Vikram Dendi, technical and strategy advisor at Microsoft Research, in Redmond, Wash., says past attempts to simply daisy-chain the technologies were unsuccessful because developers had failed to consider the drastic difference between the way we speak and the way we write.

For starters, real speech is peppered with vocalized "ums" and "ahs," awkward pauses, varying intonations, and vocal stresses, which are all absent in text. Consider what would happen if a speech translation system misinterpreted the subtle difference between these two statements:

"You're picking up the kids?"

And "You're picking up the kids!"

Suffice it to say, grumpy offspring would be the end product.

The gap exists between translating text and translating speech because some of the best machine translation systems today are taught using large volumes of high-quality text, which does not include the awkwardness that speech recognition systems deal with. So Microsoft Research set about searching for techniques to help close that gap. Among them was a software system the company developed to translate social media musings.

Before turning to social media, Microsoft's translation system extracted text from published books and Web sources that had been translated from one language to another. The data was then fed into a machine-learning pipeline that Microsoft calls phrasal statistical machine translation (phrasal SMT). The system chops up the text into a collection of small phrases called an n-gram, where n denotes the number of phrases. If the system is trying to translate, say, English to German, then the n-gram from a text in English is mapped to the n-gram of the equivalent text in German. This process teaches the computer what each phrase translates to. Once it has learned its fill from the n-gram alignment, the software is ready to encounter new, untranslated text. When the machine is asked to translate a new phrase in English, the algorithm calculates the probability that the new English segment of text maps to one of the phrases it knows in German. The system then spits out the most probable translation.

Phrasal SMT excels at memorizing and matching data. For common phrases it can translate that exact phrase across several languages, and even if the words in the phrase are slightly reordered, it still works. But if the words in an uncommon phrase are reordered, the system gets confused. Some of the confusion arises because SMT doesn't really understand grammar and so can't shift from the rules of one language to those of another. For example, an English sentence usually runs subject, verb, object. But the same sentence in Japanese would be subject, object, verb.

This is why the Microsoft Research team pioneered a system known as syntactically

informed phrasal statistical machine translation (syntactic SMT). It builds on the phrasal SMT foundation but also understands syntax. Instead of just matching

common phrases, syntactic SMT breaks up a phrase into individual words and then maps each word over to the other language.

Cutting up phrases and connecting individual words may sound like a primitive approach, but it's not. "That's pretty much the best method," says Chris Manning, professor of linguistics and computer science at Stanford. "Microsoft's machine translation team has been one of the prominent developers in this area, and basically, that is the state of the art in machine translation at the moment."

Syntactic SMT was a big step, but there was room for improvement, particularly in the fast-growing universe of social media. The Microsoft Research team began studying communications on Facebook, by Short Message Service (SMS), and on Twitter to figure out the best way to manage conversational text.

But that came with a new set of problems. Each social media platform has its own distinct characteristics—Facebook posts incorporate more emotional expressions, SMS users type shorter messages, and tweets are something in between. So researchers had to first develop a social media text normalization system, software that could automatically adapt to these variations in style to produce something that syntactic SMT can process. Adding the normalizer system to the translator's training protocol helped increase the accuracy of social-media text translation by 6 percent, according to Microsoft's Dendi. "That significantly improved the quality," he says. "Of course, there's still a lot of work to do, but when we did this, it really did move the needle on understanding and translating that type of data better." What's more, the techniques developed to improve social media translation are very similar to what was needed to bridge the gap between speech recognition and translation.

Skype Translator isn't the only speech translation system on the scene, though. According to Macduff Hughes, engineering director of Google Translate, many people use his company's software to test their own ability to speak a foreign language. He also says that in the past year, Google has added new features on its mobile apps that allow people to use Translate in more scenarios. But the system doesn't yet translate in real time and is not integrated into a video telephony application, which means multilingual speakers need to be in the same location and speak into the same app.

Google might be one of the only other companies with a shot at making a comparable system. Dendi says Microsoft's Skype work required deep knowledge of the company's Bing Web index to build the translation system, and a company would need similar assets to build another. "That's why there are only a few places in the world that can build a system of this kind and scale that can serve millions and millions of customers in this fashion across a range of scenarios," Dendi says.

http://bit.ly/1t4knfP

Shortcuts to an infant-like view on the world

Catch a baby's gaze. Can you imagine what it sees?

16:00 22 August 2014 by Shaoni Bhattacharya

We were all babies once, but none of us recall how the world appeared in those first few years of life. As our brains mature, our perceptual awareness changes. As the years go by, a gulf grows between our adult and infant minds. But new studies into the effect of psychoactive stimulants on consciousness suggest that there are ways for our adult brains to cross back.

What's it like to be a baby? Alison Gopnik, a psychologist at the University of California, Berkeley, offers the following analogies.

Go to Paris, fall in love

New experiences, such as visiting a new place or starting new relationships, can help focus our attention – something that's thought to rely on the brain's plasticity. Experiments in rats have shown that when they are trained to focus on either the frequency or intensity of sounds, some of their brain circuits restructure themselves, with certain neurons recruited to the tasks and others suppressed. Such a pliable, plastic brain is a fair approximation of what we see in babies. When we pay attention we effectively revert parts of our brain to their childhood state.

Coffee and cigarettes

Stimulants like caffeine and nicotine drive similar changes. Nicotine mimics a neurotransmitter called acetylcholine, which manages the activation of certain parts of the brain when we pay attention. At the same time, other inhibitory neurotransmitters would typically stop other parts of the brain from joining the party. But caffeine keeps these killjoy neurotransmitters at bay, making your brain more generally alert. A baby's immature brain is more plastic overall, so being a baby may be like paying attention with more of your brain. Coffee and cigarettes nudge us in that direction.

Watch a good movie

If you want to experience what it's like seeing the world through infant eyes, go and see a completely engrossing movie. Events on screen can remain vivid even as you relinquish a certain amount of conscious control over your awareness and sense of self.

Psychedelic stimulants

The effects of psilocybin – the active ingredient in magic mushrooms – on adult consciousness are even more extreme and may effectively revert key hubs in our brain to an infant-like state, at least temporarily. We appear to start life without a recognisable sense of self, developing self-awareness through social interactions.

Psychedelics like psilocybin also disrupt this sense of self, with people under the influence reporting the strange feeling that they were melting into everything around them. Brain scans show that the parts of the brain deactivated by the drug – those involved in self-awareness – are underdeveloped in babies. In a sense, psychedelics offer a window into what infantile consciousness might be like.

http://bit.ly/1ttJsPQ

Dogs Play Dumb for Our Sake

Our domestication of wolves, and our own dominant nature, has resulted in dogs that are so submissive that they suppress their independence and intellect, new research finds.

Aug 22, 2014 01:54 PM ET // by Jennifer Viegas

Dogs wait for orders, while wolves cooperate with each other to solve problems, according to the study, which was recently presented at the Animal Behavior Society's meeting at Princeton University. In a sense, we've created submissive mini-me's that mirror our own difficulties in creating egalitarian societies.

As a result, the researchers advise that we reconsider the notion of "dog-human cooperation."

Co-author Friederike Range explained to Virginia Morell of the journal Science that our ancestors bred dogs for obedience and dependency. "It's not about having a common goal," Range said. "It's about being with us, but without conflict. We tell them something, and they obey."

Range and colleague Zsófia Virányi, who are both scientists at the Messerli Research Institute at the University of Veterinary Medicine Vienna, tested both dogs and wolves to determine the animals' tolerance of their fellow pack members during a mealtime challenge. All of the animals, including the wolves, had been raised at the Wolf Science Center in Game Park Ernstbrunn, Austria. The wolves were therefore somewhat accustomed to being around humans.

For the study, the scientists paired a high-ranking dog with a low-ranking member of their pack and set out a bowl of food. They did the same thing with a pair of wolves. In every matchup, "the higher ranking dog monopolized the food," Range said at the meeting. "But in the wolf tests, both high- and low-ranking animals had access" and were able to chow down at the same time. At times, the more dominant wolves were "mildly aggressive toward their subordinates, but a lower ranking dog won't even try" when paired with a top dog, Range said. "They don't dare to challenge."

Wolves were also better able to find food after following the gazes of their fellow pack buddies. "They are very cooperative with each other, and when they have a disagreement or must make a group decision, they have a lot of communication or 'talk' first," Range said.

Dogs don't seem to do this. Instead, higher-ranking dogs "may react aggressively" toward their subordinates. It basically sounds like a day at the office for many people in non-leadership roles, so humans have transferred their own challenges to the dogs they've domesticated.

Yet another study at the meeting supported the findings.

For this second experiment, animal behaviorist Monique Udell of Oregon State University presented 20 adult dogs (10 pets and 20 from shelters) as well as 10 captive wolves with sealed containers of sausage. Each dog or wolf was allowed 2 minutes to try and open the containers.

The dogs experienced epic fail. Not one succeeded. But the wolves aced the test. Udell said that "as the dog grows and becomes more dependent on its human owner [their independent] behavior is inhibited."

Here's the clincher: the researchers conducted the same test with dog puppies and they all succeeded, just as the wolves did. Because adult dogs "suppress their independence, it's difficult to know what their normal problem-solving abilities are," Udell said at the meeting.

It makes me wonder how dominant humans are affecting the behavior and intellectual potential of those they subjugate. It will be interesting to see if we evolve different, better ways of connecting with dogs, not to mention people.

http://www.scientificamerican.com/article/school-starts-too-early/

School Starts Too Early

The later high school classes start in the morning, the more academic performance improves

Aug 19, 2014 |By Mark Fischetti

Parents, students and teachers often argue, with little evidence, about whether U.S. high schools begin too early in the morning. In the past three years, however, scientific studies have piled up, and they all lead to the same conclusion: a later start time improves learning. And the later the start, the better.

Biological research shows that circadian rhythms shift during the teen years, pushing boys and girls to stay up later at night and sleep later into the morning. The phase shift, driven by a change in melatonin in the brain, begins around age 13, gets stronger by ages 15 and 16, and peaks at ages 17, 18 or 19.

Does that affect learning? It does, according to Kyla Wahlstrom, director of the Center for Applied Research and Educational Improvement at the University of Minnesota. She published a large study in February that tracked more than 9,000 students in eight public high schools in Minnesota, Colorado and Wyoming. After one semester, when school began at 8:35 a.m. or later, grades earned in math, English, science and social studies typically rose a quarter step—for example, up halfway from B to B+.

Two journal articles that Wahlstrom has reviewed but have not yet been published reach similar conclusions. So did a controlled experiment completed by the U.S. Air Force Academy, which required different sets of cadets to begin at different times during their freshman year. A 2012 study of North Carolina school districts that varied school times because of transportation problems showed that later start times correlated with higher scores in math and reading. Still other studies indicate that delaying start times raises attendance, lowers depression rates and reduces car crashes among teens, all because they are getting more of the extra sleep they need.

And the later the delay, the greater the payoff. In various studies, school districts that shifted from 7:30 to 8:00 a.m. saw more benefits than those that shifted from 7:15 to 7:45 a.m. Studies in Brazil, Italy and Israel showed similar improvements in grades. The key is allowing teens to get at least eight hours of sleep, preferably nine. In Europe, it is rare for high school to start before 9:00 a.m.

Studies also show that common arguments against later start times ring hollow. In hundreds of districts that have made the change, students do not have a harder time fitting in after-school activities such as sports or in keeping part-time jobs. “Once these school districts change, they don't want to go back,” Wahlstrom says.

Even “the bus issue” can work out for everyone. Many districts bus kids to high school first, then rerun the routes for the elementary schools. Flipping the order would bring high schoolers to class later and benefit their little sisters and brothers; other studies show that young children are more awake and more ready to learn earlier in the morning.

http://www.eurekalert.org/pub_releases/2014-08/uol-mne082014.php

Mimicking natural evolution with 'promiscuous reactions' to improve the diversity of drugs

A revolutionary new scientific method developed at the University of Leeds will improve the diversity of 'biologically active molecules', such as antibiotics and anti-cancer agents.

The researchers, who report their findings online today in the journal Nature Chemistry, took their inspiration from evolution in nature. The research may uncover new pharmaceutical drugs that traditional methods would never have found.

"Nature produces some amazing structures with really interesting biological activity, but the plant or animal did not design them. Instead the organisms gradually evolved both the chemical structures and the methods to produce them over millennia because they were of benefit. We wanted to capture the essence of this in our approach to discovering new drugs," said George Karageorgis, a PhD student from the School of Chemistry and the Astbury Centre for Structural Molecular Biology at the University of Leeds, and first author of the study.

The traditional method for discovering new drugs involves preparing new biologically active molecules by adjusting the chemical structure of an existing one slightly and analysing the results. This trial and error method is both time consuming and limits the variety of new types of drugs that are developed.

"There is a known problem with limited diversity in drug discovery. It's like a baker always going to the same storage cupboard and using the same ingredients, yet hoping to create something that tastes different," said Dr Stuart Warriner from the School of Chemistry and the Astbury Centre for Structural Molecular Biology at the University of Leeds, a co-author of the research paper.

"Our novel approach is like taking lots of different ingredients – including things you may never think will work together – and trying different combinations of these in each cup of a cupcake tray. If the result 'tastes' promising then we use this as the starting point for another set of experiments. Only at the end, when we have something really good, do we work out exactly what we have made."

In the study, the researchers investigated the reactions of 12 types of an organic molecule called a 'diazo' compound. The researchers chose to study reactions of diazo compounds as they have many possible outcomes, depending on the specific reaction conditions (such as the temperature and concentrations used) and the choice of the reaction catalyst.

Different types and quantities of the reaction 'ingredients' were added to each of the 96 wells of an experiment tray and the products of the reaction were then tested to see if they had the required biological effect.

"The key to our method is using very promiscuous reactions which can lead to many different interesting products. Normally, these are the sort of reactions that chemists would steer well clear of, but in this case it's actually an advantage and gives us the chance of finding some diverse and active structures," said Dr Warriner.

To assess the effectiveness of the reaction products as drugs, the researchers studied how well they could activate a particular biologically relevant protein called the 'androgen receptor', which is important in the progression of certain cancers. The results informed two further rounds of experiments on the most promising candidates, from which the researchers eventually identified three biologically active molecules.

"It's very unlikely that anyone would have ever designed these molecules or thought to use these compound classes against this target, but we have reached that result very efficiently and rapidly using our methodology," said Karageorgis.

Professor Adam Nelson from the School of Chemistry and the Astbury Centre for Structural Molecular Biology at the University of Leeds, a co-author on the paper, concludes: "The beauty of our approach is that pharmaceutical companies could start using it tomorrow, as you don't need any specialist equipment. What we need to do now is to run further studies and add even more diversity to the potential products of our reactions to convince other scientists to adopt this new technique."

The Engineering and Physical Sciences Research Council (EPSRC) provided funding for the equipment used in this study. Karageorgis' PhD studies are supported by a University of Leeds scholarship.

The research paper, 'Efficient Discovery of Bioactive Scaffolds by Activity-Directed Synthesis' (http://dx.doi.org/10.1038/nchem.2034), is published online by the journal Nature Chemistry on 24 August 2014.

http://bit.ly/VNFq7C

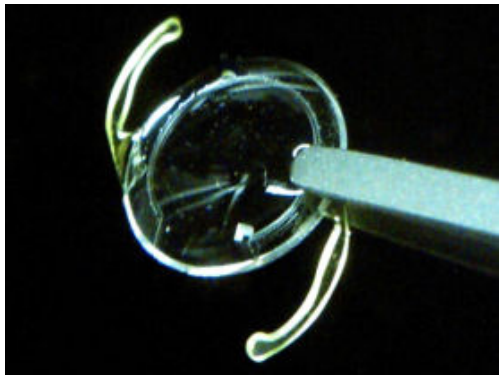
New Eye Sensor Could Be Boon for Glaucoma Patients

A new lens-mounted microfluidic sensor can measure fluid pressure inside the eye and provide a readout with a smartphone camera.

By Prachi Patel

The simple, low-cost device could make it much easier for doctors to diagnose blindness-causing glaucoma. It could also give glaucoma patients a 24-hour home-based monitoring test similar to the glucose monitors available for diabetics.

Glaucoma affects 65 million people and is the second-most common cause of blindness in the world. One of its main risk factors is an increase in the eyeball fluid pressure, which can build up enough to damage the optic nerve. Eye doctors today measure this intraocular pressure using a tonometer, but the test is not always accurate.



A microfluidic sensor embedded within an implantable lens could help monitor eye pressure in glaucoma patients. High pressure can cause blindness. The sensor is a microfluidic channel connected on one side to the eye fluid and to a tiny gas reservoir on the other. The lens' arms stabilize the lens in place within the eye. **Photo: Yossi Mandel**

The new sensor consists of an airtight 50 μm-channel that runs around most of the periphery of a lens that is used for cataract surgery. On one side it ends in a tiny gas reservoir, while on the other it connects to the aqueous eyeball fluid. A doctor would surgically implant the lens into a patient's eye.

When the microchannel is connected into the eye chamber, pressure drives the intraocular fluid into the microchannel, compressing the reservoir gas until the gas pressure and liquid pressure reach equilibrium. An increase or decrease in the intraocular pressure forces the fluid to move toward or away from the gas reservoir. A smartphone camera equipped with an optical adapter and image analysis software can be used to accurately detect the position of the liquid. The optical adapter positions the camera in front of the pupil and shades the eye, causing the pupil to dilate and reveal the sensor.

Yossi Mandel of Bar Ilan University in RamatGan, Israel and Stephen Quake of Stanford University and their colleagues reported the new sensor in the journal Nature Medicine.

The researchers first tested and calibrated the sensor in a pressure chamber by simulating changes in intraocular pressure. They found that the movement of the liquid inside the microchannel was linear to pressure changes and sensitive to pressure fluctuations as small as 1 mm Hg. Normal intraocular pressure ranges between 10-21 mm Hg, but can increase by 8 mm Hg when a person is lying down. The researchers also tested the implant in surgically removed pig eyes, where it also showed a detection limit of 1 mm Hg.

Other eye pressure sensors exist. University of Michigan researchers have developed, for instance, microelectromechanical system-based capacitive sensors. And Swiss medical device-maker Sensimed already has a commercial contact lens-based eye pressure sensor in which a piezoelectric platinum ring changes resistance when the eyeball inflates. But these approaches rely on wireless data telemetry, which requires bulky antenna and power sources.

The optical readout on the new microfluidic sensor could be easier to use, though it does have its own limitations. Reading the fluid position through a hazy cornea, which can happen in glaucoma patients, could be difficult, for instance. And gas could leak out of the sensor walls, making readings inaccurate. Nevertheless, the researchers say that their experimental results suggest a 10-year device life.

http://www.bbc.com/news/science-environment-28898223

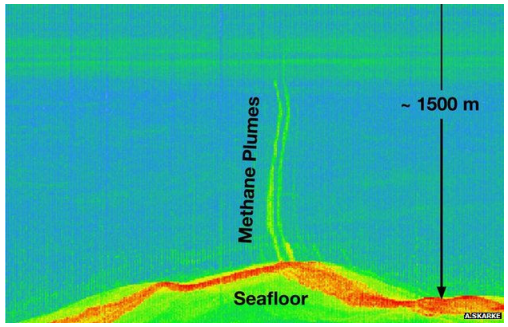
'Widespread methane leakage' from ocean floor off US coast

Researchers say they have found more than 500 bubbling methane vents on the seafloor off the US east coast.

The unexpected discovery indicates there are large volumes of the gas contained in a type of sludgy ice called methane hydrate. There are concerns that these new seeps could be making a hitherto unnoticed contribution to global warming. The scientists say there could be about 30,000 of these hidden methane vents worldwide. Previous surveys along the Atlantic seaboard have shown only three seep areas beyond the edge of the US continental shelf.

Deep seep

The team behind the new findings studied what is termed the continental margin, the region of the ocean floor that stands between the coast and the deep ocean. In an area between North Carolina and Massachusetts, they have now found at least 570 seeps at varying depths between 50m and 1,700m. Their findings came as a bit of a surprise.



A sonar image of a new methane plume discovered off the US east coast

"It is the first time we have seen this level of seepage outside the Arctic that is not associated with features like oil or gas reservoirs or active tectonic margins," said Prof Adam Skarke from Mississippi State University, who led the study. The scientists have observed streams of bubbles but they have not yet sampled the gas within them. However, they believe there is an abundance of circumstantial evidence pointing to methane. Most of the seeping vents were located around 500m down, which is just the right temperature and pressure to create a sludgy confection of ice and gas called methane hydrate, or clathrate.

The scientists say that the warming of ocean temperatures might be causing these hydrates to send bubbles of gas drifting through the water column. They do not appear to be reaching the surface. "The methane is dissolving into the ocean at depths of hundreds of metres and being oxidised to CO2," said Prof Skarke. "But it is important to say we simply don't have any evidence in this paper to suggest that any carbon coming from these seeps is entering the atmosphere."

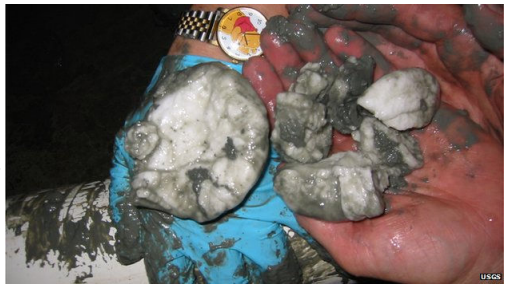
This research, though, does highlight the scale of methane that is under the waters. Estimates suggest that these undersea sediments are one of the largest reservoirs on Earth and contains around 10 times more carbon than the atmosphere.

What is methane hydrate?
Methane hydrate is in the form of a 3D ice structure with natural gas locked inside
The substance looks like white ice, but it does not behave like it
If methane hydrate is either warmed or depressurised, it will break down into water and natural gas
The energy content of methane occurring in hydrate form is immense
In the Gulf of Mexico, gas hydrate resources have recently been assessed at more than 6,000 trillion cubic feet
Source: US Department of Energy

Carbon budget revisions

Prof Skarke and his colleagues estimate that worldwide, there may be around 30,000 of the type of seeps they have discovered. They acknowledge that this is a rough calculation but they believe that it could be significant. While the vents may not be posing an immediate global warming threat, the sheer number means that our calculations on the potential sources of greenhouse gases may need revising.

Methane hydrates recovered in the Gulf of Mexico by the US Geological Survey



The scientists also found abundant life around many of these seeps, but not perhaps as we know it. The creatures they describe are termed chemosynthetic, meaning they derive energy from chemical reactions and not from the Sun as do photosynthetic organisms.

Others who have collaborated on the search for seeps say these discoveries are important. "These are significant geochemically, as they and our research teams found perhaps one of the largest seeps yet discovered with very active methane bubbling and large amounts of frozen hydrates," said Prof Steve Ross, from the University of North Carolina, Wilmington. "These seeps are also significant biologically, as we have found unique chemosynthetic communities, huge range extensions and increased biodiversity."

As to the energy potential of these new seeping sources, Prof Skarke is fairly pessimistic. "There is no evidence to say that these clathrates are related to conventional gas reservoirs, so there is no evidence to say they are a recoverable resource." The research has been published in the journal Nature Geoscience.

http://www.bbc.com/news/health-28887087

Whole organ 'grown' in world first

A whole functional organ has been grown from scratch inside an animal for the first time, say researchers in Scotland.

By James Gallagher Health editor, BBC News website

A group of cells developed into a thymus - a critical part of the immune system - when transplanted into mice. The findings, published in Nature Cell Biology, could pave the way to alternatives to organ transplantation. Experts said the research was promising, but still years away from human therapies.

The thymus is found near the heart and produces a component of the immune system, called T-cells, which fight infection.

Grow your own

Scientists at the Medical Research Council centre for regenerative medicine at the University of Edinburgh started with cells from a mouse embryo. These cells were

genetically "reprogrammed" and started to transform into a type of cell found in the thymus. These were mixed with other support-role cells and placed inside mice. Once inside, the bunch of cells developed into a functional thymus.

It is similar to a feat last year, when lab-grown human brains reached the same level of development as a nine-week-old foetus.

The thymus is a much simpler organ and in these experiments became fully functional. Structurally it contained the two main regions - the cortex and medulla - and it also produced T-cells.

Prof Clare Blackburn, part of the research team, said it was "tremendously exciting" when the team realised what they had achieved. She told the BBC: "This was a complete surprise to us, that we were really being able to generate a fully functional and fully organised organ starting with reprogrammed cells in really a very straightforward way. "This is a very exciting advance and it's also very tantalising in terms of the wider field of regenerative medicine."

Patients who need a bone marrow transplant and children who are born without a functioning thymus could all benefit. Ways of boosting the thymus could also help elderly people. The organ shrinks with age and leads to a weaker immune system.

However, there are a number of obstacles to overcome before this research moves from animal studies to hospital therapies. The current technique uses embryos. This means the developing thymus would not be a tissue match for the patient. Researchers also need to be sure that the transplant cells do not pose a cancer risk by growing uncontrollably.

Prof Robin Lovell-Badge, from the National Institute for Medical Research, said: "This appears to be an excellent study. "This is an important achievement both for demonstrating how to make an organ, albeit a relatively simple one, and because of the critical role of the thymus in developing a proper functioning immune system. "However... the methods are unlikely to be easy to translate to human patients."

Advances

The field of regenerative medicine has developed rapidly. There are already patients with lab-grown blood vessels, windpipes and bladders. These have been made by "seeding" a patient's cells into a scaffold which is then implanted. The thymus just required an injection of cells.

Dr Paolo de Coppi, who pioneers regenerative therapies at Great Ormond Street Hospital, said: "Research such as this demonstrates that organ engineering could, in the future, be a substitute for transplantation. "Engineering of relatively simple organs has already been adopted for a small number of patients and it is possible that within the next five years more complex organs will be engineered for patients using specialised cells derived from stem cells in a similar way as outlined in this paper.

"It remains to be seen whether, in the long term, cells generated using direct reprogramming will be able to maintain their specialised form and avoid problems such as tumour formation."

http://bit.ly/VNH4WV

Mangalyaan Ready for Final Lap Nine Months after Launch

Today the Indian Space Research Organisation (ISRO) said that India's Mars Orbiter Mission, known as Mangalyaan is now at a distance of just nine million kilometres from the red planet.

Submitted by Anja Prohaska on Sun, 08/24/2014 - 08:20

On Saturday ISRO said on its Facebook page, "Mars Orbiter Mission (MOM) is just nine million km away from Mars and 189 million kilometres away from the Earth. 33 more days to MARS." The spacecraft is scheduled to enter the orbit of Mars at 7.30 am on September 24. MOM was launched on 5th November 2013 by ISRO.

Dr K Radhakrishnan the chairman of ISRO told the media, "This is a very critical phase of the Mission. Our mission controllers are going through ground simulations and rehearsals to respond to contingencies."

On September 14 a decision is awaited whether there would be a requirement of another correction in the space craft's course.

The next big challenge that comes the way of the agency is to reduce the speed of the spacecraft through the process of firing the LAM engine and bring it to 1.6 km/sec. For the last three hundred days the engine has been idle and restarting it can be a great challenge for ISRO.

An official spokes person of the agency said. "The firing has to be done very precisely. When we reduce the spacecraft's velocity, it should be close enough to Mars for it to be captured by the planet's gravity."

http://dailym.ai/1l7G0ct

Will this nail polish stop sexual assault?

Male science students develop a manicure that changes color when exposed to 'date rape' drugs

By Olivia Fleming for MailOnline

Soon, a fresh manicure could have the potential to save your life.

Mixing chemistry with cosmetics, four male undergraduates at North Carolina State University have created Undercover Colors, a nail polish that changes color when exposed to date rape drugs. 'With our nail polish, any woman will be empowered to discreetly ensure her safety by simply stirring her drink with her

finger. If her nail polish changes color, she'll know that something is wrong,' according to the official Facebook page.

The nail polish's developers, Tyler Confrey-Maloney, Stephen Gray, Ankesh Madan and Tasso Von Windheim, meet while studying the same Materials Science & Engineering major.

'We were thinking about big problems in our society, the topic of drug-facilitated sexual assault came up,' Mr Madan told Higher Education Works.

'All of us have been close to someone who has been through the terrible experience, and we began to focus on preventive solutions, especially those that could be integrated into products that women already use.

'And so the idea of creating a nail polish that detects date rape drugs was born.'

Still in the development stage, Undercover Colors is raising money through a donations page to refine its prototype. 'While date rape drugs are often used to facilitate sexual assault, very little science exists for their detection,' the team explained. 'Our goal is to invent technologies that empower women to protect themselves from this heinous and quietly pervasive crime.'

A recent Washington Post analysis showed more than 3,900 allegations of forcible sex offenses on college campuses nationwide in 2012, a statistic that rose 50 percent in three years.

Terri Lomax, North Carolina State's vice chancellor for research, innovation and economic development, said the Undercover Colors prototype is 'emblematic' of this epidemic. 'N.C. State prides itself on encouraging and supporting the efforts of student entrepreneurs to address real world problems,' she explained.

The team said that the University has been 'invaluable' in helping with the nail polish's development.

Throughout the process, they have used lab space through the College of Veterinary Medicine, which is one of the only locations in North Carolina where scientists can test DEA Schedule 3 and Schedule 1 drugs.

'Our main technical advisor, Dr. Nathaniel Finney from the NCSU Chemistry Department, is a world-renowned expert on indicator development and has volunteered his time to help advise us on prototype development,' explained Mr Madan.

http://bit.ly/1BUieG0

Pig pheromone proves useful in curtailing bad behavior in dogs

One little spritz and immediately the dog stopped barking. Right on the spot.

A professor at Texas Tech discovers Androstenone can stop dogs from barking, jumping. In a sense, John McGlone was just like any other pet owner a few years ago. He simply wanted to keep his Cairn Terrier from barking incessantly.

Then again, McGlone is not like most dog owners in that he is a professor at Texas Tech University who just happens to specialize in animal welfare and behavior. And, in that capacity, he just happened to have a product on hand at his house from a previous research study called Boar Mate, an odorous concoction which helps farmers with swine breeding.

So, he gave one little spritz to his dog, Toto, and immediately the dog stopped barking. Right on the spot.

'It was completely serendipitous," said McGlone, who works in the Animal and Food Sciences department of the College of Agriculture and Natural Sciences. "One of the most difficult problems is that dogs bark a lot, and it's one of the top reasons they are given back to shelters or pounds."

Suddenly, an idea was born. After extensive testing and publishing of the results, and with funding help from Sergeant's pet care products, Stop That was developed and hit store shelves under the Sentry pet products name about a year ago. It has been met with tremendous success by pet owners who were on their last legs in trying to curtail bad behavior in dogs.

"My dogs were instantly focused and silenced with one spritz," said one product reviewer on Amazon.com. "It's changed my life."

Assist to pigs

Not only did the discovery of this product by McGlone come by accident, it came from a completely different species.

McGlone said Boar Mate contains a pig pheromone, defined as "substances secreted to the outside by an individual and received by a second individual of the same species in which they release a specific reaction."

In this case, the pheromone produced is androstenone, which, when secreted by male pigs, is picked up by female pigs in heat and ready to breed. It is a foul-smelling odor for humans and also affects dogs through their olfactory system.

Androstenone is produced by pigs in their saliva or fat, but Boar Mate androstenone is synthesized in a laboratory. One spray of Boar Mate on Toto was all it took to set the wheels of experimentation in motion.

McGlone contacted a canine research site he had worked with on previous experiments, knowing this site had a wide array of adult dogs, both mixed and pure breeds. He also knew that about half of the 100 dogs there barked constantly and would be perfect for testing.

"It doesn't mean it's going to work on a lot of dogs just because it worked on one dog," McGlone said. "It might have been the noise of the spray that stopped them and not the chemical."

McGlone asked Sergeant's to make several spray cans that had the androstenone in different concentrations and also made noise when sprayed. Testing then began.

McGlone had four different groups of barking dogs in separate kennels. The first group of dogs simply had a person with another dog stand in front of the kennels. The second group of dogs was sprayed with a placebo that made the startling, spritz noise. The third group of dogs was sprayed with the noise and a lower concentration (.01µg/mL) of androstenone in isopropyl alcohol. The fourth group was sprayed with a higher concentration (1.0 µg/mL) of androstenone in isopropyl alcohol that also made the spritz sound.

In the first group, 25 percent (3 out of 12 dogs) stopped barking. In the second group, 44 percent (4 of 9 dogs) stopped barking. In the third group, sprayed with the lower concentration of the pheromone, 78 percent (7 of 9 dogs) stopped barking. In the fourth group, sprayed with the higher concentration of androstenone, 100 percent (6 of 6 dogs) stopped barking.

"We sprayed it in their nose or toward their head while they were barking … barking and jumping, running back and forth," McGlone said. "This whole behavior stopped. You could almost see them thinking, 'What was that?'"

McGlone and his group also tested the dogs to see if there were any physiological effects from the spray on the dogs, observing them for 10 minutes before and after being sprayed after outfitting the dogs with telemetry jackets and transmitters to monitor heart rate. The androstenone had no effect on the dogs' heart rates either before or after being sprayed.

Having shown its effectiveness, McGlone was able to classify androstenone not only as a pheromone but also as an intermone, a term developed by him and his team that refers to a product that is a "pheromone in one species and has a behavioral effect in another species, but we do not know if it is a pheromone (naturally produced) in the other species."

McGlone said other tests on the product have also been conducted outside of Texas Tech and that the success rate is more than 90 percent. He also added in his paper on the subject that "additional research to determine the length of the effects of pheromones and the effects of repeated applications remains to be investigated."

Practical uses

Having shown its effectiveness in curtailing bad behavior, the product was developed and hit the stores as Stop That for both dogs and cats, available at PetSmart or through Amazon.com. But, McGlone warns, it's not an end-all, beat-all to stopping dogs from barking, as the effects last just about a minute.

"If you continue to spray the dog again it will stop," McGlone said. "If you (show the can) they will stop. It's best used as a training tool rather than a circus act to stop animals from doing what they're doing."

McGlone said he continues to experiment with other pheromones as well to see if any of those might have the same effect. It's not limited to pig pheromones, either, as he is testing those from dogs, cats, pigs and horses.

For now, though, there are quite a few pet owners relieved to be able to stop their pets' bad behavior and not have to resort to giving them up, thanks to Stop That.

"It's kind of an amazing product, actually," McGlone said.