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You're not irrational, you're just quantum probabilistic

Researchers explain human decision-making with physics theory

COLUMBUS, Ohio - The next time someone accuses you of making an irrational decision, just explain that you're obeying the laws of quantum physics.

A new trend taking shape in psychological science not only uses quantum physics to explain humans' (sometimes) paradoxical thinking, but may also help researchers resolve certain contradictions among the results of previous psychological studies.

According to Zheng Joyce Wang and others who try to model our decision-making processes mathematically, the equations and axioms that most closely match human behavior may be ones that are rooted in quantum physics.

"We have accumulated so many paradoxical findings in the field of cognition, and especially in decision-making," said Wang, who is an associate professor of communication and director of the Communication and Psychophysiology Lab at The Ohio State University.

"Whenever something comes up that isn't consistent with classical theories, we often label it as 'irrational.' But from the perspective of quantum cognition, some findings aren't irrational anymore. They're consistent with quantum theory - and with how people really behave."

In two new review papers in academic journals, Wang and her colleagues spell out their new theoretical approach to psychology. One paper appears in Current Directions in Psychological Science, and the other in Trends in Cognitive Sciences.

Their work suggests that thinking in a quantum-like way¬ - essentially not following a conventional approach based on classical probability theory - enables humans to make important decisions in the face of uncertainty, and lets us confront complex questions despite our limited mental resources.

When researchers try to study human behavior using only classical mathematical models of rationality, some aspects of human behavior do not compute. From the classical point of view, those behaviors seem irrational, Wang explained.

For instance, scientists have long known that the order in which questions are asked on a survey can change how people respond - an effect previously thought to be due to vaguely labeled effects, such as "carry-over effects" and "anchoring and adjustment," or noise in the data. Survey organizations normally change the order of questions between respondents, hoping to cancel out this effect. But in the Proceedings of the National Academy of Sciences last year, Wang and collaborators demonstrated that the effect can be precisely predicted and explained by a quantum-like aspect of people's behavior.

We usually think of quantum physics as describing the behavior of sub-atomic particles, not the behavior of people. But the idea is not so far-fetched, Wang said. She also emphasized that her research program neither assumes nor proposes that our brains are literally quantum computers. Other research groups are working on that idea; Wang and her collaborators are not focusing on the physical aspects of the brain, but rather on how abstract mathematical principles of quantum theory can shed light on human cognition and behaviors.

"In the social and behavioral sciences as a whole, we use probability models a lot," she said. "For example, we ask, what is the probability that a person will act a certain way or make a certain decision? Traditionally, those models are all based on classical probability theory - which arose from the classical physics of Newtonian systems. So it's really not so exotic for social scientists to think about quantum systems and their mathematical principles, too."

Quantum physics deals with ambiguity in the physical world. The state of a particular particle, the energy it contains, its location - all are uncertain and have to be calculated in terms of probabilities.

Quantum cognition is what happens when humans have to deal with ambiguity mentally. Sometimes we aren't certain about how we feel, or we feel ambiguous about which option to choose, or we have to make decisions based on limited information.

"Our brain can't store everything. We don't always have clear attitudes about things. But when you ask me a question, like 'What do you want for dinner?" I have to think about it and come up with or construct a clear answer right there," Wang said. "That's quantum cognition."

"I think the mathematical formalism provided by quantum theory is consistent with what we feel intuitively as psychologists. Quantum theory may not be intuitive at all when it is used to describe the behaviors of a particle, but actually is quite intuitive when it is used to describe our typically uncertain and ambiguous minds."

She used the example of Schrödinger's cat - the thought experiment in which a cat inside a box has some probability of being alive or dead. Both possibilities have potential in our minds. In that sense, the cat has a potential to become dead or alive at the same time. The effect is called quantum superposition. When we open the box, both possibilities are no longer superimposed, and the cat must be either alive or dead.

With quantum cognition, it's as if each decision we make is our own unique Schrödinger's cat.

As we mull over our options, we envision them in our mind's eye. For a time, all the options co-exist with different degrees of potential that we will choose them:

That's superposition. Then, when we zero in on our preferred option, the other options cease to exist for us.

The task of modeling this process mathematically is difficult in part because each possible outcome adds dimensions to the equation. For instance, a Republican who is trying to decide among the candidates for U.S. president in 2016 is currently confronting a high-dimensional problem with almost 20 candidates. Open-ended questions, such as "How do you feel?" have even more possible outcomes and more dimensions.

With the classical approach to psychology, the answers might not make sense, and researchers have to construct new mathematical axioms to explain behavior in that particular instance. The result: There are many classical psychological models, some of which are in conflict, and none of which apply to every situation.

With the quantum approach, Wang and her colleagues argued, many different and complex aspects of behavior can be explained with the same limited set of axioms. The same quantum model that explains how question order changes people's survey answers also explains violations of rationality in the prisoner's dilemma paradigm, an effect in which people cooperate even when it's in their best interest not to do so.

"The prisoner's dilemma and question order are two completely different effects in classical psychology, but they both can be explained by the same quantum model," Wang said. "The same quantum model has been used to explain many other seemingly unrelated, puzzling findings in psychology. That's elegant."

Co-authors on the papers included Peter Bruza of the Queensland University of Technology in Australia and Jerome Busemeyer of Indiana University, and the research was funded by the U.S. Air Force Office of Scientific Research.

http://www.eurekalert.org/pub_releases/2015-09/tjnj-lvd091015.php

Low vitamin D associated with faster decline in cognitive function

Vitamin D insufficiency was associated with faster decline in cognitive functions among a group of ethnically diverse older adults, according to an article published online by JAMA Neurology.

In addition to promoting calcium absorption and bone health, vitamin D may influence all organ systems. Both the vitamin D receptor and the enzyme that converts 25-hydroxyvitamin D (25-OHD) to the active form of the vitamin are expressed in all human organs, including the brain. Thus, research has increasingly examined the association between vitamin D status and a variety of health outcomes, including dementia and age-associated cognitive decline.

Joshua W. Miller, Ph.D., of Rutgers University, New Brunswick, N.J., and coauthors from the University of California, Davis, examined baseline vitamin D status and change in subdomains of cognitive function as measured on assessment scales in an ethnically diverse group of 382 older adults.

Serum (blood) 25-OHD was measured and vitamin D status was defined as follows: deficient was less than 12 ng/mL; insufficient was 12 to less than 20 ng/mL; adequate was 20 to less than 50 ng/mL; and high was 50 ng/mL or higher.

Study participants were an average age of 75.5 years and nearly 62 percent were female, while 41.4 percent of the group was white, 29.6 percent were African American and 25.1 percent were Hispanic. At study enrollment, 17.5 percent of the participants had dementia, 32.7 percent had mild cognitive impairment and 49.5 percent were cognitively normal.

The authors report:

The average 25-OHD level among participants was 19.2 ng/mL, with 26.2 percent of participants being vitamin D deficient and 35.1 percent vitamin D insufficient.

Average 25-OHD levels were lower for African American and Hispanic participants compared with their white counterparts (17.9, 17.2 and 21.7 ng/mL, respectively).

Average 25-OHD levels were lower in the dementia group compared with mild cognitive impairment and cognitively normal groups (16.2, 20.0 and 19.7 ng/mL, respectively.

During an average follow-up of 4.8 years, rates of decline in episodic memory and executive function among vitamin D deficient and vitamin D insufficient participants were greater than those with adequate vitamin D status after adjusting for a variety of patient factors.

Vitamin D status was not significantly associated with decline in semantic memory or visuospatial ability.

The authors note limitations to their study including that they did not directly measure dairy intake, sun exposure or exercise, each of which can influence vitamin D levels.

"Our data support the common occurrence of VitD [vitamin D] insufficiency among older individuals. In addition, these data show that African American and Hispanic individuals are more likely to have VitD insufficiency or deficiency. Independent of race or ethnicity, baseline cognitive ability, and a host of other risk factors, VitD insufficiency was associated with significantly faster declines in both episodic memory and executive function performance, which may correspond to elevated risk for incident AD [Alzheimer disease] dementia. Given that VitD insufficiency is medically correctable, well-designed clinical trials that emphasize enrollment of individuals of nonwhite race/ethnicity with hypovitaminosis D could be useful for testing the effect of VitD replacement on dementia prevention," the study concludes.

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Rocky planets may be habitable depending on their 'air conditioning system'

Some rocky planets outside our Solar System may be more promising candidates for further research

The quest for potentially habitable planets is often interpreted as the search for an Earth twin. And yet, some rocky planets outside our Solar System may in fact be more promising candidates for further research. Scientists from KU Leuven, Belgium, have run 165 climate simulations for exoplanets that permanently face their 'sun' with the same side. They discovered that two of the three possible climates are potentially habitable.

Most exoplanets orbit relatively small and cool stars known as red dwarfs. Only exoplanets that orbit close to their star can be warm enough for liquid water. What is more, being close to their star also makes these potentially habitable planets relatively easy to detect and observe for research purposes.

Many exoplanets that orbit closely to their stars always face that star with the same side. As a result, they have permanent day and night sides. And yet, the climate on these planets is not necessarily scorching hot on one side and freezing on the other. This is due to a very efficient 'air conditioning system' that keeps surface temperatures within the habitable range.

Dr. Ludmila Carone, Professor Rony Keppens, and Professor Leen Decin from KU Leuven, Belgium, have now examined the possible climates of these exoplanets in unprecedented detail. "On the basis of 3D models, we examined exoplanets with different rotation periods and sizes," Ludmila Carone explains. "We discovered that these rocky planets have three possible climates, two of which are potentially habitable."

On exoplanets with rotation periods under 12 days, an eastward wind jet known as superrotation forms in the upper layers of the atmosphere along the equator. This wind jet interferes with the atmospheric circulation on the planet, so that its day side becomes too hot to be habitable. A second possible wind system is characterised by two weaker westward wind jets at high latitudes. The third climate option combines weak superrotation with two high-latitude wind jets. These last two wind systems do not interfere with the 'air conditioning system', so that the planets remain potentially habitable.

The findings provide valuable input for future space missions. Specifically, KU Leuven researchers are currently involved in the preparation of the James Webb Space Telescope mission (2018) - the Hubble successor - as well as the planet-finder mission PLATO (2024). Not only will the study help identify the most promising candidates for further research in our solar vicinity, it will also help avoid the premature discarding of potentially habitable planets that are worth investigating despite their 'un-Earth-like' appearance.

http://www.bbc.com/news/magazine-34222452

The amazing significance of what a mother-to-be eats

New research reveals the extraordinary impact that your mother's diet at the time of your conception has on the rest of your life, writes Michael Mosley.

A couple of months ago, I found myself in a small village in Keneba, in The Gambia, chatting to a perky 90-year-old, Karamo Touray, surrounded by his many children and grandchildren. Apart from a sore toe, he said he was in good shape and he attributed the fact he had enjoyed such a long and healthy life to the will of Allah.

I suspect that the time of year when he was conceived may also have played a role.

A team from Britain's Medical Research Council, which has been collecting data on births, marriages and deaths in Keneba since the 1940s, discovered some years ago that in this part of The Gambia when you are conceived makes a huge difference to your chances of dying prematurely.

If you are conceived in, say, January and born in September then, as an adult, you are seven times more likely to die in any given year than someone conceived in September and born in June. So the effect is big, very big.

Now the reason this happens has nothing to do with astrology and an awful lot to do with the weather, and therefore, what your parents were eating at the time you were conceived. The Gambia has an unusual and very stable weather pattern. July to November is known as the wet season because it rains almost all the time. The other months are largely dry.

During the dry season people have plenty of couscous and rice to eat, and these grains form the major part of their diet. During the rainy season there are fewer calories around (these are known as the Hungry Months) but, thanks to the rain, there are a lot more leafy green vegetables to eat.

And it turns out, certainly in The Gambia, that the amount of leafy green vegetables your mother (and possibly your father) are eating around the time of your conception can have a big impact on the rest of your life.

What really surprised me is that not only are the effects so profound, but that they don't kick in for many years. Up until the age of 15 there's no discernible difference between the children. After that, however, the differences, as I described earlier, become striking, even shocking.

So, what's going on?

The fact that a mother's diet during pregnancy can have long and lasting effects on the health of her child has been known for some time. One of the most dramatic examples of this is the **Dutch Famine study**.

At the end of World War Two, the Germans blockaded parts of the Netherlands in retaliation against a rail strike called by the Dutch government. By the time the blockade was lifted, winter had begun and it was almost impossible to get food in. For months on end many people had to live on starvation diets. The famine was only ended when the Allies liberated Europe.

Thousands of people died during this famine. The Dutch Famine Birth Cohort Study was set up afterwards, the purpose of which was to see what would happen to the babies of the pregnant women caught up in the famine.

What they discovered is that if you were a young embryo at the time of the famine then you were twice as likely to develop heart disease in later life. You were also far more prone to schizophrenia, obesity, diabetes, cancer and stress-related illnesses. Worryingly, there's evidence that the effects persist into the next generation. Not only the children but the grandchildren of a woman caught up in the famine went on to have worse health in later life.

On the positive side, what this suggests is that improving the diet of pregnant women would not only improve the lives of their children but of their grandchildren. Or as the authors of the study cautiously put it: "This may imply that improved maternal nutrition during gestation may benefit the health of many generations to come."

Like the people in The Gambia, the impact of the Dutch Famine on the later lives of the children who were caught up in it are probably the result of changes to the genes, changes that occurred in the womb. Experiments in animals have shown that it is possible to make the genes in an embryo more active, or turn them off entirely, simply by varying their mother's diet.

It would obviously be unethical to do this to people, but the studies done in The Gambia certainly provide compelling evidence that these so-called "epigenetic changes" may also happen in humans in response to a change in diet. That if, during very early development, a mother eats a diet rich in leafy green vegetables, then this will change forever just how active some of her child's genes are.

In happens through a process called methylation and researchers in The Gambia **have recently shown** that babies conceived in the wet season have very different levels of activity of a particular gene that's important for regulating the immune system.

As Matt Silver, part of the MRC team, says: "Variation in methylation state in this gene could affect your ability to fight viral infections and it may also affect your chances of survival from cancers such as leukaemia and lung cancer."

If you are thinking of having a baby, then eating lots of leafy green vegetables, which are rich in B vitamins and folates, is certainly a good thing to do. Folic acid supplements are also recommended to reduce the risk of neural tube defects.

Find out more

Countdown to Life, the untold story of your nine months in the womb and how this impacts on your later life is on BBC Two at 21:00 BST on Monday 14 September.

Month 1: The first few days of the pregnancy determine whether you are one person, or two or three, or even four. No one knows how or when multiples are actually made, but a new theory is that if you don't hatch properly from your egg then that probably leads to the creation of twins and triplets.

Month 2: In the second month you start to see the formation of fingers and toes. I visited a remarkable family in Brazil who all have six fingers on each hand, and they celebrate that fact.

Month 3: Are you going to be right handed or left handed? By now a preference will already be there.

Month 4: It's a big month for the skin - at first it's totally transparent and over this month it develops fine fur-like hair called lanugo. Sweat glands grow and melanocytes, cells that give skin its colour, colonise the skin from the tissue underneath.

Month 5: The brain, and future behaviour, is being shaped by floods of hormones.

Month 6: You start off without bones, only cartilage. By now the bones that will allow you to stand should have formed.

Month 7: In your brain you're making an estimated 100 billion new connections every single day, and beginning to lay the foundations for memory.

Month 8: It's fattening up time and the foetus gains weight rapidly, building up a big fat reserve and beginning to look like a portly baby.

Month 9: Your lungs are the last organs to form, which makes perfect sense because they are not needed in the womb. Unborn babies actually practise breathing, inhaling and exhaling the amniotic fluid that surrounds them.

http://nyti.ms/1FRruur

For Older Adults, Questioning a Diagnosis of Chronic Kidney Disease

Is it really possible that half of the population older than 70 has chronic kidney disease?

Paula Span

International guidelines adopted in 2012 make it seem that way. They define the disease in terms of how efficiently kidneys filter the waste from our blood, a measure called the glomerular filtration rate. Healthy young people commonly have G.F.R.s of about 120. A G.F.R. lower than 60 or another marker of kidney

damage (such as protein in the urine) for more than three months means chronic kidney disease.

At which point, patients become scared. “When you’re told you have a disease, that’s a bad day,” said Dr. Ann O’Hare, a nephrologist at the University of Washington in Seattle who specializes in treating older adults. “Patients worry about dialysis, because that’s what they associate with kidney disease.”

Chronic kidney disease causes no symptoms until its later stages, and most seniors with the diagnosis are told they’re at Stage 3, of five - sudden, unwelcome news. Because Medicare uses these benchmarks for billing and reimbursement, they’ve become, in effect, the official definition of the disease for older Americans.

But wait a minute. Kidney function declines with age in almost everyone, and the proportion of older people with G.F.R. readings below 60 approaches 50 percent, studies have found. As the older adult population grows, the prevalence may rise even higher.

Yet the proportion of older people who will ever reach kidney failure, and thus need dialysis or a transplant, remains very low. People don’t turn to dialysis until their G.F.R. sinks much further, to about 10. In the great majority of older adults, that will never happen.

The lifetime risk of kidney failure in the United States is 3.6 percent for whites and 8 percent for African-Americans, one widely cited study found.

“Probably a majority of older patients we see have some degree of impaired renal function,” said Dr. Michael Steinman, a geriatrician at the University of California, San Francisco. “The chances are far and away that they’ll die of something else, and their kidneys will never be a problem.

“Why are we even thinking about this as a disease?”

Indeed, a small but spirited cadre of physicians and researchers are arguing - most recently in JAMA - that the guidelines should be recalibrated by age.

By using the same standards for everyone, “We’re labeling and medicalizing and victimizing a substantial fraction of the elderly population,” said Dr. Richard Glassock, an author of the article and a nephrologist at the University of California, Los Angeles.

Instead, Dr. Glassock and others propose that in people older than 65, the diagnosis should require a G.F.R. reading less than 45. At that lower threshold, they estimate, a third to half of the chronic kidney disease diagnosed in older patients would suddenly disappear. These patients should just be considered … old, the researchers say, with lower kidney function normal for their ages.

Age figures in the diagnostic criteria for some diseases, like chronic obstructive pulmonary disease or osteoporosis. But doctors diagnosing other conditions, like diabetes and hypertension, use the same benchmarks for everyone.

When it comes to kidney decline, Dr. O’Hare said, a G.F.R. below 60 would cause great concern in a 20-year-old. At older ages, “it’s a gray zone.”

Most G.F.R. readings that fall below 60 in older adults remain in the 45 to 59 range, considered a modest reduction in kidney function. Most of these seniors will not have protein in their urine or other evidence of kidney damage. “People are being told they have a condition and it doesn’t really mean anything,” Dr. O’Hare said.

In the same JAMA issue, though, another group of physician researchers warned against changing the guidelines.

“Having chronic kidney disease increases the risk of death from any cause, but particularly cardiovascular disease,” a co-author, Dr. Andrew Levey, the chief of nephrology at Tufts Medical Center, said in an interview. “People with kidney disease shouldn’t be treated the same as people without it.”

Regarding kidney disease as part of normal aging offends researchers like Dr. Levey. They point out that although the relative risk of dying is actually higher in younger people with chronic kidney disease, the absolute risk - the numbers of people who die from it - is higher at older ages.

Moreover, they argue, an older person with low G.F.R. and protein in his urine (called proteinuria or albuminuria) can take some steps to reduce the risk of eventual kidney failure, even if that’s already extremely low. Certain blood pressure medications with tongue-tangling names may protect the kidneys, for instance, though their effect on older adults is also a matter of debate.

A diagnosis can also help patients avoid drugs that can harm kidneys, said Dr. Levey and a co-author, Dr. Josef Coresh, an epidemiologist at Johns Hopkins Bloomberg School of Public Health. (Both were part of the working group that developed the guidelines.) Doctors can modify medication dosages and warn older patients away from drugs that can impair kidney function, like ibuprofen, certain injected antibiotics, and the contrast dyes used in CT scans.

Generally, though, what a doctor tells an older patient found to have chronic kidney disease is fairly standard counsel: Control your blood pressure, which exacerbates kidney disease and vice versa, and your cholesterol. Manage your diabetes. Keep track of drugs.

“That’s just sensible, healthy living, whether you have kidney disease or not,” Dr. Glassock said. So he questions whether we should even call somewhat reduced kidney function at older ages a disease.

It may amount to more than semantics. Along with fears of sitting in a dialysis center three days a week for the rest of one’s life come the costs of additional tests, appointments and referrals to specialists. “It pulls people into further engagement

with the health care system," Dr. O'Hare said. Most older adults face plenty of that already.

Still, here's the reality: Revising the international guidelines, a protracted and complicated undertaking, doesn't appear to be in the cards. The definition we have is the one we're going to have for years, maybe for good. Many older people are likely at some point to hear a physician say they have chronic kidney disease. How should they respond?

No special screening is required to learn one's glomerular filtration rate. It's part of the common basic metabolic panel. Most of us have it in our records somewhere.

One thing the kidney disease combatants agree on is that a G.F.R. less than 60 should prompt a conversation, before any prescription or advice. Doctors need to put these numbers in perspective, to explain that kidneys age with the rest of us.

It makes sense to repeat the test to see if the G.F.R. remains stable or continues to fall; it also makes sense to test the urine for protein. Physicians can use risk predictors - some exist, more are coming - to help determine an individual's odds of kidney failure. That way, Dr. Levey said, "we're identifying the patients at risk for the worst outcomes and reassuring the others."

But reassurance should be by far the more common response, whether a physician uses the D-word or not. "I don't think this is something to lose sleep over," Dr. O'Hare tells patients with modestly lower but stable G.F.R., and no other indications of kidney damage. "That's often a huge relief."

http://bit.ly/1FRrWJ2

The World Really Could Go Nuclear

Nothing but fear and capital stand in the way of a nuclear-powered future

By David Biello | September 14, 2015

In just two decades Sweden went from burning oil for generating electricity to fissioning uranium. And if the world as a whole were to follow that example, all fossil fuel–fired power plants could be replaced with nuclear facilities in a little over 30 years. That's the conclusion of a new nuclear grand plan published May 13 in PLoS One.

Such a switch would drastically reduce greenhouse gas emissions, nearly achieving much-ballyhooed global goals to combat climate change. Even swelling electricity demands, concentrated in developing nations, could be met. All that's missing is the wealth, will and wherewithal to build hundreds of fission-based reactors, largely due to concerns about safety and cost.

"If we are serious about tackling emissions and climate change, no climate-neutral source should be ignored," argues Staffan Qvist, a physicist at Uppsala University, who led the effort to develop this nuclear plan. "The mantra 'nuclear can't be done quickly enough to tackle climate change' is one of the most pervasive in the debate today and mostly just taken as true, while the data prove the exact opposite."

The data Qvist and his co-author Barry Brook, an ecologist and computer modeler at the University of Tasmania, relied on comes from two countries in Europe: Sweden and France. The Swedes began research to build nuclear reactors in 1962 in a bid to wean the country off burning oil for power as well as to protect rivers from hydroelectric dams. By 1972, the first boiling water reactor at Oskarshamn began to host fission and churn out electricity.

The cost was roughly $1,400 per kilowatt of electric capacity (in 2005 dollars), which is cheap compared to the $7,000 per kilowatt of electric capacity of two new advanced nuclear reactors being built in the U.S. right now. By 1986, with the addition of 11 more reactors, half of Sweden's electricity came from nuclear power and carbon dioxide emissions per Swede had dropped by 75 percent compared to the peak in 1970.

France, a larger nation, has a similar nuclear tale to tell, weaning itself from imported fossil fuels by building 59 nuclear reactors in the 1970s and 1980s that produce roughly 80 percent of the nation's electricity needs today.

All that would be required for the Chinas, Indias and U.S.s of the world to emulate these two nuclear pioneers is "political will, strategic economic planning, and public acceptance," Qvist and Brook write.

For example, nations would need to commit to a single design for reactors, as occurred in France and Sweden, as well as mandates requiring utilities to build said reactors and financial support for the construction from the national government.

"The state reacted to a crisis, at that time the oil prices, and implemented a plan, which quickly in 15 years had solved the problem," Qvist says. "Analogies could be drawn to the crisis we have today: climate change."

Based on numbers pulled by the research team from the experience of Sweden and France and scaled up to the globe, a best-case scenario for conversion to 100 percent nuclear power could enable the world to stop burning fossil fuels and start fissioning uranium for electricity within 34 years.

Requirements for this shift of course would include expanded uranium mining and processing, a build-out of the electric grid as well as a commitment to develop and build fast reactors - nuclear technology that operates with faster neutrons and therefore can handle radioactive waste, such as plutonium, for fuel as well as create its own future fuel. "No other carbon-neutral electricity source has been expanded anywhere near as fast as nuclear," Qvist says.

The International Atomic Energy Agency (IAEA) does expect nuclear power to expand worldwide by 2030 as more reactors are built in Asia and the Middle East - and use of nuclear could grow as much as 68 percent by then if all proposed reactors were built. But the nuclear outlook is not as bright as it could be. The world's largest nuclear fleet - the U.S.'s 99 reactors - does produce more than 60 percent of the nation's CO2-lite electricity, even with the rapid growth of renewables.

In fact, the Obama administration's new Clean Power Plan relies on existing reactors to help states meet greenhouse gas reduction targets. But the U.S. fleet is shrinking, not growing, despite four new reactors currently under construction, as nuclear power cannot compete in some states with the cost of electricity generated from cheap natural gas and cheap wind power.

Japan continues to struggle to turn its nuclear reactors back on in the wake of the meltdowns at Fukushima. Germany is moving in the opposite direction of a grand nuclear plan - preparing to phase out its fleet. On top of that, Finland and France have stumbled in bids to complete new, fail-safe nuclear reactors, projects with construction schedules and costs that have ballooned.

In China, the nation currently erecting the most new and technologically diverse nuclear power plants, the fission-based expansion is dwarfed more than 10 to one by the country's count of coal-fired power plants. And Russia runs the world's only operating fast reactors - the BN-600 and BN-800 - but, like General Electric before it, has found a limited market for the technology globally, in part due to concerns about the potential to create the ingredients for yet more nuclear weapons.

Even role model Sweden is mulling over retiring its reactors, having already shut down the two at Barseback early. As a result, an additional hundreds of millions of metric tons of CO2 are being dumped into Earth's atmosphere, as more fossil fuels are burned to replace that lost nuclear power.

France has similarly passed legislation to shift away from its reliance on nuclear power in favor of renewables. Even the IAEA projects that nuclear reliance will shrink in Europe overall over the next few decades.

These factors suggest that while a worldwide effort to follow Sweden's nuclear example is possible - it's not probable. "As long as people, nations put fear of nuclear accidents above fear of climate change, those trends are unlikely to change," Brook adds. But "no renewable energy technology or energy efficiency approach has ever been implemented on a scale or pace required."

http://www.eurekalert.org/pub_releases/2015-09/wuso-co3091415.php

Combo of 3 antibiotics can kill deadly staph infections

Three antibiotics that, individually, are not effective against a drug-resistant staph infection can kill the deadly pathogen when combined as a trio, according to new research.

The researchers, at Washington University School of Medicine in St. Louis, have killed the bug - methicillin-resistant Staphylococcus aureus (MRSA) - in test tubes and laboratory mice, and believe the same three-drug strategy may work in people.

"MRSA infections kill 11,000 people each year in the United States, and the pathogen is considered one of the world's worst drug-resistant microbes," said principal investigator Gautam Dantas, PhD, an associate professor of pathology and immunology. "Using the drug combination to treat people has the potential to begin quickly because all three antibiotics are approved by the FDA."

The study is published online Sept. 14 in the journal Nature Chemical Biology.

The three drugs - meropenem, piperacillin and tazobactam - are from a class of antibiotics called beta-lactams that has not been effective against MRSA for decades.

Working with collaborators in the microbiology laboratory at Barnes-Jewish Hospital? in St. Louis, Dantas' team tested and genetically analyzed 73 different variants of the MRSA microbe to represent a range of hospital-acquired and community-acquired forms of the pathogen. The researchers treated the various MRSA bugs with the three-drug combination and found that the treatments worked in every case.

Then, in experiments conducted by collaborators at the University of Notre Dame, the team found that the drug combination cured MRSA-infected mice and was as effective against the pathogen as one of the strongest antibiotics on the market.

"Without treatment, these MRSA-infected mice tend to live less than a day, but the three-drug combination cured the mice," Dantas said. "After the treatment, the mice were thriving."

Dantas explained that the drugs, which attack the cell wall of bacteria, work in a synergistic manner, meaning they are more effective combined than each alone.

The researchers also found that the drugs didn't produce resistance in MRSA bacteria - an important finding since more and more bacteria are developing resistance to available drugs.

"This three-drug combination appears to prevent MRSA from becoming resistant to it," Dantas said. "We know all bacteria eventually develop resistance to antibiotics, but this trio buys us some time, potentially a significant amount of time." Dantas' team also is investigating other antibiotics thought to be ineffective

against various bacterial pathogens to see if they, too, may work if used in combination with other drugs.

"We started with MRSA because it's such a difficult bug to treat," he said. "But we are optimistic the same type of approach may work against other deadly pathogens, such as Pseudomonas and certain virulent forms of E. coli."

Funding for this research comes from the National Institute of Diabetes and Digestive and Kidney Diseases and the National Institute of General Medical Sciences, and the National Institute of Allergy and Infectious Diseases of the National Institutes of Health (NIH). Additional funding comes from an NIH Director's New Innovator Award and a Ruth Kirschstein National Research Service Award from NIH. Grant numbers are DP2 DK098089, R01 GM099538, AI90818, AI104987, GM007067, T32 GM075762, F31 AI115851.

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http://www.eurekalert.org/pub_releases/2015-09/uow-doa091415.php

Discovery of a highly efficient catalyst eases way to hydrogen economy

Hydrogen could be the ideal fuel

MADISON, Wis. - Hydrogen could be the ideal fuel: Whether used to make electricity in a fuel cell or burned to make heat, the only byproduct is water; there is no climate-altering carbon dioxide. Like gasoline, hydrogen could also be used to store energy.

Hydrogen is usually produced by separating water with electrical power. And although the water supply is essentially limitless, a major roadblock to a future "hydrogen economy" is the need for platinum or other expensive noble metals in the water-splitting devices. Noble metals resist oxidation and include many of the precious metals, such as platinum, palladium, iridium and gold.

"In the hydrogen evolution reaction, the whole game is coming up with inexpensive alternatives to platinum and the other noble metals," says Song Jin, a professor of chemistry at the University of Wisconsin-Madison.

In the online edition of Nature Materials that appears today, Jin's research team reports a hydrogen-making catalyst containing phosphorus and sulfur - both common elements - and cobalt, a metal that is 1,000 times cheaper than platinum.

Catalysts reduce the energy needed to start a chemical reaction. The new catalyst is almost as efficient as platinum and likely shows the highest catalytic performance among the non-noble metal catalysts reported so far, Jin reports.

The advance emerges from a long line of research in Jin's lab that has focused on the use of iron pyrite (fool's gold) and other inexpensive, abundant materials for energy transformation. Jin and his students Miguel Cabán-Acevedo and Michael Stone discovered the new high-performance catalyst by replacing iron to make cobalt pyrite, and then added phosphorus. Although electricity is the usual energy source for splitting water into hydrogen and oxygen, "there is a lot of interest in using sunlight to split water directly," Jin says.

The new catalyst can also work with the energy from sunlight, Jin says. "We have demonstrated a proof-of-concept device for using this cobalt catalyst and solar energy to drive hydrogen generation, which also has the best reported efficiency for systems that rely only on inexpensive catalysts and materials to convert directly from sunlight to hydrogen."

Many researchers are looking to find a cheaper replacement for platinum, Jin says. "Because this new catalyst is so much better and so close to the performance of platinum, we immediately asked WARF (the Wisconsin Alumni Research Foundation) to file a provisional patent, which they did in just two weeks."

Many questions remain about a catalyst that has only been tested in the lab, Jin says. "One needs to consider the cost of the catalyst compared to the whole system. There's always a tradeoff: If you want to build the best electrolyzer, you still want to use platinum. If you are able to sacrifice a bit of performance and are more concerned about the cost and scalability, you may use this new cobalt catalyst."

Strategies to replace a significant portion of fossil fuels with renewable solar energy must be carried out on a huge scale if they are to affect the climate crisis, Jin says. "If you want to make a dent in the global warming problem, you have to think big. Whether we imagine making hydrogen from electricity, or directly from sunlight, we need square miles of devices to evolve that much hydrogen. And there might not be enough platinum to do that."

The collaborative team included Professor J.R. Schmidt, a theoretical chemist at UW-Madison, and electrical engineering Professor Jr-Hau He and his students from King Abdullah University of Science and Technology in Saudi Arabia. The U.S. Department of Energy provided major funding for the study.

http://www.eurekalert.org/pub_releases/2015-09/sumc-dpt090815.php

Drug prevents type 1 diabetes in mice, Stanford study finds

The buildup of a substance in the pancreas during the pre-symptomatic stage of Type 1 diabetes is essential to the development of the disease, Stanford University School of Medicine researchers have shown.

The investigators used a drug to block production of this substance in mouse models, staving off damage to insulin-producing cells and preventing the onset of the autoimmune disorder. The drug, which is currently used in Europe and Asia for treating gallstone-related spasms, has an excellent safety record, the researchers said.

The findings, described in a study to be published online Sept. 14 in the Journal of Clinical Investigation, suggest that it may be possible to prevent the onset of Type 1 diabetes in humans if a similar treatment is initiated before the insulin-producing cells, or beta cells, are attacked by misguided immune cells. Type 1 diabetes, formerly called juvenile diabetes, afflicts one in 300 people in the United States.

The study is the first to link the progression of Type 1 diabetes to changes in the architecture of the extracellular matrix, the carbohydrate- and protein-rich lattice in which the cells composing our tissues are embedded, said Paul Bollyky, MD, PhD, assistant professor of infectious diseases. Bollyky is the study's senior author. The lead author is postdoctoral scholar Nadine Nagy, PhD.

Most pancreatic cells are engaged in manufacturing and secreting digestive enzymes. But the pancreas is also studded with tiny, hormone-producing cell clusters called islets. A human pancreas contains thousands of islets, scattered throughout the organ like raisins in a loaf of cinnamon bread.

Inflamed islets

A pancreatic islet is composed of several cell types, each making a different hormone. Beta cells, for example, produce insulin.

"In Type 1 diabetes, only the beta cells get destroyed," said Bollyky. Why this happens is poorly understood. But it's known that during the disorder's early, pre-symptomatic stage, pancreatic islets become inflamed - that is, they get infiltrated by immune cells. At first quiescent, these warrior cells at some point begin attacking beta cells, eventually destroying enough of them to effectively erase insulin output. By the time a person begins to manifest the disease's hallmark symptom, chronic hyperglycemia, some 90 percent of pancreatic beta cells have been killed off. Neither the cause of immune cells' initial infiltration of pancreatic islets nor the trigger for their transition from mere passive presence to active aggression is yet understood. But the new study provides important clues.

In a 2014 study, Bollyky's team measured the levels of dozens of substances in the extracellular matrix of human postmortem pancreatic tissue. One substance, called hyaluronan, was overly abundant near the pancreatic beta cells of people with Type 1 diabetes. But this was seen only in pancreatic tissue from patients who had been somewhat recently diagnosed, not patients who'd lived with the disease for decades.

Hyaluronan is usually present at trace concentrations in the extracellular matrix that pervades all tissues. But hyaluronan levels spike markedly at the site of an injury. "If you twist your ankle or stub your toe, that swelling you see afterwards is due to hyaluronan," Bollyky said. This substance is prone to soaking up water, causing fluid buildup in the injured region, a cardinal feature of inflammation.

Bollyky said the absence of increased hyaluronan in long-term patients' pancreatic islets didn't mean much, as these people's beta cells had long since bit the dust. But finding excessive deposits of hyaluronan near pancreatic beta cells in recent-onset cases was intriguing.

Curious, Bollyky and his colleagues sought to determine whether this association was incidental or whether hyaluronan's increased presence actually played any causal role. So, they employed a bioengineered strain of laboratory mouse whose immune system is guaranteed to attack its pancreatic beta cells. Essentially 100 percent of these mice eventually develop Type 1 diabetes, and always over about the same period of time, making it easy to study the effects of an experimental manipulation upon the disease's progression.

The scientists also looked at another mouse strain often afflicted with a version of Type 1 diabetes that more closely parallels the human form of the disease. (These mice are tougher to study because only about half of them contract the disease, and they do so at variable rates.)

In both strains, Bollyky said, hyaluronan accumulated in pancreatic islets, but not in all of them - just in those where inflammatory immune cells had parked themselves. No excessive hyaluronan deposition was seen in the mice's heart, lung or liver tissue, consistent with the idea that the phenomenon occurs only in inflamed tissues. The islet-associated hyaluronan buildup eventually crescendoed and began tapering off, analogous to the investigators' observations in recent-onset versus long-established Type 1 diabetes cases in their earlier study of human tissue.

Preventing hyaluronan buildup

"We wondered what would happen if we prevented that buildup," Bollyky said. "And we knew a drug that does that." The drug was hymecromone, or 4-methylumbelliferone (4-MU for short). Prescribed in many European and Asian countries for painful, gallstone-associated spasms and sold by about 60 companies worldwide for research purposes, 4-MU inhibits hyaluronan synthesis. It is inexpensive, can be given orally and, over four decades of use, has what Bollyky described as an "extremely boring safety profile": a very low rate of associated adverse events. "It's even approved in Europe for kids," he said. (The Food and Drug Administration has not licensed 4-MU for any indication in the United States.)

In the mice used in the study, as in people, there's a window of time during which immune cells have infiltrated pancreatic islets but most beta cells are still intact. When the researchers initiated 4-MU treatment before the majority of the mice's beta cells had been wiped out, none of the mice developed hyperglycemia. Mice that didn't get 4-MU did. If mice stayed on a 4-MU regimen, they remained

diabetes-free for at least a year. But if the regimen was stopped, they quickly became diabetic.

Tissue analysis revealed the continued presence of immune cells situated close to beta cells even in mice getting 4-MU, but the beta cells themselves seemed normal; the immune cells had evidently refrained from attacking them. The scientists also found reduced hyaluronan levels in 4-MU-treated mice's pancreatic islets, indicating that the drug was performing as expected.

Further experiments in the mice showed that hyaluronan prevents the induction of a class of regulatory immune cells, known as Tregs, whose job is to rein in their aggressive fellow immune cells and keep them from damaging healthy tissue. Bollyky likened Tregs' function to that of military police. In the absence of appropriate supervision, immune cells can get trigger-happy, he said. But by impeding hyaluronan synthesis, 4-MU re-establishes the induction of enough Tregs to prevent beta-cell destruction.

No drug has previously been shown to do this in humans, Bollyky said. His group has received preliminary funding from SPARK, a Stanford-based program devoted to fostering drug-development entrepreneurship, and is working with the FDA in preparation for a clinical trial of 4-MU for preventing Type 1 diabetes. The Stanford Office of Technology Licensing has applied for a use patent on associated intellectual property.

The study was performed in collaboration with scientists at the Benaroya Research Institute under the direction of matrix biologist Thomas Wight, PhD, whose group Bollyky was associated with when the work began. Funding for the study came from the Juvenile Diabetes Research Foundation and the National Institutes of Health (grants R01DK096087-01, R01HL113294 and U01AI101984).

Other Stanford-affiliated co-authors are postdoctoral scholar Vivekananda Sunkari, PhD, and basic life science research associates Gernot Kaber, PhD, and Hedwich Kuipers, PhD.

Stanford's Department of Medicine also supported the work.

http://www.eurekalert.org/pub_releases/2015-09/tmsh-mmb091015.php

Molecule made by muscle shown for first time to build bone

Recently identified molecule produced by skeletal muscle in response to exercise shown to increase bone mass

A recently identified molecule produced by skeletal muscle in response to exercise, has been shown to increase bone mass, according to a collaborative study between researchers at the Mount Sinai Bone Program, Icahn School of Medicine at Mount Sinai, the Department of Experimental and Clinical Medicine at University of Ancona in Italy, and the Department of Basic Medical Science, Neuroscience and Sense Organs at the University of Bari in Italy, and published online today in the Proceedings of the National Academy of Sciences (PNAS).

Although exercise is a well known stimulus for new bone formation, it has remained unclear how muscle "talks" to bone, despite their close proximity.

"This is a novel finding, and offers promise in the lab, and in the clinic," said co-lead study author Mone Zaidi, MD, PhD., Professor of Medicine and of Structural and Chemical Biology at the Icahn School of Medicine at Mount Sinai, and Director of the Mount Sinai Bone Program. "It establishes for the first time a molecule released from muscle during exercise can act directly on long bones to increase their strength. These are the bones utilized during exercise, and also the ones most likely to break."

In the experiment, young male mice, chosen because researchers could best see bone accrual at this age, were injected with irisin. Irisin is a specialized protein molecule called a myokine, derived from skeletal muscle and implicated in the regulation of body fat. In the injected mice, researchers saw significant increases in bone mass and strength, specifically cortical bone, which is a dense and compact type of bone tissue that constitutes about 80 percent of skeletal weight. The action of the recently identified signaling molecule, irisin, was mediated primarily through bone growth. Trabecular, or spongy bone, the body's reservoir for calcium, largely was not affected.

The study suggests irisin is fundamental to muscle-bone communication, and likely translates the well-known skeletal anabolic action of exercise by directly stimulating new bone synthesis by osteoblasts.

Implications of the study are far reaching. It is known that physical exercise, and the physical force it applies to bone, benefits metabolic and skeletal health.

Decreases in the level of physical activity, for example in former athletes, can lead to progressive loss of bone and increase fracture risk. Disuse, or the weightlessness of space, can cause acute, rapid, and severe bone loss: for example, it is known astronauts lose bone mass 10 times faster than women in early menopause, and patients in a vegetative state or with spinal cord injuries display a high risk of fragility fractures.

According to the study authors, identifying irisin as a molecule responsible for muscle-bone connectivity during exercise could lead to the development of future therapies for sarcopenia, the gradual loss of muscle mass seen as one gets older, and osteoporosis, a disease in which bones become weak and brittle and more likely to break.

"These diseases often occur together, and both muscle and bone loss are common medical problems in the elderly that cause significant disability. Understanding this molecular connection between muscle and bone gives us hope for treating age-related bone and muscle loss at the same time, with the same agent," said Dr. Zaidi.

The study was funded in part by grants to European Research In Space And Terrestrial Osteoporosis, the Italian Ministry of Education, Universities and Research (MIUR), the Italian Society for Osteoporosis, Mineral Metabolism and Skeleton Diseases, and the National Institute on Aging, (NIA) and National Institute of Arthritis and Musculoskeletal and Skin Disease (NIAMS) of the National Institutes of Health.

http://www.eurekalert.org/pub_releases/2015-09/uom-lt091415.php

Lung 'filtering' technique can reduce transplant rejection

New technique reconditions poorly functioning lungs, removing donor white blood cells to increase number of lungs available for transplant

This shows an EVLP on a lung. **The University of Manchester**

University of Manchester researchers have used a new technique to recondition poorly functioning lungs and remove donor white blood cells in an attempt to increase the number of lungs available for transplant, and at the same time reduce the risk of acute rejection.

Lung transplantation is often the only option for patients with end stage lung disease, but is limited by a shortage of donor organs. When waiting list patients are lucky enough to receive a transplant, they need lifelong immunosuppression to prevent their own immune system from destroying the transplanted organ, a process called acute rejection.

This is often triggered by the presence of the donor lung's white blood cells which migrate into the recipient's body and are seen as harmful.

The University researchers, in collaboration with a team from the University of Lund in Sweden, used a new technique called ex-vivo lung perfusion (EVLP) where the lung is kept alive, breathing outside the body and supported by a supply of blood and nutrients. This can repair an organ that would normally be turned down for transplant. Given that 80% of donor lungs are currently not used, the technique is expected to significantly shorten waiting list times and increase access to transplantation.

Dr James Fildes, from the University's Collaborative Centre for Inflammation Research and the Transplant Centre at the University Hospital of South Manchester NHS Foundation Trust, led the study. He said: "Because the lung is a potential entry route for infection into the body, its immune response is highly developed. In lung transplantation the situation is made worse by the processes that occur in the donor, which automatically increase the activity of the immune system.

"All of this makes lung transplant recipients particularly susceptible to rejection, so they require continuous immunosuppression, which then increases the risk of infection and cancer. These immune processes are therefore very important and contribute to the outlook where only five out of ten patients will survive for at least five years."

The Manchester and Sweden team took lungs from pigs and transplanted them either using the normal transplant method or after three hours of EVLP, and the recipients were monitored for 24 hours. In the EVLP lungs there was little evidence of rejection, whereas in the normal transplant method, all the lungs showed signs of severe rejection.

EVLP is becoming an established technique, but this is the first time it has been used in this way. The researchers are hopeful that EVLP will be used in patients to reduce high rates of rejection and wastage of scarce donor lungs.

As the lungs were only monitored for 24 hours it is difficult to know the long-term effects, but even a delay would be beneficial in allowing the transplanted organ to become accepted. Used in conjunction with new immunosuppressive agents the team are developing, the researchers hope for even more benefits.

Dr Fildes added: "Aside from the benefits shown in this study, it is possible that EVLP could be used to deliver drugs before the lung is implanted so that the patient's immune system does not recognise the transplanted organ as harmful.

"EVLP opens up new possibilities in one of the most problematic areas of surgery."

Patricia Moore, 63, from Oswestry was diagnosed with idiopathic pulmonary fibrosis in 2011 and received a transplant in 2014. She said: "The side-effects of immunosuppression are potentially unpleasant and the thought of the associated bronchoscopy terrifies me. I'm grateful I was unconscious for the only one I've had so far. "This development seems to offer a route which means others won't have to suffer in this way and from a personal perspective I think those people will be very fortunate."

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The reason why middle class people are more likely to play music, paint and act revealed

The reason why middle class people are more likely to play music, paint and act has been revealed in a major new study.

Research involving 78,000 people found that it was not wealth or social status that were strongly linked to people taking part in arts activities as amateurs or professionals. Instead, it was the level of education that lay behind arts

participation, the study by Dr Aaron Reeves, a sociologist at the University of Oxford, found.

In an article in the journal Sociology, Dr Reeves said that of the 78,011 surveyed, 18% had taken part in painting or photography, 9% in dance, 10% in music, 2% in drama or opera; 6% had written poetry, plays or fiction. Only 22% had not done any artistic activities. He found that having a higher income did not make arts participation more likely - those earning over £30,000 a year were less likely to take part than those earning less.

Social status mattered little - those in higher professional jobs were less likely to take part in the arts than those in lower professional jobs, and only slightly more likely to take part than those in lower supervisory roles and semi-routine roles.

Instead, the clearest link with artistic activity was education. After accounting for the influence of family class background by statistical analysis, he found that those with a degree were around four times more likely to take part in painting and photography than those with no educational qualification, five times more likely to be involved in dance and in crafts, and four times more likely to play a musical instrument.

Those taking part in arts were more likely to be middle class, simply because they were more likely to be highly educated. But although having a middle class background makes it more likely that someone had gone to university, Dr Reeves's findings showed that they were no more likely to take part in arts after graduating than were working class students.

Dr Reeves said that results for arts participation were different from those for watching or listening to arts performances, where social class and status were strongly linked to higher rates of arts consumption.

"Arts participation, unlike arts consumption and cultural engagement generally, is not closely associated with either social class or social status," said Dr Reeves in the article. "This result deviates from the expectation - unexpectedly, those with higher incomes are less likely to be arts participants.

"These results show that it is educational attainment alone, and not social status, that is shaping the probability of being an arts participant."

Dr Reeves suggests two reasons for the link with education. "First, those with higher information processing capacity are more likely to enjoy highbrow cultural practices, such as arts participation, and be university graduates. In short, university graduates are more likely to possess the cultural resources necessary for both arts consumption and arts participation.

"Second, universities make admissions decisions using information on extracurricular and cultural activities, increasing the likelihood that university graduates are culturally active."

Data were taken from three pooled waves of the Taking-Part survey (2005-6, 2006-7, 2007-8) (N = 78,011). The survey consists of a representative sample of face-to-face interviews with people aged 16 or over in private households in England, with a booster sample of adults from non-white backgrounds.

The article is 'Neither class nor status: arts participation and the social strata' and appears in the latest edition of Sociology, published by the British Sociological Association and SAGE.

http://www.eurekalert.org/pub_releases/2015-09/d-wet091415.php

Women exposed to organic pollutants in early pregnancy have more than 4-times increased risk of gestational diabetes

Increased exposure to organic pollutants in early pregnancy associated with a 4.4 times increased risk of a pregnant woman developing gestational diabetes

New research presented at this year's annual meeting of the European Association for the Study of Diabetes in Stockholm shows that a 10-times increased exposure to organic pollutants in early pregnancy is associated with a 4.4 times increased risk of a pregnant woman developing gestational diabetes. The research is by Assistant Professor Leda Chatzi, University of Crete, Heraklion, Greece.

Persistent Organic Pollutants (POPs) are a group of diverse substances, including polychlorinated biphenyls (PCBs) and organochlorine pesticides that are resistant to biodegradation and present almost everywhere in the environment. Exposure to endocrine disrupting chemicals such as POPs has been linked to type 2 diabetes and metabolic disturbances in epidemiological and animal studies, but little is known about POPs exposure during pregnancy and the development of gestational diabetes mellitus (GDM). Dichlorodiphenyldichloroethene (DDE-a breakdown product of DDT) and hexachlorobenzene (HCB) are synthetic chemicals that were used widely as pesticides, while PCBs were used in many industrial processes. These chemicals have been banned for decades but remain in the environment where they bioaccumulate in the bodies of animals and humans.

The purpose of this study was to determine the extent to which exposure to current low levels of different POPs in the first trimester of pregnancy is associated with GDM risk in 639 women from the Rhea pregnancy cohort in Crete, Greece. The study is the Mother-Child Cohort in Crete, "Rhea" cohort which prospectively examines a population-based sample of pregnant women and their children at the prefecture of Heraklion, Crete, Greece. Female residents who became pregnant during a period of one year starting in February 2007 were contacted and asked to participate in the study. The first contact was made at the time of the first comprehensive ultrasound and several contacts followed (6th month of pregnancy, at birth, 9 months, 1st year, 4 and 7 years after birth). The Principal Investigator of the study is Assistant Professor Leda Chatzi.

The authors determined the concentrations of several PCBs, DDE, and HCB in first trimester maternal serum by mass spectrometry. Pregnant women were screened for gestational diabetes mellitus (GDM) between 24 and 28 weeks of gestation.

A total of 68 (7%) women had GDM, and the authors found that a 10-fold increase in total PCBs was associated with a 4.4 times increased risk of GDM after adjusting for pre-pregnancy BMI and several other confounders. The association was similar for non dioxin-like PCBs (4.4 times increased risk). However prenatal DDE and HCB exposure were not significantly associated with GDM risk.

The authors conclude: "These findings suggest that women with high PCBs levels in early pregnancy had higher risk for gestational diabetes. Further studies are needed to replicate these results and to evaluate potential biological mechanisms underlying the observed associations."

They add: "As countries around the world, including Greece, deal with an increasing prevalence of gestational diabetes, the findings are important from a public health perspective as knowledge of environmental risk factors could help to reverse this trend. Our future research in this cohort will examine whether prenatal exposure to POPs is associated with alterations in glucose metabolism and diabetes development of the offspring in early childhood."

http://www.eurekalert.org/pub_releases/2015-09/uoc - vic091415.php

Virus in cattle linked to human breast cancer

A new study by University of California, Berkeley, researchers establishes for the first time a link between infection with the bovine leukemia virus and human breast cancer.

BERKELEY - In the study, published this month in the journal PLOS ONE and available online, researchers analyzed breast tissue from 239 women, comparing samples from women who had breast cancer with women who had no history of the disease for the presence of bovine leukemia virus (BLV). They found that 59 percent of breast cancer samples had evidence of exposure to BLV, as determined by the presence of viral DNA. By contrast, 29 percent of the tissue samples from women who never had breast cancer showed exposure to BLV.

"The association between BLV infection and breast cancer was surprising to many previous reviewers of the study, but it's important to note that our results do not prove that the virus causes cancer," said study lead author Gertrude Buehring, a professor of virology in the Division of Infectious Diseases and Vaccinology at UC Berkeley's School of Public Health. "However, this is the most important first step. We still need to confirm that the infection with the virus happened before, not after, breast cancer developed, and if so, how."

Bovine leukemia virus infects dairy and beef cattle's blood cells and mammary tissue. The retrovirus is easily transmitted among cattle primarily through infected blood and milk, but it only causes disease in fewer than 5 percent of infected animals.

A 2007 U.S. Department of Agriculture survey of bulk milk tanks found that 100 percent of dairy operations with large herds of 500 or more cows tested positive for BLV antibodies. This may not be surprising since milk from one infected cow is mixed in with others. Even dairy operations with small herds of fewer than 100 cows tested positive for BLV 83 percent of the time.

What had been unclear until recently is whether the virus could be found in humans, something that was confirmed in a study led by Buehring and published last year in Emerging Infectious Diseases. That paper overturned a long-held belief that the virus could not be transmitted to humans.

"Studies done in the 1970s failed to detect evidence of human infection with BLV," said Buehring. "The tests we have now are more sensitive, but it was still hard to overturn the established dogma that BLV was not transmissible to humans. As a result, there has been little incentive for the cattle industry to set up procedures to contain the spread of the virus."

The new paper takes the earlier findings a step further by showing a higher likelihood of the presence of BLV in breast cancer tissue. When the data was analyzed statistically, the odds of having breast cancer if BLV were present was 3.1 times greater than if BLV was absent.

"This odds ratio is higher than any of the frequently publicized risk factors for breast cancer, such as obesity, alcohol consumption and use of post-menopausal hormones," said Buehring.

There is precedence for viral origins of cancer. Hepatitis B virus is known to cause liver cancer, and the human papillomavirus can lead to cervical and anal cancers. Notably, vaccines have been developed for both those viruses and are routinely used to prevent the cancers associated with them.

"If BLV were proven to be a cause of breast cancer, it could change the way we currently look at breast cancer control," said Buehring. "It could shift the emphasis to prevention of breast cancer, rather than trying to cure or control it after it has already occurred."

Buehring emphasized that this study does not identify how the virus infected the breast tissue samples in their study. The virus could have come through the consumption of unpasteurized milk or undercooked meat, or it could have been transmitted by other humans.

The University of California Breast Cancer Research Program and the U.S. Department of Defense Breast Cancer Research Program helped support this research.

http://www.eurekalert.org/pub_releases/2015-09/uosf-smp091515.php

Spleen may provide new target for treating stroke's debilitating chronic inflammation

Preclinical study shows transplanted human bone marrow stem cells preferentially migrate to the spleen, reducing systemic inflammation of later-stage stroke

Tampa, FL - Stroke injures the brain, but a new University of South Florida (USF) study indicates an abdominal organ that plays a vital role in immune function, the spleen, may be a target for treating stroke-induced chronic inflammation leading to further brain cell death.

Neuroscientists at the USF Center of Excellence for Aging and Brain Repair found that human bone marrow stem cells intravenously administered to post-stroke rats preferentially migrated to the spleen and reduced the inflammatory-plagued secondary cell death associated with stroke progression in the brain.

The study is reported in the September 2015 issue of the American Heart Association journal Stroke.

The USF study helps resolve a perplexing observation by many scientists evaluating the effects of stem cell therapies: Functional recovery occurs in experimental models of neurological disorders, including stroke, despite little or mediocre survival of transplanted stem cells within the injured brain.

"Our findings suggest that even if stem cells do not enter the brain or survive there, as long as the transplanted cells survive in the spleen the anti-inflammatory effects they promote may be sufficient enough to therapeutically benefit the stroke brain," said principal investigator Cesario Borlongan, PhD, professor and director of the USF Center of Excellence for Aging and Brain Repair.

Stroke is a leading cause of death and the number one cause of chronic disability in the United States, yet treatment options are limited. Stem cell therapy has emerged as a potential treatment for ischemic stroke, but most preclinical studies have looked at the effects of stem cells transplanted during acute stroke - one hour to 3 days after stroke onset.

Following acute stroke, an initial brain attack caused by lack of blood flow, the blood-brain barrier is breeched, allowing the infiltration of inflammatory molecules that trigger secondary brain cell death in the weeks and months that follow. This acerbated inflammation is the hallmark of chronic stroke.

The USF researchers intravenously administered human bone marrow stem cells to rats 60 days following stroke onset - the chronic stage. The transplanted stem cells were attracted predominantly to the spleen; the researchers found 30-fold more stem cells survived in this peripheral organ than in the brain.

Once in the spleen, the stem cells dampened an inflammatory signal (tumor necrosis factor) activated immediately after stroke and prevented the migration from spleen to the compromised brain of harmful macrophages that stimulate inflammation.

This reduced systemic inflammation correlated with significant decreases in the size of lesions caused by acute stroke in the striatum - a portion of the brain controlling movement.

There was a trend toward prevention of additional neuron loss in the portion of the brain affecting memory and thinking.

"In the chronic stage of stroke, macrophages are like fuel to the fire of inflammation," Dr. Borlongan said.

"So if we can find a way to effectively block the fuel with stem cells, then we may prevent the spread of damage in the brain and ameliorate the disabling symptoms many stroke patients live with."

The USF researchers next plan to test whether transplanting human bone marrow stem cells directly into the spleen will lead to behavioral recovery in post-stroke rats.

The one drug approved for emergency treatment of stroke, the clot-busting drug tPA, must be administered less than 4.5 hours after onset of ischemic stroke, and benefits only 3 to 4 percent of patients, Dr. Borlongan said.

While more study is needed, evidence from USF and other groups thus far indicates stem cells may help provide a more effective treatment for stroke over a wider timeframe.

"Stem cells are not a magic bullet, but a combination of stem cells and other anti-inflammatory agents may lead to the optimal therapeutic benefit for stroke patients," he said.

Lead study author Sandra Acosta, PhD, a postdoctoral fellow in the USF Department of Neurosurgery and Brain Repair, said targeting the spleen with stem cells or the anti-inflammatory molecules they secrete offers hope for treating chronic neurodegenerative diseases like stroke at later stages.

"We've shown (in an animal model) that it's possible to stop disease progression 60 days after the initial stroke injury, when chronic inflammation in the brain was widespread," she said. "If that can be replicated in humans, it will be powerful."

The USF study was supported by grants from the National Institute of Neurological Disorders and Stroke and the James and Esther King Biomedical Research Foundation.

Sandra A. Acosta; Naoki Tajira; Jaclyn Hoover; Yuji Kaneko; and Cesar Borlongan, "Intravenous Bone Marrow Stem Cell Grafts Preferentially Migrate to Spleen and Abrogate Chronic Inflammation in Stroke," Stroke, September 2015; DOI: 10.1161/STROKEAHA.115.009854.

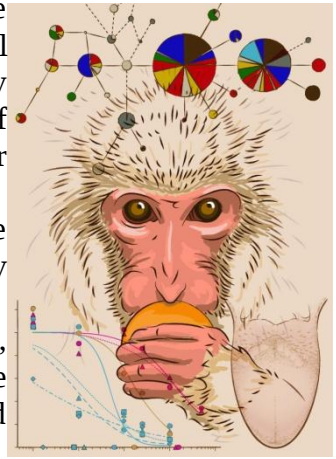
http://www.eurekalert.org/pub_releases/2015-09/ku-sab091515.php

Savoring a bitter bite: Japanese monkeys drop their guard to survive

Kyoto University uncovers evolutionary edge in macaque population

This news release is available in Japanese.

Kyoto, Japan - Most poisons taste bitter: being able to tell typically leads to longer life. Species lacking an ability to taste bitterness are usually thought to be at a disadvantage - that is until now. Researchers at Kyoto University have recently discovered that a genetic mutation in a population of monkeys has caused a loss in their ability to taste bitter foods, resulting in increasing their chances to survive.



This higher tolerance to bitter foods may actually be beneficial, reversing a common belief that the inability to taste bitterness is a negative trait.

Mammals experience the five taste sensations of sweet, sour, salty, umami, and bitterness - the last being the least desired. This natural reaction is essential to avoid ingestion of toxins in food.

An inability to taste bitterness was once thought to be an undesired trait, but Kyoto University researchers have shown that Japanese macaque monkeys have an evolutionary advantage if they cannot taste bitter fruit. **Credit: Kyoto University**

In mammals, bitter tastes are detected mainly through a receptor in the taste buds known as TAS2Rs. "TAS2R38", one of TAS2Rs, recognizes synthetic bitter compounds such as phenylthiocarbamide and propylthiouracil, and natural bitter compounds like glucosinolates and limonin, which are found in cruciferous and citrus plants, respectively.

The Kyoto team, led by Hiroo Imai conducted genetic analysis of almost 600 macaques throughout Japan. "Using cellular and behavioral experiments, we found that a large number of Kii monkeys, through adaptive evolution, have lost TAS2R38 function, leading to the inability to taste bitternes," first-author Nami Suzuki-Hashido explains. "This finding may explain the change in fitness related to feeding habit specificity."

Study results showed that bitterness "non-tasters" were more common than could be explained demographically, suggesting that the inability to taste bitterness led to an evolutionary edge. Notably, Citrus tachibana, bitter citrus fruit native to Japan, was the first citrus to grow in Japan, and as it originates in the Kii region, a link can be seen to why the Kii macaque developed this trait.

"We can postulate that wild mammals adapt to various environments by altered molecular mechanisms, as well as by learning," Imai says. "Agriculture over the past several hundred years has rapidly expanded the distribution of cruciferous plants such as cabbage and radish, along with citrus plants. This may relate to the rapid expansion of non-tasters for bitterness among Japanese macaques."

The paper "Rapid Expansion of Phenylthiocarbamide Non-Tasters among Japanese Macaques" appeared 22 July 2015 in PLOS ONE, with doi: 10.1371/journal.pone.0132016

http://www.medscape.com/viewarticle/850160

Essential Oils and Aromatherapy: Worth the Hype?

Question *What is the evidence for essential oils and aromatherapy? Do they really work?*

Response from Gayle Nicholas Scott Assistant Professor, Eastern Virginia Medical School, Norfolk, Virginia

Essential Oils

All plants contain oils (eg, corn oil, peanut oil, coconut oil), but only about 3000 contain essential oils, also called "volatile oils" or "aromatic oils," in their flowers, leaves, bark, wood, fruit, or peel. Essential oils probably developed in flowers to attract insects for pollination and in other plant parts as deterrents to predators.

The term "essential" refers to the essence or fragrance of a plant rather than a necessary component of the oil or something biologically vital. Essential oils are usually extracted by distillation and typically contain such chemicals as terpenes, quinines, benzene compounds, and aromatic/aliphatic esters and alcohols. Oils produced with the aid of chemical solvents are not considered true essential oils.[1-3]

In theory, chemical components of essential oils may bind to receptors in the olfactory bulb and have an effect on the limbic system, which governs emotions.

Topical application of some aromatic oils may exert antibacterial, anti-inflammatory, and analgesic effects.[1] Essential oils are found commercially as odorants in cosmetics, perfumes, soaps, detergents, and various other products ranging from insecticides to paints.

Essential oils are used in dental products and occasionally as flavoring in medicine.[2,3] Some well-known nonprescription products contain essential oils; for example, Vicks® VapoRub™ contains camphor, eucalyptus, and menthol.

Penetration enhancers, often an oil (sometimes termed "carrier oil"), are mixed with essential oils to enhance absorption through the skin. Some essential oils, alone or with a penetration enhancer, can increase drug absorption through the skin. Commonly used carrier oils include grapeseed, sweet almond, and sesame oils.[3]

Essential oils also have been used as flavoring in food products. The US Food and Drug Administration (FDA) regulates essential oils in food and pharmaceutical products.

Aromatherapy

Essential oils also are used in aromatherapy, where the oil is heated or added to bathwater, applied to the skin, and occasionally taken by mouth. Essential oils used for aromatherapy do not need FDA approval, and they cannot legally be promoted to prevent, treat, or cure disease.[1]

Yet, they are promoted for a variety of conditions, even though the therapeutic effects are not well supported by clinical research. Many available studies are marred by poor methodological quality, including bias, small sample sizes, and inherent difficulties with masking active vs placebo controls.

In addition, personal expectation of the effect of aromatherapy appears to play a role in responsiveness.[4,5] To further confound determination of efficacy, essential oils are often used in massage therapy.

Systematic reviews of aromatherapy have been published for such conditions as anxiety, dementia, hypertension, nausea and vomiting, pain, sleep, and stress.

Anxiety. A review of 15 randomized controlled trials that were characterized as poor-quality concluded that aromatherapy could be useful for anxiety symptoms, but more research with better-quality methodology should be conducted.[6] In a review of interventions to reduce anxiety in healthcare waiting areas, the research on aromatherapy was deemed inconclusive.[7] Lavender aromatherapy is often used to relieve anxiety.[8]

Dementia. A Cochrane review included seven studies with a total of 428 patients, although only two studies had usable results. The results were equivocal, with the authors citing the need for more results from large-scale, well-designed, randomized, controlled trials to draw clear conclusions.[9]

Another review included 11 studies and suggested that aromatherapy shows potential for reducing behavioral and psychosocial symptoms of dementia. Again the authors mentioned the need for better-designed randomized, controlled trials.[10]

Hypertension. One randomized controlled trial and four nonrandomized controlled trials were included in a review of aromatherapy for hypertension. All five trials reported a beneficial effect on hypertension; however, study quality was judged to be poor, with a high risk for bias. The authors concluded that available research has not shown convincingly that aromatherapy is effective for hypertension.[11]

Nausea and vomiting. A Cochrane review included nine studies (six randomized controlled trials and three nonrandomized controlled clinical trials) with a total of 402 patients of postoperative nausea and vomiting. Two of the studies used peppermint oil; the others used isopropyl alcohol as aromatherapy. Inhaled isopropyl alcohol was more effective than saline placebo for reducing postoperative nausea and vomiting but less effective than standard antiemetic medications. Peppermint oil was ineffective in two studies reviewed.[12]

Another more favorable review included five studies of 328 patients with nausea and vomiting related to a variety of conditions, including postoperative nausea and vomiting. Concluding that inhaled peppermint or ginger essential oils reduced the incidence and severity of nausea and vomiting and also reduced the need for antiemetic medications, the authors described the evidence as encouraging but not compelling, owing to methodological flaws in existing research.[13]

Pain. A Cochrane review included two studies using aromatherapy for pain in childbirth. One of the studies offered women a choice of five essential oils (Roman chamomile, clary sage, frankincense, lavender, and mandarin), and the other randomly assigned women to use ginger or lemongrass essential oil. No difference was observed in pain intensity or the use of pharmacologic pain relief.[14]

Sleep. One review reported on 15 quantitative studies, including 11 randomized controlled trials. A majority of the studies suggested a positive effect of essential oils, most frequently lavender, on sleep.[15]

A meta-analysis of 12 studies found the use of aromatherapy effective for improving sleep quality. All except one study used lavender essential oils alone or in addition to one or two other essential oils. Inhalation aromatherapy was more effective than massage application.[16]

Stress. A review of aromatherapy for stress reduction in healthy adultsreported on five randomized controlled trials, most with a high risk for bias. Three of the studies used lavender essential oil, and the other two studies used lavender or peppermint essential oil or a combination of lavender, clary sage, and bergamot essential oils. The meta-analysis suggested that aroma inhalation has favorable effects on stress, but the authors judged the size and quality of available randomized controlled trials to be too low to draw firm conclusions.[17]

Are Essential Oils Safe to Use?

The use of essential oils appears to be safe for most people, on the basis of the low frequency of adverse effects reported in the medical literature.

Most adverse effects have been skin irritation and contact dermatitis after application of essential oils to the skin. The most frequently implicated essential oils are bergamot, laurel, lavender, peppermint, tea tree oil, and ylang-ylang.

Inhalation has been associated with adverse effects more rarely.[18]

Patients with broken skin, poor circulation, epilepsy, and asthma should use essential oils with caution.

Very little information is available about the oral use of essential oils as aromatherapy.

Safety in pregnant women or children has not been established. In the limited research available, aromatherapy does not seem to have adverse effects on the mother (eg, duration of labor, mode of delivery) or the baby.[14]

Two studies have used topical lavender essential oil applied directly or in bathwater for colicky[19] or crying[20] infants, but adverse events were not addressed in either report. Given the higher surface area-to-weight ratio of infants, caution is advised with topical application.[21]

In summary, more large-scale, well-designed, randomized, controlled trials are needed to define the role of essential oils in medical care. Essential oils should not be used in place of established medical therapy to treat, cure, or prevent disease.

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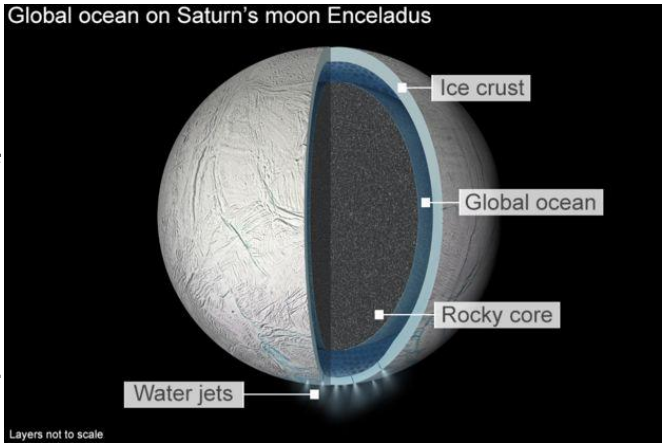
Enceladus ocean 'must be global'

Scientists have determined that the sub-surface body of water on the Saturnian moon Enceladus must be far more extensive than first thought.

By Jonathan Amos BBC Science Correspondent



Using pictures from the Cassini probe, the researchers have detected and tracked a slight wobble in the moon. After seven years of study, they have concluded this flutter would be much less if the icy crust was connected directly to Enceladus's rock core. It is strong support for the idea of an intervening, global mass of liquid.

"If the surface and core were rigidly connected, the core would provide so much dead weight that the wobble would be far smaller than we observe it to be," said Matthew Tiscareno, a Cassini scientist based at the Seti Institute but previously affiliated to Cornell University, US. "This proves that there must be a global layer of liquid separating the surface from the core."

Activity on Enceladus has been one of the great discoveries on the Cassini mission, which arrived at Saturn in 2004.

The first clue that something interesting was going on was some low-resolution images showing a plume coming off the south pole that had the space-interested internet all abuzz. Shortly after, Cassini detected a disturbance in magnetic fields produced by the presence of what appeared to be an atmosphere.

Scientists then established that the moon was actually venting huge jets of water vapour through south polar surface cracks dubbed tiger stripes because of their resemblance to the big cat's fur coat. Models were subsequently produced to explain how liquid water could be maintained on a 500km-wide body in the outer Solar System, and how that water might be feeding the jets.

But there has always been a debate about how large the hidden reservoir might be. Early thinking suggested it might only be a relatively small lens of water.

This new result, published in the journal Icarus, is the best evidence yet that the sub-surface sea is not regional in nature, but encircles the entire globe.

It is significant because it makes it more possible that Enceladus is a habitable world. In those jets, Cassini has also detected salts and organic molecules. The chemistry has scientists intrigued, and fired up to send a dedicated mission to the moon. When that might happen is unclear. Both the US and European space agencies are only planning currently to send probes to Jupiter, and even they are not likely to get to their destination until the 2030s.

Cassini itself is winding up its observations in the Saturn system. It has another couple of close passes of Enceladus this year before it then starts to manoeuvre towards disposal in the ringed planet's atmosphere in 2017.

http://nyti.ms/1FmRZx0

Antidepressant Paxil Is Unsafe for Teenagers, New Analysis Says

A reanalysis of a 2001 study found that Paxil, the antidepressant, is not safe for teenagers.

By BENEDICT CAREY SEPT. 16, 2015

Fourteen years ago, a leading drug maker published a study showing that the antidepressant Paxil was safe and effective for teenagers. On Wednesday, a major medical journal posted a new analysis of the same data concluding that the opposite is true. That study - featured prominently by the journal BMJ - is a clear break from scientific custom and reflects a new era in scientific publishing, some experts said, opening the way for journals to post multiple interpretations of the same experiment.

It comes at a time of self-examination across science - retractions are at an all-time high; recent cases of fraud have shaken fields as diverse as anesthesia and political science; and earlier this month researchers reported that less than half of a sample of psychology papers held up.

"This paper is alarming, but its existence is a good thing," said Brian Nosek, a professor of psychology at the University of Virginia, who was not involved in either the original study or the reanalysis. "It signals that the community is waking up, checking its work and doing what science is supposed to do - self-correct."

The authors of the reanalysis said that many clinical studies had some of the same issues as the original Paxil study, and that data should be made freely available across clinical medicine, so that multiple parties could analyze them.

The dispute itself is a long-running one: Questions surrounding the 2001 study played a central role in the so-called antidepressant wars of the early 2000s, which led to strong warnings on the labels of Paxil and similar drugs citing the potential suicide risk for children, adolescents and young adults. The drugs are considered beneficial and less risky for many adults over 25 with depression.

Over the years, thousands of people taking or withdrawing from Paxil or other psychiatric drugs have committed violent acts, including suicide, experts said, though no firm statistics are available. Because many factors could have contributed to that behavior, it is still far from clear who is at risk - and for whom the drugs are protective.

The maker of Paxil, GlaxoSmithKline, said it stood by the original conclusions, given what was known at the time. The company also noted that it had provided all the data for the new analysis, "an unprecedented level of data sharing that speaks to our absolute commitment to transparency."

The team that reanalyzed the data included several longtime critics of the original study, including a psychiatrist who has been a paid expert witness in lawsuits against Glaxo. But with the company's permission they spent about a year poring over Glaxo's files on the study, combing through summaries, internal trial reports and a sample of what is known as patient-level data, the detailed descriptions of what happened for each person in the original trial.

The original study began in the late 1990s, when antidepressant makers started testing the drugs in young people. Antidepressant trials are an extremely tricky enterprise, in part because anywhere from a third to more than half of subjects typically improve on placebo. Choices about how to measure improvement - and how to label side effects - can make all the difference in how good a drug looks.

And so it was in the Paxil study. The original research, led by Dr. Martin Keller of Brown University, tracked depression scores over eight weeks in three groups of about 90 adolescents each, one taking Paxil, one on placebo pills and one taking imipramine, an older generic drug for depression. The Paxil group did no better than the other two groups on the study's main measure - a standard depression questionnaire - but did rate higher on other, "secondary" measures, like another scale of mood problems, the authors reported.

Researchers consider secondary measures like these as akin to circumstantial evidence, potentially meaningful but not as strong as the primary ones.

The drug's manufacturer - SmithKline Beecham, now a part of GlaxoSmithKline - submitted the trial and others to federal regulators, who told the company that the drug was on track for approval for use in adolescents.

But critics began picking apart the study soon after it was published in the Journal of the American Academy of Child and Adolescent Psychiatry, charging that it was not at all convincing, and that serious side effects had been played down.

Dr. Keller and his co-authors responded at the time that the testing of antidepressants in young people was a new area, that the paper was upfront about its use of secondary measures and that charges of bias were baseless. Glaxo stood by the team's conclusions.

Prescriptions of antidepressants to young people surged in the wake of the study, increasing by 36 percent between 2002 and 2003, according to one analysis. The growth slowed after regulators ordered the black-box warnings on labels.

The reanalysis delivers the same critique as before - no clear effectiveness, and mislabeling of serious side effects - only from the inside, using voluminous data from the study itself. Its authors include Jon Jureidini, of the University of Adelaide in Australia, an early critic, and Dr. David Healy, a professor of psychiatry at Bangor University in Wales, who, with the help of a BBC reporter, Shelley Jofre, first noticed and made public the serious side effects in the early 2000s and who has acted as an expert witness against Glaxo.

In an interview, Dr. Healy said that five of six adverse events labeled "emotional lability" in the original study involved suicidal thinking or behavior but were not presented as such. The patient-level files provided detail on what, exactly, happened in those cases: One teenager was hospitalized after taking 80 Tylenol tablets. Another overdosed on Paxil and other medications after a "disagreement with her mother." Others suffered "severe suicidal ideation," and one was "admitted due to severe suicidal and homicidal ideation, towards his parents." No completed suicides occurred.

"When I first heard about this new analysis, I suspected it might be biased," said Dr. Erick Turner, an associate professor of psychiatry at Oregon Health & Science University, who was not involved in the report. "But I did my own analysis and found, as they did, no significant effect." Dr. Turner added, "The only way to really know about adverse events is to dig into the patient-level data."

Dr. Keller and his co-authors strongly disputed the reassessment of their work. In a joint statement, he and his team said they incorporated secondary measures before knowing which patients were taking Paxil and which were not - not afterward, as the new analysis claims, for some of the measures. "In summary, to describe our trial as 'misreported' is pejorative and wrong," they conclude.

http://www.eurekalert.org/pub_releases/2015-09/oup-asn091415.php

Antibacterial soap no more effective than plain soap at reducing bacterial contamination

Antibacterial soap for hand-washing no more effective than plain soap

Scientists in Korea have discovered that using antibacterial soap when hand-washing is no more effective than using plain soap, according to a paper published today in the Journal of Antimicrobial Chemotherapy.

The study examined the effect of triclosan (the most commonly used active antiseptic ingredient used in soap) on bacteria in two ways. The first was to examine the bactericidal effects of triclosan in soaps against all 20 strains, and the second compared the ability of antibacterial and non-antibacterial soap to remove bacteria from human hands, by using 16 healthy adult volunteers. The results of the study indicate that there is no significant difference between the effects of plain soap and antibacterial soap when used under 'real life' conditions.

The scientists recreated the conditions of human hand washing by exposing the bacteria for 20 seconds at 22°C (room temperature) and 40°C (warm temperature) to triclosan with a concentration of 0.3% - the maximum allowed by law. There were significantly great effects after more than nine hours, but not during the short time required for hand washing. Lead author on the paper, Dr. Rhee, commented that: "advertisement and consumer belief regarding the effectiveness of antibacterial soaps needs to be addressed."

http://www.eurekalert.org/pub_releases/2015-09/smh-sfa091415.php

Study finds association between energy drinks and traumatic brain injury in teens

Energy drink consumption could interfere with recovery efforts

TORONTO - Teens who reported a traumatic brain injury in the past year were seven times more likely to have consumed at least five energy drinks in the past week than those without a history of TBI, according to a study published today in PLOS ONE. Researchers also found that teens who reported sustaining a TBI within the past year were at least twice as likely to have consumed energy drinks

mixed with alcohol than teens who reported sustaining a TBI more than a year previously.

"We've found a link between increased brain injuries and the consumption of energy drinks or energy drinks mixed with alcohol," said Dr. Michael Cusimano, a neurosurgeon at St. Michael's Hospital. "This is significant because energy drinks have previously been associated with general injuries, but not specifically with TBI."

Dr. Cusimano said energy drink consumption could interfere with recovery efforts for teens who have sustained a TBI. "Energy drinks, such a Red Bull and Rockstar, contain high levels of caffeine and change the chemical state of the body, which can prevent people from getting back on track after a TBI," said Dr. Cusimano. "Brain injuries among adolescents are particularly concerning because their brains are still developing."

At a time when energy drink consumption is rising among teens in Canada and the United States, the study also suggests that the caffeinated drinks are particularly linked with those who play sports.

"I think that energy drinks appeal to teens, especially athletes, because the drinks provide temporary benefits such as increased alertness, improved mood and enhanced mental and physical states," said Dr. Cusimano. "Advertisements for the drinks also often feature prominent athletes." Teens who reported suffering a TBI in the past year while playing sports were twice as likely to consume energy drinks as teens who reported a TBI from other injuries in the same time period.

Data for the study was collected by the Centre for Addiction and Mental Health's 2013 Ontario Student Drug Use and Health Survey. Approximately 10,000 students ages 11 to 20 participated in the self-administered, in-classroom survey. TBI was defined as an injury resulting in the loss of consciousness for at least five minutes, or being hospitalized for at least one night.

"It is particularly concerning to see that teens who report a recent TBI are also twice as likely to report consuming energy drinks mixed with alcohol," said Dr. Robert Mann, senior scientist at the Centre for Addiction and Mental Health in Toronto and director of the OSDUHS. "While we cannot say this link is causal, it's a behaviour that could cause further injury and so we should be looking at this relationship closely in future research."

About 22 per cent of all students surveyed reported they'd experienced a TBI, with sports injuries accounting for almost half of TBI cases experienced in the past year. Previous research at St. Michael's Hospital found that TBI is associated with poor academic performance, mental health issues, violence, substance abuse and aggression in both teens and adults - factors that can interfere with rehabilitation, said Dr. Cusimano.

According to the new study, a better understanding of the link between TBI and energy drinks could help medical professionals, parents, teachers and coaches understand how to better prevent, diagnose and treat brain injuries.

This work was funded by a Team Grant from Canadian Institutes of Health Research and by funds from the Ontario Neurotrauma Foundation, AUTO21 and the Ontario Ministry of Health and Long-Term Care.

http://www.eurekalert.org/pub_releases/2015-09/uoca-css091415.php

CU-Boulder study shows caffeine at night delays human circadian clock

A double espresso before bedtime induces 40-minute time delay in internal clock

It's no secret that slugging down caffeinated drinks in the evening can disrupt sleep.

But a new study led by the University of Colorado Boulder and the Medical Research Council's Laboratory of Molecular Biology in Cambridge, England shows for the first time that evening caffeine delays the internal circadian clock that tells us when to get ready for sleep and when to prepare to wake up. The research team showed the amount of caffeine in a double espresso or its equivalent three hours before bedtime induced a 40-minute phase delay in the roughly 24-hour human biological clock.

The study also showed for the first time how caffeine affects "cellular timekeeping" in the human body, said CU-Boulder Professor Kenneth Wright, who co-led the study with John O'Neill of the Medical Research Council's Laboratory of Molecular Biology (LMB) in Cambridge. While it has been known that caffeine influences circadian clocks of even primitive creatures like algae and fruit flies, the new study shows that the internal clocks in human cells can be impacted by caffeine intake.

"This is the first study to show that caffeine, the mostly widely used psychoactive drug in the world, has an influence on the human circadian clock," said Wright, a professor in CU-Boulder's Department of Integrative Physiology. "It also provides new and exciting insights into the effects of caffeine on human physiology."

A paper on the subject led by Wright and O'Neill is being published online in the Sept 16 issue of Science Translational Medicine.

For the study the team recruited five human subjects, three females and two males, who went though a double-blind, placebo-controlled 49-day protocol through CU-Boulder's Sleep and Chronobiology Laboratory, which is directed by Wright. The subjects were tested under four conditions: low light and a placebo pill; low light and the equivalent of a 200-milligram caffeine pill dependent on the subject's weight; bright light and a placebo pill; and bright light and the caffeine pill.

Saliva samples of each participant were tested periodically during the study for levels of the hormone melatonin, which is produced naturally by the pineal gland when directed to do so by the brain's "master clock." The master clock is re-set by exposure to light and coordinates cellular clocks throughout the human body. Melatonin levels in the blood increase to signal the onset of biological nighttime during each 24-hour period and decrease at the start of biological daytime, said Wright.

Those who took the caffeine pill under low-light conditions were found to have a roughly 40-minute delay in their nightly circadian rhythm compared to those who took the placebo pill under low light conditions, said Wright. The magnitude of delay from the caffeine dose was about half that of the delay induced in test subjects by a three-hour exposure to bright, overhead light that began at each person's normal bedtime.

The study also showed that bright light alone and bright light combined with caffeine induced circadian phase delays in the test subjects of about 85 minutes and 105 minutes respectively. There were no significant differences between the dim light/caffeine combination and the bright light/placebo combination. Nor were there significant differences between the bright light/placebo and bright light/caffeine combinations. The results may indicate a "ceiling" was reached in the phase delay of the human circadian clock due to the external factors, Wright said.

In addition, researchers at O'Neill's lab at the LMB in Cambridge used "reporter" genes that made cells glow when the clock genes were expressed to measure changes caused by caffeine. O'Neill's group showed that caffeine can block cell receptors of the neurotransmitter adenosine, which normally promotes sleep and suppresses arousal.

The results may help to explain why caffeine-drinking "night owls" go to bed later and wake up later and may have implications for the treatment of some circadian sleep-wake disorders, said Wright. The new results could benefit travelers. Properly timed caffeine use could help shift the circadian clocks of those flying west over multiple time zones, said Wright.

In a 2013 study, Wright and his research team showed one week of camping in the Rocky Mountains with no artificial light, not even flashlights, synchronized the circadian clocks of the eight study subjects with the timing of sunrise and sunset.

Other co-authors on the new paper included former CU-Boulder students and researchers Tina Burke, Rachel Markwald, Andrew McHill, Evan Chinoy, Jesse Snider, Sara Bessman and Christopher Jung. Markwald and Bessman are now at the Naval Health Research Center in San Diego, while Jung is at the University of Alaska Anchorage, and McHill and Chinoy are at Brigham and Women's Hospital and Division of Sleep Medicine at Harvard Medical School.

The study was funded by the National Institutes of Health, including NIH's National Center for Advancing Translational Science, as well as the Howard Hughes Medical Institute in collaboration with CU-Boulder's Biological Sciences Initiative and its Undergraduate Research Opportunity Program. The Medical Research Council and the Wellcome Trust also helped to fund the study.

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Microbiome implicated in sickle cell disease -- but antibiotics can counter its effects

Could offer the first effective strategy for warding off the disease's long-term complications

BRONX, NY - New research on sickle cell disease (SCD) has found that using antibiotics to deplete the body's microbiome may prevent acute sickle cell crisis and could offer the first effective strategy for warding off the disease's long-term complications, such as organ failure.

The study, conducted by scientists at Albert Einstein College of Medicine and Montefiore Health System, could also lead to better treatment for other inflammatory blood-vessel disorders including septic shock. The findings were published online today in Nature.

SCD affects approximately 100,000 Americans and occurs in about 1 in 500 Black or African-American births. The disease affects millions of people throughout the world, particularly those with ancestors from sub-Saharan Africa and Spanish-speaking regions in the Western Hemisphere (South America, the Caribbean, and Central America.)

People with the disease have an inherited gene mutation that leads to abnormal hemoglobin, the red-cell protein that carries oxygen to the body's tissues. Red cells with abnormal hemoglobin take on a sickle shape and become less flexible. The sickled red cells tend to clog small vessels--impeding blood flow and preventing oxygen from reaching tissues. This can result in sudden attacks of severe pain called sickle cell crisis, or vaso-occlusive crisis, which often require hospitalization.

Over many years, the poor oxygen delivery due to SCD can damage organs including the spleen, liver and kidneys. On average, Americans with the disease can expect to live only into their mid-40s.

The Einstein study was led by Paul Frenette, M.D., professor of medicine and of cell biology and chair and director of Einstein's Gottesman Institute for Stem Cell and Regenerative Medicine Research. Dr. Frenette reported in 2002 that SCD vessel blockages occur when sickled red cells bind to white cells called

neutrophils that have adhered to the vessel walls. Neutrophils are the most common type of white cells in the blood and protect against disease-causing microbes.

"This earlier work indicated that not all neutrophils are the same," said Dr. Frenette. "Some appear to be inert while others appear overly active in promoting inflammation--which is useful for attacking microbes but causes neutrophils to capture sickled red cells inside vessels. So in the current study, we investigated whether the age of the neutrophils might be influencing whether they become active and pro-inflammatory."

Certain surface proteins reveal whether neutrophils are resting or have become active; different cell-surface proteins indicate whether neutrophils are young or old.

After transfusing whole blood into mice and then analyzing young neutrophils (harvested 10 minutes post-transfusion) and aged neutrophils (harvested six hours post-transfusion), Dr. Frenette and colleagues found that neutrophils became more active as they age in the circulation--suggesting they receive some kind of external signals telling them to age.

The researchers carried out experiments that traced these "aging" signals to the body's microbiome. They found that the microbiome produces chemicals that cross the intestinal barrier and enter the bloodstream, where they generate the aged, overly active subset of neutrophils that contributes to SCD.

"Since the body's microbiota seem to "educate" neutrophils to age," said Dr. Frenette, "we realized that purging those microbes through use of antibiotics might help against SCD."

To find out, Dr. Frenette's team carried out studies on a mouse model of SCD. They found that SCD mice possessed five times as many aged neutrophils as healthy control mice. When the researchers depleted the microbiota of SCD mice using antibiotics, they observed a striking reduction in neutrophils but not of other white cells such as monocytes, T cells and B cells.

Moreover, giving antibiotics to SCD mice appeared to prevent sickle cell crisis: interactions between neutrophils and red cells were markedly reduced in microbiota-depleted SCD mice, resulting in improved local blood flow and greatly improved survival of these mice.

"What was most surprising and exciting to us was the effect of antibiotics on chronic tissue damage," said Dr. Frenette. "We found that the spleen enlargement of SCD mice was significantly reduced in the microbiota-depleted animals, and liver analysis revealed major reductions in liver damage including inflammation, scarring and tissue death. This is the first time that anything has been found to have an impact on the organ damage that can be so devastating in SCD."

The researchers then studied septic shock--another serious blood disorder in which activated, pro-inflammatory neutrophils play a role. Sepsis affects more than one million Americans each year and kills up to half of them.

To induce septic shock, control and microbiota-depleted mice received a dose of a bacterial toxin that would normally be lethal. The control mice exhibited the neutrophil aggregates and clumping of neutrophil DNA that contributes to death from septic shock; but the microbiota-depleted mice were largely free of neutrophil complications and survived.

"Remarkably," said Dr. Frenette, "we could prevent microbiota-depleted mice from surviving septic shock if we infused them with aged neutrophils but not if we infused the same number of young neutrophils. So depleting the microbiota may help against inflammatory blood diseases in addition to SCD."

Finally, the researchers investigated whether their findings in mice might be relevant to people with SCD. With help from the Sickle Cell Disease Program at the Children's Hospital at Montefiore (CHAM), they obtained blood samples from nine healthy children and from 34 patients with SCD: 11 patients were taking penicillin daily to ward off infections, as is recommended for children with SCD age five or younger; the other 23 patients with SCD had been off penicillin for at least two months.

Consistent with the findings in SCD mice, children with SCD not taking penicillin had many more circulating aged neutrophils compared with healthy children who served as controls. The researchers then compared neutrophil levels in two groups of children with SCD--those taking penicillin and those not on the drug--and found a much lower number of aged neutrophils in the blood of those who were taking penicillin.

"Daily penicillin for patients with SCD younger than five works really well in preventing infections," said Dr. Frenette. "Our study suggests that penicillin and other antibiotics could play an even broader role in potentially benefiting older patients. In collaboration with Deepa Manwani, M.D., who directs the CHAM's Sickle Cell Disease Program, we hope to carry out a clinical trial to determine whether antibiotics can help patients with SCD by preventing the sickle cell crisis and long-term organ damage associated with the disease."

The Nature paper is titled "Neutrophil ageing is regulated by the microbiome." In addition to Drs. Frenette and Manwani, other Einstein authors were lead author Dachuan Zhang, B.S., Grace Chen, Ph.D., Chunliang Xu, Ph.D., Robert D. Burk, M.D., Yuya Kunisaki, M.D., Ph.D., Jung-Eun Jang, Ph.D., and Christopher Scheiermann. Additional authors were Jeremiah J. Faith, Ph.D., Miriam Merad, Ph.D., and Arthur Mortha, all at the Icahn School of Medicine at Mount Sinai.

http://www.eurekalert.org/pub_releases/2015-09/uoc--hbn091615.php

Hearts build new muscle with this simple protein patch

An international team of researchers has identified a protein that helps heart muscle cells regenerate after a heart attack.

Researchers also showed that a patch loaded with the protein and placed inside the heart improved cardiac function and survival rates after a heart attack in mice and pigs. Animal hearts regained close to normal function within four to eight weeks after treatment with the protein patch. It might be possible to test the patch in human clinical trials as early as 2017. The team, led by Professor Pilar Ruiz-Lozano at Stanford University and involving researchers from the University of California, San Diego and Sanford Burnham Prebys Medical Discovery Institute (SBP) published their findings in the Sept. 16 online issue of Nature.

"We are really excited about the prospect of bringing this technology to the clinic," said Mark Mercola, professor of Bioengineering at UC San Diego and professor in the Development, Aging, and Regeneration Program at SBP. "It's commercially viable, clinically attractive and you don't need immunosuppressive drugs."

High throughput technology in Mercola's lab was critical in identifying a natural protein, called Follistatin-like 1 (FSTL1), and showing that it can stimulate cultured heart muscle cells to divide. Researchers led by Ruiz-Lozano at Stanford embedded the protein in a patch and applied it to the surface of mouse and pig hearts that had undergone an experimental form of myocardial infarction or "heart attack." Remarkably, FSTL1 caused heart muscle cells already present within the heart to multiply and re-build the damaged heart and reduce scarring. Heart muscle regeneration and scarring are two major issues that current treatments for heart attacks do not address, said Ruiz-Lozano. "Treatments don't deal with this fundamental problem--and consequently many patients progressively lose heart function, leading to long-term disability and eventually death," she said.

Today, most patients survive a heart attack immediately after it happens. But the organ is damaged and scarred, making it harder to pump blood. Sustained pressure causes scarring to spread and ultimately leads to heart failure. Heart failure is a major source of mortality worldwide, and roughly half of heart failure patients die within five to six years. Treatments available today focus primarily on making it easier for the heart to pump blood, and advances have extended patients' lives. But they can't help regenerate heart tissue.

The team initially looked to other species for inspiration. Lower vertebrates, such as fish, can regenerate heart muscle, and prior studies in fish suggested that the epicardium, the heart's outside layer, might produce regenerative compounds. The researchers joined forces to find a solution.

The team started with the epicardial cells themselves, and showed that they stimulated existing heart muscle cells, or cardiomyocytes, to replicate. To find whether a single compound might be responsible, the Mercola lab used mass spectrometry, a sophisticated technology, to find over 300 proteins produced by the cells that could fit the bill. They then screened a number of these candidates using high throughput assays to look for the ones that had the same activity as the cells, and found that only one did the job: Follistatin-like 1 (FSTL1).

The group at Stanford--including teams led by Ruiz-Lozano, Dan Bernstein, Manish Butte and Phil Yang-- led the development effort for a therapeutic patch made out of collagen, which was cast with FSTL1 at its core. The patch has the elasticity of fetal heart tissue and slowly releases the protein. "It could act like a cell nursery," Ruiz-Lozano said. "It's a hospitable environment. Over time, it gets remodeled and becomes vascularized as new muscle cells come in."

Testing the patch loaded with FSTL1 in a heart attack model in mice and pigs showed that it stimulated tissue regeneration even if implanted after the injury. For example, in pigs that had suffered a heart attack, the fraction of blood pumped out of the left ventricle dropped from the normal 50 percent to 30 percent. But function was restored to 40 percent after the patch was surgically placed onto the heart a week after injury and remained stable. The pigs' heart tissue also scarred considerably less.

Ruiz-Lozano is the co-founder of EpikaBio, a startup that aims to bring the patches to human clinical trials as soon as possible.

http://www.eurekalert.org/pub_releases/2015-09/uoc--adc091615.php

Alzheimer's disease consists of 3 distinct subtypes, according to UCLA study

Finding could mean that each variation would need to be treated differently

Alzheimer's disease, long thought to be a single disease, really consists of three distinct subtypes, according to a UCLA study. The finding could lead to more highly targeted research and, eventually, new treatments for the debilitating neurological disorder, which robs people of their memories.

The study further found that one of the three variations, the cortical subtype, appears to be fundamentally a different condition than the other two, said Dr. Dale Bredesen, the study's author, a UCLA professor of neurology and member of the Easton Laboratory for Neurodegenerative Disease Research.

"Because the presentation varies from person to person, there has been suspicion for years that Alzheimer's represents more than one illness," said Bredesen, who also is the founding president of the Buck Institute for Research on Aging. "When laboratory tests go beyond the usual tests, we find these three distinct subtypes.

"The important implications of this are that the optimal treatment may be different for each group, there may be different causes, and, for future clinical trials, it may be helpful to study specific groups separately."

The subtypes are:

Inflammatory, in which markers such as C-reactive protein and serum albumin to globulin ratios are increased.

Non-inflammatory, in which these markers are not increased but other metabolic abnormalities are present.

Cortical, which affects relatively young individuals and appears more widely distributed across the brain than the other subtypes of Alzheimer's. It typically does not seem to cause memory loss at first, but people with this subtype of the disease tend to lose language skills. It is often misdiagnosed, typically affects people who do not have an Alzheimer's-related gene and is associated with a significant zinc deficiency.

The findings of the two-year study, which involved metabolic testing of 50 people, appear in the current issue of the peer-reviewed journal Aging.

No effective therapy for Alzheimer's exists. And scientists have yet to completely identify the cause, although multiple studies have pointed to metabolic abnormalities such as insulin resistance, hormonal deficiencies and hyperhomocysteinemia, a condition characterized by an abnormally high level of an amino acid in the blood.

In a 2014 paper, Bredesen showed that making lifestyle, exercise and diet changes designed to improve the body's metabolism reversed cognitive decline in nine out of 10 patients with early Alzheimer's disease or its precursors. The current finding grew out of an extensive evaluation of the data from last year's study, and it could eventually help scientists pinpoint more precise targets for treatments -- the same approach that has led to major advances in treating other diseases.

For example, Bredesen explained, researchers have recently been able to develop precise treatments for cancer by sequencing tumor genomes and comparing them to the patients' genomes to better understand what drives the formation and growth of tumors.

"However, in Alzheimer's disease, there is no tumor to biopsy," Bredesen said. "So how do we get an idea about what is driving the process? The approach we took was to use the underlying metabolic mechanisms of the disease process to guide the establishment of an extensive set of laboratory tests, such as fasting insulin, copper-to-zinc ratio and dozens of others."Going forward, Bredesen and his team will seek to determine whether the subtypes have different underlying causes, and whether they respond differently to potential treatments.

The need for a new approach to treat Alzheimer's is urgent. It is the most common age-related dementia, and the number of people with the disease in the U.S. is expected to increase to 15 million in 2050, from nearly 6 million today. The cost to treat people in the U.S. with Alzheimer's and other dementias is expected to be $226 billion in 2015 alone, and could reach $1.1 trillion in 2050.

The study was funded by the National Institutes of Health (AG165070, AG034427 and AGO36975), the Mary S. Easton Center for Alzheimer's Disease Research at UCLA, the Douglas and Ellen Rosenberg Foundation, the S.D. Bechtel, Jr. Foundation, the Joseph Drown Foundation, the Alzheimer's Association, the Accelerate Fund, the Buck Institute and Marin Community Foundation, the Michael and Catherine Podell Fund, Craig Johnson, Allan Bortell and Michaela Hoag.

http://www.eurekalert.org/pub_releases/2015-09/jhm-vc091715.php

Vaccine clears some precancerous cervical lesions in clinical trial

Genetically engineered vaccine successfully eradicates high-grade precancerous cervical lesions

Scientists have used a genetically engineered vaccine to successfully eradicate high-grade precancerous cervical lesions in nearly one-half of women who received the vaccine in a clinical trial. The goal, say the scientists, was to find nonsurgical ways to treat precancerous lesions caused by HPV.

"Every standard therapeutic option for women with these lesions destroys part of the cervix, which is particularly relevant for women of childbearing age, who may then be at risk for preterm birth due to a weakened cervix," says Cornelia Trimble, M.D., professor of gynecology and obstetrics, oncology, and pathology at the Johns Hopkins University School of Medicine, and first author of the new report, which appears online Sept. 17 in The Lancet. "A vaccine able to cure precancerous lesions could eventually be one way women can avoid surgery that is invasive and can also harm their fertility."

High-grade cervical lesions, termed CIN2/3, occur most often in women 40 or younger, according to Trimble, a member of Johns Hopkins' Kelly Gynecologic Oncology Service and Kimmel Cancer Center. Because the lesions can progress to cancer, they are usually removed by surgery, freezing or laser. The procedures are successful in removing the precancerous areas in approximately 80 percent of women, says Trimble. Less troublesome lesions, called low-grade dysplasia, are usually monitored by physicians rather than immediately removed because they pose less of a risk for cancer and usually regress on their own.

For the study, the scientists used a vaccine, originally developed by University of Pennsylvania scientist David Weiner, Ph.D., which is engineered to teach immune system cells to recognize precancerous and cancerous cells. Those cells are coated with proteins linked to an infection with two strains of HPV -- 16 and 18 -- that cause cervical cancer. The vaccine, given by injection into the arm, is made by

Inovio Pharmaceuticals Inc., which funded the clinical trial, and whose employees co-authored the report with Trimble.

Between 2011 and 2013, the scientists recruited 167 women, ages 18 to 55, with newly diagnosed, high-grade precancerous cervical lesions. The women were randomly assigned to receive either three doses of the vaccine or saline injections over a 12-week period at 36 hospitals and private gynecology practices in the U.S. and six other countries. After each of the injections, the scientists gave the women a small electric pulse at the site of the injection. Cells near the electric pulse open their pores, says Trimble, increasing the likelihood that the vaccine will be taken up by immune system cells.

Of 114 women who received at least one vaccine dose, 55 (48.2 percent) had a regression of their precancerous lesion, meaning their lesions disappeared or converted to low-grade lesions, compared with 12 of 40 (30 percent) who received saline injections. Of the 114, 107 received all three vaccine doses, and 53 of them (49.5 percent) had regression of their lesions. Of the 40 in the saline group, 36 got all three injections, and 11 of them (30.6 percent) had regression of their lesions. Thirteen women dropped out of the study after enrollment. Two patients discontinued the study because of pain at the injection site. Skin redness was more common in the vaccine group compared with saline.

Among women who completed all three injections, scientists could find no trace of HPV in the cervixes of 56 of the 107 women who received the vaccine, compared with only nine of 35 saline recipients. "In many of these women, the vaccine not only made their lesions disappear, but it also cleared the virus from their cervix," says Trimble. "In most unvaccinated patients whose lesions went away, the virus was still present, and many still had low-grade lesions." Trimble says clearance of the virus is a "significant bonus" from receiving the vaccine because persistent HPV infection is a major risk factor for recurrence of cervical lesions.

After 12 weeks, doctors surgically removed lesions that did not regress and took biopsies of each study participant's cervix. In the surgically removed lesions, scientists found miniscule cancers in two of the women who received the vaccine. Trimble says these microinvasive cancers are rarely diagnosed by a biopsy but are found in surgical specimens.

In the biopsy samples, the scientists found that patients whose lesions completely regressed after treatment had more immune cells, called T cells, present in the tissue. "It's important that T cells capable of recognizing HPV stay in the cervix and fight off any recurrence of the infection," says Trimble.

"This is a great first step," says Trimble. "We showed that the vaccine may enable an immune response in a person whose immune system was initially not adequately engaged or was hampered in some way so as to let the lesion occur."

Trimble says that precancerous lesions are unlikely to progress to cancer during the vaccine treatment period, and monitoring of high-grade lesions is done routinely for pregnant women. "It typically takes about 10 or more years for precancerous cells to become cancer, so there is a window of opportunity to intervene with nonsurgical approaches to reverse the process of viral-associated cancers," says Trimble.

Trimble says she and her colleagues are now working to identify biomarkers from cervical tissue that can predict which lesions are more likely to persist and eventually progress to cancer. The research team will be monitoring this initial group of study participants to see whether they have fewer recurrences than unvaccinated patients. Trimble is also studying other types of vaccines to prevent the progression of high-grade cervical lesions to cancer.

Trimble received an unrestricted grant from Inovio Pharmaceuticals Inc., but she has no other financial or consulting arrangements with the company.

In addition to Trimble, scientists who contributed to the research include Lance Edwards from Suffolk Obstetrics and Gynecology in Port Jefferson, New York; R. Lamar Parker from Lyndhurst Gynecologic Associates in Winston-Salem, North Carolina; Lynette Denny from the University of Cape Town's Groote Schuur Hospital in South Africa; David B. Weiner from the University of Pennsylvania; and Matthew P. Morrow, Kimberly A. Kraynyak, Xuefei Shen, Michael Dallas, Jian Yan, Mary Giffear, Ami Shah Brown, Kathleen Marcozzi-Pierce, Divya Shah, Anna M. Slager, Albert J. Sylvester, Amir Khan, Kate E. Broderick, Robert J. Juba, Timothy A. Herring, Jean Boyer, Jessica Lee, Niranjan Y. Sardesai, David B. Weiner and Mark L Bagarazzi from Inovio Pharmaceuticals Inc.

http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(15)00239-1/abstract

http://bit.ly/1iG0FEW

The Future of Animal-to-Human Organ Transplants

Could a genetically engineered pig heart one day function in a person?

By Heather Hansman

On a farm in Virginia, a company called Revivicor is breeding pigs that have some genetic similarities to humans. The scientists call them GalSafe pigs, and they have added five human genes to the pigs' livers, kidneys and hearts. The hope is that the organs can be harvested and used for transplants, and that human bodies won't reject them.

It sounds like science fiction, but it's sort of working. Revivicor (started by the British company PPL Therapeutics that produced Dolly the cloned sheep) is making strides in the slowly growing field of xenotransplantation, or the

transplanting of non-human organs or cells into a human body. The first step has been to make transplants from one animal species to another a reality.

Last month, surgeons at the National Heart, Lung, and Blood Institute, in Bethesda, Maryland, managed to keep one of Revivicor's genetically modified pig hearts alive inside a baboon's stomach for 945 days. They were testing the baboon's immune response to the foreign organ, not the pig heart's ability to function as the animal's heart. Humans share more than 90 percent of their DNA with baboons, so transplanting a pig organ into the primate is a step in the right direction.

There's a shortage of human organs for transplants—an average of 21 people die each day in the United States because they don't get transplants in time. Lungs or hearts can only stay functional on ice for a few hours, and so they often aren't used before they expire. Revivicor thinks pig organs can fill that void, and create a much more accessible and plentiful supply of transplantable organs, if only scientists can get our bodies to accept them.

Pigs are genetically distant from humans, but their organs are of a similar size and they're easy to breed, which is why they've been a target for xenotransplantation. Pig valves are already used successfully in heart transplants.

Human-to-human organ transplantation has only been around since the 1950s, and scientists have been working on animal-to-human transplants for almost that long. In the '60s, Keith Reemtsma experimented with transplanting chimpanzee kidneys into humans. Most of them failed within a few weeks, but one woman lived for nine months. Most other attempted xenotransplantations, especially hearts and lungs, have had similar degrees of success. In 1984, in one of the most famous cross-species transplantations, Leonard Bailey transplanted a baboon heart into a infant, Baby Fae. The heart failed after 20 days, but it became a gateway for the first pediatric human-to-human heart transplant a year later. Recently, with genetic engineering, scientists have kept, in addition to the pig heart, a pig kidney alive and functioning in a baboon for 136 days.

So far, cross-species transplantations have been impossible to sustain indefinitely, because the human immune system is built to reject foreign organs. In lab trials, troubles occur when human blood pumps through pig organs. According to Revivicor, the immune response is triggered by natural antibodies directed against the galactose epitope, or the part of the pig cells that determines whether antibodies can attach themselves or not. So the company is working to modify that epitope by adding human thrombomodulin, the protein that coats those epitopes, to the pig's genome. That makes them seem more human, and, therefore, it is less likely for the body to reject them.

The challenge is to target the genes that human bodies reject and then find ways to edit them. The baboon that survived with the heart transplant was on a heavy course of immunosuppressant drugs and died when it was taken off the regimen. But scientists are still hopeful about the next experiment—actually replacing a baboon's heart with a pig heart.

"Based on the data from long-term surviving grafts, we are hopeful that we will be able to repeat our results in the life-supporting model. This has potential for paving the way for the use of animal organs for transplantation into humans," Muhammad M. Mohiuddin, of the National Heart, Lung, and Blood Institute, told the American Association for Thoracic Surgery.

Part of Revivicor's push for pig organs is personal. Martine Rothblatt, founder of Revivicor's current parent company United Therapeutics, has a daughter with pulmonary arterial hypertension, a lung condition that is usually fatal. The only way to treat it is with a transplant, so she's sunk time and money into organ transplants and tissue engineering. Revivicor is focusing on hearts and livers before lungs, because lungs are more influenced by the immune system. They've said they want to do the first complete pig-to-human organ transplant within a decade.

Rothblatt's dream for Revivicor to become an assembly line for new organs, so that there's never a shortage, is just that, a dream. Although there's been significant progress in how the organs maintain their integrity, direct pig-to-human transplants are still a long ways off.

"The immunological and pathophysiological problems associated with pig xenotransplantation...are significant and probably reflect the fact that it has been 80 million years since the pig and human diverged on the evolutionary scale," wrote David K.C. Cooper, a surgeon at the Thomas E. Starzl Transplantation Institute at the University of Pittsburgh Medical Center, in a 2012 paper about xenotransplantation. "Therefore, in the words of [German scientist] Claus Hammer, what we are trying to do is to 'outwit evolution.'"

In addition to bodies rejecting the organs, there's fear about cross-species infection, like swine flu, because humans don't have immunity to viruses that originate in animals. These infections would be especially dangerous, because patients would have to be on immunosuppressants to prevent organ rejection. There's also tricky moral ground to cross. Bailey's heart transplant is still controversial, and there's worry about both informed consent from the patient's side and animal welfare. Animal rights groups, as you might expect, are opposed to raising animals for the purpose of harvesting their organs.

Anyone doing xenotransplantation in the U.S. has to get clearance from the Food and Drug Administration. The FDA's guidelines on the risks of animal-to-human

disease transmission, informed consent and animal welfare are perpetually updated, and they are due for a revision in March 2016.

According to *MIT Technology Review*, "The last time a doctor transplanted a pig heart into a person, in India in 1996, he was arrested for murder."

http://bit.ly/1PqcNGx

Ancient Cats Drove Ancient Dogs to Extinction

The rivalry runs deep

By Danny Lewis

The battle between cats and dogs goes back millions of years – and it looks like the cats won one of the early rounds.

During the Eocene Era, about 55.8-33.9 million years ago, mammal populations were exploding across the planet. The earliest primates had appeared just a few million years before and at their peak, about 30 different canine species roamed what is now North America. But according to a new study, most of these ancient dogs suddenly disappeared about 20 million years ago. The culprit? Early cats.

"While several groups of carnivores might have competed with dogs, felids [cats] are the groups that shows by far the strongest evidence of competition," computational biologist and lead author Daniele Silvestro told Katherine Ellen Foley for Quartz via email.

To figure out exactly what caused these ancient canines to go extinct, Silvestro and his team looked at more than 2,000 fossils from all sorts of animals that lived in the same area from about 20-40 million years ago. The researchers compared the body types of carnivores like bears, wolves and big cats to see which animals might have directly competed for food at a time when the planet was undergoing severe climate change. According to Silvestro, ancient cats like the false-sabretooth cat fit the profile perfectly: they were about the same size as the canines, they ate the same food and were thriving and diversifying at the same time as the dogs rapidly disappeared from the fossil record, Foley writes.

Today, there are only about nine different dog species living in North America. Even though the planet's climate was rapidly changing at the time, it appears that cats were just better predators than their rivals.

"We usually expect climate changes to play an overwhelming role in the evolution of biodiversity," Silvestro said in a statement. "Instead, competition among different carnivore species proved to be even more important for canids."

While early cats might have driven many species of early dogs to extinction, it appears that dogs had a leg up in their partnership with early humans. According a recent genetic study, dogs began to separate from wolves about 27,000 years ago, much earlier than was previously believed. On the other hand, the earliest evidence of wildcats living alongside humans only dates back about 9,500 years.

http://www.bbc.com/news/health-34269315

'Super-gonorrhoea' outbreak in Leeds

Highly drug-resistant gonorrhoea is spreading in the north of England with an outbreak centred in Leeds, sexual health doctors have told the BBC.

By James Gallagher Health editor, BBC News website

One of the main treatments has become useless against the new strain of the sexually transmitted infection. Twelve cases have been confirmed in Leeds and a further four have been reported in Macclesfield, Oldham and Scunthorpe. However, there are likely to be more undiagnosed cases. The strain in this outbreak is able to shrug off the antibiotic azithromycin, which is normally used alongside another drug, ceftriaxone.

'Highly resistant'

Peter Greenhouse, a consultant in sexual health based in Bristol, told the BBC News website: "This azithromycin highly resistant outbreak is the first one that has triggered a national alert.

"It doesn't sound like an awful lot of people, but the implication is there's a lot more of this strain out there and we need to stamp it out as quickly as possible.

"If this becomes the predominant strain in the UK we're in big trouble, so we have to be really meticulous in making sure each of these individuals has all their contacts traced and treated."

The outbreak started in March.

The British Association for Sexual Health and HIV says all cases have been in heterosexuals and some have reported sexual partners from across England.

Dr Jan Clarke, the organisation's president, told the BBC: "It was sufficiently serious to alert our whole national chain of clinics that there is the possibility that we've got a very resistant strain of gonorrhoea. "We are really skating on thin ice as far as treating gonorrhoea is concerned at the moment."

What is gonorrhoea?

The disease is caused by the bacterium called Neisseria gonorrhoeae.

The infection is spread by unprotected vaginal, oral and anal sex. Of those infected, about one in 10 heterosexual men and more than three-quarters of women, and men who have sex with men, have no easily recognisable symptoms.

But symptoms can include a thick green or yellow discharge from sexual organs, pain when urinating and bleeding between periods. Untreated infection can lead to infertility, pelvic inflammatory disease and can be passed on to a child during pregnancy.

Gonorrhoea is the second most common sexually transmitted infection in England and cases are soaring. The number of infections increased by 19% from 29,419 in 2013 to 34,958 the following year.

Dr Mike Gent from Public Health England said in a statement: "We can confirm investigations are under way. "Those affected are being treated with an alternative antibiotic, but the resistance to first-line treatment remains a concern. "The bacteria that cause gonorrhoea are known to mutate and develop new resistance, so we cannot afford to be complacent."

He urged people to practise safe sex including the use of condoms. The outbreak in Leeds adds to growing concern that gonorrhoea is becoming untreatable.

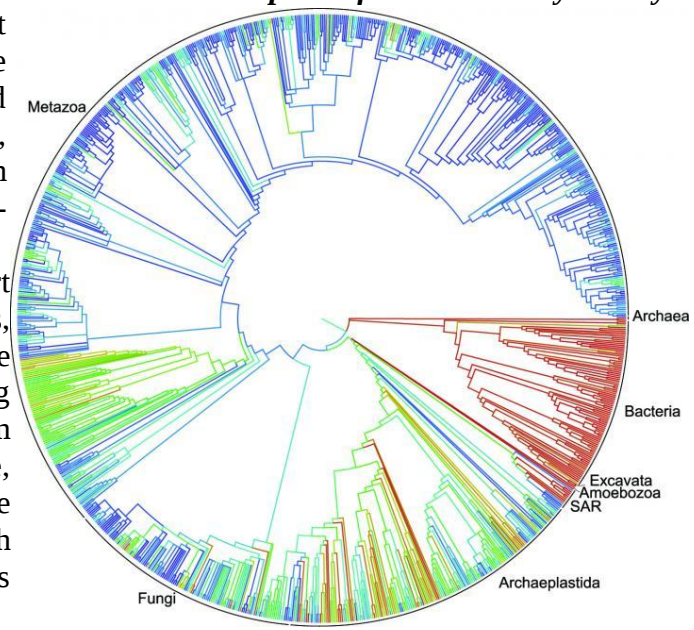
In 2011, Japan reported a case of complete resistance to cephalosporin-class antibiotics, which included the main treatment ceftriaxone.

http://www.eurekalert.org/pub_releases/2015-09/du-ol091815.php

'Tree of life' for 2.3 million species released

Large, open-access resource aims to be 'Wikipedia' for evolutionary history

DURHAM, N.C. - A first draft of the "tree of life" for the roughly 2.3 million named species of animals, plants, fungi and microbes -- from platypuses to puffballs -- has been released.



This circular family tree of Earth's lifeforms is considered a first draft of the 3.5-billion-year history of how life evolved and diverged. **opentreeoflife.org**

A collaborative effort among eleven institutions, the tree depicts the relationships among living things as they diverged from one another over time, tracing back to the beginning of life on Earth more than 3.5 billion years ago.

Tens of thousands of smaller trees have been published over the years for select branches of the tree of life -- some containing upwards of 100,000 species -- but this is the first time those results have been combined into a single tree that encompasses all of life. The end result is a digital resource that available free online for anyone to use or edit, much like a "Wikipedia" for evolutionary trees.

"This is the first real attempt to connect the dots and put it all together," said principal investigator Karen Cranston of Duke University. "Think of it as Version 1.0."

The current version of the tree -- along with the underlying data and source code -- is available to browse and download at https://tree.opentreeoflife.org.

It is also described in an article appearing Sept. 18 in the Proceedings of the National Academy of Sciences.

Evolutionary trees, branching diagrams that often look like a cross between a candelabra and a subway map, aren't just for figuring out whether aardvarks are more closely related to moles or manatees, or pinpointing a slime mold's closest cousins. Understanding how the millions of species on Earth are related to one another helps scientists discover new drugs, increase crop and livestock yields, and trace the origins and spread of infectious diseases such as HIV, Ebola and influenza.

Rather than build the tree of life from scratch, the researchers pieced it together by compiling thousands of smaller chunks that had already been published online and merging them together into a gigantic "supertree" that encompasses all named species. The initial draft is based on nearly 500 smaller trees from previously published studies.

To map trees from different sources to the branches and twigs of a single supertree, one of the biggest challenges was simply accounting for the name changes, alternate names, common misspellings and abbreviations for each species. The eastern red bat, for example, is often listed under two scientific names, Lasiurus borealis and Nycteris borealis. Spiny anteaters once shared their scientific name with a group of moray eels. "Although a massive undertaking in its own right, this draft tree of life represents only a first step," the researchers wrote. For one, only a tiny fraction of published trees are digitally available.

A survey of more than 7,500 phylogenetic studies published between 2000 and 2012 in more than 100 journals found that only one out of six studies had deposited their data in a digital, downloadable format that the researchers could use.

The vast majority of evolutionary trees are published as PDFs and other image files that are impossible to enter into a database or merge with other trees.

"There's a pretty big gap between the sum of what scientists know about how living things are related, and what's actually available digitally," Cranston said.

As a result, the relationships depicted in some parts of the tree, such as the branches representing the pea and sunflower families, don't always agree with expert opinion.

Other parts of the tree, particularly insects and microbes, remain elusive.

That's because even the most popular online archive of raw genetic sequences -- from which many evolutionary trees are built -- contains DNA data for less than five percent of the tens of millions species estimated to exist on Earth.

"As important as showing what we do know about relationships, this first tree of life is also important in revealing what we don't know," said co-author Douglas Soltis of the University of Florida.

To help fill in the gaps, the team is also developing software that will enable researchers to log on and update and revise the tree as new data come in for the millions of species still being named or discovered.

"It's by no means finished," Cranston said. "It's critically important to share data for already-published and newly-published work if we want to improve the tree."

"Twenty five years ago people said this goal of huge trees was impossible," Soltis said. "The Open Tree of Life is an important starting point that other investigators can now refine and improve for decades to come."

This research was supported by a three-year, $5.76 million grant from the U.S. National Science Foundation (1208809).

Other study co-authors include Cody Hinchliff and Stephen Smith of the University of Michigan; James Allman of Interrobang Corporation; Gordon Burleigh, Ruchi Chaudhary and Jiabin Deng of the University of Florida; Lyndon Coghill, Peter Midford and Richard Ree of the Field Museum of Natural History; Keith Crandall and Christopher Owen of George Washington University; Bryan Drew of the University of Nebraska-Kearney; Romina Gazis and David Hibbett of Clark University; Karl Gude of Michigan State University; Laura Katz and H. Dail Laughinghouse IV of Smith College; Emily Jane McTavish of the University of Kansas; Jonathan Rees of the National Evolutionary Synthesis Center and Tiffani Williams at Texas A&M University.

CITATION: "Synthesis of Phylogeny and Taxonomy Into a Comprehensive Tree of Life," C. Hinchliff et al. Proceedings of the National Academy of Sciences (PNAS Sept. 18, 2015. DOI: 10. 1073/pnas.1423041112.

http://www.eurekalert.org/pub_releases/2015-09/dqms-rtb091715.php

Repairing the brain

Two genes unlock potential for treatment of schizophrenia

Research led by scientists from Duke-NUS Graduate Medical School Singapore (Duke-NUS) has linked the abnormal behaviour of two genes (BDNF and DTNBP1) to the underlying cause of schizophrenia. These findings have provided a new target for schizophrenia treatment.

Schizophrenia is a devastating mental disorder that affects nearly 1% of the total human population. The dominant cause of the disorder lies in impaired brain development that eventually leads to imbalanced signals within the brain. This imbalance within the brain is thought to cause hallucinations and paranoia in people with schizophrenia.

"We wanted to understand the mechanism by which the brain circuit operates," explained senior author Assistant Professor Shawn Je, from the Neuroscience and Behavioural Disorders Programme at Duke-NUS. "In particular, we wanted to understand the ability of a specific type of cell in the brain, termed interneurons, to modulate brain network activity to maintain a balance in brain signalling."

Dr. Je and his team analysed signalling activity in neuronal cultures that either did not have the DTNBP1 gene or had lowered levels of the gene, because reduced DTNBP1 levels and genetic disruptions of DTNBP1 in mice resulted in schizophrenia-like behaviours. Using multiple model systems, they found that the low levels of DTNBP1 resulted in dysfunctional interneurons and over-activated neuronal network activity. Reducing levels of DTNBP1 also lowered the levels of the secreted protein molecule, BDNF.

BDNF was then shown to be one of the most important factors that regulate the development of a normal brain circuit. It plays an important role in the interneurons ability to connect to the brain. Interneurons receive BDNF via a transport system run by DTNBP1. This can be likened to the delivery of a parcel: DTNBP1 is the driver of the delivery van and without the driver, the parcel BDNF cannot be delivered to the required destination. Without BDNF, the abnormal circuit development and brain network activity observed in schizophrenia patients results.

Additionally, Dr. Je and his team also found that when BDNF levels were restored, brain development and activity were rescued and returned to more normal levels, despite the absence of DTNBP1.

While the two genes DTNBP1 and BDNF have been singled out as risk genes for schizophrenia in studies before, this is the first study to show that the two function together. Pinpointing the importance of the abnormal delivery of BDNF has shed considerable insight into how the brain network develops. It also presents possibilities for potential treatments for schizophrenia designed around enhancing BDNF levels.

In a follow-up study, Dr. Je plans to test if these findings are viable in an animal model. If proven successful, this could mean that correcting the imbalance within the brain circuits of schizophrenia patients may bring us closer to producing a treatment.

Study facts at a glance:

The study was published online in the journal Biological Psychiatry.

DTNBP1 and BDNF are two genes that increase the risk of schizophrenia.

Dr. Je's study is the first ever to show that DTNBP1 is required for proper trafficking of BDNF to its appropriate location within the brain circuit.

BDNF is required for the development and action of interneurons within the brain circuit that maintains signalling balance.

Results have shown that regulating BDNF levels can rescue the signalling imbalance observed in schizophrenia, providing new hope for a treatment.

http://www.eurekalert.org/pub_releases/2015-09/tcd-trr091715.php

Trinity researchers report major breakthrough in understanding Alzheimer's disease

Scientists at Trinity College Dublin have shed light on a fundamental mechanism underlying the development of Alzheimer's disease, which could lead to new forms of therapy for those living with the condition.

Alzheimer's is the most common form of dementia globally and affects up to 40,000 people in Ireland today. It is the fourth leading cause of death in individuals over the age of 65 and it is the only cause of death among the top ten that cannot be prevented, cured or even slowed down.

The condition is classically associated with memory loss. However, other symptoms and warning signs include difficulty performing familiar tasks, problems with language such as forgetting phrases or words, and changes in mood, behaviour and personality.

The research, published this week in leading international journal, Science Advances, was supported by Science Foundation Ireland (SFI) and the US-based charity, Brightfocus Foundation.

Alzheimer's disease is characterized, in part, by the build-up of a small protein ('amyloid-beta') in the brains of patients. Impaired clearance of this protein appears to be a major factor in the build-up of plaques, and then in the disease process itself. While the mode by which amyloid-beta is cleared remains unclear, it is evident that it needs to be removed from the brain via the bloodstream.

Unlike blood vessels anywhere else in the body, those in the brain have properties that strictly regulate what gets in and out of the delicate tissue - this is what is known as the blood-brain barrier (BBB). The BBB functions as a tightly regulated site of energy and metabolite exchange between the brain tissue and the bloodstream.

"We have shown that distinct components of these blood vessels termed tight junctions are altered in Alzheimer's disease. We think that this alteration could be an entrained mechanism to allow for the clearance of toxic amyloid-beta from the brain in those living with Alzheimer's disease," said postdoctoral researcher in Trinity's School of Genetics and Microbiology, Dr James Keaney, who spearheaded the study.

Working with the Dublin Brain Bank, which is based in Beaumont Hospital, the researchers from Trinity examined brain tissues of individuals who were affected by Alzheimer's disease during their lifetime and then compared results to those observed in model systems in the laboratory.

Research Assistant Professor in Genetics at Trinity, Dr Matthew Campbell, added: "Our recent findings have highlighted the importance of understanding diseases at the molecular level. The concept of periodic clearance of brain amyloid-beta across the BBB could hold tremendous potential for Alzheimer's patients in the future. The next steps are to consider how this might be achieved.

"Given the recent advances in clinical trials of anti-amyloid beta antibodies, we hope our findings may lead to improved and adjunctive forms of therapy for this devastating condition."

Scientists in the laboratories of Dr Matthew Campbell, Professor Peter Humphries, Trinity's Smurfit Institute of Genetics, Professor Dominic Walsh of Harvard University, and Professor Michael Farrell, Consultant Pathologist and Director of the Dublin Brain Bank at Beaumont Hospital, collaborated on this study.

http://www.bbc.com/news/health-34279190

Tai Chi 'could be prescribed' for illnesses

Tai Chi is a suitable exercise for older people with conditions like arthritis, a study has found.

The ancient Chinese art improves physical performance and enhances quality of life, say researchers.

Tai Chi combines deep breathing and relaxation with slow and gentle movements.

The study, published in the British Journal of Sports Medicine, suggests the exercise helps with pain and stiffness in arthritis.

It can also help improve quality of life in the lung condition, chronic obstructive pulmonary disease (COPD).

And it may have some physical benefits for people with breast cancer or heart failure, according to researchers from the University of British Colombia, Vancouver.

In the future, it might even be possible to consider prescribing Tai Chi for patients with several illnesses, they said.

"Our findings support the results of a previous systematic review that showed the effectiveness of Tai Chi on health outcomes in older patients with chronic conditions," Dr Yi-Wen Chen and colleagues wrote in their research paper.

"Tai Chi can improve some physical performance outcomes in four chronic conditions (cancer, osteoarthritis, heart failure and COPD) but not at the expense of worsening pain or dyspnoea (breathlessness)."

The data comes from a review of more than 30 studies looking at the health benefits of the exercise.

Past research has found that Tai Chi may reduce the risk of falls among older adults who are at increased risk.

http://bit.ly/1FVnfOn

The lies we tell are more convincing when we need to pee

David Cameron uses bladder control for focus, but it can also be used to inhibit the impulse to tell the truth

David Cameron's full-bladder technique really does work – but perhaps not in a way that the UK prime minister intends. Before important speeches or negotiations, Cameron keeps his mind focused by refraining from micturating. The technique may be effective – but it also appears to help people to lie more convincingly.

Iris Blandón-Gitlin of California State University in Fullerton and her colleagues asked 22 students to complete a questionnaire on controversial social or moral issues. They were then interviewed by a panel, but instructed to lie about their opinions on two issues they felt strongly about. After completing the questionnaire, and 45 minutes before the interview, in what they were told was an unrelated task, half drank 700 ml of water and the other half 50 ml.

The interviewers detected lies less accurately among those with a full bladder. Subjects who needed to urinate showed fewer signs that they were lying and gave longer, more detailed answers than those who drank less.

The findings build on work by Mirjam Tuk of Imperial College London, whose study in 2011 found that people with full bladders were better able to resist short-term impulses and make decisions that led to bigger rewards in the long run. These findings hinted that different activities requiring self-control share common mechanisms in the brain, and engaging in one type of control could enhance another.

Other research has suggested that we have a natural instinct to tell the truth which must be inhibited when we lie. Blandón-Gitlin was therefore interested to see whether the "inhibitory spillover effect" identified by Tuk would apply to deception.

Although we think of bladder control and other forms of impulse control as different, they involve common neural resources, says Blandón-Gitlin. "They're subjectively different but in the brain they're not. They're not domain-specific. When you activate the inhibitory control network in one domain, the benefits spill over to other tasks."

Blandón-Gitlin stresses that her study does not suggest that David Cameron would be more deceitful as a consequence of his full bladder technique. But she says that deception might be made easier using the approach – as long as the desire to urinate isn't overwhelming. "If it's just enough to keep you on edge, you might be able to focus and be a better liar," she says.

Intriguingly, exerting different forms of self-control sequentially rather than simultaneously seems to have the opposite effect, depleting an individual's powers of restraint. Tuk found that participants who are instructed to inhibit their emotions while watching a film eat fewer crisps during the film, but eat more if they get access to the crisps later.

Tuk says the new study doesn't add much to our understanding of impulse control, but the results "provide an important confirmation of the hypothesis that bladder control impacts human behaviour".

Aldert Vrij, an expert on lie detection at the University of Portsmouth, UK, says it's premature to discuss the implications from one small study. Publishing research on how to make people better liars also raises ethical concerns, he adds.

Journal reference: Consciousness and Cognition, DOI: 10.1016/j.concog.2015.09.003

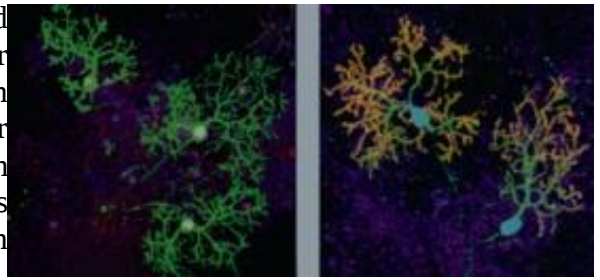
http://bit.ly/1FnDTvf

On the Horizon: Lab-Grown Spare Parts for Brains

Researchers have figured out how to coax stem cells into becoming organized clusters of neurons

By John Pavlus | Aug 13, 2015

The "brain in a vat" has long been a staple of philosophical thought experiments and science fiction. Now scientists are one step closer to creating the real thing, which could enable groundbreaking experiments of a much more empirical kind.



Research teams at Stanford University and the RIKEN Center for Developmental Biology in Japan have each discovered methods for coaxing human stem cells to form three-dimensional neural structures that display activity associated with that of an adult brain.

***Purkinje cells are a type of neuron found only in the cerebellum. The team at RIKEN in Japan confirmed that its embryonic stem cells had grown into mature Purkinje cells (above) by checking for molecules that occur at different stages of development.* "Self-Organization Of Polarized Cerebellar Tissue In 3d Culture Of Human Pluripotent Stem Cells," By Keiko Muguruma Et Al., In Cell Reports, Vol. 10, No. 4; February 3, 2015**

By applying a variety of chemical growth factors, the RIKEN researchers transformed human embryonic stem cells into neurons that self-organized in patterns unique to the cerebellum, a region of the brain that coordinates movement. The Stanford team worked with induced pluripotent stem cells derived from skin cells and chemically nudged them to become neurons that spontaneously wired up into networks of 3-D circuits, much like the ones found in the cerebral cortex—

the wrinkled gray matter of the brain that supports attention, memory and self-awareness in humans.

“For years people have used mouse embryonic stem cells to generate teratomas—things that look like they could be organs,” says David Panchision, a neuroscientist at the National Institutes of Health, which supported the Stanford research. “But it's not organized and systematic, the way a developing brain needs to be to function.” In contrast, the Stanford team's neural structures not only self-assembled as cortexlike tissue, the neurons also sent signals to one another in coordinated patterns—just as they would in a brain. The cerebellar tissue generated by the Japanese scientists did, too.

see also:

So what could one do with a working chunk of lab-grown brain? Using it to someday grow neural spare parts for diseased or aging patients “is not impossible,” says RIKEN's Keiko Muguruma. But the near-term goal is to subject these living mini brains, dubbed “organoids” by scientists, to medical research that is otherwise impossible or unethical. “You can do detailed, mechanistic experiments that are directly relevant to human disease,” Panchision explains. “If you're looking for very specific molecular targets or pathways in the brain, and how drugs might act on them, the difference between human cells and mouse cells is significant.”

Panchision foresees organoids being used in virtual clinical safety trials for new psychiatric medications. “Most brain disorders aren't understood at the circuit level,” he says. So whereas growing spare parts for your brain remains a fantasy for now, having these neural crash-test dummies for research purposes could be the next best thing.

http://www.bbc.com/news/magazine-34290981

The extraordinary case of the Guevedoces

The discovery of a small community in the Dominican Republic, where some males are born looking like girls and only grow penises at puberty, has led to the development of a blockbuster drug that has helped millions of people, writes Michael Mosley.

Johnny lives in a small town in the Dominican Republic where he, and others like him, are known as "Guevedoces", which effectively translates as "penis at twelve".

We came across Johnny when we were filming for a new BBC Two series Countdown to Life, which looks at how we develop in the womb and how those changes, normal and abnormal, impact us later in life.

Like the other Guevedoces, Johnny was brought up as a girl because he had no visible testes or penis and what appeared to be a vagina. It is only when he approached puberty that his penis grew and testicles descended.

Johnny, once known as Felicita, remembers going to school in a little red dress, though he says he was never happy doing girl things.

"I never liked to dress as a girl and when they bought me toys for girls I never bothered playing with them - when I saw a group of boys I would stop to play ball with them."

When he became obviously male he was taunted at school, and responded with his fists.

"They used to say I was a devil, nasty things, bad words and I had no choice but to fight them because they were crossing the line."

We also filmed with Carla, who at the seven is on the brink of changing into Carlos. His mother has seen the change coming for quite a while.

"When she turned five I noticed that whenever she saw one of her male friends she wanted to fight with him. Her muscles and chest began growing. You could see she was going to be a boy. I love her however she is. Girl or boy, it makes no difference."

So why does it happen? Well, one of the first people to study this unusual condition was Dr Julianne Imperato-McGinley, from Cornell Medical College in New York.

In the 1970s she made her way to this remote part of the Dominican Republic, drawn by extraordinary reports of girls turning into boys.

When she got there she found the rumours were true.

She did lots of studies on the Guevedoces (including what must have been rather painful biopsies of their testicles) before finally unravelling the mystery of what was going on.

When you are conceived you normally have a pair of X chromosomes if you are to become a girl and a set of XY chromosomes if you are destined to be male.

For the first weeks of life in womb you are neither, though in both sexes nipples start to grow.

Then, around eight weeks after conception, the sex hormones kick in. If you're genetically male the Y chromosome instructs your gonads to become testicles and sends testosterone to a structure called the tubercle, where it is converted into a more potent hormone called dihydro-testosterone.

This in turn transforms the tubercle into a penis. If you're female and you don't make dihydro-testosterone then your tubercle becomes a clitoris.

When Imperato-McGinley investigated the Guevedoces she discovered the reason they don't have male genitalia when they are born is because they are deficient in an enzyme called 5-alpha-reductase, which normally converts testosterone into dihydro-testosterone.

This deficiency seems to be a genetic condition, quite common in this part of the Dominican Republic, but vanishingly rare elsewhere. So the boys, despite having an XY chromosome, appear female when they are born.

At puberty, like other boys, they get a second surge of testosterone. This time the body does respond and they sprout muscles, testes and a penis.

Imperato-McGinley's thorough medical investigations showed that in most cases their new, male equipment seems to work fine and that most Guevedoces live out their lives as men, though some go through an operation and remain female.

Another thing that Imperato-McGinley discovered, which would have profound implications for many men around the world, was that the Guevedoces tend to have small prostates.

This observation, made in 1974, was picked up by Roy Vagelos, head of research at the multinational pharmaceutical giant, Merck.

He thought this was extremely interesting and set in progress research which led to the development of what has become a best-selling drug, finasteride, which blocks the action of 5-alpha-reductase, mimicking the lack of dihydro-testosterone seen in the Guevedoces.

My wife, who is a GP, routinely prescribes finasteride as it is an effective way to treat benign enlargement of the prostate, a real curse for many men as they get older. Finasteride is also used to treat male pattern baldness.

A final interesting observation that Imperato-McGinley made was that these boys, despite being brought up as girls, almost all showed strong heterosexual preferences.

She concluded in her seminal paper that hormones in the womb matter more than rearing when it comes to your sexual orientation.

This is still a controversial topic and one I explore later in the film when I meet Mati, who decided from the earliest age that though "he" looked like a boy, Mati was really a girl.

As for Johnny, since he developed male genitalia he has had a number of short term girlfriends, but he is still looking for love. "I'd like to get married and have children, a partner who will stand by me through good and bad," he sighs wistfully.

More from the Magazine

The number of children aged 10 and under who have been referred to NHS support services to help deal with transgender feelings has more than quadrupled in the last six years, the Victoria Derbyshire programme has learned.

Here is the story of two of the youngest transgender children in the UK - with permission from their parents and with the support of the children's schools.

The story of two transgender children

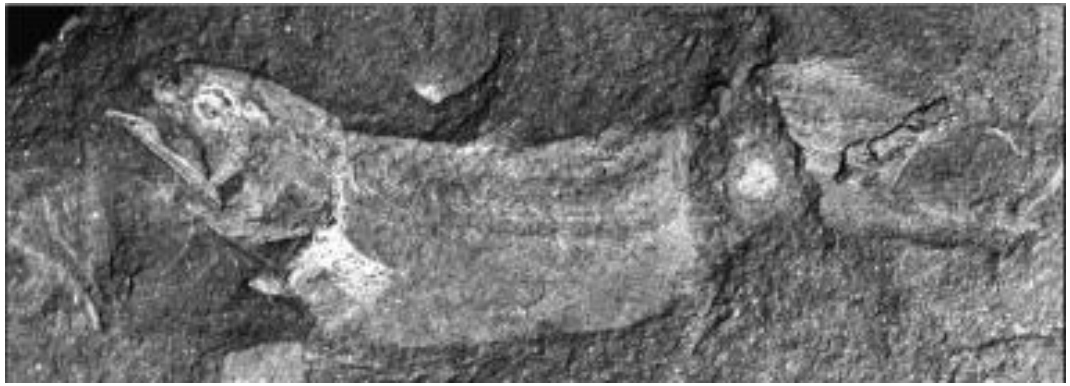
http://www.eurekalert.org/pub_releases/2015-09/uotw-aek091815.php

Africa's earliest known coelacanth found in Eastern Cape

More than 30 complete specimens of the new fossil species, Serenichthys kowiensis, were collected from the famous Late Devonian aged Waterloo Farm locality

Various specimens of Africa's earliest coelacanth have been found in a 360 million year-old fossil estuary near Grahamstown, in South Africa's Eastern Cape.

More than 30 complete specimens of the new fossil species, Serenichthys kowiensis, were collected from the famous Late Devonian aged Waterloo Farm locality, by palaeontologist Dr Robert Gess and described by him in collaboration with Professor Michael Coates of the University of Chicago.



Serenichthys coelacanth holotype is shown. **Wits University**

Gess did the research whilst he was completing his PhD at the Evolutionary Studies Institute at the University of the Witwatersrand. An article describing the new species will be published in the in the prestigious Zoological Journal of the Linnean Society of London on Monday, 21 August.

"Remarkably, all of the delicate whole fish impressions represent juveniles. This suggests that Serenichthys was using a shallow, waterweed-filled embayment of the estuary as a nursery, as many fish do today," says Gess.

The fossils come from black shales originally disturbed by road works at Waterloo Farm. These shales are the petrified compacted remains of mud, which was deposited in the quiet reaches of an estuary not unlike some of those along the Eastern Cape coast today.

"This earliest known record of a coelacanth nursery foreshadows a much younger counterpart, known from the 300 million year old Mazon Creek beds of Illinois in the United States," says Gess.

"This glimpse into the early life history of ancient coelacanths raises further questions about the life history of the modern coelacanth, Latimeria, which is

known to bear live young, but whether they, too, are clustered in nurseries remains unknown," explains Coates.

360 million years ago, Africa was part of the southern supercontinent Gondwana, made up of Africa, India, Australia, Antarctica and South America. At that time, the rocks of Waterloo Farm were forming along the shores of the semi-enclosed Agulhas Sea, not far from the South Pole.

Gess originally identified coelacanth remains from the locality whilst carrying out excavations at Waterloo Farm in the mid-1990s under the supervision of Dr Norton Hiller, of the Rhodes University Geology Department.

These fossils were not, however, well enough preserved to be reconstructed and described. His painstaking excavation of tons of shale salvaged during subsequent roadworks has now shed light on dozens more specimens, a few of which are preserved in exquisite detail.

These were prepared under a microscope and have allowed the species to be reconstructed in minute detail. They prove to be a new genus and species.

Coelacanths are believed to have arisen during the Devonian Period (about 419.2 ± 3.2 million years ago), however only five species of reconstructable Devonian coelacanths have previously been described, in addition to a number of very fragmentary remains.

None of these came from Africa, but rather from North America, Europe, China and Australia. The new species gives important additional information on the early evolution of coelacanths.

"According to our evolutionary analysis (conducted by Gess and Coates), it is the Devonian species that most closely resembles the line leading to modern coelacanths," says Gess.

The new species was discovered a mere 100km from the mouth of the Chalumna River, off which the type specimen of Latimeria chalumnae (the first discovered modern coelacanth) was caught in 1938.

Furthermore, the Geology Department at Rhodes, where Gess was based when he found his first fossil coelacanth, is on the site of the former Chemistry Department where Latimeria was first described. In keeping with the naming of its living relative (after an Eastern Cape river), the species name of the new fossil form, kowiensis, is after the Kowie River which rises among the hills where it was found, and the genus name, Serenichthys, honours Serena Gess, who provided land for the storage of more than 70 tons of black shale rescued from roadworks for ongoing research - in which all the new material was found.

All specimens have been deposited in the palaeontological collection of the Albany Natural History Museum, in Grahamstown, Eastern Cape Province, South Africa.