http://www.eurekalert.org/pub_releases/2015-02/tjnj-sua021915.php

Sauna use associated with reduced risk of cardiac, all-cause mortality

A sauna may do more than just make you sweat.

A new study suggests men who engaged in frequent sauna use had reduced risks of fatal cardiovascular events and all-cause mortality, according to an article published online by JAMA Internal Medicine.

Although some studies have found sauna bathing to be associated with better cardiovascular and circulatory function, the association between regular sauna bathing and risk of sudden cardiac death (SCD) and fatal cardiovascular diseases (CVD) is not known.

Jari A. Laukkanen, M.D., Ph.D., of the University of Eastern Finland, Kuopio, and coauthors investigated the association between sauna bathing and the risk of SCD, fatal coronary heart disease (CHD), fatal CVD and all-cause mortality in a group of 2,315 middle-aged men (42 to 60 years old) from eastern Finland.

Results show that during a median (midpoint) follow-up of nearly 21 years, there were 190 SCDs, 281 fatal CHDs, 407 fatal CVDs and 929 deaths from all causes.

Compared with men who reported one sauna bathing session per week, the risk of SCD was 22 percent lower for 2 to 3 sauna bathing sessions per week and 63 percent lower for 4 to 7 sauna sessions per week. The risk of fatal CHD events was 23 percent lower for 2 to 3 bathing sessions per week and 48 percent lower for 4 to 7 sauna sessions per week compared to once a week. CVD death also was 27 percent lower for men who took saunas 2 to 3 times a week and 50 percent lower for men who were in the sauna 4 to 7 times a week compared with men who indulged just once per week. For all-cause mortality, sauna bathing 2 to 3 times per week was associated with a 24 percent lower risk and 4 to 7 times per week with a 40 percent reduction in risk compared to only one sauna session per week.

The amount of time spent in the sauna seemed to matter too. Compared with men who spent less than 11 minutes in the sauna, the risk of SCD was 7 percent lower for sauna sessions of 11 to 19 minutes and 52 percent less for sessions lasting more than 19 minutes. Similar associations were seen for fatal CHDs and fatal CVDs but not for all-cause mortality events.

"Further studies are warranted to establish the potential mechanism that links sauna bathing and cardiovascular health," the study concludes.

Editor's Note: Health Benefits of Sauna Bathing

In a related Editor's Note, Rita F. Redberg, M.D., of the University of California, San Francisco, and editor-in-chief of JAMA Internal Medicine, writes: "Although we do not know why the men who took saunas more frequently had greater longevity (whether it is the time spent in the hot room, the relaxation time, the leisure of a life that allows for more relaxation time or the camaraderie of the sauna), clearly time spent in the sauna is time well spent."

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http://www.eurekalert.org/pub_releases/2015-02/nioa-sfp022015.php

Study finds peanut consumption in infancy prevents peanut allergy

NIH-funded trial compares consumption and avoidance of peanut

Introduction of peanut products into the diets of infants at high risk of developing peanut allergy was safe and led to an 81 percent reduction in the subsequent development of the allergy, a clinical trial has found. The study was supported by the National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health, and was conducted by the NIAID-funded Immune Tolerance Network (ITN). The results appear in the current online issue of the New England Journal of Medicine and were presented today at the annual meeting of the American Academy of Allergy, Asthma and Immunology.

Researchers led by Gideon Lack, M.D., of King's College London, designed a study called Learning Early About Peanut Allergy (LEAP), based on observations that Israeli children have lower rates of peanut allergy compared to Jewish children of similar ancestry residing in the United Kingdom. Unlike children in the UK, Israeli children begin consuming peanut-containing foods early in life. The study tested the hypothesis that the very low rates of peanut allergy in Israeli children were a result of high levels of peanut consumption beginning in infancy.

"Food allergies are a growing concern, not just in the United States but around the world," said NIAID Director Anthony S. Fauci, M.D. "For a study to show a benefit of this magnitude in the prevention of peanut allergy is without precedent. The results have the potential to transform how we approach food allergy prevention."

LEAP compared two strategies to prevent peanut allergy - consumption or avoidance of dietary peanut - in infants who were at high risk of developing peanut allergy because they already had egg allergy and/or severe eczema, an inflammatory skin disorder.

"The study also excluded infants showing early strong signs of having already developed peanut allergy. The safety and effectiveness of early peanut consumption in this group remains unknown and requires further study," said Dr. Lack. "Parents of infants and young children with eczema or egg allergy should consult with an allergist, pediatrician, or their general practitioner prior to feeding them peanut products."

More than 600 high-risk infants between 4 and 11 months of age were assigned randomly either to avoid peanut entirely or to regularly include at least 6 grams of peanut protein per week in their diets. The avoidance and consumption regimens were continued until 5 years of age. Participants were monitored throughout this period with recurring visits with health care professionals, in addition to completing dietary surveys by telephone.

The researchers assessed peanut allergy at 5 years of age with a supervised, oral food challenge with peanut. They found an overall 81 percent reduction of peanut allergy in children who began early, continuous consumption of peanut compared to those who avoided peanut.

"Prior to 2008, clinical practice guidelines recommended avoidance of potentially allergenic foods in the diets of young children at heightened risk for development of food allergies," said Daniel Rotrosen, M.D., director of NIAID's Division of Allergy, Immunology and Transplantation. "While recent studies showed no benefit from allergen avoidance, the LEAP study is the first to show that early introduction of dietary peanut is actually beneficial and identifies an effective approach to manage a serious public health problem."

A follow-up study called LEAP-On will ask all LEAP study participants to avoid peanut consumption for one year. These results will determine whether continuous peanut consumption is required to maintain a child's tolerance to peanut.

This work was funded in part by NIAID under award numbers NO1-AI-15416, UM1AI109565 and HHSN272200800029C. Other organizations providing support include Food Allergy and Research Education, the Asthma UK Centre, and the UK Department of Health. The study results can be found on Trialshare, an open-access website that hosts studies conducted by the ITN. Additional details are available at ClinicalTrials.gov using the identifier NCT00329784 for LEAP and NCT01366846 for LEAP-On.

http://www.eurekalert.org/pub_releases/2015-02/byu-wtg022315.php

Want to get drivers' attention? Use road signs showing more action

New research has significant implications for auto-pedestrian safety

When a car travelling relatively fast needs to come to an immediate stop, milliseconds matter. Sometimes only a few feet is the difference between life and death.

Researchers from the University of Michigan and BYU have discovered a way to provide a little extra cushion when it comes to near-accidents. Their new study, published in the Journal of Consumer Research, finds that people react significantly faster to warning signs that depict greater movement.

"A sign that evokes more perceived movement increases the observer's perception of risk, which in turn brings about earlier attention and earlier stopping," said study co-author Ryan Elder a professor in BYU's Marriott School of Management. "If you want to grab attention, you need signs that are more dynamic."

Three crosswalk signs from different countries depict an increasing level of movement or dynamism. **Ryan Elder**

Dynamic signs include images appearing to move at a higher speed. For example (see the related image), the crosswalk sign from the U.S. has low dynamism. The sign in the middle, from Poland, has more, and the one on the right is highly dynamic - the figures appear to be sprinting.

"If the figures look like they're walking, then your brain doesn't worry about them shooting out into the road," Elder said. "But if they're running, then you can imagine them being in front of your car in a hurry."

Elder and lead authors Luca Cian and Aradhna Krishna of the University of Michigan pursued the research to explore how static imagery that implies motion can impact behavior. Using driving simulations, click-data heat maps, surveys, reaction time exercises and eye-tracking, the trio found that signs conveying a higher perception of movement lead to quicker action from observers.

In one study experiment, researchers found that participants in a driving simulation reacted an average of 50 milliseconds faster to warning signs with higher dynamism. For a car going 60 mph, that 50 milliseconds translates into an extra 4.4 feet of distance - which can make a difference in close shaves.

In a second experiment, the team used eye-tracking technology to measure how long it takes a person's eyes to notice a traffic sign. The eye-tracker results showed that signs with higher perceived movement attracted (and maintained) significantly earlier attention than static signs.

"Things that look like they're going to move get moved in our minds," Elder said. "Our minds want to continue the motion that is contained within an image - and that has important consequences."

Elder and his fellow researchers hope the study can ultimately influence policy leading to changes that help reduce accident-related injuries and deaths.

More than 37,000 people are killed every year in the U.S. due to car accidents, with another 2.35 million injured or disabled. The researchers believe increasing the number of dynamic warning signs will help increase the effectiveness of those signs and ultimately lead to fewer deaths.

http://www.eurekalert.org/pub_releases/2015-02/cumc-bmd022315.php

Brain makes decisions with same method used to break WW2 Enigma code

Neurons in the brain making simple decisions apply the same statistical trick used by Alan Turing to help break Germany's Enigma code

When making simple decisions, neurons in the brain apply the same statistical trick used by Alan Turing to help break Germany's Enigma code during World War II, according to a new study in animals by researchers at Columbia University's Mortimer B. Zuckerman Mind Brain Behavior Institute and Department of Neuroscience. Results of the study were published Feb. 5 in Neuron.

As depicted in the film "The Imitation Game," Alan Turing and his team of codebreakers devised the statistical technique to help them decipher German military messages encrypted with the Enigma machine. (The technique today is called Wald's sequential probability ratio test, after Columbia professor Abraham Wald, who independently developed the test to determine if batches of munitions should be shipped to the front or if they contained too many duds.)

Finding pairs of messages encrypted with the same Enigma settings was critical to unlocking the code. Turing's statistical test, in essence, decided as efficiently as possible if any two messages were a pair.

The test evaluated corresponding pairs of letters from the two messages, aligned one above the other (in the film, codebreakers are often pictured doing this in the background, sliding messages around on grids). Although the letters themselves were gibberish, Turing realized that Enigma would preserve the matching probabilities of the original messages, as some letters are more common than others.

The codebreakers assigned values to aligned pairs of letters in the two messages. Unmatched pairs were given a negative value, matched pairs a positive value. Starting at different points in the messages, the codebreakers began adding and subtracting (see video above). When the sum reached a positive or negative threshold, the two messages were deemed a pair from machines with the same setting, or not.

Neurons in the brains of rhesus monkeys do the same thing when faced with decisions, says Michael Shadlen, MD, PhD, professor of neuroscience at Columbia and an HHMI investigator.

In his study, Dr. Shadlen and co-first authors Shinichiro Kira, a former member of Dr. Shadlen's lab and currently at Harvard Medical School, and Tianming Yang, of Shanghai Institutes for Biological Sciences, recorded the activity of neurons in the brains of two monkeys as they made a simple decision: look at a sequence of symbols on a computer screen, one after another, and whenever ready, choose between two spots for a reward.

To make the correct decision - the one that brought a reward - the monkeys had to weigh different clues encoded in the symbols that flashed onto the screen. Some of the eight symbols were unreliable clues about the reward's location; others were more dependable.

And the monkeys had to think fast. Each symbol appeared for only 250 milliseconds.

As the monkeys watched the symbols, recordings of their neurons revealed how they came to a decision. Each symbol contributed a positive value (reward is in the left spot) or negative value (reward is in the right spot) to the accumulated evidence, which was represented in the neuron's firing rate. More reliable symbols had a larger impact on the firing rate than less reliable symbols.

Just as in the Turing's code breaking, once a positive or negative threshold was reached, the decision was deemed complete and the monkey indicated its choice.

Assuming that humans have the same capabilities - and that's a good bet, says Dr. Shadlen - it means our brains are weighing probabilities and making rational decisions in very short periods of time. "It's the basis of a very basic kind of rationality," he says.

These types of decisions are mostly unconscious on our part. "They're decisions like, 'I'm going to pick up a book,' or 'I'm going to walk toward the left of the coffee table, not the right,'" Dr. Shadlen adds.

"We make lots of these decisions every day, and it turns out, we're making them by using the laws of probability in a way that statisticians think is optimal."

The paper is titled "A neural implementation of Wald's sequential probability ratio test." The work was supported by the National Institutes of Health (EY011378, RR000166, and P30EY01730) and the Howard Hughes Medical Institute. S.K. was supported by a predoctoral fellowship from the Nakajima Foundation.

http://www.bbc.com/news/health-31585292

WHO calls for action over Mers virus

Too little is being done to control the spread of Middle East Respiratory Syndrome, which has infected 50 people in Saudi Arabia so far this month, the World Health Organization has warned.

The rising number of cases in health-care facilities indicates current infection-control measures are not being implemented, it says. There have been at least 1,026 recorded infections and 376 deaths since 2012. Experts in the UK say the risk to the general population remains very low. Cases have been confirmed in the UK, Jordan, Qatar, the United Arab Emirates, France, Germany, Italy, Tunisia, Egypt, and the US - usually after travel to Saudi Arabia.

Camel milk

WHO assistant director general Dr Keiji Fukuda said: "When health workers are infected at work, this puts other health-care workers at risk but also can be a risk to all other patients who seek care for other health conditions. "Understanding where the breach in these measures is occurring and taking the steps needed to fully implement infection prevention and control measures can put an end to these nosocomial infections."

Dr Berhe Tekolathe, from the UN's Food and Agriculture Organization, said it was working to establish the root cause of the infection, which researchers believe crosses over to humans from animals - possibly camels. So far, person-to-person transmission has remained limited to clusters. The WHO warned people to avoid raw camel milk and urine and to ensure meat was properly cooked.

What is Mers?

A type of coronavirus, which causes respiratory infections
First death recorded in 2012 in Saudi Arabia
Camels are suspected to be the primary source of infection for humans
Symptoms include fever, cough, and shortness of breath
The best way to prevent it is to follow good hygiene advice - use a tissue for coughs and sneezes and wash your hands The mystery virus with no known cure

http://bit.ly/1AJt9l9

Beaver Teeth Have Iron Advantage

Beaver enamel is rich in iron - which is even more effective than fluoride at staving off cavities. Christopher Intagliata reports

Download MP3

Ah yes. The ol' fluoride rinse at the dentist. Not pleasant. But hey, good for your teeth, right? Well now materials scientists have been able to figure out why - by mapping the nanostructure of tooth enamel.

If you zoom way in, tooth enamel looks almost like the weave of a basket. "Where each thread is made from thousands of nanowires." Derk Joester, of Northwestern University. And in between those crystalline nanowires, Joester and his colleagues discovered a sort of amorphous glue. And that's where the fluoride hangs out, helping to stave off an acid attack of the enamel - in other words, a cavity.

But the researchers found something that works even better than fluoride: iron. And they found it in beaver teeth. "Beavers don't get caries. Chewing through wood is a very good way to clean your teeth." But another reason, they say, is the iron-enriched glue in beaver enamel - which was even more acid-resistant than fluoride-treated enamel. The findings are in the journal Science. [Lyle M. Gordon et al, Amorphous intergranular phases control the properties of rodent tooth enamel]

Of course iron-rich enamel comes with an unfortunate side effect: reddish-brown teeth. But Joester says future human dental treatments that employ iron might find a way around that. "We have the entire periodic table to play with minus a few things that are not too healthy. So I'm sure we can come up with a way to do what the beaver does but do it better and do it in a way that still maintains a nice smile."

http://www.medscape.com/viewarticle/840011

Measles: A One-Stop Shop of Resources for Pediatric PCPs

William T. Basco, Jr., MD, MS

Measles Outbreak - California, December 2014-February 2015

Zipprich J, Winter K, Hacker J, Xia D, Watt J, Harriman K

Theme Park Measles Outbreak

The California Department of Public Health received its first notification about a suspected measles case on January 5, 2015. The index case was an unvaccinated 11-year-old child. Also on January 5, the California Department of Public Health received reports about four additional suspected measles cases, along with two reports from Utah; all of the persons had visited a California theme park complex during the period of December 17 through December 20, 2015. By February 11, 2015, there were 125 confirmed cases of measles in the United States, and 110 of those children (88%) were from California.

Approximately one third of the children had visited one of the theme parks, 31% were secondary cases, and 34% had measles from an unknown exposure. Of the secondary cases, 76% were household or close contacts of known cases. Eight additional children were exposed in community settings. Cases related to theme park exposure were found in seven other states; in addition, there was one case in Mexico and 10 cases in Canada.

Among the 110 children from California, 45% were not vaccinated, but 12 were infants and too young to be vaccinated. This meant that 34% of the California

patients were unvaccinated but eligible for vaccine. An additional 5% had received only one dose of the vaccine. Two thirds of those eligible California children were unvaccinated owing to personal beliefs. Approximately 20% of the children for whom complete healthcare data could be verified were hospitalized.

Viewpoint

Only a pediatric provider who had been on some sort of extended leave without electronic communication would find this article to be "news," but it is still very interesting to read the actual figures and appreciate the extent of the epidemic. It's worth noting that the United States experienced more confirmed measles cases in in 2014 (> 600) than in 2011-2013 combined. In fact, the yearly frequency of measles cases was generally < 100 and has only been in the range of 200 cases for 3 years, from 2001 to 2013. Obviously, the large California outbreak occurring so early in the year has raised concerns that 2015 will be another very active year for measles in the United States.

However, I chose this article to review the resources that have been put forth by various organizations to help pediatric primary care providers navigate this epidemic in the office. One of the first resources is the update on measles recommendations from the American Academy of Pediatrics 2015 Red Book. It updates the required evidence that can serve to document immunity to measles. Two sections deal with options for postexposure prophylaxis. First, unvaccinated individuals should be given the measles vaccine within 72 hours of measles exposure, as postexposure prophylaxis to modify the disease course. Although infants aged 6-12 months may receive the vaccine as part of efforts to control outbreaks, they will still need to receive a dose at 12 months and another at 48 months or later. Individuals who cannot receive measles vaccine owing to immune issues can be given immune globulin within 6 days of exposure as postexposure prophylaxis.

There is a nice table (Table 3.38) in the Red Book update that lists measles vaccine recommendations for various scenarios, including unimmunized children, partially immunized children, and those with egg allergy, among others. It might be a good table to post on the wall in your office.

The Centers for Disease Control and Prevention (CDC) has an excellent Frequently Asked Questions page on measles and measles vaccination. There are photos of patients with measles and other very helpful clinical information at another CDC page on measles for providers. Finally, a patient information page was published by the *JAMA* network of journals.

I don't think we have heard the end of the public discussion about measles and measles vaccination the United States. In fact, I have quite honestly been surprised at the backlash directed at parents who choose not to vaccinate and practices that support delayed vaccinations. Although it is overdue that vaccine proponents are as vocal in the public discourse as are vaccine objectors, it is unfortunate that it required children contracting measles to get us to this point.

Abstract

http://www.eurekalert.org/pub_releases/2015-02/lu-pue022415.php

Previously unknown effect of vitamin A identified

First study of the effects of retinoic acid in relation to how blood cells develop from human stem cells

The signal molecule, retinoic acid, is a product of vitamin A which helps to instruct how different types of tissue are to be formed in the growing embryo. For the first time, Professor Niels-Bjarne Woods' laboratory, Lund Stem Cell Center in Sweden, has studied the effects of retinoic acid in relation to how blood cells develop from human stem cells. In the laboratory model, the stem cells are exposed to specific signal molecules, thereby developing into blood-producing cells.

The researchers observed that increased levels of retinoic acid drastically reduced the number of blood cells that could be produced. A reduction in the retinoic acid instead increased the production of blood cells by 300 per cent. On the basis of these results, Niels-Bjarne Woods and his colleagues propose a new explanatory model of how retinoic acid affects the embryonic development of blood.

Even if vitamin A is required for a normal pregnancy, it has long been known that too much vitamin A can be damaging to the foetus, with the risk of foetal malformation and miscarriage. Pregnant women have therefore been recommended to limit their consumption of foods that are high in vitamin A in the form of retinoids, such as liver.

"Our results show that vitamin A in high doses has a negative effect on blood development. This suggests that there is an additional reason for pregnant women to avoid excessive intake of vitamin A during pregnancy," says Niels-Bjarne Woods. While the concept that retinoic acid affects blood cell development has been demonstrated in animal models, this is the first time the experiments have been done using human cells.

Niels-Bjarne Woods' research is about finding ways of artificially generating blood stem cells for use in blood stem cell transplants to patients with blood disorders and cancers, who do not have access to a suitable donor.

"The current research findings increase our understanding of the complexity of the process of blood formation during embryonic development. We hope that this, together with new future discoveries, will lead to the generation of blood stem cells in the laboratory, which in turn can be used to treat blood disorders and malignancies," says Niels-Bjarne Woods.

http://www.eurekalert.org/pub_releases/2015-02/mc-dis022315.php

Decline in smoking rates may increase lung cancer mortality

many nonsmokers who could have benefited from early detection of lung cancer are dying because they don't qualify for low-dose CT scans

ROCHESTER, Minn. - A decline in smoking rates may mean that many people who could have benefited from early detection of lung cancer are dying because they don't qualify for low-dose CT scans, according to a group of Mayo Clinic researchers. Their research appears in the Feb. 24 issue of JAMA, the journal of the American Medical Association.

"As smokers quit earlier and stay off cigarettes longer, fewer are eligible for CT screening, which has been proven effective in saving lives," says Ping Yang, M.D., Ph.D., an epidemiologist at Mayo Clinic Cancer Center. "Patients who do eventually develop lung cancer are diagnosed at a later stage when treatment can no longer result in a cure."

Dr. Yang says researchers and policymakers need to re-examine screening criteria to identify a greater proportion of patients who develop lung cancer.

"The existing screening program will become less effective at reducing lung cancer mortality in the general population, if they continue to use the same criteria," Dr. Yang says.

The study retrospectively tracked residents of Olmsted County in Minnesota who were older than 20 years from 1984 through 2011 - about 140,000 people.

Lung cancer cases were identified using the Rochester Epidemiology Project database and confirmed by pathology definition of the World Health Organization.

Researchers determined the proportion of lung cancer patients who would have met CT scan screening criteria set by the U.S. Preventive Services Task Force. Those criteria, used by doctors and insurance companies, recommend CT screening for asymptomatic adults age 55 to 80 who have smoked at least 30 pack-years (one pack a day for 30 years), and are still smoking or have reduced consumption in the last 15 years.

A total of 1,351 people in the study developed primary lung cancer between 1984 and 2011.

Researchers found that the incidence of primary lung cancer fell overall during the study period - but only for men by about one-third. Among women, the incidence of lung cancer rose 8 percent.

According to Dr. Yang, the data with greatest relevance to CT screening is the proportion of lung cancer patients who smoked at least 30 pack-years which declined over the study period. And the proportion of cancer patients who had quit for more than 15 years increased.

"While more people have quit for a longer period of time, they are still getting lung cancer," Dr. Yang says, "and they make up a larger proportion of newly diagnosed lung cancer patients."

As a result, the proportion of lung cancer patients who would have been eligible for screening fell steadily during the study period - from 57 percent in 1984-1990 to 43 percent in 2005-2011. The proportion of women who would have been eligible under the criteria decreased from 52 percent to 37 percent, and among men from 60 percent to 50 percent.

That trend has important consequences, says Dr. Yang.

First, many more patients will miss out on early detection, when treatment of lung cancer is most successful. "That means more patients are going to be diagnosed at a later stage, because they could not take advantage of early detection," she says. As a result, more patients will die.

Second, Dr. Yang hopes to see screening criteria adjusted to include smokers who have smoked less than 30 pack-years and those who quit more than 15 years ago. "We don't want to penalize people who succeeded in smoking cessation," she says. Dr. Yang says she is aware of many smokers who are cancer-free but continue to smoke in order to be eligible for CT screening.

Third, CT screening - the only screening technology proven to save lives among patients with lung cancer - will become less and less effective unless screening criteria are revised to include more patients who are likely to develop cancer.

Dr. Yang acknowledges there is a danger in relaxing CT-screening criteria too much, citing concerns about cost, radiation exposure and overtreatment due to false positives that increase patient pressure on physicians to remove tumors even if they do not appear dangerous.

"There are ways to screen at-risk patients while still avoiding false alarms and overtreatment," says Dr. Yang. "Researchers need to discover biological markers, such as genetic or physiological traits, to help them better identify high-risk patients."

She says screening criteria might also be adjusted to include some smokers who have smoked less than 30 pack-years or quit more than 15 years ago. Dr. Yang says she and her colleagues are preparing papers on these issues to develop proposals for more effective CT screening that will save more lives from lung cancer.

The study was supported by grants from the National Institutes of Health, a grant from the National Institute on Aging, and funding from the Mayo Clinic Foundation.

Co-authors include David Midthun, M.D., Jason Wampfler, B.S., of Mayo Clinic; and Yi Wang, M.D., of Medical University, Whenzhou, China.

http://www.eurekalert.org/pub_releases/2015-02/mu-itt022315.php

It's tough to shift that weight, McMaster studies show

People of all ages find it difficult to prevent weight gain; that it is terrifically difficult to get rid of it later and to keep it off once lost

Hamilton, ON - New studies by McMaster University researchers, published in CMAJ Open, have confirmed that people of all ages find it difficult to prevent weight gain; that it is terrifically difficult to get rid of it later and to keep it off once lost. However, even small weight losses can mean better health.

The McMaster Evidence Review and Synthesis Centre reviewed hundreds of recent studies about overweight and obesity published in the past decade. The last of its five related papers was published today.

"This is an important area to investigate, as we know that overweight and obesity are public health problems impacting a growing proportion of the Canadian population, and that this is related to many health problems," said Leslea Peirson, lead author and study co-ordinator.

The reports reviewed studies about the prevention and treatment of overweight and obesity among children; the prevention and treatment of overweight and obesity among adults and about keeping lost weight off. Regarding prevention of overweight/obesity among children and youth, a review of 90 studies found:

There were small improvements in weight outcomes. The programs that work best targeted school-aged children and youth, were delivered in educational settings, included both diet and exercise and lasted 12 weeks to a year.

Regarding treating overweight/obesity among children and youth, a review of 31 studies found:

Evidence showed that enrolment in a program that focuses on changes in diet, exercise and lifestyle can help reduce weight and, more importantly, enrolment in such a program also improves health and quality of life in children and adolescents. However, the permanence of this weight loss has not been well studied.

Regarding prevention of overweight/obesity among adults, a search of more than two decades of research literature found:

Almost no trials have been conducted to investigate programs that help normal-weight adults maintain their normal weight. A single small study conducted in the U.S. in the 1980s showed benefits from a 12-month education and incentive-based program.

Regarding treating overweight/obesity among adults, a review of 68 studies found:

Doing some activity is better than doing nothing. Adults who took part in some form of treatment had, on average, a three kilogram (or seven pound) greater weight loss than adults who did not. Weight loss results did not differ whether treatments involved diet, exercise, lifestyle changes or drugs (orlistat or metformin), but the drugs had side effects that the other strategies did not.

A clinically meaningful weight loss of five to 10 per cent of body weight, which was found in this review, can positively impact the health of adults who lose weight.

Regarding keeping that weight off once lost, a review of eight studies since 2011 found:

Doing something to keep that weight off, either through diet, exercise, lifestyle changes or even drugs, can help, at least in the short term. There just weren't any studies addressing the long-term sustainability of weight maintenance strategies.

Use of drugs along with behavioural changes may help maintain a loss of five percent body weight, but this combined strategy did not make a difference in maintaining a loss of 10 per cent of body weight.

"We know that more research is needed that looks at programs designed to prevent weight gain in normal weight adults, youth and children," said Peirson. "Future research should look at the longevity of weight loss and study the health consequences of repeated cycling of weight loss and gain."

These systematic reviews provide the evidence behind the Canadian Task Force on Preventive Health Care's Adult Obesity Guidelines (released last month) and Child Obesity Guidelines, which are scheduled to be released in CMAJ at the end of March.

The studies were funded by the Public Health Agency of Canada and the Canadian Institutes for Health Research.

Prevention of overweight and obesity in children and youth: a systematic review and meta-analysis is at http://www.cmajopen.ca/content/3/1/E23.full

Prevention of overweight and obesity in adult populations: a systematic review is at http://www.cmajopen.ca/content/2/4/E268.full

Treatment for overweight and obesity in adult populations: a systematic review and meta-analysis is at http://www.cmajopen.ca/content/2/4/E306.full.pdf+html

Strategies for weight maintenance in adult populations treated for overweight and obesity: a systematic review and meta-analysis is at http://www.cmajopen.ca/content/3/1/E47.full

The fifth paper, Treatment of overweight and obesity in children and youth: a systematic review and meta-analysis is embargoed until it is published Feb. 24 at noon. During the embargo it may be found at: http://www.cmajopen.ca/site/press/cmajo.20140047.pdf

Post embargo, the paper may be found at: http://www.cmajopen.ca/content/3/1/E35.full

http://www.bbc.com/news/health-31594856

UK approves three-person babies

The UK has now become the first country to approve laws to allow the creation of babies from three people.

By James Gallagher Health editor, BBC News website

The modified version of IVF has passed its final legislative obstacle after being approved by the House of Lords.

The fertility regulator will now decide how to license the procedure to prevent babies inheriting deadly genetic diseases.

The first baby could be born as early as 2016. A large majority of MPs in the House of Commons approved "three-person babies" earlier this month.
The House of Lords tonight rejected an attempt to block the plan by a majority of 232.

Power packs

Mitochondria are the tiny compartments inside nearly every cell of the body that convert food into useable energy.
But genetic defects in the mitochondria mean the body has insufficient energy to keep the heart beating or the brain functioning.
The structures are passed down only from the mother and have their own DNA, although it does not alter traits including appearance or personality.
The technique, developed in Newcastle, uses a modified version of IVF to combine the healthy mitochondria of a donor woman with DNA of the two parents.
It results in babies with 0.1% of their DNA from the second woman and is a permanent change that would echo down through the generations.

Timeline

March to August - The UK fertility regulator will develop and then publish their licensing rules for assessing applications to perform three-person IVF

Early Summer - The team in Newcastle publish the final safety experiments demanded by the regulator

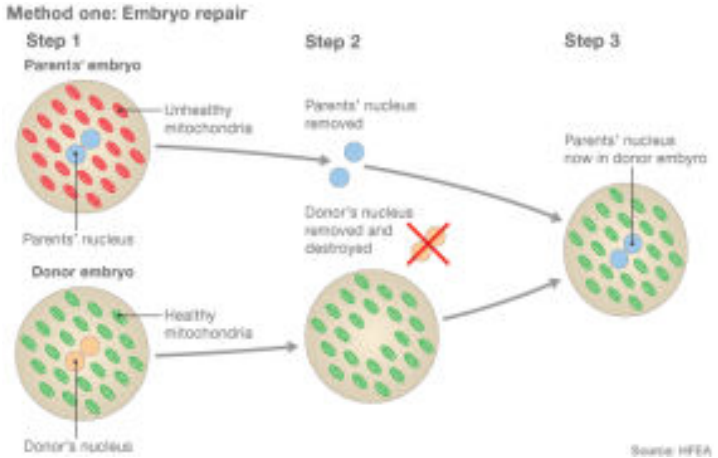
29 October - Regulations come into force

24 November - Clinics can apply to the regulator for a licence

By the end of 2015 - the first attempt could take place

'Hope'

In the debate, health minister Lord Howe said there was an opportunity to offer "real hope" to families. He stated the UK was leading the world and that three safety reviews by experts suggested it would be safe.
Lord Howe told the House: "Families can see that the technology is there to help them and are keen to take it up, they have noted the conclusions of the expert panel."It would be cruel and perverse in my opinion, to deny them that opportunity for any longer than absolutely necessary."
Lord Deben, the former government minister John Gummer, countered that there were "real doubts about safety". He also voiced concerns about whether the creation of such babies would be legal. "It is quite clear that there is considerable disagreement, let me put it simply like that, about whether this action is legal under European law."
Baroness Scotland of Asthal, a former Labour attorney general, also questioned the legality asking: "Why the haste? "Everyone agrees we have to get this right. If we're going to do something which everyone agrees is novel, different and important internationally we really have to be confident that we are on solid ground. If we are not we give a disservice."
Fertility doctor, Lord Winston, told the House there were comparison with the early days of IVF which was "also a set in the dark".



1) Two eggs are fertilised with sperm, creating an embryo from the intended parents and another from the donors 2) The pronuclei, which contain genetic information, are removed from both embryos but only the parents' are kept 3) A healthy embryo is created by adding the parents' pronuclei to the donor embryo, which is finally implanted into the womb

He added: "I don't believe my Lords, in spite of what we've heard this evening, that this technology threatens the fabric of society in the slightest bit."
Sally Cheshire, the chairwoman of the Human Fertilisation and Embryology Authority, said: "Britain is the first country in the world to permit this treatment, and it is a testament to the scientific expertise and well-respected regulatory regime that exists across the UK that Parliament has felt able to approve it.
"The HFEA now have to develop a robust licensing process, which takes into account on a case by case basis the technical and ethical complexities of such treatments to ensure that any children born have the best chance of a healthy life.
"The HFEA has a long tradition of dealing with medical and scientific breakthroughs, ensuring that IVF techniques, pioneered in the UK and now practised across the world, can be used safely and effectively in fertility treatment."
Prof Alison Murdoch, who was instrumental in developing the technique at Newcastle University, said: "For 10 years we have publically discussed mitochondrial donation to explain how it could help patients whose families are blighted by the consequences of mitochondrial abnormalities.
"Whilst acknowledging the views of those who have a fundamental objection to our work, Parliament has determined that we should continue. We hope that

opponents will accept its democratic decision. "The science will be reviewed and, if accepted, we hope to be able to submit a treatment application to the HFEA when regulatory policies have been determined."

Objections 'hopeless'

James Lawford Davies, a lawyer from Lawford Davies Denoon which specialises in the life sciences, told the BBC: "All of the legal arguments made in opposition to the regulations are hopeless. "The regulations do not breach the Clinical Trials Directive which applies only to medicinal products.

"The regulations do not breach the EU Charter of Fundamental Rights and Freedoms which prohibit 'eugenic practices' as this is intended to prevent practices such as forced sterilisation and reproductive cloning, not treatments intended to prevent the transmission of disease."

The Catholic and Anglican Churches in England said the idea was not safe or ethical, not least because it involved the destruction of embryos.

Other groups, including Human Genetics Alert, say the move would open the door to further genetic modification of children in the future - so-called designer babies, genetically modified for beauty, intelligence or to be free of disease.

Estimates suggest 150 couples would be suitable to have babies through the technique each year.

If the measure goes ahead, the first "three-person" baby could be born next year.

http://www.bbc.com/news/health-31585299

Skin may helps spot Alzheimer's and Parkinson's disease

Scientists have proposed a new idea for detecting brain conditions including Alzheimer's - a skin test.

By Michelle Roberts Health editor, BBC News online

Their work, which is at an early stage, found the same abnormal proteins that accumulate in the brain in such disorders can also be found in skin. Early diagnosis is key to preventing the loss of brain tissue in dementia, which can go undetected for years.

But experts said even more advanced tests, including ones of spinal fluid, were still not ready for clinic. If they were, then doctors could treatment at the earliest stages, before irreversible brain damage or mental decline has taken place.

Brain biomarker

Investigators have been hunting for suitable biomarkers in the body - molecules in blood or exhaled breath, for example, that can be measured to accurately and reliably signal if a disease or disorder is present.

Dr Ildefonso Rodriguez-Leyva and colleagues from the University of San Luis Potosi, Mexico, believe skin is a good candidate for uncovering hidden brain disorders.

Skin has the same origin as brain tissue in the developing embryo and might, therefore, be a good window to what's going on in the mind in later life - at least at a molecular level - they reasoned.

Post-mortem studies of people with Parkinson's also reveal that the same protein deposits which occur in the brain with this condition also accumulate in the skin.

To test if the same was true in life as after death, the researchers recruited 65 volunteers - 12 who were healthy controls and the remaining 53 who had either Parkinson's disease, Alzheimer's or another type of dementia.

They took a small skin biopsy from behind the ear of each volunteer to test in their laboratory for any telltale signs of disease. Specifically, they looked for the presence of two proteins - tau and alpha-synuclein.

The 20 people with Alzheimer's and the 16 with Parkinson's had raised levels of both these proteins in their skin compared to the healthy controls and the patients with other types of dementia.

The people with Parkinson's also had higher levels of alpha-synuclein protein.

Dr Rodriguez-Leyva, who will soon present his findings to the annual meeting of the American Academy of Neurology, said: "More research is needed to confirm these results, but the findings are exciting because we could potentially begin to use skin biopsies from living patients to study and learn more about these diseases.

"This new test offers a potential biomarker that may allow doctors to identify and diagnose these diseases earlier on." It could also guide research into new treatments, he said.

Dr Arthur Roach, Parkinson's UK Director of Research and Development, said: "This work points to a possible diagnostic test that would be minimally invasive and could provide earlier, more accurate diagnosis. "There is still a need for more innovation in this area - at the moment there's no way to definitively diagnose Parkinson's."

Dr Simon Ridley of Alzheimer's Research UK said it was too early to say if a skin test would become available.

He said research into biomarkers in cerebrospinal fluid - the fluid that surrounds the brain and spinal cord - was at a more advanced stage, but that even these methods were not yet close to becoming a routine test.

Progressive brain diseases

In Parkinson's disease, nerve cells are gradually lost which leads to symptoms including tremor, stiff muscles and slow movement

Patients with Parkinson's may also experience dementia

Alzheimer's disease is a type of dementia where progressive brain cell loss leads to memory problems and a loss of mental ability

http://www.eurekalert.org/pub_releases/2015-02/mbae-aea022015.php

An evolutionary approach reveals new clues toward understanding the roots of schizophrenia

Is mental illness simply the evolutionary toll humans have to pay in return for our unique and superior cognitive abilities when compared to all other species?

But if so, why have often debilitating illnesses like schizophrenia persisted throughout human evolutionary history when the affects can be quite negative on an individual's chances of survival or reproductive success?

In a new study appearing in Molecular Biology and Evolution, Mount Sinai researcher Joel Dudley has led a new study that suggests that the very changes specific to human evolution may have come at a cost, contributing to the genetic architecture underlying schizophrenia traits in modern humans.

"We were intrigued by the fact that unlike many other mental traits, schizophrenia traits have not been observed in species other than humans, and schizophrenia has interesting and complex relationships with human intelligence," said Dr. Joel Dudley, who led the study along with Dr. Panos Roussos.

"The rapid increase in genomic data sequenced from large schizophrenia patient cohorts enabled us to investigate the molecular evolutionary history of schizophrenia in sophisticated new ways."

The team examined a link between these regions, and human-specific evolution, in genomic segments called human accelerated regions, or HARs. HARs are short signposts in the genome that are conserved among non-human species but experienced faster mutation rates in humans. Thus, these regions, which are thought to control the level of gene expression, but not mutate the gene itself, may be an underexplored area of mental illness research.

The team's research is the first study to sift through the human genome and identify a shared pattern between the location of HARs and recently identified schizophrenia gene loci.

To perform their work, they utilized a recently completed, largest schizophrenia study of its kind, the Psychiatric Genomics Consortium (PGC), which included 36,989 schizophrenia cases and 113,075 controls. It is the largest genome-wide association study ever performed on any psychiatric disease.

They found that the schizophrenic loci were most strongly associated in genomic regions near the HARs that are conserved in non-human primates, and these HAR-associated schizophrenic loci are found to be under stronger evolutionary selective pressure when compared with other schizophrenic loci.

Furthermore, these regions controlled genes that were expressed only in the prefrontal cortex of the brain, indicating that HARs may play an important role in regulating genes found to be linked to schizophrenia.

They specifically found the greatest correlation between HAR-associated schizophrenic loci and genes controlling the expression of the neurotransmitter GABA, brain development, synaptic formations, adhesion and signaling molecules.

Their new evolutionary approach provides new insights into schizophrenia, and genomic targets to prioritize future studies and drug development targets. In addition, there are important new avenues to explore the roles of HARs in other mental diseases such as autism or bipolar disorder.

http://www.eurekalert.org/pub_releases/2015-02/uoa-wou022515.php

Warning on use of drug for children's sleep

Sleep researchers at the University of Adelaide are warning doctors and parents not to provide the drug melatonin to children to help control their sleep problems.

Melatonin is a hormone produced in the body with the onset of darkness. It plays an important role in fine tuning people's circadian rhythms, such as the timing of sleep onset, as well as other biological processes.

In a paper published in the Journal of Paediatrics and Child Health, Professor David Kennaway, Head of the Circadian Physiology Laboratory at the University of Adelaide's Robinson Research Institute, warns that providing melatonin supplements to children may result in serious side effects when the children are older.

"The use of melatonin as a drug for the treatment of sleep disorders for children is increasing and this is rather alarming," Professor Kennaway says.

Professor Kennaway says the United States is the only country where melatonin is completely unregulated. "It's considered to be a 'dietary supplement', not a regulated drug, and is therefore readily available," he says.

"In Australia, melatonin is registered as a treatment for primary insomnia only for people aged 55 years and over, but it's easily prescribed as an 'off label' treatment for sleep disorders for children."

Professor Kennaway says there is extensive evidence from laboratory studies that melatonin causes changes in multiple physiological systems, including cardiovascular, immune and metabolic systems, as well as reproduction in animals.

"Melatonin is also a registered veterinary drug which is used for changing the seasonal patterns of sheep and goats, so they are more productive for industry. If doctors told parents that information before prescribing the drug to their children,

I'm sure most would think twice about giving it to their child," Professor Kennaway says.

"The word 'safe' is used very freely and loosely with this drug, but there have been no rigorous, long-term safety studies of the use of melatonin to treat sleep disorders in children and adolescents. "There is also the potential for melatonin to interact with other drugs commonly prescribed for children, but it's difficult to know without clinical trials assessing its safety."

Professor Kennaway, who has been researching melatonin for the past 40 years, says these concerns have largely been ignored throughout the world.

"Considering the small advances melatonin provides to the timing of sleep, and considering what we know about how melatonin works in the body, it is not worth the risk to child and adolescent safety," he says.

http://www.eurekalert.org/pub_releases/2015-02/ci-fas022315.php

Found: Ancient, super-bright quasar with massive black hole

Brightest quasar ever found in the early universe is powered by the most massive black hole observed for an object from that time

Washington, D.C. - Quasars - supermassive black holes found at the center of distant massive galaxies - are the most-luminous beacons in the sky. These central supermassive black holes actively accrete the surrounding materials and release a huge amount of their gravitational energy.

An international team of astronomers, including Carnegie's Yuri Beletsky, has discovered the brightest quasar ever found in the early universe, which is powered by the most massive black hole observed for an object from that time. Their work is published February 26 by Nature.

The quasar was found at a redshift of z=6.30. This is a measurement of how much the wavelength of light emitted from it that reaches us on Earth is stretched by the expansion of the universe.

As such, it can be used to calculate the quasar's age and distance from our planet. A higher redshift means larger distance and hence looking further back in time. At a distance of 12.8 billion light years from Earth, this quasar was formed only 900 million years after the Big Bang.

Named SDSS J0100+2802, studying this quasar will help scientists understand how quasars evolved in the earliest days of the universe. There are only 40 known quasars have a redshift of higher than 6, a point that marks the beginning of the early universe.

"This quasar is very unique. Just like the brightest lighthouse in the distant universe, its glowing light will help us to probe more about the early universe," said team-leader Xue-Bing Wu of Peking University and the Kavli Institute of Astronomy and Astrophysics.

With a luminosity of 420 trillion that of our own Sun's, this new quasar is seven times brighter than the most distant quasar known (which is 13 billion years away).

It harbors a black hole with mass of 12 billion solar masses, proving it to be the most luminous quasar with the most massive black hole among all the known high redshift quasars.

The team developed a method of detecting quasars at redshifts of 5 and higher. These detections were verified by the 6.5-meter Multiple Mirror Telescope (MMT) and 8.4m Large Binocular Telescope (LBT) in Arizona; the 6.5m Magellan Telescope at Carnegie's Las Campanas Observatory in Chile; and the 8.2m Gemini North Telescope in Hawaii.

"This quasar is a unique laboratory to study the way that a quasar's black hole and host galaxy co-evolve," Beletsky said. "Our findings indicate that in the early Universe, quasar black holes probably grew faster than their host galaxies, although more research is needed to confirm this idea."

Other co-authors on the paper are: FeigeWang, Jinyi Yang, and Qian Yang, also of Peking University and the Kavli Institute; Xiaohui Fan of University of Arizona and the Kavli Institute; Weimin Yi of the Chinese Academy of Sciences; Wenwen Zuo of Peking University and the Chinese Academy of Sciences; Fuyan Bian of Australian National University; Linhua Jiang and RanWang of the Kavli Institute; and Ian D. McGreer and David Thompson of University of Arizona.

This work was funded by the NSFC, the Strategic Priority Research Program "The Emergence of Cosmological Structures" of the Chinese Academy of Sciences, the National Key Basic Research Program of China, and the U.S. NSF.

http://www.eurekalert.org/pub_releases/2015-02/gsu-wuf022315.php

Widely used food additive promotes colitis, obesity and metabolic syndrome, research shows

Emulsifiers can alter the gut microbiota composition to induce intestinal inflammation, promoting the development of IBD

ATLANTA - Emulsifiers, which are added to most processed foods to aid texture and extend shelf life, can alter the gut microbiota composition and localization to induce intestinal inflammation that promotes the development of inflammatory bowel disease and metabolic syndrome, new research shows.

The research, published Feb. 25 in Nature, was led by Georgia State University Institute for Biomedical Sciences' researchers Drs. Benoit Chassaing and Andrew T. Gewirtz, and included contributions from Emory University, Cornell University and Bar-Ilan University in Israel.

Inflammatory bowel disease (IBD), which includes Crohn's disease and ulcerative colitis, afflicts millions of people and is often severe and debilitating. Metabolic

syndrome is a group of very common obesity-related disorders that can lead to type-2 diabetes, cardiovascular and/or liver diseases.

Incidence of IBD and metabolic syndrome has been markedly increasing since the mid-20th century.

The term "gut microbiota" refers to the diverse population of 100 trillion bacteria that inhabit the intestinal tract. Gut microbiota are disturbed in IBD and metabolic syndrome. Chassaing and Gewirtz's findings suggest emulsifiers might be partially responsible for this disturbance and the increased incidence of these diseases.

"A key feature of these modern plagues is alteration of the gut microbiota in a manner that promotes inflammation," says Gewirtz.

"The dramatic increase in these diseases has occurred despite consistent human genetics, suggesting a pivotal role for an environmental factor," says Chassaing. "Food interacts intimately with the microbiota so we considered what modern additions to the food supply might possibly make gut bacteria more pro-inflammatory."

Addition of emulsifiers to food seemed to fit the time frame and had been shown to promote bacterial translocation across epithelial cells. Chassaing and Gewirtz hypothesized that emulsifiers might affect the gut microbiota to promote these inflammatory diseases and designed experiments in mice to test this possibility.

The team fed mice two very commonly used emulsifiers, polysorbate 80 and carboxymethylcellulsose, at doses seeking to model the broad consumption of the numerous emulsifiers that are incorporated into almost all processed foods.

They observed that emulsifier consumption changed the species composition of the gut microbiota and did so in a manner that made it more pro-inflammatory.

The altered microbiota had enhanced capacity to digest and infiltrate the dense mucus layer that lines the intestine, which is normally, largely devoid of bacteria.

Alterations in bacterial species resulted in bacteria expressing more flagellin and lipopolysaccharide, which can activate pro-inflammatory gene expression by the immune system.

Such changes in bacteria triggered chronic colitis in mice genetically prone to this disorder, due to abnormal immune systems.

In contrast, in mice with normal immune systems, emulsifiers induced low-grade or mild intestinal inflammation and metabolic syndrome, characterized by increased levels of food consumption, obesity, hyperglycemia and insulin resistance. The effects of emulsifier consumption were eliminated in germ-free mice, which lack a microbiota.

Transplant of microbiota from emulsifiers-treated mice to germ-free mice was sufficient to transfer some parameters of low-grade inflammation and metabolic syndrome, indicating a central role for the microbiota in mediating the adverse effect of emulsifiers. The team is now testing additional emulsifiers and designing experiments to investigate how emulsifiers affect humans. If similar results are obtained, it would indicate a role for this class of food additive in driving the epidemic of obesity, its inter-related consequences and a range of diseases associated with chronic gut inflammation.

While detailed mechanisms underlying the effect of emulsifiers on metabolism remain under study, the team points out that avoiding excess food consumption is of paramount importance.

"We do not disagree with the commonly held assumption that over-eating is a central cause of obesity and metabolic syndrome," Gewirtz says.

"Rather, our findings reinforce the concept suggested by earlier work that low-grade inflammation resulting from an altered microbiota can be an underlying cause of excess eating."

The team notes that the results of their study suggest that current means of testing and approving food additives may not be adequate to prevent use of chemicals that promote diseases driven by low-grade inflammation and/or which will cause disease primarily in susceptible hosts.

This study was funded by the National Institutes of Health and Crohn's & Colitis Foundation of America.

http://www.eurekalert.org/pub_releases/2015-02/uoc - upo022515.php

UCLA physicists offer a solution to the puzzle of the origin of matter in the universe

Possible solution to the mystery of the origin of matter in the universe

Most of the laws of nature treat particles and antiparticles equally, but stars and planets are made of particles, or matter, and not antiparticles, or antimatter. That asymmetry, which favors matter to a very small degree, has puzzled scientists for many years. New research by UCLA physicists, published in the journal Physical Review Letters, offers a possible solution to the mystery of the origin of matter in the universe.

Alexander Kusenko, a professor of physics and astronomy in the UCLA College, and colleagues propose that the matter-antimatter asymmetry could be related to the Higgs boson particle, which was the subject of prominent news coverage when it was discovered at Switzerland's Large Hadron Collider in 2012.

Specifically, the UCLA researchers write, the asymmetry may have been produced as a result of the motion of the Higgs field, which is associated with the Higgs boson, and which could have made the masses of particles and antiparticles in the universe temporarily unequal, allowing for a small excess of matter particles over antiparticles.

If a particle and an antiparticle meet, they disappear by emitting two photons or a pair of some other particles. In the "primordial soup" that existed after the Big Bang, there were almost equal amounts of particles of antiparticles, except for a tiny asymmetry: one particle per 10 billion. As the universe cooled, the particles and antiparticles annihilated each other in equal numbers, and only a tiny number of particles remained; this tiny amount is all the stars and planets, and gas in today's universe, said Kusenko, who is also a senior scientist with the Kavli Institute for the Physics and Mathematics of the Universe. The research also is highlighted by Physical Review Letters in a commentary in the current issue.

The 2012 discovery of the Higgs boson particle was hailed as one of the great scientific accomplishments of recent decades. The Higgs boson was first postulated some 50 years ago as a crucial element of the modern theory of the forces of nature, and is, physicists say, what gives everything in the universe mass. Physicists at the LHC measured the particle's mass and found its value to be peculiar; it is consistent with the possibility that the Higgs field in the first moments of the Big Bang was much larger than its "equilibrium value" observed today.

The Higgs field "had to descend to the equilibrium, in a process of 'Higgs relaxation,'" said Kusenko, the lead author of the UCLA research.

Two of Kusenko's graduate students, Louis Yang of UCLA and Lauren Pearce of the University of Minnesota, Minneapolis, were co-authors of the study. The research was supported by the U.S. Department of Energy (DE-SC0009937), the World Premier International Research Center Initiative in Japan and the National Science Foundation (PHYS-1066293).

http://www.eurekalert.org/pub_releases/2015-02/acs-tdt022515.php

Tagging drugs to fight counterfeit medicines

Clamping down on the sales of fake pharmaceuticals

The U.S. and other countries are enacting rules to clamp down on the sales of fake pharmaceuticals, which pose a public health threat. But figuring out a system to track and authenticate legitimate drugs still faces significant obstacles, according to an article in Chemical & Engineering News (C&EN), the weekly newsmagazine of the American Chemical Society.

Citing a report by the U.S. Center for Medicine in the Public Interest, C&EN Contributing Editor Leonora Walet notes that makers of counterfeit medicines raked in $75 billion in 2010. The global market for fighting these fakes has grown to $1 billion in response. Biotechnology companies continue to work on improved methods to stamp out pharmaceutical imposters and are turning to microtags. These are tiny specks made of various materials, including silicon dioxide or even DNA, that encode information specific to a product batch.

While tagging technologies could become a powerful tool in fighting counterfeit drugs, developers still have to overcome major challenges. They have to find a way to incorporate tags in pharmaceuticals without compromising safety or effectiveness. Doing so could cost millions more.

http://www.eurekalert.org/pub_releases/2015-02/acos-otp022515.php

One-minute test predicts how well a patient may recover after an operation

Surgical team discovers that a shortened test to assess frailty can help determine which surgical patients are most at risk for complications

CHICAGO - Frailty has been used to predict how well a patient may recover from a major operation. Because frailty assessments are not routinely utilized in busy surgical practices, surgeons at Emory University School of Medicine in Atlanta have discovered that a short, approximately one-minute assessment can accurately determine how likely a patient is to have complications after an operation.

Their study results are published online as an "article in press" in the Journal of the American College of Surgeons (JACS). The study will appear in a print edition of the journal later this year.

Contrary to what most consumers believe, frailty is not always connected to old age. "Many people would suspect that frailty only applies to someone in their 80s," said study author Viraj Master, MD, PHD, FACS, associate professor of urology and director of clinical research.

"It's startling to think that people in their 30s and 40s could actually be frail, but there is a population of patients who are young but are actually frail."

Measuring frailty before a major operation is important because frail patients, regardless of age, tend to be at a higher risk for postoperative complications. "Frail means they don't have the physiologic reserve to bounce back after the operation, so they start down a path that they may not easily recover from," explained Kenneth Ogan, MD, a study coauthor and associate professor of urology.

The standard test to measure frailty, described by geriatrician Linda P. Fried and colleagues at Johns Hopkins University,* includes five criteria:

Shrinking: Self-reported unintentional weight loss of more than 10 pounds in the last year

Grip Strength: Measured by having the patient squeeze a hand-held dynamometer adjusted for gender and body mass index (BMI)

Exhaustion: Measured by responses to questions about effort and motivation

Low Activity: Ascertained by inquiring about leisure time activities

Slowed Walking Speed: Measured by the speed at which a patient walks 15 feet adjusted by gender and height

Despite the importance of measuring patient frailty, many surgical practices may skip performing this five-step assessment for two reasons: it may take too long for a busy practice, and it requires a trained professional. The test also introduces bias since patients may overestimate activity levels and underestimate exhaustion.

A one-minute frailty assessment

Dr. Master, Dr. Ogan, and their colleagues set out to find a simpler, quicker, more accurate way to assess frailty. The research team completed the full five-step frailty assessment on 351 patients age 18 or older who were admitted to Emory for major abdominal, urologic, or gastrointestinal operations.

They then looked at medical records and found that 36.7 percent had experienced a complication within 30 days after an operation: 24.5 percent of patients experienced a minor complication, while 14.2 percent experienced a major complication. Examples of complications included, wound infection, pneumonia, stroke, and death.

The researchers next compared the full frailty test's ability to predict these complications to a more truncated version that only assessed two of the five factors: grip strength and involuntary weight loss.

They found that assessing just those two factors was equally as accurate at predicting complications as doing the full five-step test.

They also found that adding two additional factors - American Society of Anesthesiology score (ASA), which measures physical status for anesthesia, and levels of hemoglobin, the protein in red blood cells that carries oxygen - improved the model's ability to predict postoperative complications.

"If you just looked at weight loss and grip strength, those factors were just as good as doing all five steps. And if you add in hemoglobin and ASA scores, the prediction was even better," explained Dr. Master. "The nice thing is that the patient's ASA and hemoglobin are already recorded in the chart before an operation."

The full five-step test normally requires a trained clinician to collect the data, and could take about 10 minutes. "This method - asking one question about weight loss and the grip strength activity - can take less than a minute and can be done by anyone who interacts with the patient," Dr. Master added.

Setting patient expectations

Moving forward, the research team's goal is to increase surgical teams' willingness to perform the frailty test on each patient before an operation, not to reject patients for a procedure but rather as a planning measure.

"This step is important for setting expectations for the patient and the family," said Dr. Ogan. "If a patient is found to be frail prior to surgery, it is critical that the patient is aware that their risk of a postoperative complication is increased. Our data is clear: If you have a weak grip and you're losing weight, you're at risk. We want to be better prepared for any risks after the operation."

For patients who are considered frail, that could mean making lifestyle changes to address weight loss and grip strength. It could also mean planning for a longer hospital stay or arranging for the patient to be discharged to a skilled nursing facility before going home. The truncated frailty test will be rolled out to all of Emory's surgical patients this year.

Dr. Ogan and Dr. Master are also planning a larger study to assess whether frailty assessments can impact hospital readmissions and mortality post-operatively.

Other study authors are Louis M Revenig, MD; Daniel J Canter, MD, FACS; Sungjin Kim, MS; Yuan Liu, PhD; John F Sweeney, MD, FACS; Juan M Sarmiento, MD, FACS; David A Kooby, MD, FACS ; and Shishir K Maithel, MD, FACS.

"FACS" designates that a surgeon is a "Fellow of the American College of Surgeons.

** Fried, LP; Tangen, CM; Walston, J; Newman, AB, et al. "Frailty in older adults: evidence for a phenotype." J Gerontol A Biol Sci Med Sci. 2001; 56 (3): M146-56.*

http://www.eurekalert.org/pub_releases/2015-02/mbl-spi022515.php

Sewage provides insight into human microbiome

Microbes in sewage could provide a window into public health without the need for sampling from individuals

WOODS HOLE, MA - A new study demonstrates that sewage is an effective means to sample the fecal bacteria from millions of people. Researchers say the information gleaned from the work provides a unique opportunity to monitor, through gut microbes, the public health of a large population without compromising the privacy of individuals.

Humans harbor tremendous amounts of bacteria in their gastrointestinal tract and gut bacteria serve important functions in healthy humans. Studies of the human microbiome, the collection of trillions of microbes living in and on the human body, have gained traction during the last decade. There is a great interest in identifying a "healthy microbiome" by identifying one or more bacterial community types that may be associated with healthy individuals, however financial considerations and privacy concerns limit the number of individuals who can be screened.

In a new study published in the January/February 2015 issue of the journal mBio, researchers from the Marine Biological Laboratory (MBL) and the University of Wisconsin-Milwaukee (UWM) School of Freshwater Sciences introduce the idea of using sewage as a population level pool that carries a signal for the microbiomes of humans.

Using oligotyping, a novel approach developed at the MBL, scientists compared the gut bacterial community profiles of 137 healthy adults provided by The

Human Microbiome Project to the bacterial community profiles of more than 200 sewage influent samples collected from 71 U.S. cities.

In the paper led by UWM's Ryan Newton, researchers found that geographically distributed populations share a small core set of bacteria whose members represent various common community states within U.S. adults. The study uses the percent of obese individuals in a given city as a measure of lifestyle differences across cities, and demonstrates that the bacterial community structure is a good predictor, with 81 to 89 percent accuracy, of a city's estimated level of obesity. Lifestyle differences can reproducibly alter the human gut microbiome, and microbial community composition is a known indicator of obesity.

"This method is similar to trying to create a map of a geographical region," explains A. Murat Eren, an Assistant Research Scientist at the MBL, and one of the authors of the study. "The way we have been working with microbiomes of individuals has been similar to driving around and mapping the streets and structures of a city in a detailed manner. This approach takes our efforts to a much larger scale. In this sense it is similar to taking one big aerial picture of a city, trading off intricate details of a small number of well-described streets for broader insights and larger patterns."

The researchers say the use of oligotyping, which provides greater sensitivity, allowed them to better explain the distribution of very closely related bacterial organisms to compare microbiomes among 71 human populations.

"The sewage samples of 71 cities do not tell us anything specific about 'individuals' who live in those cities" says Eren. "However, only using sewage samples, we were able to differentiate these cities based on their estimated level of obesity. This approach can be beneficial to answer various public health questions while not compromising the privacy of individuals. For instance, microbial observatories plugged into sewage systems can keep us informed about the general health of large populations without being intrusive."

"This work fits into our long-term goal of developing better water pollution and public health assessments," says UWM professor and study co-author Sandra McLellan. "It's a great example of how new sequencing technologies and novel computational approaches can allow us to glean new information from complex environments."

The results of the oligotyping comparison of human gut to a sewage influent data were published on February 24, 2015 in mBio, an open access journal published by The American Society for Microbiology, by Eren, Joseph Vineis, Hilary Morrison, and Mitchell Sogin of the MBL's Josephine Bay Paul Center and Ryan Newton, Sandra McLellan, and Deborah Dila of the School of Freshwater Sciences, University of Wisconsin-Milwaukee.

The team's research was supported by a NIH grant R01AI091829-01A1 to Sandra McLellan and Mitchell Sogin.

Citation: Newton RJ, McLellan SL, Dila DK, Vineis JH, Morrison HG, Eren AM, Sogin ML. 2015. Sewage reflects the microbiomes of human populations. mBio 6(2):e02574-14. doi:10.1128/mBio.02574-14.

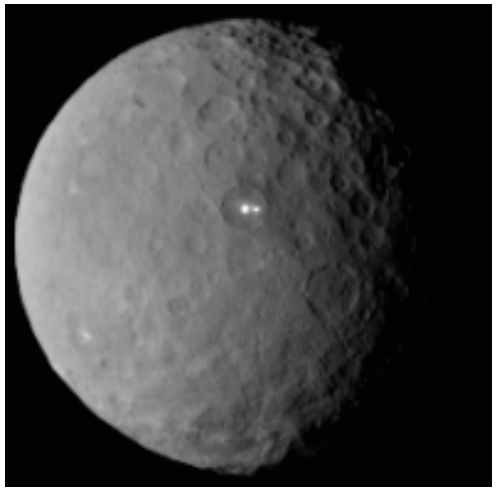
http://bit.ly/1GyFP00

Ceres' Mystery Bright Dots May Have Volcanic Origin

As NASA's Dawn mission slowly spirals in on its dwarf planet target, Ceres' alien landscape is becoming sharper by the day.

Feb 25, 2015 02:40 PM ET // by Ian O'Neill

And, at a distance of only 29,000 miles (46,000 kilometers), the robotic spacecraft has revealed multiple bright patches on the surface, but one of the brightest spots has revealed a dimmer bright patch right next door.



"Ceres' bright spot can now be seen to have a companion of lesser brightness, but apparently in the same basin," said Chris Russell, of the University of California, Los Angeles (UCLA) and principal investigator for the Dawn mission. "This may be pointing to a volcano-like origin of the spots, but we will have to wait for better resolution before we can make such geologic interpretations."

This image was taken by NASA's Dawn spacecraft of dwarf planet Ceres on Feb. 19 from a distance of nearly 29,000 miles (46,000 kilometers). It shows that the brightest spot on Ceres has a dimmer companion, which apparently lies in the same basin.

NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

Regions of higher than average albedo (reflectiveness) have been long known to exist on Ceres, but the low resolution of the observations have prevented planetary scientists from interpreting what they could be. But with the slow arrival of Dawn, these bright spots turn out to be discrete locations that might indicate surface ice features - possibly evidence for cryo-volcanism.

Cryovolcanoes can form on cold bodies in the solar system, such as the moons orbiting Jupiter and Saturn or dwarf planets in the Kuiper belt, but rather than molten rock being ejected to the surface (such is the case for regular volcanoes on Earth), liquid water, methane or ammonia may be forced to the surface after undergoing some heating through radioactive or tidal processes.

Once vented, these cryovolcanoes may leave frozen residue on the surface, possibly resembling what we are beginning to see on Ceres. But until we get closer, any positive identification will remain elusive for the time being.

"The brightest spot continues to be too small to resolve with our camera, but despite its size it is brighter than anything else on Ceres," said Andreas Nathues, of the Max Planck Institute for Solar System Research in Gottingen, Germany, and lead investigator for Dawn's framing camera team. "This is truly unexpected and still a mystery to us."

Having already visited massive asteroid Vesta from 2011 to 2012, Dawn is slowly approaching its second asteroid belt target where it will continue to explore for the next 16 months. Soon after, its thruster fuel will run dry and it will remain, stuck in orbit around Ceres as a permanent artificial satellite of the dwarf planet. Before this happens, however, Dawn will transform our view of Ceres, providing us with invaluable and historic knowledge of the solar system's innermost dwarf planet.

http://bit.ly/1ETPu07

First human head transplant could happen in two years

A radical plan for transplanting a head onto someone else's body is set to be announced. But is such ethically sensitive surgery even feasible?

25 February 2015 by Helen Thomson

IT'S heady stuff. The world's first attempt to transplant a human head will be launched this year at a surgical conference in the US. The move is a call to arms to get interested parties together to work towards the surgery.

The idea was first proposed in 2013 by Sergio Canavero of the Turin Advanced Neuromodulation Group in Italy. He wants to use the surgery to extend the lives of people whose muscles and nerves have degenerated or whose organs are riddled with cancer. Now he claims the major hurdles, such as fusing the spinal cord and preventing the body's immune system from rejecting the head, are surmountable, and the surgery could be ready as early as 2017.

Canavero plans to announce the project at the annual conference of the American Academy of Neurological and Orthopaedic Surgeons (AANOS) in Annapolis, Maryland, in June. Is society ready for such momentous surgery? And does the science even stand up?

The first attempt at a head transplant was carried out on a dog by Soviet surgeon Vladimir Demikhov in 1954. A puppy's head and forelegs were transplanted onto the back of a larger dog. Demikhov conducted several further attempts but the dogs only survived between two and six days.

The first successful head transplant, in which one head was replaced by another, was carried out in 1970.

A team led by Robert White at Case Western Reserve University School of Medicine in Cleveland, Ohio, transplanted the head of one monkey onto the body of another. They didn't attempt to join the spinal cords, though, so the monkey couldn't move its body, but it was able to breathe with artificial assistance. The monkey lived for nine days until its immune system rejected the head. Although few head transplants have been carried out since, many of the surgical procedures involved have progressed. "I think we are now at a point when the technical aspects are all feasible," says Canavero.

This month, he published a summary of the technique he believes will allow doctors to transplant a head onto a new body (*Surgical Neurology International*, doi.org/2c7). It involves cooling the recipient's head and the donor body to extend the time their cells can survive without oxygen. The tissue around the neck is dissected and the major blood vessels are linked using tiny tubes, before the spinal cords of each person are cut. Cleanly severing the cords is key, says Canavero.

The recipient's head is then moved onto the donor body and the two ends of the spinal cord – which resemble two densely packed bundles of spaghetti – are fused together. To achieve this, Canavero intends to flush the area with a chemical called polyethylene glycol, and follow up with several hours of injections of the same stuff. Just like hot water makes dry spaghetti stick together, polyethylene glycol encourages the fat in cell membranes to mesh.

Next, the muscles and blood supply would be sutured and the recipient kept in a coma for three or four weeks to prevent movement. Implanted electrodes would provide regular electrical stimulation to the spinal cord, because research suggests this can strengthen new nerve connections.

When the recipient wakes up, Canavero predicts they would be able to move and feel their face and would speak with the same voice. He says that physiotherapy would enable the person to walk within a year. Several people have already volunteered to get a new body, he says.

The trickiest part will be getting the spinal cords to fuse. Polyethylene glycol has been shown to prompt the growth of spinal cord nerves in animals, and Canavero intends to use brain-dead organ donors to test the technique. However, others are sceptical that this would be enough. "There is no evidence that the connectivity of cord and brain would lead to useful sentient or motor function following head transplantation," says Richard Borgens, director of the Center for Paralysis Research at Purdue University in West Lafayette, Indiana.

If polyethylene glycol doesn't work, there are other options Canavero could try. Injecting stem cells or olfactory ensheathing cells – self-regenerating cells that connect the lining of the nose to the brain – into the spinal cord, or creating a bridge over the spinal gap using stomach membranes have shown promise in

helping people walk again after spinal injury. Although unproven, Canavero says the chemical approach is the simplest and least invasive.

But what about the prospect of the immune system rejecting the alien tissue? Robert White's monkey died because its head was rejected by its new body.

William Mathews, chairman of the AANOS, says he doesn't think this would be a major problem today. He says that because we can use drugs to manage the acceptance of large amounts of tissue, such as a leg or a combined heart and lung transplant, the immune response to a head transplant should be manageable. "The system we have for preventing immune rejection and the principles behind it are well established."

Canavero isn't alone in his quest to investigate head transplants. Xiao-Ping Ren of Harbin Medical University in China recently showed that it is possible to perform a basic head transplant in a mouse (*CNS Neuroscience & Therapeutics*, doi.org/2d5). Ren will attempt to replicate Canavero's protocol in the next few months in mice, and monkeys.

The essence of you

Another hurdle will be finding a country to approve such a transplant. Canavero would like to do the experiment in the US, but believes it might be easier to get approval somewhere in Europe. "The real stumbling block is the ethics," he says. "Should this surgery be done at all? There are obviously going to be many people who disagree with it."

Patricia Scripko, a neurologist and bioethicist at the Salinas Valley Memorial Healthcare System in California, says that many of the ethical implications related to the surgery depend on how you define human life. "I believe that what is specifically human is held within the higher cortex. If you modify that, then you are not the same human and you should question whether it is ethical. In this case, you're not altering the cortex." However, she adds that many cultures would not approve of the surgery because of their belief in a human soul that is not confined to the brain.

As with many unprecedented procedures, there may also be concerns about a slippery slope. In this case, it would be whether this would eventually lead to people swapping bodies for cosmetic reasons. However, Scripko – who doesn't believe the surgery will ever happen – doesn't think this applies here. "If a head transplant were ever to take place, it would be very rare. It's not going to happen because someone says 'I'm getting older, I'm arthritic, maybe I should get a body that works better and looks better'."

Unsurprisingly, the surgical community is also wary of embracing the idea. Many surgeons contacted by *New Scientist* refused to comment on the proposed project, or said it sounded "too outlandish" to be a serious consideration.

"This is such an overwhelming project, the possibility of it happening is very unlikely," says Harry Goldsmith, a clinical professor of neurological surgery at the University of California, Davis, who has performed one of the few surgeries that enabled someone with a spinal cord injury to regain the ability to walk. "I don't believe it will ever work, there are too many problems with the procedure. Trying to keep someone healthy in a coma for four weeks – it's not going to happen."

Nick Rebel, executive director of the US branch of the International College of Surgeons, says that although his organisation, along with the AANOS, is giving Canavero a stage, it is not sponsoring his ideas. "We're creating a venue for him to launch the project. There will be a lot of top international surgeons at the conference and we shall see whether it is well received or not."

Mathews is more enthusiastic about the project. "I embrace the concept of spinal fusion," he says, "and I think there are a lot of areas that a head transplant can be used, but I disagree with Canavero on the timing. He thinks it's ready, I think it's far into the future."

Canavero is philosophical. "This is why I first spoke about the idea two years ago, to get people talking about it," he says. "If society doesn't want it, I won't do it. But if people don't want it in the US or Europe, that doesn't mean it won't be done somewhere else. I'm trying to go about this the right way, but before going to the moon, you want to make sure people will follow you."

http://bit.ly/1C2F6FM

6 things you're dying to ask about head transplants

Read about the proposed head transplant surgery? Here are answers to questions on the tip of your tongue. And no, we can't defrost all the cryogenic heads

14:00 26 February 2015 by Helen Thomson

Why are we calling this procedure a head transplant rather than a body transplant?

The head transplant moniker is partly a hangover from monkey and dog experiments of the last century. This was how the surgeons that carried out those experiments referred to the procedure, and it stuck.

Technically, calling it a body transplant would be more accurate because the head is representative of the person receiving the new body part. But be careful, it's not a whole body transplant. That term is usually used to describe a procedure in which the brain of one organism is transplanted into the body – and skull – of another.

By calling Sergio Canavero's proposed surgery a head transplant it makes it clearer that this involves the head and the brain inside.

What's the difference between brain and head transplants?
A brain transplant would involve removing the brain from the skull and placing it in a donor skull. It is more difficult than a head transplant because of the complex surgery to separate the brain and blood supply without damaging delicate tissue.

Could the transplant technique work for a cryogenically frozen head?
No. The proposed technique requires a healthy human head and brain. It is not yet known whether it is possible to "defrost" a cryogenically frozen head and resurrect healthy brain tissue.

Would the surgery be psychologically damaging?
Some people who have received face or limb transplants mourn the loss of their old body part or feel that their self image is conflicted. Studies show that inputs from our body, such as a heartbeat or rumbling stomach, can influence our will power, emotions and language. Who knows whether the person who comes out of the operating room would be the same as the one who went in.

Would there be any benefits apart from getting a healthier body?
If the recipient head is older than the donor body, they may get a rejuvenating boost. Infusions of young blood can raise physical endurance and cognitive function in older animals. A study is now seeing if young blood has the same effect on people with Alzheimer's.

I'm a registered organ donor. Could my body be used for this?
Each country has its own rules. In the UK, joining the register would not automatically allow your body to be used. "If a person needs something not specified on our forms, we would ask a potential donor's family to consent," says an NHS spokesperson. "We would only approach a family if the planned procedure had ethical approval."

http://nyti.ms/1MXqVF3

A Faster Way to Try Many Drugs on Many Cancers

New national effort will treat cancer based not on the organ it started in, but on the mutations driving its growth

By GINA KOLATA FEB. 25, 2015

Chemotherapy and radiation failed to thwart Erika Hurwitz's rare cancer of white blood cells. So her doctors offered her another option, a drug for melanoma. The result was astonishing. Within four weeks, a red rash covering her body, so painful she had required a narcotic patch and the painkiller OxyContin, had vanished. Her cancer was undetectable.

"It has been a miracle drug," said Mrs. Hurwitz, 78, of Westchester County.

She is part of a new national effort to try to treat cancer based not on what organ it started in, but on what mutations drive its growth.

Cancers often tend to be fueled by changes in genes, or mutations, that make cells grow and spread to other parts of the body. There are now an increasing number of drugs that block mutations in cancer genes and can halt a tumor's growth. While such an approach has worked in a few isolated cases, those cases cannot reveal whether other patients with the same mutation would have a similar experience.

Now, medical facilities like Memorial Sloan Kettering Cancer Center in New York, where Mrs. Hurwitz is a patient, are starting coordinated efforts to find answers. And this spring, a federally funded national program will start to screen tumors in thousands of patients to see which might be attacked by any of at least a dozen new drugs. Those whose tumors have mutations that can be attacked will be given the drugs.

The studies of this new method, called basket studies because they lump together different kinds of cancer, are revolutionary, much smaller than the usual studies, and without control groups of patients who for comparison's sake receive standard treatment.

Researchers and drug companies asked the Food and Drug Administration for its opinion, realizing that if the F.D.A. did not accept the studies, no drugs would ever be approved on the basis of them. But the F.D.A. said it sanctioned them and could approve drugs with basket study data alone. Instead of insisting on traditional studies, said Dr. Richard Pazdur, who directs the F.D.A. office that approves new cancer drugs, the agency will look at the data and ask, "Is the American population going to be better off with this drug than without it?"

These are the sorts of studies many seriously ill patients have been craving - a guarantee that if they enter a study they will get a promising new drug. And the studies move fast; it does not take years to see a big effect if there is one at all.

In Mrs. Hurwitz's case, the mutation in her rare cancer is in a gene, BRAF, found in about 50 percent of melanomas but rare in other cancers. She is among dozens of patients with the same mutation, but different cancers, in the new study that gives everyone the melanoma drug that attacks the mutation.

Basket studies became possible only recently, when gene sequencing became so good and its price so low that doctors could routinely look for 50, 60 or more known cancer-causing mutations in tumors. At the same time, more and more drugs were being developed to attack those mutations. So even if, as often happens, only a small percentage of patients with a particular tumor type have a particular mutation, it was possible to find a few dozen patients or more for a clinical trial by grouping everyone with that mutation together.

In a way, this is a leading edge of precision medicine that aims to target the drug to the patient. Unlike previous efforts that looked for small differences between a

new treatment and an older one, with basket studies, researchers are gambling on finding huge effects. "This is really a new breed of study," said Dr. David Hyman, a cancer specialist at Memorial Sloan Kettering who directs the study Mrs. Hurwitz is in and two similar ones.

And they are seeing some unprecedented responses, along with some failures. The responses, though, can be so striking that control groups might be unwarranted or infeasible, Dr. Pazdur said. "Conventional therapy might give a response rate of 10 or 20 percent," Dr. Pazdur said. "The newer drug has a response rate of 50 or 60 percent. Does it make sense to do a randomized trial?" And even if a trial were planned, he said: "Who would go on that trial? Would you go on that trial?"

"When you are having a big effect, it is kind of jaw dropping," Dr. Pazdur added. "These are response rates we haven't seen before in diseases."

But these are still the early days, researchers caution. "It is a different world we are walking into," said Dr. Daniel Costa, a lung cancer researcher at Beth Israel Deaconess Medical Center in Boston. "And we are learning as we go along."

The new studies pose new problems. With no control groups, the effect has to be enormous and unmistakable to show it is not occurring by chance. When everyone gets a drug, it can be hard to know if a side effect is from the drug, a cancer or another disease. And gene mutations can be so rare that patients for a basket study are difficult to find.

The rarity of the mutations, in fact, is one reason for the new national effort, supported by the National Cancer Institute. Its study, called Match, is essentially a basket of basket studies. Doctors around the country will be sending tumor samples from at least 3,000 patients to central labs that will examine them for mutations. Those with any of a dozen or so mutations in their tumors can enroll in studies of drugs that target their tumor's mutation.

Dr. Keith Flaherty of Massachusetts General Hospital, principal investigator for the Match trial, said the number of baskets was uncertain - it would depend on the number of drugs. But he expects 12 to 15 baskets to start, expanding to perhaps 40 or more. There will be 31 patients per drug.

He anticipates mixed results. "We are exploring an unknown space here," Dr. Flaherty said. "But it is essentially impossible for this whole set of baskets to fail."

To show what is possible, Dr. José Baselga of Memorial Sloan Kettering points to preliminary results he presented in December for the basket study that includes Mrs. Hurwitz.

Among 70 patients, there are eight types of cancer. Eighteen patients had one of two very rare cancers, Erdheim-Chester disease or Langerhans disease, the cancer that struck Mrs. Hurwitz. Of them, 14 responded to the melanoma drug - their tumors vanished, shrank or stopped growing - and the remaining four have not been taking the drug long enough to say.

"Unbelievable," Dr. Baselga said. "This is working in a way that is clear, that is unprecedented," he said. "I don't have enough patients to do a Phase 3 study," he added, referring to the large, randomized study traditionally used to test new drugs, "and I even question the morality of it."

But others in basket studies have not fared so well.

Eleni Vavas entered a basket study at Memorial Sloan Kettering hoping to stop the stomach cancer that was killing her. The study, said her husband, John Vavas, "was our last-ditch, Hail Mary effort." His wife, who was 36, entered it last spring, the only patient with stomach cancer. But, Mr. Vavas said, "she just didn't respond."

She died on July 1.

http://www.eurekalert.org/pub_releases/2015-02/chr-ofa022515.php

Omega-3 fatty acids and vitamin D may control brain serotonin

Affecting behavior and psychiatric disorders

Oakland, CA - Although essential marine omega-3 fatty acids and vitamin D have been shown to improve cognitive function and behavior in the context of certain brain disorders, the underlying mechanism has been unclear. In a new paper published in FASEB Journal by Rhonda Patrick, PhD and Bruce Ames, PhD of Children's Hospital Oakland Research Institute (CHORI), serotonin is explained as the possible missing link tying together why vitamin D and marine omega-3 fatty acids might ameliorate the symptoms associated with a broad array of brain disorders.

In a previous paper published last year, authors Patrick and Ames discussed the implications of their finding that vitamin D regulates the conversion of the essential amino acid tryptophan into serotonin, and how this may influence the development of autism, particularly in developing children with poor vitamin D status.

Here they discuss the relevance of these micronutrients for neuropsychiatric illness. Serotonin affects a wide-range of cognitive functions and behaviors including mood, decision-making, social behavior, impulsive behavior, and even plays a role in social decision-making by keeping in check aggressive social responses or impulsive behavior.

Many clinical disorders, such as autism spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD), bipolar disorder, schizophrenia, and depression share as a unifying attribute low brain serotonin. "In this paper we explain how serotonin is a critical modulator of executive function, impulse control, sensory gating, and pro-social behavior," says Dr. Patrick. "We link serotonin production

and function to vitamin D and omega-3 fatty acids, suggesting one way these important micronutrients help the brain function and affect the way we behave."

Eicosapentaenoic acid (EPA) increases serotonin release from presynaptic neurons by reducing inflammatory signaling molecules in the brain known as E2 series prostaglandins, which inhibit serotonin release and suggests how inflammation may negatively impact serotonin in the brain. EPA, however, is not the only omega-3 that plays a role in the serotonin pathway. Docosahexaenoic acid (DHA) also influences the action of various serotonin receptors by making them more accessible to serotonin by increasing cell membrane fluidity in postsynaptic neurons.

Their paper illuminates the mechanistic links that explain why low vitamin D, which is mostly produced by the skin when exposed to sun, and marine omega-3 deficiencies interacts with genetic pathways, such as the serotonin pathway, that are important for brain development, social cognition, and decision-making, and how these gene-micronutrient interactions may influence neuropsychiatric outcomes. "Vitamin D, which is converted to a steroid hormone that controls about 1,000 genes, many in the brain, is a major deficiency in the US and omega-3 fatty acid deficiencies are very common because people don't eat enough fish," said Dr. Ames.

This publication suggests that optimizing intakes of vitamin D, EPA, and DHA would optimize brain serotonin concentrations and function, possibly preventing and ameliorating some of the symptoms associated with these disorders without side effects.

Vitamin D and the Omega-3 Fatty Acids Control Serotonin Synthesis and Action Part 2: Relevance for ADHD, Bipolar, Schizophrenia, and Impulsive Behavior. FASEB Journal

http://www.eurekalert.org/pub_releases/2015-02/mu-ap022615.php

'Blue-green algae' proliferating in lakes

Global study shows increase in potentially toxic algae accelerating since mid-1900s

The organisms commonly known as blue-green algae have proliferated much more rapidly than other algae in lakes across North America and Europe over the past two centuries - and in many cases the rate of increase has sharply accelerated since the mid-20th century, according to an international team of researchers led by scientists at McGill University.

Their study, published today in the journal Ecology Letters, represents the first continental-scale examination of historical changes in levels of cyanobacteria, the scientific term for the photosynthetic bacteria that form blue-green scum on the surface of ponds and lakes during hot summer months.

Cyanobacteria blooms pose a serious threat to drinking-water sources, because certain species contain toxins harmful to the liver or nervous system.

"We found that cyanobacterial populations have expanded really strongly in many lakes since the advent of industrial fertilizers and rapid urban growth," says Zofia Taranu, who led the study as a PhD candidate in McGill's Department of Biology. "While we already knew that cyanobacteria prefer warm and nutrient-rich conditions, our study is also the first to show that the effect of nutrients, such as phosphorus and nitrogen, overwhelm those of global warming."

Alpine lakes affected

Researchers from France, Italy, Spain, the UK, Malaysia, and across Canada contributed to the study. While the increase in cyanobacteria in agriculturally developed watersheds was in line with their expectations, the scientists were surprised to find that cyanobacteria also increased in many remote, alpine lakes. In those sites, warmer temperatures and nutrient loading from atmospheric sources are likely to have played a bigger role than direct agricultural runoff.

Dense algal blooms have become a summertime staple of media coverage - and a growing concern of lakefront homeowners - in certain regions, but until now there had been little in the way of long-term, large-scale synthesis of data on the phenomenon.

This left room for doubt as to whether harmful algal blooms were truly on the rise, or whether communities were simply better equipped to identify and report blooms when they occur.

The rapid increase in cyanobacteria identified in the study points to the potential for a parallel increase in the concentration of harmful cyanotoxins, says Taranu, who is now a postdoctoral fellow at Université de Montréal. While potentially toxic species don't synthesize toxins at all times, studies have shown that one of the best predictors of toxin concentrations in lakes is the total abundance of cyanobacteria.

Cyanobacteria can produce toxins that cause damage to the liver or nervous system. The most common symptoms of acute exposure to harmful algal blooms are skin rash or irritation, gastroenteritis and respiratory distress. Chronic, low dose exposures over a lifetime may also result in liver tumors or endocrine disruption.

Preliminary studies also suggest that a recently isolated cyanotoxin may become more concentrated across food chains and may be associated with the formation of progressive neurodegenerative diseases such as Alzheimer's, Parkinson's and ALS diseases. Although this latter work is still controversial among scientists, "our results underline the importance of further research in this area," Taranu says.

Collaborations needed to tackle problem

"Our work shows that we need to work harder as a society to reduce nutrient discharges to surface waters," says Irene Gregory-Eaves, an associate professor of biology at McGill and co-author of the study.

"Because diffuse nutrient loading (as opposed to end-of-pipe effluent) is the main issue, we need to build collaborations to tackle this complex problem. For example, partnerships among freshwater scientists and farmers are starting to happen, and more of this needs to take place, so that we can strike a balance between maximizing crop yields and minimizing excess fertilizer application."

The research was funded in part by the Natural Sciences and Engineering Research Council of Canada, the Fonds de Recherche du Québec - Nature et technologies, and the Canada Foundation for Innovation.

"Acceleration of cyanobacterial dominance in north temperate subarctic lakes during the Anthropocene", Zofia E. Taranu, Irene Gregory-Eaves, et al. Ecology Letters, published online Feb. 26, 2015. doi: 10.1111/ele.12420

Link to the abstract: http://doi.wiley.com/10.1111/ele.12420

http://www.eurekalert.org/pub_releases/2015-02/igdc-soc022615.php

Skeleton of cells controls cell multiplication

New study reveals how cell proliferation is affected by proteins that control cell rigidity

A research team from Instituto Gulbenkian de Ciencia (IGC; Portugal), led by Florence Janody, in collaboration with Nicolas Tapon from London Research Institute (LRI; UK), discovered that the cell's skeleton can trigger the multiplication of cells through the action of proteins that control cellular rigidity. During this process genes that promote cancer - oncogenes - become activated, leading to tumor formation in living organisms. This study was published in the latest edition of the scientific journal Current Biology*.

The cell's skeleton - the cytoskeleton - is composed of a mesh of filaments made of protein. Similar to our skeleton that supports our body and helps us in several daily functions, the cytoskeleton confers the shape of the cell, helps cells moving, and also works as a road that proteins use to move inside the cell and perform their job. For long, scientists have been studying the different roles of the cytoskeleton, but only recent studies done in cultured cells suggested that mechanical forces could impact on how the cytoskeleton is organized and could result in the proliferation of cells. Florence Janody and her team took a step forward and have now shown that proteins of the cytoskeleton, which control mechanical forces, can induce the activation of factors that promote tumor growth in a living organism: the fruit fly (Drosophila melanogaster, in its scientific name). Janody's team observed that when the dynamics of the cell's skeleton changes, this leads to different rearrangements in the mesh of filaments, which can have direct consequences on cell proliferation and tissue overgrowth: if the cytoskeleton becomes less elastic, the cells proliferate faster.

Using both genetic and molecular approaches, the research team identified a protein important for this process, named Zyxin. This protein controls the "correct" assembly of the cytoskeleton to allow cell's normal function. If Zyxin does not work properly, it compromises the cytoskeleton organization, unleashing the function of other proteins that ultimately lead to uncontrolled cell proliferation and tumor development.

Florence Janody says: "The cell's skeleton has been discovered more that 150 years ago, as the cellular structure allowing muscles to create forces. We came to realize only recently that mechanical forces generated by the cell's skeleton dictate the behavior of all cells of the body. The next challenge will be to identify the large diversity of mesh of skeleton filaments built in the cells and characterize their mechanical properties".

Pedro Gaspar, researcher in Florence Janody's laboratory and first author in this study, adds: "We hope that our findings will shed new light to understand how mechanical forces are relayed through the cell skeleton and how they impact on cell proliferation. In the future, we hope these perspectives may inspire new bioengineering approaches in tumor therapy and regenerative medicine."

Since the proteins identified in fruit flies to be involved in this mechanism also exist in other organisms, including humans, it is expected that similar mechanisms also occur in human cells.

This study was carried out at Instituto Gulbenkian de Ciencia (Oeiras, Portugal), funded by Fundacao para a Ciencia e a Tecnologia (FCT), and at London Research Institute, Cancer Research UK (London, UK), funded by Cancer Research UK (CRUK).

http://www.eurekalert.org/pub_releases/2015-02/msu-wcd022415.php

World's challenges demand science changes - and fast, experts say

The world has little use - and precious little time - for detached experts.

A group of scientists - each of them experts - makes a compelling case in this week's Science Magazine that the growing global challenges has rendered sharply segregated expertise obsolete.

Disciplinary approaches to crises like air pollution, biodiversity loss, climate change, food insecurity, and energy and water shortages, are not only ineffective, but also making many of these crises worse because of counterproductive interactions and unintended consequences, said Jianguo "Jack" Liu, lead author of the paper "Systems Integration for Global Sustainability". He also is Rachel Carson Chair in Sustainability and director of the Center for Systems Integration and Sustainability (CSIS) at Michigan State University (MSU).

"The real world is integrated," Liu said. "Artificially breaking down the real world into separate pieces has caused many global problems. Solving these problems requires systems integration - holistic approaches to integrate various pieces of the real world at different organizational levels, across space and over time."

Sustainability demands new methods

The paper's authors, themselves with experience spanning agriculture, biodiversity, climate change, ecology, economics, energy, environment, food security, trade, water, and more, in essence paint a new paradigm of research that crosses boundaries among natural and social science disciplines, as well as other disciplines such as engineering and medical sciences.

Using examples that are both far-flung and tightly intertwined, these scientists show how systems integration can tackle the complex world, from unexpected impacts of biofuels to hidden roles of virtual resources such as virtual water.

The paper's first illustration wraps Brazil, China, the Caribbean and Saharan Africa into an example of how the world demands to be approached not just for its singular qualities, but for its lack of boundaries over time, distance or the organizational levels mankind imposes.

The rapidly growing food export to China from Brazil destroys tropical forests and changes food markets in other parts of the world, including the Caribbean and Africa. Agricultural practices in the Sahara Desert in Africa stir up dust which enters the atmosphere and floats as far as the Caribbean. That African dust has been shown to contribute to coral reef decline and increased asthma rates in the Caribbean. It also affects China and Brazil that have made heavy investment in Caribbean tourism, infrastructure, and transportation. All these interactions, and the many more that exist in one example, defy borders both on maps and in academic disciplines.

Yet conventional research and decision-making often have taken place within separate disciplines or sectors. The paper notes that one of the systems integration frameworks - human-nature nexuses - "help anticipate otherwise unforeseen consequences, evaluate tradeoffs, produce co-benefits and allow the different and often competing interests to seek a common ground." For example, the energy-food nexus considers both the effects of energy on food production, processing, transporting, and consumption, and the effects of food production, like corn, on the generation of energy, such as ethanol.

Other systems integration frameworks also bring multiple aspects of human-nature interactions together. Natural systems provide benefits like clean water and food to people, but human activities often inflict harm on natural systems. Considering a variety of benefits and costs simultaneously can help evaluate trade-offs and synergies among them. The environmental footprints framework helps quantify resources consumed and wastes generated by people.

Telecoupling - a way to make sense of a complex world

Many studies on sustainability have focused on one place, but the world is increasingly "telecoupled" - a term which embraces socioeconomic and environmental interactions over distances, sometimes several thousand miles away. For example, the large amount of coal from Australia sold to far-away markets like Japan, the European Union and Brazil affects not only those markets, but has global impacts far beyond. The money and environmental impacts such as CO2 emissions that flow with the coal, along with the mechanisms of transporting and burning the fossil fuel, spill over to countries between the partners.

Acknowledging that everything must be integrated is critical for scientific advances and effective policies, the authors say. So is the engagement between researchers and stakeholders.

For example, Liu has partnered with environmental and social scientists to show how policies in China to curb human's role in deforestation and panda habitat degradation were strengthened by enlisting nature reserve residents to receive subsidies to monitor the forests. The innovations were spurred by careful observation of the push-and-pull dynamics of managing a system to allow both people and the environment to thrive.

The paper says that effective policies and management for global sustainability needs the human and the natural systems to be more integrated across multiple spatial and temporal and awauthors think it is essential to quantify human-nature feedbacks and spillover systems. Science has largely ignored these, but they can have profound impacts on sustainability and human well-being.

It is time to integrate all disciplines for fundamental discoveries and synergetic solutions because of increasingly connected world challenges, Liu said. "Furthermore, the world no longer has the luxury of the past, when there were fewer people on the planet and resources were more abundant," Liu said. This will require funding agencies and universities to make more drastic changes to alter the reward mechanisms and transform the scientific community from isolated experts to integrated scholars."

Liu is joined by Harold Mooney of Stanford University, Vanessa Hull of MSU CSIS, Steven Davis of the University of California - Irvine, Joanne Gaskell of the World Bank, Thomas Hertel of Purdue University, Jane Lubchenco of Oregon State University, Karen Seto of Yale University; Peter Gleick of The Pacific Institute, Claire Kremen of University of California, Berkeley, and Shuxin Li, also of MSU CSIS.

The work was supported by the National Science Foundation's programs on Dynamics of Coupled Natural and Human Systems, and MacroSystems Biology; and Michigan AgBioResearch.

http://www.eurekalert.org/pub_releases/2015-02/wtsi-lma022415.php

Leukemia-associated mutations almost inevitable as we age

Researchers estimate that 7 in 10 over 90-year-olds have early leukemia cells

It is almost inevitable that we will develop genetic mutations associated with leukaemia as we age, according to research published today in Cell Reports.

Based on a study of 4219 people without any evidence of blood cancer, scientists estimate that up to 20 per cent of people aged 50-60 and more than 70 per cent of people over 90 have blood cells with the same gene changes as found in leukaemia.

Scientists investigating the earliest stages of cancer development used an exquisitely sensitive sequencing method capable of detecting DNA mutations present in as few as 1.6 per cent of blood cells, to analyse 15 locations in the genome, which are known to be altered in leukaemia. By comparing their findings with other research conducted with a lower degree of sensitivity over whole exomes, the scientists were able to conclude that the incidence of pre-leukaemic cells in the general population is much higher than previously thought and increases dramatically with age.

"Leukaemia results from the gradual accumulation of DNA mutations in blood stem cells, in a process that can take decades," explains Dr Thomas McKerrell, joint first author from the Wellcome Trust Sanger Institute. "Over time, the probability of these cells acquiring mutations rises. What surprised us was that we found these mutations in such a large proportion of elderly people. This study helps us understand how aging can lead to leukaemia, even though the great majority of people will not live long enough to accumulate all the mutations required to develop the disease."

The pre-leukaemic mutations studied appear to give a growth advantage to the cells carrying them and this starts a process in which cells with these mutations dominate blood making. As they increase in number, the likelihood that one or more of them will acquire more mutations becomes greater, something that could eventually lead to leukaemia and leukaemia-like disorders. Interestingly, the study found that mutations affecting two particular genes, SF3B1 and SRSF2, appeared exclusively in people aged 70, suggesting that these mutations only give a growth benefit later in life, when there is less competition. This finding explains why myelodysplastic syndromes, a group of leukaemia-like conditions associated with these genes, appear almost exclusively in the elderly.

None of the 4219 people studied were found to have a mutation in NPM1, the most common acute leukaemia gene mutated in up to 40 per cent of cases. This unexpected result suggests that mutations in NPM1 behave as gatekeepers for this cancer; once a mutation in this gene occurs in a cell with particular previously accumulated pre-leukaemic mutations, the disease progresses rapidly to become leukaemia.

"The significance of mutations in this gene is astonishingly clear from these results: it simply doesn't exist where there is no leukaemia," says Dr Naomi Park, joint first author from the Sanger Institute. "When it is mutated in the appropriate cell, the floodgates open and leukemia is then very likely to develop. This fits with studies we've conducted in the past in which we found that the gene primes blood stem cells for leukaemic transformation."

Leukaemia serves as a useful model for research into the origins of cancer because blood samples are much easier to obtain than tissue samples. Each cancer begins with a single mutation in just one cell; this research allows scientists to look at how these first mutated cells accumulate to form cancer.

"Ultra-deep sequencing has allowed us to see the very beginnings of cancer," says Dr George Vassiliou, senior author from the Sanger Institute and Cambridge University Hospitals NHS Trust. "These mutations will be harmless for the majority of people but for a few unlucky carriers they will take the body on a journey towards leukaemia. We are now beginning to understand the major landmarks on that journey."

McKerrell T, Park N, et al. (2015). Leukemia-associated somatic mutations drive distinct patterns of age-related clonal hemopoiesis. Cell Reports. DOI: 10.1016/j.celrep.2015.02.005

This project was funded by a Wellcome Trust Clinician Scientist Fellowship (TM) and by the Wellcome Trust Sanger Institute (grant number WT098051). GV is funded by a Wellcome Trust Senior Fellowship in Clinical Science (Wt095663MA) and work in his laboratory is also funded by Leukaemia Lymphoma Research and the Kay Kendal Leukaemia Fund. IV is funded by Spanish Ministerio de Economía y Competitividad subprogram Ramón y Cajal.

http://www.eurekalert.org/pub_releases/2015-02/uotm-rih022615.php

Researchers identify how humans can develop immunity to deadly Marburg virus

Mechanisms involved in antibody response to the deadly Marburg virus are identified

A collaborative team from The University of Texas Medical Branch at Galveston, Vanderbilt University and The Scripps Research Institute have identified mechanisms involved in antibody response to the deadly Marburg virus by studying the blood of a Marburg survivor. This study now appears online and will be in the Feb. 26 edition of Cell.

Using blood samples from a Marburg survivor, the researchers were able to determine how a person's immune system can fight against the virus.

In the study, researchers investigated the human immune response to Marburg virus, which is a close relative of the Ebola virus. The researchers isolated blood

cells of an American who was infected with the Marburg virus several years ago during a visit to a cave in Uganda that is home to Egyptian fruit bats, some of which are now known to carry Marburg. After returning to the U.S., this person developed a very severe, but not fatal, case of Marburg infection. The researchers used the survivor's blood to isolate a large number of B cells that produce antibodies, which are small protein molecules capable of inactivating the virus. Using a combination of methods, the researchers localized the site on the virus where antibodies were found to bind. This appeared to be the same spot thought to interact with human cells targeted by the virus during the initial phase of infection. The study shows that the human immune system can effectively fight Marburg virus infections by producing antibodies and shows how these antibodies inactivate the virus. Understanding these mechanisms will help researchers to develop effective antibody-based treatments against both Marburg and Ebola viruses.

"Three years ago, when we started this collaborative work with James Crowe's laboratory at Vanderbilt University, not much was known about the mechanisms of antibody immune response to the filoviruses Marburg and Ebola," said virologist Alex Bukreyev, professor at UTMB and co-senior author. "It was even unclear whether an infected person can develop an effective antibody response to these infections. During these years, the whole area of research moved forward dramatically."

Other authors of this paper include Philipp Ilinykh, Xiaoli Shen, Tania Garron, Thomas Ksiazek and Curtis Klages from the University of Texas Medical Branch; Andrew Flyak, James Slaughter and Gopal Sapparapu from Vanderbilt University and Charles Murin, Marnie Fusco, Takao Hashiguchi, Zachary Bornholdt, Andrew Ward and Erica Ollmann Saphire from The Scripps Research Institute.

This study was supported by the Defense Threat Reduction Agency and the National Institutes of Health.

http://www.eurekalert.org/pub_releases/2015-02/aaon-ccr021215.php

Can coffee reduce your risk of MS?

Drinking coffee may be associated with a lower risk of developing multiple sclerosis

WASHINGTON, DC - Drinking coffee may be associated with a lower risk of developing multiple sclerosis (MS), according to a study released today that will be presented at the American Academy of Neurology's 67th Annual Meeting in Washington, DC, April 18 to 25, 2015.

"Caffeine intake has been associated with a reduced risk of Parkinson's and Alzheimer's diseases, and our study shows that coffee intake may also protect against MS, supporting the idea that the drug may have protective effects for the brain," said study author Ellen Mowry, MD, MCR, with Johns Hopkins University School of Medicine in Baltimore and a member of the American Academy of Neurology.

For the study, researchers looked at a Swedish study of 1,629 people with MS and 2,807 healthy people, and a U.S. study of 1,159 people with MS and 1,172 healthy people. The studies characterized coffee consumption among persons with MS one and five years before MS symptoms began (as well as 10 years before MS symptoms began in the Swedish study) and compared it to coffee consumption of people who did not have MS at similar time periods. The study also accounted for other factors such as age, sex, smoking, body mass index, and sun exposure habits.

The Swedish study found that compared to people who drank at least six cups of coffee per day during the year before symptoms appeared, those who did not drink coffee had about a one and a half times increased risk of developing MS. Drinking large amounts of coffee five or 10 years before symptoms started was similarly protective.

In the US study, people who didn't drink coffee were also about one and a half times more likely to develop the disease than those who drank four or more cups of coffee per day in the year before symptoms started to develop the disease.

"Caffeine should be studied for its impact on relapses and long-term disability in MS as well," said Mowry.

The study was supported by the Swedish Medical Research Council, the Swedish Research Council for Health, Working Life and Welfare, the Knut and Alice Wallenberg, AFA, and Swedish Brain Foundations, the Swedish Association for Persons with Neurological Disabilities and the U.S. National Institute of Neurological Disorders and Stroke, the National Institute of Environmental Health Sciences and the National Institute on Aging.

http://www.bbc.com/news/science-environment-31648990

Scientists find evidence of wheat in UK 8,000 years ago

Wheat was present in Britain 8,000 years ago, according to new archaeological evidence.

By Helen Briggs Environment Correspondent, BBC News

Fragments of wheat DNA recovered from an ancient peat bog suggests the grain was traded or exchanged long before it was grown by the first British farmers.

The research, published in Science, suggests there was a sophisticated network of cultural links across Europe. The grain was found at what is now a submerged cliff off the Isle of Wight.

Farming of plants and animals first appeared in the Near East, with the technology spreading along two main routes into Europe. The accepted date of arrival on the British mainland is around 6,000 years ago, as ancient hunter gatherers began to

grow crops such as wheat and barley. The DNA of the wheat - known as einkorn - was collected from sediment that was once a peat bog next to a river.

Scientists think traders arrived in Britain with the wheat, perhaps via land bridges that connected the south east coast of Britain to the European mainland, where they encountered a less advanced hunter gatherer society.

The wheat may have been made into flour to supplement the diet, but a search for pollen and other clues revealed no signs that the crop was grown in Britain until much later.

Cultural connection

Dr Robin Allaby of the University of Warwick, who led the research, said 8,000 years ago the people of mainland Britain were leading a hunter-gatherer existence, while at the same time farming was gradually spreading across Europe.

"Common throughout neolithic Southern Europe, einkorn is not found elsewhere in Britain until 2,000 years after the samples found at Bouldnor Cliff," he said.

"For the einkorn to have reached this site there needs to have been contact between mesolithic [the culture between paleolithic and neolithic] Britons and neolithic farmers far across Europe.\

"The land bridges provide a plausible facilitation of this contact. As such, far from being insular, mesolithic Britain was culturally and possibly physically connected to Europe."

The research shows that scientists can analyse genetic material preserved within the sediments of the landscapes stretching between Britain and Europe in prehistoric times. Co-researcher Prof Vincent Gaffney, of the University of Bradford, said the find marked a new chapter in British and European history.

"It now seems likely that the hunter-gather societies of Britain, far from being isolated were part of extensive social networks that traded or exchanged exotic foodstuffs across much of Europe," he said.

Tangible link

And Garry Momber of the Maritime Archaeology Trust, which collected the samples from the site, said work in the Solent had opened up an understanding of the UK's formative years in a way that he never dreamed possible.

"The material remains left behind by the people that occupied Britain as it was finally becoming an island 8,000 years ago, show that these were sophisticated people with technologies thousands of years more advanced than previously recognised

"The DNA evidence corroborates the archaeological evidence and demonstrates a tangible link with the continent that appears to have become severed when Britain became an island."

http://www.eurekalert.org/pub_releases/2015-02/cu-la022715.php

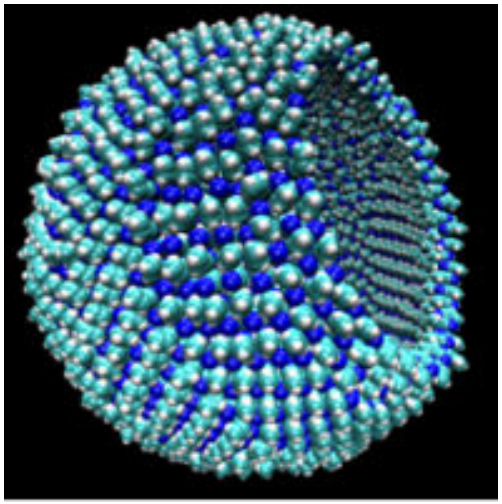
Life 'not as we know it' possible on Saturn's moon Titan

A new type of methane-based, oxygen-free life form that can metabolize and reproduce similar to life on Earth has been modeled by a team of Cornell University researchers.

ITHACA, N.Y. - Taking a simultaneously imaginative and rigidly scientific view, chemical engineers and astronomers offer a template for life that could thrive in a harsh, cold world - specifically Titan, the giant moon of Saturn.

A planetary body awash with seas not of water, but of liquid methane, Titan could harbor methane-based, oxygen-free cells.

Their theorized cell membrane, composed of small organic nitrogen compounds and capable of functioning in liquid methane temperatures of 292 degrees below zero, is published in Science Advances, Feb. 27.



The work is led by chemical molecular dynamics expert Paulette Clancy and first author James Stevenson, a graduate student in chemical engineering. The paper's co-author is Jonathan Lunine, director for Cornell's Center for Radiophysics and Space Research.

Download study and images: https://cornell.box.com/azotosome

A representation of a 9-nanometer azotosome, about the size of a virus, with a piece of the membrane cut away to show the hollow interior. **James Stevenson**

Lunine is an expert on Saturn's moons and an interdisciplinary scientist on the Cassini-Huygens mission that discovered methane-ethane seas on Titan.

Intrigued by the possibilities of methane-based life on Titan, and armed with a grant from the Templeton Foundation to study non-aqueous life, Lunine sought assistance about a year ago from Cornell faculty with expertise in chemical modeling. Clancy, who had never met Lunine, offered to help.

"We're not biologists, and we're not astronomers, but we had the right tools," Clancy said. "Perhaps it helped, because we didn't come in with any preconceptions about what should be in a membrane and what shouldn't. We just worked with the compounds that we knew were there and asked, 'If this was your palette, what can you make out of that?'"

On Earth, life is based on the phospholipid bilayer membrane, the strong, permeable, water-based vesicle that houses the organic matter of every cell.

A vesicle made from such a membrane is called a liposome. Thus, many astronomers seek extraterrestrial life in what's called the circumstellar habitable zone, the narrow band around the sun in which liquid water can exist.

But what if cells weren't based on water, but on methane, which has a much lower freezing point?

The engineers named their theorized cell membrane an "azotosome," "azote" being the French word for nitrogen. "Liposome" comes from the Greek "lipos" and "soma" to mean "lipid body;" by analogy, "azotosome" means "nitrogen body."

The azotosome is made from nitrogen, carbon and hydrogen molecules known to exist in the cryogenic seas of Titan, but shows the same stability and flexibility that Earth's analogous liposome does.

This came as a surprise to chemists like Clancy and Stevenson, who had never thought about the mechanics of cell stability before; they usually study semiconductors, not cells.

The engineers employed a molecular dynamics method that screened for candidate compounds from methane for self-assembly into membrane-like structures.

The most promising compound they found is an acrylonitrile azotosome, which showed good stability, a strong barrier to decomposition, and a flexibility similar to that of phospholipid membranes on Earth. Acrylonitrile - a colorless, poisonous, liquid organic compound used in the manufacture of acrylic fibers, resins and thermoplastics - is present in Titan's atmosphere.

Excited by the initial proof of concept, Clancy said the next step is to try and demonstrate how these cells would behave in the methane environment - what might be the analogue to reproduction and metabolism in oxygen-free, methane-based cells.

Lunine looks forward to the long-term prospect of testing these ideas on Titan itself, as he put it, by "someday sending a probe to float on the seas of this amazing moon and directly sampling the organics."

Stevenson said he was in part inspired by science fiction writer Isaac Asimov, who wrote about the concept of non-water-based life in a 1962 essay, "Not as We Know It."

Said Stevenson: "Ours is the first concrete blueprint of life not as we know it."

http://www.eurekalert.org/pub_releases/2015-02/aps-zos022715.php

Zombie outbreak? Statistical mechanics reveal the ideal hideout

A team of Cornell University researchers focusing on a fictional zombie outbreak as an approach to disease modeling suggests heading for the hills, in the Rockies, to save your brains from the undead.

Reading World War Z, an oral history of the first zombie war, and a graduate statistical mechanics class inspired a group of Cornell University researchers to explore how an "actual" zombie outbreak might play out in the U.S.

During the 2015 American Physical Society March Meeting, on Thursday, March 5 in San Antonio, Texas, the group will describe their work modeling the statistical mechanics of zombies--those thankfully fictional "undead" creatures with an appetite for human flesh. (See the abstract: http://meeting.aps.org/Meeting/MAR15/Session/S48.8)

Why model the mechanics of zombies? "Modeling zombies takes you through a lot of the techniques used to model real diseases, albeit in a fun context," says Alex Alemi, a graduate student at Cornell University.

Alemi and colleagues' work offers a nice introduction to disease modeling in general, as well as some techniques of statistical physics for measuring second-order phase transitions.

"It's interesting in its own right as a model, as a cousin of traditional SIR [susceptible, infected, and resistant] models--which are used for many diseases--but with an additional nonlinearity," points out Alemi.

All told, the project was an overview of modern epidemiology modeling, starting with differential equations to model a fully connected population, then moving on to lattice-based models, and ending with a full U.S.-scale simulation of an outbreak across the continental U.S.

It involved a lot of computational results generated from simulations the researchers wrote themselves. "At their heart, the simulations are akin to modeling chemical reactions taking place between different elements and, in this case, we have four states a person can be in--human, infected, zombie, or dead zombie--with approximately 300 million people," Alemi explains.

The project's large-scale simulations are stochastic in nature, meaning that they have an element of randomness.

"Each possible interaction--zombie bites human, human kills zombie, zombie moves, etc.--is treated like a radioactive decay, with a half-life that depends on some parameters, and we tried to simulate the times it would take for all of these different interactions to fire, where complications arise because when one thing happens it can affect the rates at which all of the other things happen," he says.

In most films or books, "if there is a zombie outbreak, it is usually assumed to affect all areas at the same time, and some months after the outbreak you're left with small pockets of survivors," explains Alemi. "But in our attempt to model zombies somewhat realistically, it doesn't seem like this is how it would actually go down."

Cities would fall quickly, but it would take weeks for zombies to penetrate into less densely populated areas, and months to reach the northern mountain-time zone. "Given the dynamics of the disease, once the zombies invade more sparsely populated areas, the whole outbreak slows down--there are fewer humans to bite, so you start creating zombies at a slower rate," he elaborates. "I'd love to see a fictional account where most of New York City falls in a day, but upstate New York has a month or so to prepare."

If you somehow happen to find yourself in the midst of a fictional zombie outbreak and want to survive as long as possible, Alemi recommends making a run for the northern Rockies.

While not an entirely practical implication, it's "fun to know," he says, and points out the benefits of applying hard science to fun topics--especially to help make learning more entertaining and enjoyable.

"A lot of modern research can be off-putting for people because the techniques are complicated and the systems or models studied lack a strong connection to everyday experiences," Alemi adds. "Not that zombies are an everyday occurrence, but most people can wrap their braains around them."

What's next for Alemi and colleagues? "Given the time, we could attempt to add more complicated social dynamics to the simulation, such as allowing people to make a run for it, include plane flights, or have an awareness of the zombie outbreak, etc.," he notes.

http://www.eurekalert.org/pub_releases/2015-02/uog-tcr022715.php

The Curiosity robot confirms methane in Mars' atmosphere which may hint that life existed

An article published in Science confirms the existence of methane fluctuations in the atmosphere of Mars, as a result of the detailed analysis of data sent during 605 sols or Martian days

The tunable laser spectrometer in the SAM (Sample Analysis at Mars) instrument of the Curiosity robot has unequivocally detected an episodic increase in the concentration of methane in Mars' atmosphere after an exhaustive analysis of data obtained during 605 sols or Martian days.

This has been revealed in an article authored by scientists from the MSL (Mars Science Laboratory) mission, recently published in Science. One of the authors of this article is Francisco Javier Martín-Torres, a researcher at the Andalusian Institute of Earth Sciences (CSIC-UGR).

This puts an end to the long controversy on the presence of methane in Mars, which started over a decade ago when this gas was first detected with telescopes from Earth. The controversy increased afterwards with the measurements obtained by orbiting satellites, some of which were occasionally contradictory. These new and incontrovertible data open paths for new research that can identify the sources that produce this gas--which could include some type of biological activity--and the mechanisms by means of which the gas is eliminated with such inexplicable speed.

Ever since the Telescope in the Mauna Kea Canada-France-Hawaii Observatory first announced the detection of methane in the Martian atmosphere, several other measurements of the gas have been conducted by means of a diversity of instruments, both remotely from earth, and also by means of satellites like the Mars Express and the Mars Global Surveyor.

Since methane can be the product of biological activity--practically all the existing methane in Earth's atmosphere originates in this way--this has created great expectations that Martian methane could also be of a similar origin.

Methane in Mars

These observations appeared to be contradictory. Some of them suggested a distribution pattern that was limited in space (with its source in the Northern hemisphere) and time (with a peak of concentration during summer in the Northern hemisphere and its subsequent vanishing in just a matter of months). Both facts are inexplicable by available photochemical and general circulation models, which are currently used to define our understanding of Martian atmosphere.

According to these models, if there really existed methane in Mars, it would remain there for an average 300 years, and during this period it would be homogeneously distributed across the atmosphere. Since we lack a model that can account for its generation, localization and swift disappearance, detections were all called in doubt, and the results were attributed to the instruments employed in their detection, which were working on the very limit of their capacity, and also to the fact that the concentration values of the gas that they yielded were of the ppbv order (parts per billion by volume).

"Within this context, and when we were all almost fully persuaded that the data we had so far collected were at the very least rough it not fully invalid, the expectations to decide on this were bestowed upon the capacity of the SAM instrument to come up with more precise measurements", says this researcher at the Andalusian Institute of Earth Sciences.

By means of its TLS unit, SAM has been detecting basal levels of methane concentration of around 0,7 ppbv, and has confirmed an event of episodic increase of up to ten times this value during a period of sixty sols (Martian days), i.e., of about 7 ppvb.

The new data are based on observations during almost one Martian year (almost two Earth years), included in the initial prediction for the duration of the mission (nominal mission), during which Curiosity has surveyed about 8 kms in the basin of the Gale crater.

Martian seasons

During this period, which comprehends all the full cycle of Martian seasons, the reference to the environmental data collected by the meteorological REMS (Rover Environmental Monitoring Station) station has allowed for the establishment of possible correlations with the environmental parameters that this instrument records: relative humidity, temperature and atmospheric opacity. Data on atmospheric opacity was obtained both by the UV sensor in REMS and also by MastCam (Mast Camera), the camera at Curiosity, which is employed for support in atmospheric surveys.

REMS is an instrument that has been developed and it is being scientifically exploited by Spanish researchers, some of whom have been members of the team that has conducted this important research. The hypothetical existence of seasonal variations in methane concentration in correlation with certain environmental variables, in any case, will be only confirmed through sustained measurements in the future, specifically oriented to establish which factors can determine the sporadic emission and subsequent degradation of this gas in Mars. As far as the spatial disposition of the methane plumes, they have concluded that they are generated in very brief and weak events and in very specific places.

TLS is a two-channel tunable laser spectrometer which analyses in the infrared region--more specifically in a 2,7 μm wavelength through the first channel, and 3,27 μm through the second. The latter channel is specifically prepared for the detection of methane. It has a resolution of 0,0002 cm-1, which allows for the detection of methane through its spectrographic footprint of three very clearly defined lines, and the procedure which is applied (laser light absorption through a sample contained in a closed cell) "is simple, non-invasive and sensitive" as the article itself claims.

Small margin of error

The containing cell can be full of Martian environment or as a vacuum to make contrasting measurements, which include some conducted through artificially increased concentrations, "which has resulted in a very reduced margin for error and guarantees the accuracy of results, which can now be deemed definitively conclusive", says Martín-Torres.

According to him, the new questions posed by these results far outnumber the answers it does provide. "It is a finding that puts paid to the question of the presence of methane in the Martian atmosphere, but it does pose some other more complex and far-reaching questions, such as the nature of its sources--which must lie, we believe, in one or two additional sources that were not originally contemplated in the models used so far. Among these sources, we must not rule out biological methanogenesis. Another new question is related to the bizarre evolution of methane in the Martian atmosphere after its emission. Both questions should be addressed in the future with specifically designed new research."

The newly arrived MAVEN (Mars Atmosphere and Volatile Evolution) from NASA will immediately provide continuity for the study of this subject, and in the near future the Trace Gas Orbiter (TGO), jointly developed by the European Space Agency (ESA) and the Russian Space Agency (Ruscosmos), which is also part of the ExoMars mission, will measure the concentration of methane at larger scale, and it will allow for the establishment of a framework to contextualize the results obtained, and deepen our knowledge of methane dynamics in Mars.

C.R. Webster et al. "Mars Methane Detection and Variability at Gale Crater". Science, 16 de diciembre de 2014.

http://www.eurekalert.org/pub_releases/2015-02/uof-fdc022715.php

Feast-and-famine diet could extend life, study shows

Think of it as interval training for the dinner table.

University of Florida Health researchers have found that putting people on a feast-or-famine diet may mimic some of the benefits of fasting, and that adding antioxidant supplements may counteract those benefits. Fasting has been shown in mice to extend lifespan and to improve age-related diseases. But fasting every day, which could entail skipping meals or simply reducing overall caloric intake, can be hard to maintain.

"People don't want to just under-eat for their whole lives," said Martin Wegman, an M.D.-Ph.D. student at the UF College of Medicine and co-author of the paper recently published in the journal Rejuvenation Research. "We started thinking about the concept of intermittent fasting."

Michael Guo, a UF M.D.-Ph.D. student who is pursuing the Ph.D. portion of the program in genetics at Harvard Medical School, said the group measured the participants' changes in weight, blood pressure, heart rate, glucose levels, cholesterol, markers of inflammation and genes involved in protective cell responses over 10 weeks.

"We found that intermittent fasting caused a slight increase to SIRT 3, a well-known gene that promotes longevity and is involved in protective cell responses," Guo said.

The SIRT3 gene encodes a protein also called SIRT3. The protein SIRT3 belongs to a class of proteins called sirtuins. Sirtuins, if increased in mice, can extend their lifespans, Guo said.

Researchers think proteins such as SIRT3 are activated by oxidative stress, which is triggered when there are more free radicals produced in the body than the body can neutralize with antioxidants. However, small levels of free radicals can be beneficial: When the body undergoes stress -- which happens during fasting -- small levels of oxidative stress can trigger protective pathways, Guo said.

"The hypothesis is that if the body is intermittently exposed to low levels of oxidative stress, it can build a better response to it," Wegman said.

The researchers found that the intermittent fasting decreased insulin levels in the participants, which means the diet could have an anti-diabetic effect as well.

The group recruited 24 study participants in the double-blinded, randomized clinical trial. During a three-week period, the participants alternated one day of eating 25 percent of their daily caloric intake with one day of eating 175 percent of their daily caloric intake.

For the average man's diet, a male participant would have eaten 650 calories on the fasting days and 4,550 calories on the feasting days. To test antioxidant supplements, the participants repeated the diet but also included vitamin C and vitamin E.

At the end of the three weeks, the researchers tested the same health parameters. They found that the beneficial sirtuin proteins such as SIRT3 and another, SIRT1, tended to increase as a result of the diet.

However, when antioxidants were supplemented on top of the diet, some of these increases disappeared. This is in line with some research that indicates flooding the system with supplemental antioxidants may counteract the effects of fasting or exercise, said Christiaan Leeuwenburgh, Ph.D., co-author of the paper and chief of the division of biology of aging in the department of aging and geriatric research.

"You need some pain, some inflammation, some oxidative stress for some regeneration or repair," Leeuwenburgh said. "These young investigators were intrigued by the question of whether some antioxidants could blunt the healthy effects of normal fasting."

On the study participants' fasting days, they ate foods such as roast beef and gravy, mashed potatoes, Oreo cookies and orange sherbet -- but they ate only one meal. On the feasting days, the participants ate bagels with cream cheese, oatmeal sweetened with honey and raisins, turkey sandwiches, apple sauce, spaghetti with chicken, yogurt and soda -- and lemon pound cake, Snickers bars and vanilla ice cream.

"Most of the participants found that fasting was easier than the feasting day, which was a little bit surprising to me," Guo said. "On the feasting days, we had some trouble giving them enough calories."

Leeuwenburgh said future studies should examine a larger cohort of participants and should include studying a larger number of genes in the participants as well as examining muscle and fat tissue.

http://www.eurekalert.org/pub_releases/2015-02/cums-sdr022315.php

Scientists discover robust evidence that chronic fatigue syndrome is a biological illness

Immune signatures in blood point to distinct disease stages, open door to better diagnosis and treatment

Researchers at the Center for Infection and Immunity at Columbia University's Mailman School of Public Health identified distinct immune changes in patients diagnosed with chronic fatigue syndrome, known medically as **myalgic encephalomyelitis** (**ME/CFS**) or **systemic exertion intolerance disease**. The findings could help improve diagnosis and identify treatment options for the disabling disorder, in which symptoms range from extreme fatigue and difficulty concentrating to headaches and muscle pain.

These immune signatures represent the first robust physical evidence that ME/CFS is a biological illness as opposed to a psychological disorder, and the first evidence that the disease has distinct stages. Results appear online in the new American Association for the Advancement of Science journal, Science Advances. With funding to support studies of immune and infectious mechanisms of disease from the Chronic Fatigue Initiative of the Hutchins Family Foundation, the researchers used immunoassay testing methods to determine the levels of 51 immune biomarkers in blood plasma samples collected through two multicenter studies that represented a total of 298 ME/CFS patients and 348 healthy controls. They found specific patterns in patients who had the disease three years or less that were not present in controls or in patients who had the disease for more than three years. Short duration patients had increased amounts of many different types of immune molecules called cytokines. The association was unusually strong with a cytokine called interferon gamma that has been linked to the fatigue that follows many viral infections, including Epstein-Barr virus (the cause of infectious mononucleosis). Cytokine levels were not explained by symptom severity.

"We now have evidence confirming what millions of people with this disease already know, that ME/CFS isn't psychological," states lead author Mady Hornig, MD, director of translational research at the Center for Infection and Immunity and associate professor of Epidemiology at Columbia's Mailman School. "Our results should accelerate the process of establishing the diagnosis after individuals first fall ill as well as discovery of new treatment strategies focusing on these early blood markers."

There are already human monoclonal antibodies on the market that can dampen levels of a cytokine called interleukin-17A that is among those the study shows were elevated in early-stage patients. Before any drugs can be tested in a clinical trial, Dr. Hornig and colleagues hope to replicate the current, cross-sectional results in a longitudinal study that follows patients for a year to see how cytokine levels, including interleukin-17A, differ within individual patients over time, depending on how long they have had the disease.

Stuck in High Gear

The study supports the idea that ME/CFS may reflect an infectious "hit-and-run" event. Patients often report getting sick, sometimes from something as common as infectious mononucleosis (Epstein-Barr virus), and never fully recover. The new research suggests that these infections throw a wrench in the immune system's ability to quiet itself after the acute infection, to return to a homeostatic balance; the immune response becomes like a car stuck in high gear. "It appears that ME/CFS patients are flush with cytokines until around the three-year mark, at which point the immune system shows evidence of exhaustion and cytokine levels drop," says Dr. Hornig. "Early diagnosis may provide unique opportunities for treatment that likely differ from those that would be appropriate in later phases of the illness."

The investigators went to great lengths to carefully screen participants to make sure they had the disease. The researchers also recruited greater numbers of patients whose diagnosis was of relatively recent onset. Patients' stress levels were standardized; before each blood draw, patients were asked to complete standardized paperwork, in part to engender fatigue. The scientists also controlled for factors known to affect the immune system, including the time of day, season and geographic location where the samples were taken, as well as age, sex and ethnicity/race.

In 2012, W. Ian Lipkin, MD, director of the Center for Infection and Immunity, and colleagues reported the results of a multicenter study that definitively ruled out two viruses thought to be implicated in ME/CFS: XMRV (xenotropic murine leukemia virus [MLV]-related virus) and murine retrovirus-like sequences (designated pMLV: polytropic MLV). In the coming weeks, Drs. Hornig and Lipkin expect to report the results of a second study of cerebrospinal fluid from ME/CFS patients. In separate ongoing studies, they are looking for "molecular footprints" of the specific agents behind the disease--be they viral, bacterial, or fungal--as well as the longitudinal look at how plasma cytokine patterns change within ME/CFS patients and controls across a one-year period, as noted above. "This study delivers what has eluded us for so long: unequivocal evidence of immunological dysfunction in ME/CFS and diagnostic biomarkers for disease," says senior author W. Ian Lipkin, MD, also the John Snow Professor of Epidemiology at Columbia's Mailman School. "The question we are trying to address in a parallel microbiome project is what triggers this dysfunction."

Co-authors include Andrew F. Schultz, Xiaoyu Che, and Meredith L. Eddy at the Center for Infection and Immunity; Jose G. Montoya at Stanford University; Anthony L. Komaroff at Harvard Medical School; Nancy G. Klimas at Nova Southeastern University; Susan Levine at Levine Clinic; Donna Felsenstein at Massachusetts General Hospital; Lucinda Bateman at Fatigue Consultation Clinic; and Daniel L. Peterson and Gunnar Gottschalk at Sierra Internal Medicine. The authors report no competing interests.

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http://bit.ly/1wxbtuJ

Sharks Have Scary-Good Memories

New research on one species reveals an astounding ability to learn complex tricks and remember them for at least a year

By Laura Clark

Sharks have a reputation for being mindless, stomach-driven killing machines. But, just as your mother warned, you can't judge a book just by its blood-soaked cover. A new study testing the intelligence of the grey bamboo shark has shown the species' amazing intellectual capabilities as well as their ability to remember certain information for at least a year. According to BBC Earth, this cognitive capacity puts them in competition with other animals known to have enduring memories, including crows and some primates.

The study, recently published in the journal Animal Cognition, had juvenile sharks undergo different cognitive experiments. In one, the animals were placed in a holding tank and taught through a food-reward system to identify either a triangle or a square by touching their noses to the projected image.

A researcher then tested whether the sharks could transfer this skill. Would they still be able to identify the appropriate shape even when depicted in an optical illusion called Kanizsa figures? More often than not, they could. The sharks' wits remained razor sharp when subjected to different experiments asking them to identify differing line lengths which were then also obscured by optical illusions.

At the end of these intelligence experiments, some 50 months after the start of the study, the researcher tested the grey bamboo sharks to see if they still remembered the first experiments' training. "Up to 50 weeks later, almost all the sharks still remembered which shape to select," reports BBC Earth.

So what's the biological purpose of all of these shark-smarts? BBC suggests that the mostly bottom-feeding sharks' "ability to fill in information from incomplete visual cues most likely translates to abilities that increase their chances of survival in the wild." In other words, there's an advantage to being to identify—and remember—varied prey in the sand or a safe little nook from which to hide from predators.

http://bit.ly/1JZ9dC0

"Big Brain" Gene Allowed for Evolutionary Expansion of Our Neocortex

The newly identified gene is found in modern-day humans, Neandertals and Denisovans, but not in chimps

February 27, 2015 |By Tia Ghose and LiveScience

A single gene may have paved the way for the rise of human intelligence by dramatically increasing the number of brain cells found in a key brain region.

This gene seems to be uniquely human: It is found in modern-day humans, Neanderthals and another branch of extinct humans called Denisovans, but not in chimpanzees.

By allowing the brain region called the neocortex to contain many more neurons, the tiny snippet of DNA may have laid the foundation for the human brain's massive expansion.

"It is so cool that one tiny gene alone may suffice to affect the phenotype of the stem cells, which contributed the most to the expansion of the neocortex," said study lead author Marta Florio, a doctoral candidate in molecular and cellular biology and genetics at the Max Planck Institute of Molecular Cell Biology and Genetics in Dresden, Germany. Still, it's likely this gene is just one of many genetic changes that make human cognition special, Florio said.

An expanding brain

The evolution from primitive apes to humans with complex language and culture has taken millions of years. Some 3.8 million ago, Australopithecus afarensis, the species typified by the iconic early human ancestor fossil Lucy, had a brain that was less than 30 cubic inches (500 cubic centimeters) in volume, or about a third the size of the modern human brain. By about 1.8 million years ago, Homo erectus was equipped with a brain that was roughly twice as big as that of Australopithecus. H. erectus also showed evidence of tool and fire use and more complex social groups.

Once anatomically modern humans, and their lost cousins the Neanderthals and Denisovans, arrived on the scene, the brain had expanded to roughly 85 cubic inches (1.4 liters) in volume. Most of this growth occurred in a brain region called the neocortex.

"The neocortex is so interesting because that's the seat of cognitive abilities, which, in a way, make us human — like language and logical thinking," Florio told Live Science.

The neocortex is so large because it is jam-packed with neurons, or brain cells. But what genetic changes ushered in this explosion of neurons?

Single gene

To understand that question, Florio, along with her thesis advisor, Dr. Wieland Huttner, a neurobiologist also at the Max Planck Institute, were studying one type of neural progenitor cell, a stem cell that divides and then forms brain cells during embryonic development. In mice, these cells divide once, and then make neurons. But in humans, these same types of cells divide many times over before forming a huge number of neurons.

Florio isolated this pool of cells, and then analyzed the genes that were turned on in both mice and humans at a stage of peak brain development. (The researchers looked at this process in both 13-week gestation human fetuses whose tissue had been donated by women after abortions and in mice at 14 days gestation.)

The researchers found that a particular gene, called ARHGAP11B, was turned on and highly activated in the human neural progenitor cells, but wasn't present at all in mouse cells. This tiny snippet of DNA, just 804 letters, or bases, long, was once part of a much longer gene, but somehow this fragment was duplicated and the duplicated fragment was inserted into the human genome.

Then the team inserted and expressed (turned on) this DNA snippet in the brains of mice. Though mice normally have a tiny, smooth neocortex, the mice with the gene insertion grew what looked like larger neocortices; these amped-up brain regions contained loads of neurons and some even began forming the characteristic folds, or convolutions, found in the human brain, a geometry that packs a lot of dense brain tissue into a small amount of space. (The researchers did not check to see if the mice actually got smarter, though that is a potential avenue of future research, Florio said).

Unique gene

Building on past work by Evan Eichler and colleagues at the University of Washington, the team also looked at the genomes of several other species, and confirmed that Neanderthals and Denisovans had this gene, but chimpanzees and mice do not.

That suggests the gene emerged soon after humans split off from chimpanzees, and that it paved the way for the rapid expansion of the human brain.

Still, this genetic change is unlikely to fully explain human smarts, Huttner said. Both humans and Neanderthals had large brains, but humans' unique intelligence may have more to do with how brain cells form and prune neural networks over time, he said.

Though the gene creates many more neurons to work with, "how those neurons wire up to allow us to fly to the moon, but not the Neanderthal, that is more likely to be a function of genes expressed in neurons," as opposed to genes expressed in progenitor cells, Huttner told Live Science.

The gene was described Feb. 26 in the journal Science.

http://bit.ly/1AIULYO

Nearly Halted in Sierra Leone, Ebola Makes Comeback by Sea

It seemed as if the Ebola crisis was abating.

By SHERI FINK FEB. 28, 2015

FREETOWN, Sierra Leone — New cases were plummeting. The president lifted travel restrictions, and schools were to reopen. A local politician announced on the radio that two 21-day incubation cycles had passed with no new infections in his Freetown neighborhood. The country, many health officials said, was "on the road to zero." Then Ebola washed in from the sea.

Sick fishermen came ashore in early February to the packed wharf-side slums that surround the country's fanciest hotels, which were filled with public health workers. Volunteers fanned out to contain the outbreak, but the virus jumped quarantine lines and cascaded into the countryside, bringing dozens of new infections and deaths.

"We worked so hard," said Emmanuel Conteh, an Ebola response coordinator in a rural district. "It is a shame to all of us."

Public health experts preparing for an international conference on Ebola on Tuesday seem to have no doubt that the disease can be vanquished in the West African countries ravaged by it in the last year. But the steep downward trajectory of new cases late last year and into January did not lead to the end of the epidemic. In Sierra Leone, the hardest hit of the countries, the decline leveled off in late January, and the country has reported 60 to 80 new cases weekly since then. Guinea has experienced months of lower-level spread. Even in Liberia, where only a handful of treatment beds remain occupied, responders lament that a health care worker who recently became ill might have exposed dozens of colleagues and patients, and that a knife fight had exposed gang members to the blood of a man who tested positive for Ebola.

"I doubt it will stop just suddenly," said Dr. Pierre Rollin, an infectious disease expert with the United States Centers for Disease Control and Prevention. "It's always bumpy, and the bigger the outbreak, the more chance you have a bumpy thing."

As large epidemics taper off, it is common to find new complications in the effort to reach zero cases. "Oftentimes we find surprises when we get to a low level that were hidden by the epidemic itself early on," said Dr. William Foege, a former director of the C.D.C. and a leading figure in the eradication of smallpox.

For example, health officials managed to reduce measles drastically in the United States in the 1970s, but it took some time before experts realized that a few travelers per week arriving from other countries were developing the illness, continuing its spread. Importation of measles is again a problem today, and it is suspected as a factor in the current outbreak linked to Disneyland.

Then there is polio, which experts had resolved to eliminate globally by 2000, before wars and unexpected resistance disrupted the plan.

"I don't think we ever foresaw a time when people would shoot and kill polio vaccinators," Dr. Foege said, referring to incidents in Pakistan and Nigeria that interrupted inoculation campaigns.

Eliminating smallpox about 35 years ago required a deep understanding of the communities in which it hid. During its last stand, in Somalia, people obscured cases, partly out of embarrassment.

"I think Ebola will turn out to be the same thing," Dr. Foege said. "The surprises will not be so much scientific as cultural: the ability to hide cases; the desire not to be identified as having Ebola or being in contact with Ebola. Those are the things we have to find out how to overcome."

That challenge is apparent now in Sierra Leone, where the arrival of infected mariners — combined with a recent easing of anti-Ebola measures, persistent community resistance to containment measures and misunderstanding — has contributed to the surge in the capital. Vice President Samuel Sam-Sumana said Saturday that he had placed himself under quarantine after one of his security officers died of Ebola on Tuesday.

Two wooden boats carrying three sick fishermen arrived at a small wharf in Freetown in early February, cutting short a two-week trip. "The captain was vomiting," said Mohamed Bangura, 23, a crew member of one boat.

The wharf, Tamba Kula, is an informal settlement where hundreds of people live in shanties made of reclaimed wood and corrugated metal roofs. At the slum's entrance, a towering sign displays an image of the Statue of Liberty, an advertisement for daily British Airways flights with connections to the United States that were canceled when the Ebola outbreak was declared.

Now, commerce in Tamba Kula is also restricted. Those who contracted Ebola there and nearby — two dozen people since early February — include fishermen, boat cleaners and two women who sold fish.

There are various theories about how the seamen might have been infected and how they spread Ebola to others. Some fishermen delayed reporting their illnesses, stopping instead at an island for treatment with native herbs before coming home to the capital. A few wharf residents who later fell ill thought they had come into contact with contaminated bodily fluids at a shared toilet block that was recently built in Tamba Kula by the aid group Oxfam.

When the cluster erupted at the wharf area — part of a large neighborhood known as Aberdeen, with about 9,000 residents — some Ebola prevention workers were taken by surprise because they had been continuing surveillance efforts. Officials imposed a quarantine, prompting many fishermen to take to the sea to avoid it. The authorities sent out word for them to return.

On a recent afternoon, James Bangura, an official leading the Ebola response in the capital, chastised the deputy harbor master of Tamba Kula for failing to keep arriving fisherman on their boats to be evaluated.

"Once they're lost and nobody accounts for them, we can't get to zero," Mr. Bangura told the man. "They scatter," the deputy harbor master responded, but he checked the men from the next boat that arrived.

Outreach teams in recent days made their way over twisting dirt paths filled with garbage, fish bones and shells along seaside settlements in Aberdeen, where narrow passages made it impossible to avoid physical contact with others. The volunteers stopped at dozens of residences. "Nobody sick?" they asked in the Krio language. "You aren't hiding anybody?"

One night at 11:30, Foday Kamara, a community monitor, walked breathlessly up the road from Tamba Kula. He said he had spent two hours with soldiers chasing down a dozen or so residents who had tried to escape quarantine in the dark. They said that they felt cooped up and that food did not always arrive.

"Ebola work is not easy," Mr. Kamara said. "I feel like these people, they aren't ready to end Ebola yet."

The hard work — by teams of student volunteers, with national and international public health experts — was rewarded, as new cases in Tamba Kula declined.

"I feel like our response was rapid, it was strong, and it appears to have helped," Dr. John T. Redd, an epidemiologist with the C.D.C., said at the district's command center in Freetown 10 days ago. On a white board, he had drawn two smiley faces next to the number zero for the previous day's positive cases.

But the problem was not over. It had moved.

In early February, Abass Koroma, who ran a food grinding shop in Tamba Kula, left there with the help of his wife. His sister had recently died, and he was sick. Mr. Koroma's mother, Fatmata Kalokoh, a rice farmer who had traveled to Freetown after her daughter's death, said her son's wife had paid a taxi driver about $40 for the three-hour journey back to the family's village, Rosanda, east of the capital. Her son had refused to go to the hospital in Freetown out of fear, she said. When he arrived in Rosanda, she took him to a traditional healer, who prepared an herbal medicine to help him sleep. Mr. Koroma drank it and began vomiting blood. The next day, he died en route to another village to see another traditional healer.

His death was reported to teams in charge of safe burials, but some villagers said they had touched him while he was sick, thinking that something like a curse had killed him and not Ebola. Mr. Koroma has been linked to the subsequent infections of 42 people in the community, some of whom have died, according to Ebola response officials in the district.

"His wife caused all this," Ms. Kalokoh said. Now a patient at an International Medical Corps treatment center, she gestured to a treatment tent where her daughter-in-law lay. A survivor working at the center shushed Ms. Kalokoh, saying that it was in God's hands and that she should not blame anyone.

Every day last week, ambulances bumped over dusty roads, going to Rosanda to carry villagers 45 minutes to the medical center. Two mothers walked weakly to the open doors of an ambulance as their young sons watched, shoulders heaving with sobs. A young girl was taken last Sunday as her mother stood helpless behind candy-striped quarantine tape. The girl, Marie Kamara, died on Friday.

As cases mounted, Dr. Conteh, the district's Ebola response coordinator, summoned about 125 traditional healers, tribal chiefs and other local leaders. He called for a suspension of traditional practices and warned that criminal summonses were being issued to anyone accused of hiding the sick. Experts fear that such threats will lead more people to go underground.

"The war is still on," Dr. Conteh told colleagues the next day. "We're at a critical stage. We can either make or break."

http://www.eurekalert.org/pub_releases/2015-03/soir-its021915.php

Image-guided treatment shown to break the migraine cycle

Patients report using less pain-relief medicine after interventional radiology intranasal treatment

ATLANTA--An innovative interventional radiology treatment has been found to offer chronic migraine sufferers sustained relief of their headaches, according to research being presented at the Society of Interventional Radiology's Annual Scientific Meeting. Clinicians at Albany Medical Center and the State University

New York Empire State College in Saratoga Springs used a treatment called image-guided, intranasal sphenopalatine ganglion (SPG) blocks to give patients enough ongoing relief that they required less medication to relieve migraine pain.

"Migraine headaches are one of the most common, debilitating diseases in the Unites States, and the cost and side effects of medicine to address migraines can be overwhelming," said Kenneth Mandato, M.D., the study's lead researcher and an interventional radiologist at Albany Medical Center. "Intranasal sphenopalatine ganglion blocks are image-guide, targeted, breakthrough treatments. They offer a patient-centered therapy that has the potential to break the migraine cycle and quickly improve patients' quality of life," he added.

Mandato and his team conducted a retrospective analysis of 112 patients suffering migraine or cluster headaches. Patients reported the severity of their headaches on a visual analogue scale (VAS), ranging from 1-10, to quantify the degree of debilitation experienced from the migraine. During the treatment, which is minimally invasive and does not involve needles touching the patient, researchers inserted a spaghetti-sized catheter through the nasal passages and administered 4 percent lidocaine to the sphenopalatine ganglion, a nerve bundle just behind the nose associated with migraines.

Before treatment, patients reported an average VAS score of 8.25, with scores greater than 4 at least 15 days per month. The day after the SPG block patients' VAS scores were cut in half, to an average of 4.10. Thirty days after the procedure, patients reported an average score of 5.25, a 36 percent decrease from pretreatment. Additionally, 88 percent of patients indicated that they required less or no migraine medication for ongoing relief.

"Administration of lidocaine to the sphenopalatine ganglion acts as a 'reset button' for the brain's migraine circuitry," noted Mandato. "When the initial numbing of the lidocaine wears off, the migraine trigger seems to no longer have the maximum effect that it once did. Some patients have reported immediate relief and are making fewer trips to the hospital for emergency headache medicine," he said. Because of the minimally invasive nature of the treatment and the medication's safety profile, Mandato believes patients can have the SPG block repeated, if needed.

While patients reported relief from their migraines, Mandato added that SPG blocks are not a cure for migraines; they are a temporary solution as are other current treatment options for chronic headaches. Because of the minimally invasive nature of the treatment and the medication's safety profile, Mandato believes patients can have the SPG block repeated, if needed.

To further study SPG blocks, Mandato will track how the 112 patients have responded six months after treatment. He is also considering conducting a double-blind, prospective study to more rigorously evaluate the effectiveness of SPG blocks in treating chronic migraines.

Abstract 77: "Image-guided sphenopalatine ganglion blocks: An IR solution for chronic headaches," K. Mandato, G. Siskin, R. Tartaglione, G. Bolotin, C. Stavrakis, M. Englander, L. Keating, A. Herr, Radiology, Albany Medical Center, N.Y.; D. Geer, SUNY Empire State College, Saratoga Springs, N.Y.; SIR Annual Scientific Meeting, Feb. 28-March 5. This abstract can be found at http://www.sirmeeting.org.