http://www.eurekalert.org/pub_releases/2012-04/lu-nsc042312.php

New stem cell found in the brain

Researchers at Lund University have discovered a new stem cell in the adult brain.

These cells can proliferate and form several different cell types - most importantly, they can form new brain cells. Now the researchers hope to put the discovery to use to develop methods that can repair diseases and injury to the brain.

Analysing brain tissue from biopsies, the researchers for the first time found stem cells located around small blood vessels in the brain. The cell's specific function is still unclear, but its plastic properties suggest great potential. A similar cell type has been identified in several other organs where it can promote regeneration of muscle, bone, cartilage and adipose tissue.

In other organs, researchers have shown clear evidence that these types of cells contribute to repair and wound healing. Scientists suggest that the curative properties may also apply to the brain. The next step is to try to control and enhance stem cell self-healing properties with the aim of carrying out therapies targeted to a specific area of the brain.

"Our findings show that the cell capacity is much larger than we originally thought, and that these cells are very versatile," said Gesine Paul-Visse, Ph.D., Associate Professor of Neuroscience at Lund University.

"Most interesting is their ability to form neuronal cells, but they can also be developed for other cell types. The results contribute to better understanding of how brain cell plasticity works and opens up new opportunities to exploit these very features."

The study, published in the journal PLoS ONE, is of interest to a broad spectrum of brain research. Future possible therapeutic targets range from neurodegenerative diseases to stroke. "We hope that our findings may lead to a new and better understanding of the brain's own repair mechanisms," said Dr. Paul-Visse. "Ultimately the goal is to strengthen these mechanisms and develop new treatments that can repair the diseased brain."

Title: ***The Adult Human Brain Harbors Multipotent Perivascular Mesenchymal Stem Cells***

http://www.eurekalert.org/pub_releases/2012-04/foas-ivp041812.php

Intravenous vaccination promotes brain plasticity and prevents memory loss in Alzheimer's disease

Currently, intravenous human immunoglobulin treatment is being explored in multiple off-label uses

San Diego, CA - Alzheimer's disease (AD) is an incurable, progressive neurodegenerative disease affecting over five million people worldwide, and is the leading cause of dementia in the elderly. Currently, intravenous human immunoglobulin (IVIG) treatment is being explored in multiple off-label uses other than immunotherapy, including AD. Several clinical studies assessing the tolerability and efficacy of IVIG in Alzheimer's disease subjects are in progress with inconsistent outcomes. Recent studies conducted by Dr. Giulio Maria Pasinetti, Saunders Family Chair and Professor in Neurology and Psychiatry at Mount Sinai School of Medicine in New York, suggests that the divergent outcomes in Alzheimer's disease clinical studies of IVIG may be due to differences in temporal administration and administered dosages.

Dr. Pasinetti and his team of investigators recently found that prolonged administration of human immunoglobulin in models of Alzheimer's disease, using a dose of immunoglobulin ~5-20-fold less than equivalent doses used in Alzheimer's disease patients, is effective at attenuating Alzheimer's disease-type cognitive dysfunction while promoting synaptic plasticity. "This experimental observation provides a rational basis for rectifying the inconsistency of study outcomes in Alzheimer's disease clinical trials with IVIG," said Dr. Pasinetti. Recent evidence from Dr. Pasinetti's laboratory and others suggests that a mechanism by which IVIG may benefit cognition is through the increase of brain contents of certain mediators of natural immunity, such as the complement component-derived anaphylatoxins C5a and C3a, capable of promoting synaptic plasticity and neuroprotection.

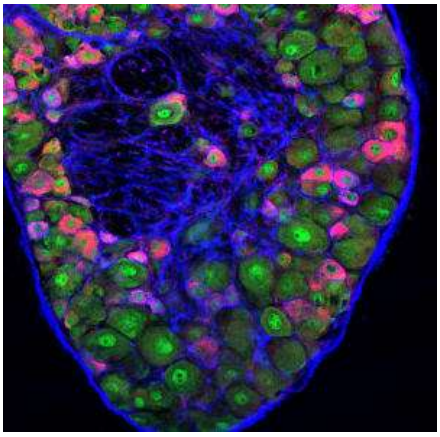
"We now have the much needed information supporting the potential application of slow release of immunoglobulins delivered subcutaneously to delay the onset of Alzheimer's disease, even at pre-symptomatic stages of the disease" said Dr. Pasinetti.

Dr. Pasinetti hypothesizes that the slow release of immuglobulins into the circulation and eventually into the brain for a protracted period of time may delay Alzheimer's disease dementia onset and eventually its progression through epigenetic changes in the downstream gene expression of C5a-mediated pCREB-C/EBP signaling components associated with modulation of synaptic plasticity and eventually learning and memory functions.

http://www.sciencedaily.com/releases/2012/04/120423103715.htm

Pain Relief With PAP Injections May Last 100 Times Longer Than a Traditional Acupuncture Treatment

Scientists at the University of North Carolina at Chapel Hill have identified a new way to deliver long-lasting pain relief through an ancient medical practice.



PAP (red) is found in neurons that sense pain-producing stimuli. **Credit: Zylka lab, UNC-Chapel Hill**

ScienceDaily - In an article published in the April 23 online edition of Molecular Pain, UNC researchers describe how exploiting the molecular mechanism behind acupuncture resulted in six-day pain relief in animal models. They call this new therapeutic approach PAPupuncture.

Principal investigator Mark J. Zylka, PhD, associate professor in the Department of Cell and Molecular Physiology and the UNC Neuroscience Center, said this is a promising study that moves his lab's work with prostatic acid phosphatase, known as PAP, towards translational research.

Several years ago, Zylka and members of his lab documented how injecting PAP into the spine eased chronic pain for up to three days in rodents. The only problem was PAP's delivery.

"Spinal injections are invasive and must be performed in a clinical setting, and hence are typically reserved for patients with excruciating pain," said Zylka. Though he had never received acupuncture or researched traditional Chinese medicine, Zylka said recent research showing how acupuncture relieved pain caught his eye.

"When an acupuncture needle is inserted into an acupuncture point and stimulated, nucleotides are released. These nucleotides are then converted into adenosine," said Zylka. Adenosine has antinociceptive properties, meaning adenosine can decrease the body's sensitivity to pain. The release of adenosine offers pain relief, but for most acupuncture patients that relief typically lasts for a few hours. "We knew that PAP makes adenosine and lasts for days following spinal injection, so we wondered what would happen if we injected PAP into an acupuncture point?" Zylka said. "Can we mimic the pain relief that occurs with acupuncture, but have it last longer?"

To find out, Zylka and his lab injected PAP into the popliteal fossa, the soft tissue area behind the knee. This also happens to be the location of the Weizhong acupuncture point. Remarkably, they saw that pain relief lasted 100 times longer than a traditional acupuncture treatment. What's more, by avoiding the spine the researchers could increase the dose of PAP. A single injection was also effective at reducing symptoms associated with inflammatory pain and neuropathic pain. "Pinning down the mechanisms behind acupuncture, at least in animal models, was critical," said Zylka. "Once you know what chemicals are involved, you can exploit the mechanism, as we did in our study."

The next step for PAP will be refining the protein for use in human trials. UNC has licensed the use of PAP for pain treatment to Aerial BioPharma, a Morrisville, N.C.-based biopharmaceutical company. Zylka said PAP could be applicable to any area where regional anesthesia is performed to treat pain. And PAP has the potential to last longer than a single injection of local anesthetic -- the class of drugs used in regional anesthesia.

"When it comes to pain management, there is a clear need for new approaches that last for longer periods of time," said Julie Hurt, PhD, a postdoctoral fellow in Zylka's lab.

Zylka co-authored the paper with Hurt. The research was undertaken at UNC and was supported by the National Institute of Neurological Disorders and Stroke, a component of the National Institutes of Health.

Julie K Hurt, Mark J Zylka. PAPupuncture has localized and long-lasting antinociceptive effects in mouse models of acute and chronic pain. Molecular Pain, 2012; 8 (1): 28 ***DOI: 10.1186/1744-8069-8-28***

http://www.sciencedaily.com/releases/2012/04/120423131512.htm

Making Human Textiles: Research Team Ups the Ante With Development of Blood Vessels Woven from Donor Cells

A lot of people were skeptical when two young California-based researchers set out more than a decade ago to create a completely human-derived alternative to the synthetic blood

ScienceDaily - A lot of people were skeptical when two young California-based researchers set out more than a decade ago to create a completely human-derived alternative to the synthetic blood vessels commonly used in dialysis patients. Since then, they've done that and more.

"There were a lot of doubts in the field that you could make a blood vessel, which is something that needs to resist pressure constantly, 24-7, without any synthetic materials in it," explains Nicolas L'Heureux, a co-founder and the chief scientific officer of Cytograft Tissue Engineering Inc. "They didn't think that was possible at all."

But they were wrong. Cytograft, which L'Heureux and Todd McAllister co-founded in 2000, has indeed developed vessels that are "completely biological, completely human and living, which is the Cadillac of treatments … and it seems to work really well," L'Heureux says.

First the team created blood vessels from patients' own skin cells. Then, in June, the company announced that three dialysis patients had received the world's first lab-grown blood vessels made from skin cells from donors, which eliminates the long lead time needed for making vessels from a patient's own cells. And now Cytograft has developed a new technique for making human textiles that promises to reduce the production cost of these vessels by half. L'Heureux presented his team's latest findings on April 23, at the annual meeting of the American Association of Anatomists, which is being held in conjunction with the Experimental Biology 2012 meeting in San Diego.

Laying the foundation for a human textile

Cytograft's new approach builds on what already has been proved successful. In 2005, the team began extracting fibroblasts from patients' own skin, cultured those cells into thin sheets, rolled up those sheets, cultured them some more so that they would fuse together, and implanted the lab-grown cylindrical vessels. The vessel-growing process was lengthy, at about seven months, but, because the vessels were derived from the patients' own cells, the implants were easily accepted by the patients' bodies, and they held up to the rigors of dialysis, which requires repeated punctures with large-gauge needles.

Then the researchers created allogeneic vessels -- ones grown from donor cells -- with the hope that they were laying the foundation for an off-the-shelf stockpile of 100 percent human replacement parts.

"By combining these two methods we could make something that is allogeneic, cheaper to produce, and that you could store forever, meaning that the clinician can pull it off the shelves whenever they want," L'Heureux explains. "If it is frozen and allogeneic, that is kind of the homerun."

Those donor-based vessels were implanted into three patients in Poland, and they have performed well with no signs of rejection. That accomplishment was a big one, from a manufacturing standpoint, L'Heureux says, because "it is very, very costly to segregate all the patients' cells at all the steps with all the material and all the media and the culturing zones."

Though using donor cells dramatically reduces costs, putting the price tag of a lab-grown human vessel somewhere between $6,000 to $10,000 (although this will come down with automation and volume), it doesn't cut down the manufacturing time all that much, because the culturing of the cells so that they fuse together takes many months. So the researchers decided it was time to try out an idea they'd been kicking around for some years: human textiles.

Not your grandmother's knitting

Today the Cytograft team is deconstructing the sheets of cultured cells into threads and then using a variety of medical-textile-making techniques to weave together blood vessels. Most medical textiles used today are made of permanent synthetic fibers, such as polyester. "They weave synthetic threads to create patches, for example, for blood vessels … and they can make a large blood-vessel replacement conduit that they use for arterial repair. They can use patches for hernia repair," L'Heureux explains. "What we are doing here is using a completely biological, completely human -- and chemically nonprocessed in any way -- fiber from which we can now build all kinds of structures by weaving, knitting, braiding or a combination of techniques."

L'Heureux says that, once the cell sheets are grown, the weaving of these human textiles into a vessel takes only a couple of days, even with the prototype loom currently in use at the Cytograft lab. And the threads of cells, while more delicate than synthetic fibers, are strong. "It is not like your grandmother with the little knitting pins," L'Heureux says. "It is much faster than that. Basically, the time it takes for making the threads and assembling them in a blood vessel is negligible compared to the time that it took you to make the sheet."

The time is now

L'Heureux notes that, having shown that vessels grown from donor cells are a good, natural alternative to synthetic vessels, it's time to roll out "a treatment that is more streamlined and more cost effective," and this third-generation woven allogeneic blood vessel could be the solution.

"We just came to a point where we had proved a lot of what we could do with our blood vessels and it made sense to find a way to make it faster. And this weaving method that makes the vessel out of the same material that we used in the sheet makes it ready in about a third of the time that it took before," he says.

Additionally, he says, weaving actually produces a more robust vessel than one that has been cultured in a cylindrical shape. "There is no seam, which is a problem when you roll something -- there's always a flap on the inside and a flap on the outside, and you need to be sure that these flaps are really well fused with the rest, and that takes a long time for the cells to do," he says. The work remains in the early stages, and an animal trial

showed promising results. For one thing, the woven vessel has proved to resist puncture, "which is important for dialysis," he says.

Next steps

From the beginning, Cytograft's team has focused primarily on the lab-grown vessels' use in dialysis patients, "because that's where the largest need is," L'Heureux says. But they could be used in a variety of patients. Babies with congenital heart defects, for instance, need replacement vessels that can grow and change. Heart bypass patients today endure the often-painful recovery associated with removing a vessel from one part of the body for implantation elsewhere, and a lab-grown and -woven one could eliminate the need for the first surgery.

Also, human-based replacement vessels are far less susceptible to infection than synthetic ones, L'Heureux emphasizes. "With synthetics, one of the big drawbacks is that they get easily infected. What happens is that the synthetic harbors microbes, and immune cells can't deal with the synthetic. They can't grab it. It's like chasing a dog on an ice rink." Immune cells, meanwhile, can recognize and interact with the lab-grown tissue since it is completely biological.

Despite the doubts about Cytograft's work in the early days, there is a push nowadays for finding natural alternatives to synthetics, in part because of the infection risk, L'Heureux says. "Today, 15 years later, the goal of eliminating synthetic materials from tissue-engineered products has become pretty mainstream."

http://www.eurekalert.org/pub_releases/2012-04/jhmi-bts042412.php

Blood transfusions still overused and may do more harm than good in some patients

Johns Hopkins study shows wide variation in transfusion use in operating rooms

Citing the lack of clear guidelines for ordering blood transfusions during surgery, Johns Hopkins researchers say a new study confirms there is still wide variation in the use of transfusions and frequent use of transfused blood in patients who don't need it. The resulting overuse of blood is problematic, the researchers say, because blood is a scarce and expensive resource and because recent studies have shown that surgical patients do no better, and may do worse, if given transfusions prematurely or unnecessarily. "Transfusion is not as safe as people think," says Steven M. Frank, M.D., leader of the study described in the journal Anesthesiology.

"Over the past five years, studies have supported giving less blood than we used to, and our research shows that practitioners have not caught up," says Frank, an associate professor of anesthesiology and critical care medicine at the Johns Hopkins University School of Medicine. "Blood conservation is one of the few areas in medicine where outcomes can be improved, risk reduced and costs saved all at the same time. Nothing says it's better to give a patient more blood than is needed." The exceptions, Frank says, are cases of trauma, hemorrhage or both, where infusing blood quickly can be lifesaving.

General guidelines from three different medical societies govern when a surgical patient should get blood, but they tend to be vague, Frank says. In a healthy adult, a normal hemoglobin level - the quantity of red blood cells carrying oxygen through the body - is roughly 14 grams per deciliter. The guidelines state that when a patient's hemoglobin level falls below six or seven grams per deciliter, a patient will benefit from a transfusion, and that if the levels are above 10, a patient does not need a transfusion. But when blood levels are in-between, there has been little consensus about what to do.

The recent studies, Frank says, suggest that physicians can safely wait until hemoglobin levels fall to seven or eight before transfusing, even in some of the sickest patients. A Department of Health and Human Services committee complained last year of "both excessive and inappropriate use of blood transfusions in the U.S.," noted that "blood transfusion carries significant risk that may outweigh its benefits in some settings," and stated that misuse adds unnecessary costs.

For the new study, Frank and his colleagues examined the electronic anesthesia records of more than 48,000 surgical patients at The Johns Hopkins Hospital over the 18 months from February 2010 to August 2011. Overall, 2,981 patients (6.2 percent) were given blood transfusions during surgery. The researchers found wide variation among surgeons and among anesthesiologists, compared to their peers, and how quickly they order blood.

For example, patients undergoing cardiac surgeries received blood at much lower trigger points compared to patients having other surgeries. Patients undergoing surgery for pancreatic cancer, orthopedic problems and aortic aneurysms, on the other hand, received blood at higher trigger points, often at or above 10 grams per deciliter. The amount of blood transfused, Frank says, did not clearly correlate with how sick the patients were or with how much blood is typically lost during specific types of surgery. Blood is lost during many operations, though hemoglobin levels don't often fall to the point where blood transfusion is necessary, he says.

Blood transfusion, which introduces a foreign substance "transplant" into the body, initiates a series of complex immune reactions. Patients often develop antibodies to transfused red blood cells making it more

difficult to find a match if future transfusions are needed. Transfused blood also has a suppressive effect on the immune system, which increases the risk of infections, including pneumonia and sepsis, he says. Frank also cites a study showing a 42 percent increased risk of cancer recurrence in patients having cancer surgery who received transfusions. Blood is in short supply and pricey, says Frank. It costs $278 dollars to buy a unit of blood from the American Red Cross, for example, and as much as $1,100 for the nonprofit to acquire, test, store and transport. Medicare pays just $180 for that unit of blood.

The decision about when to give a blood transfusion during surgery is made jointly by the surgeon and the anesthesiologist, but it is the responsibility of the anesthesiologist to administer the blood, Frank says. The surgeon and the anesthesiologist may have different opinions about when a transfusion is necessary. Discussions about transfusion trigger points would ideally be made before surgery, since it is too late to be making decisions when the surgery is under way, he says.

Frank's research at Johns Hopkins produced a list of blood use and trigger points for each individual surgeon and anesthesiologist. Frank recently told the Hopkins surgeon who uses blood most often that he held that distinction and explained the reasons he might want to wait until hemoglobin levels are lower before ordering a transfusion. In the two months before their conversation, 30 percent of that surgeon's patients got blood transfusions. In the two months after, only 18 percent did. After Frank presented his research to Johns Hopkins' Department of Surgery, the director told the surgeons assembled that although most of them were trained to transfuse when hemoglobin levels fall below 10, transitioning to a trigger of seven or eight made sense.

"A lot of our practices are just handed down through the generations," Frank says.

Although Frank's study focuses only on one hospital, he says the lack of consistent guidelines for ordering blood puts patients at risk all over the country. Coming up with an exact algorithm for the timing of blood transfusion is impossible, as each situation and each individual surgery is different. But Frank believes what is best for patients is to strive to transfuse less whenever possible.

Other Johns Hopkins researchers involved in the study include Will J. Savage, M.D.; Jim A. Rothschild, M.D.; Richard J. Rivers, M.D.; Paul M. Ness, M.D.; Sharon L. Paul, B.S., M.S.; and John A. Ulatowski, M.D., Ph.D., M.B.A.

http://www.eurekalert.org/pub_releases/2012-04/foas-cop041812.php

Component of pizza seasoning herb oregano kills prostate cancer cells

Oregano has long been known to possess a variety of beneficial health effects

San Diego, CA - Oregano, the common pizza and pasta seasoning herb, has long been known to possess a variety of beneficial health effects, but a new study by researchers at Long Island University (LIU) indicates that an ingredient of this spice could potentially be used to treat prostate cancer, the second leading cause of cancer death in American men.

Prostate cancer is a type of cancer that starts in the prostate gland and usually occurs in older men. Recent data shows that about 1 in 36 men will die of prostate cancer. Estimated new cases and deaths from this disease condition in the US in 2012 alone are 241,740 and 28,170, respectively. Current treatment options for patients include surgery, radiation therapy, hormone therapy, chemotherapy, and immune therapy. Unfortunately, these are associated with considerable complications and/or severe side effects.

Dr. Supriya Bavadekar, PhD, RPh, Assistant Professor of Pharmacology at LIU's Arnold & Marie Schwartz College of Pharmacy and Health Sciences, is currently testing carvacrol, a constituent of oregano, on prostate cancer cells. The results of her study demonstrate that the compound induces apoptosis in these cells. Apoptosis, Dr. Bavadekar explains, is programmed cell death, or simply "cell suicide." Dr. Bavadekar and her group are presently trying to determine the signaling pathways that the compound employs to bring about cancer cell suicide.

"We know that oregano possesses anti-bacterial as well as anti-inflammatory properties, but its effects on cancer cells really elevate the spice to the level of a super-spice like turmeric," said Dr. Bavadekar. Though the study is at its preliminary stage, she believes that the initial data indicates a huge potential in terms of carvacrol's use as an anti-cancer agent. "A significant advantage is that oregano is commonly used in food and has a 'Generally Recognized As Safe' status in the US. We expect this to translate into a decreased risk of severe toxic effects."

"Some researchers have previously shown that eating pizza may cut down cancer risk. This effect has been mostly attributed to lycopene, a substance found in tomato sauce, but we now feel that even the oregano seasoning may play a role," stated Dr. Bavadekar. "If the study continues to yield positive results, this super-spice may represent a very promising therapy for patients with prostate cancer." The results of the study will be presented at the Experimental Biology 2012 poster session on Tuesday, April 24.

http://www.eurekalert.org/pub_releases/2012-04/lu-pit042412.php

Prions in the brain eliminated by homing molecules

Toxic prions in the brain can be detected with self-illuminating polymers.

The originators, at Linköping University in Sweden, has now shown that the same molecules can also render the prions harmless, and potentially cure fatal nerve-destroying illnesses.

Linköping researchers and their colleagues at the University Hospital in Zürich tested the luminescent conjugated polymers, or LCPs, on tissue sections from the brains of mice that had been infected with prions. The results show that the number of prions, as well as their toxicity and infectibility, decreased drastically. This is the first time anyone has been able to demonstrate the possibility of treating illnesses such as mad cow disease and Creutzfeldt-Jacobs with LCP molecules.

"When we see this effect on prion infections, we believe the same approach could work on Alzheimer's disease as well," says Peter Nilsson, researcher in Bioorganic Chemistry funded by ERC, the European Research Council. Along with professors Per Hammarström and Adriano Aguzzi and others, he is now publishing the results in The Journal of Biological Chemistry.

Prions are diseased forms of normally occurring proteins in the brain. When they clump together in large aggregates, nerve cells in the surrounding area are affected, which leads to serious brain damage and a quick death. Prion illnesses can be inherited, occur spontaneously or through infection, for example through infected meat – as was the case with mad cow disease. The course of the illness is relentless when the prions fall to pieces and replicate at an exponential rate. When researchers inserted the LCP molecules into their model system, the replication was arrested, possible through stabilizing the prion aggregates.

The variable components in an LCP are various chemical subgroups attached onto the polymer. In the published study, eight different substances were tested, and all of them had significant effect on the toxicity of the prions. "Based on these results, we can now customise entirely new molecules with potentially even better effect. These are now being tested on animal models," Nilsson says. Researchers want to go even further and test whether the molecules will function on fruit flies with an Alzheimer's-like nerve disorder. Alzheimer's is caused by what is known as amyloid plaque, which has a similar but slower course than prion diseases.

The study is part of the EU LUPAS project (http://www.lupas-amyloid.eu) with participants from Sweden, Switzerland, France, Israel, Norway, and Germany. The coordinator is Per Hammarström, at Linköping University.

Article: Polythiophenes inhibit prion propagation by stabilizing PrP aggregates by I. Margalith, C. Suter, B. Ballmer, P. Schwarz, C. Tiberi, T. Sonati, J. Falsig, S. Nyström, P. Hammarström, A. Åslund, K. P. R. Nilsson, A. Yam, E. Whitters, S. Hornemann and A. Aguzzi. The Journal of Biological Chemistry, online early edition 6 April 2012.

http://www.bbc.co.uk/news/science-environment-17809503

Ancient virus DNA thrives in us

Traces of ancient viruses which infected our ancestors millions of years ago are more widespread in us than previously thought.

By David Shukman Science editor, BBC News

A study shows how extensively viruses from as far back as the dinosaur era still thrive in our genetic material. It sheds light on the origins of a big proportion of our genetic material, much of which is still not understood. The scientists investigated the genomes of 38 mammals including humans, mice, rats, elephants and dolphins.

The research was carried out at Oxford University, the Aaron Diamond AIDS Research Centre in New York and the Rega Institute in Belgium. It is reported in the journal Proceedings of the National Academy of Sciences.

One of the viruses was found to have invaded the genome of a common ancestor around 100 million years ago with its remnants discovered in almost every mammal in the study. Another infected an early primate with the result that it was found in apes, humans and other primates as well. The work established that many of these viruses lost the ability to transfer from one cell to another. Instead they evolved to stay within their host cell where they have proliferated very effectively - spending their entire life cycle within the cell.

Forced choice

The researchers found evidence of the viruses multiplying so extensively within mammals' genomes that they have been compared to an outbreak of disease. The senior author of the study, Dr Robert Belshaw from Oxford University's Zoology Department, said: "This is the story of an epidemic within every animal's genome, a story which has been going on for 100 million years and which continues today.

"We suspect that these viruses are forced to make a choice: either to keep their 'viral' essence and spread between animals and species. Or to commit to one genome and then spread massively within it."

The study shows that the viruses involved have lost a gene called Env, which is responsible for transmission between cells. Known as endogenous retroviruses, these micro-organisms have gone on to become 30 times more abundant in their host cells.

The study is one of many attempting to understand the full complexity of the human genome. Astonishingly, only 1.5% of the genetic material in our cells codes for human life. Half of the rest is sometimes described as "junk DNA" with no known function, and the other half consist of genes introduced by viruses and other parasites.

Positive services

According to the lead author, Dr Gkikas Magiorkinis, "much of the dark matter in our genome plays by its own rules, in the same way as an epidemic of an infectious disease but operating over millions of years.

"Learning the rules of this ancient game will help us understand their role in health and disease."

This raises the extraordinary scenario of our DNA serving as an environment in which viruses can evolve - a micro-ecology within the double-helix of our genetic material. There is evidence that they can provide positive services. For example the protein syncytin - derived from a virus - helps develop the placenta.

Dr Belshaw says that endogenous retroviruses (ERVs) are not known to have any obvious or direct health effects. "But there could be effects we're not picking up on or things we could even take advantage of if we detect ERVs moving around or expressing proteins as a result of cancer or infection."

The study was supported by the Wellcome Trust and the Royal Society.

http://phys.org/news/2012-04-turing-proteins-decades-old.html

Turing was right: Two proteins fit decades-old prediction

In 1952 he sketched out a biological model in which two chemicals - an activator and an inhibitor - could interact to form the basis for everything from the color patterns of a butterfly's wings to the black and white stripes of a zebra.

Today, Alan Turing is best known as the father of modern computer science, but in 1952 he sketched out a biological model in which two chemicals - an activator and an inhibitor - could interact to form the basis for everything from the color patterns of a butterfly's wings to the black and white stripes of a zebra. It was an innovative hypothesis, made all the more impressive by the fact that it was postulated without the benefit of modern molecular biology - the double-helix structure of DNA wouldn't be discovered for another year.

Harvard research now shows that Nodal and Lefty - two proteins linked to the regulation of asymmetry in vertebrates and the development of precursor cells for internal organs - fit the model described by Turing six decades ago. In a paper published online in Science April 12, Alexander Schier, professor of molecular and cellular biology, and his collaborators Patrick Müller, Katherine Rogers, Ben Jordan, Joon Lee, Drew Robson, and Sharad Ramanathan demonstrate a key aspect of Turing's model: that the activator protein Nodal moves through tissue far more slowly than its inhibitor Lefty. "That's one of the central predictions of the Turing model," Schier said. "So I think we can now say that Nodal and Lefty are a clear example of this model in vivo."

Schier's latest finding is the result of more than a decade of research into the Nodal/Lefty pairing. In a 2002 paper, his group described results that suggested the two proteins act as an activator/inhibitor pair, one of the key tenets of the model outlined by Turing. But it was the recent experiments on how the proteins move through tissue that clinched it.

To test the biophysical properties of Nodal and Lefty, Schier's team began by generating modified versions of Nodal or Lefty that would fluoresce under laser light. They observed that Lefty moved farther through zebrafish embryos than Nodal. To measure the diffusion rates of these proteins, they used a process called photobleaching to "erase" an area of either Nodal or Lefty. They then measured the time needed for Lefty and Nodal to diffuse into the bleached space. The results matched the prediction of the Turing model.

In a separate test, the researchers explored whether the two proteins might have different stabilities, which could also explain why Lefty moves farther through the embryo than Nodal. To test this possibility, researchers irradiated the modified versions of either Nodal or Lefty with lasers, causing the fluorescent proteins to change their color from green to red. By measuring how long it took for the red color to disappear, they were able to determine that Nodal and Lefty are similarly stable.

"That tells us that it's the mobility not the stability that is different between these two molecules," Schier said. "That's important, because it is the diffusion that's different in the models proposed by Turing.

"Turing was brilliant," Schier continued. "There wasn't a single molecule known that would regulate development or pattern formation when he proposed this model. For him, it was a pure mathematical model. The Turing equation is simple but there's a certain beauty to it. It can be applied to many different biological systems and what you get are amazing and beautiful patterns. Our paper shows that aspects of the Turing model

actually do work in vivo. We still don't know how a zebra's stripes or a leopard's spots are formed, but the Turing model shows one way it could work."

Going forward, Schier said, he hopes to understand the mechanism behind the different mobility of Nodal and Lefty. "We know these proteins are different, but why are they different?" Schier asked. "They are similar in size, they have similar structures – but somehow they must interact differently with other molecules, affecting how they move. That's a question for the future." *Provided by Harvard University*

http://phys.org/news/2012-04-mysterious-monster-amateur-paleontologist.html

Mysterious 'monster' discovered by amateur paleontologist

Around 450 million years ago, shallow seas covered the Cincinnati region and harbored one very large and now very mysterious organism.

Phys.org - Despite its size, no one has ever found a fossil of this "monster" until its discovery by an amateur paleontologist last year.

The fossilized specimen, a roughly elliptical shape with multiple lobes, totaling almost seven feet in length, will be unveiled at the North-Central Section 46th Annual Meeting of the Geological Society of America, April 24, in Dayton, Ohio. Participating in the presentation will be amateur paleontologist Ron Fine of Dayton, who originally found the specimen, Carlton E. Brett and David L. Meyer of the University of Cincinnati geology department, and Benjamin Dattilo of the Indiana University Purdue University Fort Wayne geosciences faculty.

Fine is a member of the Dry Dredgers, an association of amateur paleontologists based at the University of Cincinnati. The club, celebrating its 70th anniversary this month, has a long history of collaborating with academic paleontologists.

"I knew right away that I had found an unusual fossil," Fine said. "Imagine a saguaro cactus with flattened branches and horizontal stripes in place of the usual vertical stripes. That's the best description I can give."

The layer of rock in which he found the specimen near Covington, Kentucky, is known to produce a lot of nodules or concretions in a soft, clay-rich rock known as shale. "While those nodules can take on some fascinating, sculpted forms, I could tell instantly that this was not one of them," Fine said. "There was an 'organic' form to these shapes. They were streamlined."

A close-up reveals the intriguing texture of the seven-foot-long specimen.

Fine was reminded of streamlined shapes of coral, sponges and seaweed as a result of growing in the presence of water currents. "And then there was that surface texture," Fine said. "Nodules do not have surface texture. They're smooth. This fossil had an unusual texture on the entire surface."

For more than 200 years, the rocks of the Cincinnati region have been among the most studied in all of paleontology, and the discovery of an unknown, and large, fossil has professional paleontologists scratching their heads.

"It's definitely a new discovery," Meyer said. "And we're sure it's biological. We just don't know yet exactly what it is."

To answer that key question, Meyer said that he, Brett, and Dattilo were working with Fine to reconstruct a timeline working backward from the fossil, through its preservation, burial, and death to its possible mode of life. "What things had to happen in what order?" Meyer asked. "Something caused a directional pattern. How did that work? Was it there originally or is it post-mortem? What was the burial event? How did the sediment get inside? Those are the kinds of questions we have."

It has helped, Meyer said, that Fine has painstakingly reassembled the entire fossil. This is a daunting task, since the large specimen is in hundreds of pieces. "I've been fossil collecting for 39 years and never had a need to excavate. But this fossil just kept going, and going, and going," Fine said. "I had to make 12 trips, over the course of the summer, to excavate more material before I finally found the end of it."

Even then he still had to guess as to the full size, because it required countless hours of cleaning and reconstruction to put it all back together. "When I finally finished it was three-and-a-half feet wide and six-and-a-half feet long," Fine said. "In a world of thumb-sized fossils that's gigantic!"

Meyer, co-author of A Sea without Fish: Life in the Ordovician Sea of the Cincinnati Region, agreed that it might be the largest fossil recovered from the Cincinnati area.

"My personal theory is that it stood upright, with branches reaching out in all directions similar to a shrub," Fine said. "If I am right, then the upper-most branch would have towered nine feet high. "

As Meyer, Brett and Dattilo assist Fine in studying the specimen, they have found a clue to its life position in another fossil. The mystery fossil has several small, segmented animals known as primaspid trilobites attached to its lower surface. These small trilobites are sometimes found on the underside of other fossilized

animals, where they were probably seeking shelter. "A better understanding of that trilobite's behavior will likely help us better understand this new fossil," Fine said.

Although the team has reached out to other specialists, no one has been able to find any evidence of anything similar having been found. The mystery monster seems to defy all known groups of organisms, Fine said, and descriptions, even pictures, leave people with more questions than answers.

The presentation April 24 is a "trial balloon," Meyer said, an opportunity for the team to show a wide array of paleontologists what the specimen looks like and to collect more hypotheses to explore. "We hope to get a lot of people stopping by to offer suggestions," he said. In the meantime, the team is playing around with potential names. They are leaning toward "Godzillus."

More information: ***http://www.geosoci … /nc/2012mtg/***

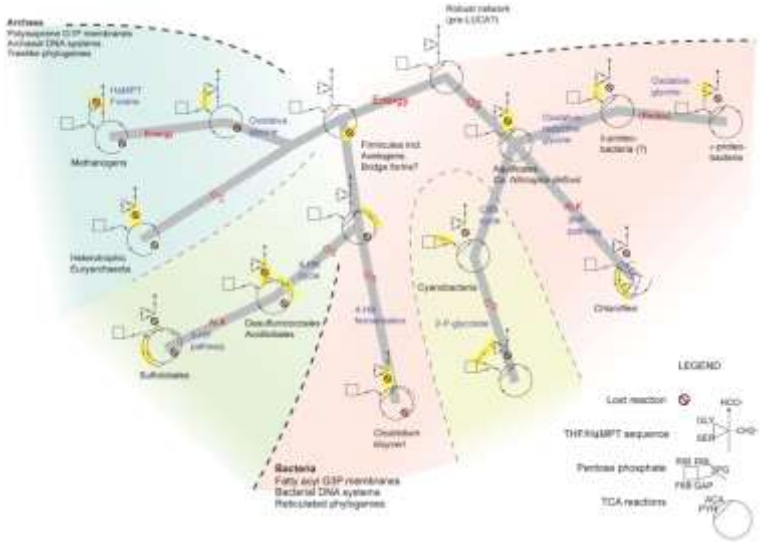
http://www.sciencedaily.com/releases/2012/04/120424142145.htm

Following Life's Chemistry to the Earliest Branches On the Tree of Life

A study maps the development of life-sustaining chemistry to the history of early life and six methods of carbon fixation seen in modern life back to a single ancestral form

ScienceDaily - In a study published in PLoS Computational Biology, the Santa Fe Institute's Rogier Braakman and D. Eric Smith map the development of life-sustaining chemistry to the history of early life and trace six methods of carbon fixation seen in modern life back to a single ancestral form.

Carbon fixation - life's mechanism for making carbon dioxide biologically useful - forms the biggest bridge between Earth's non-living chemistry and its living biosphere. All organisms that fix carbon do so in one of six ways. These six mechanisms have overlaps, but it was previously unclear which of the six types came first, and how their development interweaved with environmental and biological changes.



Phylometabolic tree of carbon fixation. Each small black network represents a carbon-fixation pathway, and the tree describes the evolutionary process that connects them. In red are identified environmental driving forces. Through integrating phylogenetics with metabolic constraints, phylometabolic analysis allows a clear description down to the root of the tree, and shows how carbon-fixation structured the deep history of life on Earth. **Braakman and Smith, doi/10.1371/journal.pcbi.1002455.g005**

The authors used a method that creates "trees" of evolutionary relatedness based on genetic sequences and metabolic traits. From this, they were able to reconstruct the complete early evolutionary history of biological carbon-fixation, relating all ways in which life today performs this function.

The earliest form of carbon fixation identified by scientists achieved a special kind of built-in robustness -- not seen in modern cells -- by layering multiple carbon-fixing mechanisms. This redundancy allowed early life to compensate for a lack of refined control over its internal chemistry, and formed a template for the later splits that created the earliest major branches in the tree of life.

For example, the first major life-form split came with the earliest appearance of oxygen on Earth, causing the ancestors of blue-green algae and most other bacteria to separate from the branch that includes Archaea, which, outside of bacteria, are the other major early group of single-celled microorganisms.

"It seems likely that the earliest cells were rickety assemblies whose parts were constantly malfunctioning and breaking down," explains Smith, an SFI External Professor. "How can any metabolism be sustained with such shaky support? The key is concurrent and constant redundancy."

Once early cells had more refined enzymes and membranes, allowing greater control over metabolic chemistry, environmental driving forces directed life's unfolding. These forces included changes in oxygen level and alkalinity, as well as minimization of the amount of energy (in the form of ATP) used to create biomass.

In other words, the environment drove major divergences in predictable ways -- in contrast to the common widely held belief that chance dominated evolutionary innovation and that rewinding and replaying the evolutionary tape would lead to an irreconcilably different tree of life.

"Mapping cell function onto genetic history gives us a clear picture of the physiology that led to the major foundational divergences of evolution," explains Braakman, an SFI Omidyar Fellow. "This highlights the central role of basic chemistry and physics in driving early evolution." With the ancestral form uncovered and evolutionary drivers pinned to branching points in the tree, the researchers now want to make the study more mathematically formal and further analyze the early evolution of metabolism.

Rogier Braakman, Eric Smith. The Emergence and Early Evolution of Biological Carbon-Fixation. PLoS Computational Biology, 2012; 8 (4): e1002455 DOI: 10.1371/journal.pcbi.1002455

http://nyti.ms/JCykcn

Fly and Human Mothers Share a Milk Enzyme

Production of the enzyme could be manipulated to help reduce flies that spread diseases.

By SINDYA N. BHANOO

Female tsetse flies produce only one egg at a time. The larva hatches in the mother's uterus, and she feeds it with a milklike substance that she produces.

Now, researchers report that tsetse milk contains an enzyme called sphingomyelinase, or sMase, that is also important in mammalian lactation. And that means the flies can be used to help study issues in human lactation, said Joshua Benoit, an entomologist at Yale University who was involved with the research. He and his colleagues report their findings in the journal The Biology of Reproduction.

In humans, for example, sMase deficiencies can cause Niemann-Pick disease, a neurological disorder that can be fatal in young children. Then there is sleeping sickness (and a related animal disease, nagana), which is caused by parasites transmitted by the bite of the tsetse fly. Sleeping sickness can be fatal if it is not treated early, and there is no vaccine for the disease.

The researchers believe that manipulating the production of the lactation enzyme in female flies could aid in reducing their population. This might be done by chemical spraying of the animals that the flies feed on, Dr. Benoit said.

http://www.eurekalert.org/pub_releases/2012-04/sri-som042012.php

Splatters of molten rock signal period of intense asteroid impacts on Earth

Rock layers raise questions about the source of impactors

New research reveals that the Archean era - a formative time for early life from 3.8 billion years ago to 2.5 billion years ago - experienced far more major asteroid impacts than had been previously thought, with a few impacts perhaps even rivaling those that produced the largest craters on the Moon, according to a paper published online today in Nature.

The fingerprints of these gigantic blasts are millimeter- to centimeter-thick rock layers on Earth that contain impact debris: sand-sized droplets, or spherules, of molten rock that rained down from the huge molten plumes thrown up by mega-impacts. This barrage of asteroids appears to have originated in an extended portion of the inner asteroid belt that is now mostly extinct.

Computer models suggest the zone was likely destabilized about 4 billion years ago by the late migration of the giant planets from the orbits they formed on to where we find them today. The team conducting this study includes members or associates of the NASA Lunar Science Institute's Center of Lunar Origin and Evolution (CLOE), based at the Southwest Research Institute (SwRI) in Boulder, Colo.

The millimeter-scale gray circles are all formerly molten droplets ejected into space when an asteroid struck the Earth about 2.56 billion years ago. These droplets, known as impact spherules, returned to Earth and were concentrated at the base of the Reivilo layer in South Africa. The droplets originally consisted of glass and crystals formed in flight that have since been replaced by other minerals. The spherules still contain substantial extraterrestrial material based, for example, on their containing 176 parts per million iridium in bulk. The flat to irregular black masses were originally mud fragments ripped up by high-energy currents and/or waves during the deposition of the layer; the source of that energy may have been an asteroid striking the ocean.

Credit: Courtesy Bruce Simonson, Oberlin College and Conservatory

Archean rocks are scarcer than rocks of any other age, and impact spherule beds have been found only in terrains where conditions were ideal for capture and preservation, such as in shales deposited on the seafloor below the reach of waves. At least 12 spherule beds deposited between 3.47 and 1.7 billion years ago (Ga) have been found, with most in the Archean; 7 between 3.23-3.47 Ga, 4 between 2.49-2.63 Ga and 1 between 1.7-2.1

Ga. "The beds speak to an intense period of late bombardment of the Earth, but their source has long been a mystery," says CLOE Principal Investigator and SwRI Researcher Dr. William Bottke.

By comparison, the Chicxulub impact that is believed to have killed the dinosaurs 65 million years ago was the only known collision over the past half-billion years that made a spherule layer as thick as those of the Archean period. "The Archean beds contain enough extraterrestrial material to rule out alternative sources for the spherules, such as volcanoes," says Bruce Simonson, a geologist from the Oberlin College and Conservatory who has studied these ancient layers for decades.

The timing of these major events is curious because they occur well after the presumed end of the so-called Late Heavy Bombardment, or LHB, of the Moon. This period occurred about 4 billion years ago and produced the largest lunar craters, or basins. The precise nature of the LHB continues to be debated, and testing what happened and for how long was the top science priority for future exploration of the Moon, according to a previously published report by the National Research Council.

The best available model of the LHB, often referred to as the Nice model after the observatory where it was developed in Nice, France, invokes a large-scale repositioning of the giant planets Jupiter, Saturn, Uranus and Neptune as a trigger for a solar system-wide bombardment of asteroids and comets. The extensive pummeling of the Earth and Moon identified in the Nice model, however, lasted 100- to 200-million years, not nearly long enough to explain the Archean spherule beds.

Following up on the implications of the Nice model, the team examined a possible missing source of impactors, one that would have come from the inner edge of the main asteroid belt between the orbits of Mars and Jupiter. While most of this region is now unstable, researchers believe this may not have been the case 4 billion years ago. The difference was that the giant planets, whose gravitational forces control the orbital stability of solar system worlds, were likely in a more compact configuration than they are now.

By creating a hypothetical extension to the primordial asteroid belt and tracking what would have happened to these bodies when the giant planets reorganized themselves, team members found the bodies could have delivered numerous big impactors to the Earth and Moon over a much longer time. As additional validation of the model, team members found it could reproduce a tiny population of asteroids called the Hungarias, a reservoir of relatively stable but fairly small asteroids located between the orbits of Mars and the inner edge of the main asteroid belt.

They found that approximately 70 (and 4) dinosaur killer-sized or larger impacts hit the Earth (and Moon) over a span that lasted between 3.8 and 1.8 billion years ago. The frequency of these impacts was enough to reproduce the known impact spherule beds. It also hints at the possibility that the enormous 180-kilometer (112-mile) diameter Vredefort crater in South Africa, which is 2 billion years old, and the nearly 250-kilometer (155-mile) Sudbury crater in Canada, which is 1.85 billion years old, might be literally the last gasp of the LHB on Earth.

Team members predict that the largest Archean-era impacts should be similar to the 15 or so youngest and largest lunar basins, which range in diameter from about 300 - 200 kilometers (186-miles). The implication of such enormous impacts over the Archean era is unknown, but some are believed to have released nearly 500 times the blast energy of the Chicxulub impact.

"It will be interesting to see whether these mammoth events affected the evolution of early life on our planet or our biosphere in important ways," says Bottke.

In a companion paper also published online today in Nature, another team of researchers, led by Brandon Johnson and Jay Melosh of Purdue University, used computer models to estimate the gargantuan projectile sizes needed to explain the nature and distribution of the Archean spherule layers. Their work provides experimental data to correlate with this study.

The impact study team includes Bottke, Dr. David Nesvorny and Dr. Hal Levison, Southwest Research Institute; Dr. David Minton, Purdue University; Prof. Bruce Simonson, Oberlin College and Conservatory; Dr. David Vokrouhlicky, Charles University, Prague, Czech Republic; Dr. Alessandro Morbidelli, Observatorie de la Cote d'Azur, Nice, France; and Dr. Ramon Brasser, Academia Sinica Institute of Astronomy and Astrophysics, Taipei, Taiwan.

Funding for this study was provided by the NASA Lunar Science Institute, the Grant Agency of the Czech Republic and Germany's Helmholtz Alliance.

The article, "An Archaean Heavy Bombardment from a Destabilized Extension of the Asteroid Belt" appears in the May 3 issue of Nature.

http://www.sciencedaily.com/releases/2012/04/120425115314.htm

Strong Support for Once-Marginalized Theory On Parkinson's Disease

Scientists have used powerful computational tools and laboratory tests to discover new support for a once-marginalized theory about the underlying cause of Parkinson's disease.

ScienceDaily - University of California, San Diego scientists have used powerful computational tools and laboratory tests to discover new support for a once-marginalized theory about the underlying cause of Parkinson's disease. The new results conflict with an older theory that insoluble intracellular fibrils called amyloids cause Parkinson's disease and other neurodegenerative diseases. Instead, the new findings provide a step-by-step explanation of how a "protein-run-amok" aggregates within the membranes of neurons and punctures holes in them to cause the symptoms of Parkinson's disease.

The discovery, published in the March 2012 issue of the FEBS Journal, describes how α-synuclein (a-syn), can turn against us, particularly as we age. Modeling results explain how α-syn monomers penetrate cell membranes, become coiled and aggregate in a matter of nanoseconds into dangerous ring structures that spell trouble for neurons.

"The main point is that we think we can create drugs to give us an anti-Parkinson's effect by slowing the formation and growth of these ring structures," said Igor Tsigelny, lead author of the study and a research scientist at the San Diego Supercomputer Center and Department of Neurosciences, both at UC San Diego.

Familial Parkinson's disease is caused in many cases by a limited number of protein mutations. One of the most toxic is A53T. Tsigelny's team showed that the mutant form of α-syn not only penetrates neuronal membranes faster than normal α-syn, but the mutant protein also accelerates ring formation.

"The most dangerous assault on the neurons of Parkinson's patients appears to be the relatively small α-syn ring structures themselves," said Tsigelny. "It was once heretical to suggest that these ring structures, rather than long fibrils found in neurons of people having Parkinson's disease, were responsible for the symptoms of the disease; however, the ring theory is becoming more and more accepted for this neurodegenerative disease and others such as Alzheimer's disease. Our results support this shift in thinking."

The modeling results also are consistent with the electron microscopy images of neurons in Parkinson's disease patients; the damaged neurons are riddled with ring structures.

Wasting no time, the modeling discoveries have spawned an intense hunt at UC San Diego for drug candidates that block ring formation in neuron membranes. The sophisticated modeling required involves a complex realm of science at the intersection of chemistry, physics, and statistical probabilities. A kaleidoscope of interacting forces in this realm makes α-syn proteins bump and tremble like they're in an earthquake, coil and uncoil, and join together in pairs or larger groups of inventive ballroom dancers.

The modeling is creating a much better understanding of the mysterious a-syn protein itself, according to Tsigelny. A few years ago it was shown to accumulate in the central nervous system of patients with Parkinson's disease and a related disorder called dementia with Lewy bodies.

The new modeling study has revealed precisely how two α-syn proteins insert their molecular toes into the membrane of a neuron, wiggle into it in only a few nanoseconds and immediately join together as a pair. The pair isn't itself toxic; however, when more α-syn proteins join the dance, a key threshold is eventually crossed; polymerization accelerates into a ring structure that perforates the membrane, damaging the cell.

Tsigelny said many ring structures may be required to actually kill neurons, which are known for their durability. The nerve cells may be able to repair dozens of ring-induced perforations, keeping pace with a-syn assault. But at some point, the rate of perforations surpasses the ability of neurons to repair them. As a result, symptoms of Parkinson's disease gradually appear and worsen. "We think we can create a drug that stops the α-syn polymerization at the point of non-propagating dimers," Tsigelny said. "By interrupting the polymerization at this crucial step, we may be able to slow the disease significantly."

Tsigelny's research team included Yuriy Sharikov, with SDSC and UC San Diego's Department of Neurosciences; Wolfgang Wrasidlo, with the university's Moores Cancer Center; and Tania Gonzalez, Paula A. Desplats, Leslie Crews, and Brian Spencer, all with UC San Diego's Department of Neurosciences. The experimental validation studies were performed by Eliezer Masliah, a professor in the UC San Diego departments of Neurosciences and Pathology, and his associates. They relied on 3-D models of proteins, plus molecular dynamics simulations of the proteins, other modeling techniques and cell-culture experiments.

Given their deeper understanding of α-syn polymerization in neurons, they are now focused on understanding how monomers of α-syn stick to one another. Their search for drug candidates will include molecules that induce different conformations of α-syn proteins that are less inclined to stick together. Tsigelny said this effect, even if small, could reduce symptoms.

This computationally intensive approach includes an examination of the many possible three-dimensional arrangements of α-syn dimers, trimmers and tetramers. Pharmaceutical companies have used versions of the approach to develop drug candidates designed to bind to 'anchor residues' or 'hot spots' within target proteins. Algorithms assess in virtual experiments the theoretical ability of thousands of candidate drugs to bind to human proteins in the ever-expanding database of known 3-D structures of those proteins. However, attempts to find drugs this way have generated promising candidates that fail in clinical trials with expensive regularity.

"Out of these failures we've come to appreciate that proteins change their shapes so often that what would appear to be a primary drug target may be present one nanosecond, gone the next, or it wasn't relevant in the first place," said Tsigelny, a physicist-turned-drug-designer.

Tsigelny's approach takes advantage of classical drug-discovery algorithms, but adds additional analytical techniques to expand the search to include how a target protein's conformations change in response to the forces operating on the scale of molecules. "Sometimes, the drug-discovery models, despite being 'nice looking,' can be completely wrong," Tsigelny said. "Scientists involved in drug discovery need to know when and to what extent to trust them. Even a slight shift in a cell's environment can profoundly change the interactions of proteins with neighboring molecules. We think it's realistically possible to design a drug to treat neurodegenerative diseases such as Parkinson's disease and other diseases like diabetes with a more fundamental understanding of the proteins involved in those diseases."

The research was funded by grants from the National Institutes of Health and Department of Energy, with computational support from Argonne National Laboratory's IBM Blue Gene supercomputer as well as computational resources at SDSC.

http://www.sciencedaily.com/releases/2012/04/120425140320.htm

Bacteria Beware: Researchers Have a Natural Sidekick That May Resolve the Antibiotic-Resistant Bacteria Dilemma

Antibiotic-resistant bacteria continue to be a global concern with devastating repercussions, such as increased healthcare costs, potential spread of infections across continents, and prolonged illness.

ScienceDaily - However, researchers at Brigham and Women's Hospital (BWH) could change the playing field of man versus bacteria. Charles Serhan, PhD, director of the BWH Experimental Therapeutics and Reperfusion Injury Center, has identified pathways of naturally occurring molecules in our bodies that can enhance antibiotic performance. The study will be electronically published on April 25, 2012 in Nature.

Mice infected with Escherichia coli (E. coli) or Staphylococcus aureus (S. aureus) bacteria were given molecules called specialized pro-resolving mediators (SPMs) along with antibiotics. SPMs are naturally found in our bodies, and are responsible for mediating anti-inflammatory responses and resolve inflammation. An anti-inflammatory response is the body's attempt to protect itself from infectious agents and initiate the healing process. The researchers found that specific types of SPM molecules, called resolvins and protectins, were key in the anti-inflammatory response to limit tissue damage by stimulating the body's white blood cells to contain, kill and clear the bacteria.

Administered with antibiotics, resolvins and protectins heightened immune response by commanding white blood cells to attack and engulf the bacteria, thereby quickly reducing the amount of bacteria in the blood and tissues. RvD5-a type of resolvin-in particular was also helpful in regulating fever caused by E.coli, as well as counter-regulating genes responsible for mounting excess inflammation associated with infections; hence, limiting the collateral damage to the body while fighting infection.

Serhan and colleagues are the first to demonstrate RvD5, as well as its actions against bacterial invasion. The BWH team, collaborating with Fredrik Bäckhed, PhD of the Sahlgrenska Center for Cardiovascular and Metabolic Research in Sweden, found that germ-free animals produce high levels of resolvins.

When Nan Chiang, PhD, BWH Experimental Therapeutics and Reperfusion Injury Center, and lead study author, added these natural mediators together with antibiotics, less antibiotics were needed. This demonstrated for the first time that stimulating resolution programs can limit negative consequences of infection.

"How the body responds to inflammation has been the subject of Dr. Serhan's work for more than 20 years, and his new study is important for understanding that sequence of events," said Richard Okita, PhD, National Institute of General Medical Sciences, National Institutes of Health which funded the research. "One of the particularly exciting findings is that SPMs can enhance the effectiveness of antibiotics, potentially lowering the amount needed to treat infections and reducing the risk of bacteria developing resistance."

According to the researchers, another advantage of SPMs is that, unlike anti-inflammatory drugs (e.g. aspirin, steroids, ibuprofen), SPMs do not cripple the body's normal immune response.

"Anti-inflammatory agents are widely known to be immunosuppressive," said Serhan. "Now we have naturally occurring molecular pathways in our bodies that work like these agents and stimulate bacterial containment and resolution of infections, but do not come with the side effect of being immunosuppressive."

E. coli infections continue to be both a world- and nationwide concern. In the United States, E. coli infections account for approximately 270,000 cases per year. S. aureus is responsible for causing skin infections and a majority of hospital-acquired infections.

This research was 100 percent supported by the following grants from the National Institutes of Health and National Institute of General Medical Sciences: P01GM095467 and R01GM38765 (CNS).

Nan Chiang, Gabrielle Fredman, Fredrik Bäckhed, Sungwhan F. Oh, Thad Vickery, Birgitta A. Schmidt, Charles N. Serhan. Infection regulates pro-resolving mediators that lower antibiotic requirements.
Nature, 2012; 484 (7395): 524 ***DOI: 10.1038/nature11042***

http://www.scientificamerican.com/article.cfm?id=nothing-to-sneeze-at-allergies-may-be-good-for-you

Nothing to Sneeze at: Allergies May Be Good for You

A new hypothesis argues that allergies emerged to protect us from harmful environmental substances

By Melinda Wenner Moyer | Wednesday, April 25, 2012 | 4

Ah, glorious springtime. It brings flowers, warmer temperatures—and for many, incessant sneezes and sniffles. Everybody curses allergies as annoying at best, and some allergic reactions—such as anaphylaxis, which rapidly lowers blood pressure and closes the airways—can be fatal. But a handful of researchers now propose that allergies may actually have evolved to protect us. Runny noses, coughs and itchy rashes keep toxic chemicals out of our bodies, they argue, and persuade us to steer clear of dangerous environments.

Most immunologists consider allergies to be misdirected immune reactions to innocuous substances such as pollen or peanuts. Viral and bacterial infections invoke what are called "type 1" immune responses, whereas allergies involve "type 2" responses, which are thought to have evolved to protect against large parasites. Type 1 responses directly kill the pathogens and the human cells they infect; type 2 works by strengthening the body's protective barriers and promoting pest expulsion. The idea is that smaller pathogens can be offensively attacked and killed, but it's smarter to fight larger ones defensively.

But Ruslan Medzhitov, an immunobiologist at Yale University, has never accepted the idea of allergies as rogue soldiers from the body's parasite-fighting army. Parasites and the substances that trigger allergies, called allergens, "share nothing in common," he says—first, there are an almost unlimited number of allergens. Second, allergic responses can be extremely fast—on the scale of seconds—and "a response to parasites doesn't have to be that fast," he says.

In a paper published April 26 in Nature, Medzhitov and his colleagues argue that allergies are triggered by potentially dangerous substances in the environment or food to protect us. (Scientific American is part of Nature Publishing Group) As evidence, they cite research including a 2006 study published in The Journal of Clinical Investigation reporting that key cells involved in allergic responses degrade and detoxify snake and bee venom. A 2010 study published in the same journal suggests that allergic responses to tick saliva prevent the pests from attaching and feeding. This mechanism, he argues, is distinct from the classic type 2 response the body uses to defend itself against internal parasites.

More generally, hated allergic symptoms keep unhealthy environmental irritants out of the body, Medzhitov posits. "How do you defend against something you inhale that you don't want? You make mucus. You make a runny nose, you sneeze, you cough, and so forth. Or if it's on your skin, by inducing itching, you avoid it or you try to remove it by scratching it," he explains. Likewise, if you've ingested something allergenic, your body might react with vomiting. Finally, if a particular place or circumstance ramps up your allergies, you're likely to avoid it in the future. "The thing about allergies is that as soon as you stop exposure to an allergen, all the symptoms are gone," he says.

Importantly, Medzhitov notes that although allergies are intended to be helpful, they are sometimes excessive and detrimental—the body can go too far. And allergies don't always make sense. "I would say that food is still mostly innocuous," says Dale Umetsu, an immunologist at Children's Hospital Boston, yet "food allergies affect one in 12 kids." How is that protective? According to Medzhitov, foods may have proteins in them that are harmful or they might mimic potentially harmful substances. (With food, he says, there's often little consensus about what, exactly, the offending allergen is.) And one has to think of the evolutionary past, he adds: for our ancestors hundreds of thousands of years ago, many plants that looked like food were toxic, so allergies may have evolved to protect us from them. Finally, he says that some allergies may develop through a "guilt by association" mechanism: An individual might develop an egg allergy after eating eggs in a polluted

environment, for instance. "This is a type of detection by proxy—you use some cue, like smell, or a visual cue or taste, to indicate if a food is associated with something that's noxious. Next time you're exposed to it, you avoid it."

This still doesn't explain why some people are more allergy-prone than others. "Allergens are everywhere," says Erika von Mutius, an allergy specialist at Munich University Children's Hospital in Germany. "So if this is a defense, why isn't everybody allergic?" According to Medzhitov, allergies may be more common in people with defects in other defensive tactics. For instance, 42 percent of people who have a mutation in a structural skin protein called filaggrin commonly experience allergic skin reactions. "If you don't have optimal physical barriers, you rely on a greater degree on allergic defenses," he says.

And what about the growing body of research suggesting that childhood environment shapes allergy risk? A 2011 study published in The New England Journal of Medicine reported that children who grow up on farms, where they are exposed to many microorganisms, are less likely than other kids to develop asthma and allergies. This idea, known as the hygiene hypothesis, suggests that individuals who encounter a multitude of bacteria and viruses early in life invest more immune resources into type 1 responses at the cost of type 2 reactions, including allergies. Medzhitov maintains that this theory can co-exist with his own. "It's a different aspect of disease susceptibility that has to do with early programming," he says.

Ultimately, Medzhitov's theory raises more questions than it answers, but many agree that the basic tenets are plausible. "It stimulates us as scientists to draw up some new hypotheses," says Kari Nadeau, an immunologist at the Stanford School of Medicine. "The hypotheses need to be tested and might not necessarily be confirmed, but at least this paper drives us to understand allergies better."

http://phys.org/news/2012-04-major-japan-quakes.html

Signs of three major Japan quakes before 2011

A team of scientists announced Wednesday that three major earthquakes seem to have hit northern Japan before the disaster.

Three major earthquakes seem to have occurred in northern Japan before it was hit in March 2011 by a massive quake and tsunami, researchers said Wednesday based on new evidence. The findings by Swiss, German and Japanese scientists, which could have a significant impact on future risk assessments, were ***presented at the annual conference*** of the European Geosciences Union in Vienna.

"We were able to get a record of at least three major sedimentary remobilisation events that potentially suggest the occurrence of previous large potentially 2011 Tohoku-type earthquakes," Michael Strasser, a geologist from the Swiss Federal Institute of Technology (ETH) Zurich, told journalists. "In theory, it might not be an earthquake because you can trigger large scale resedimentation also by other processes, but at this stage, it's the most likely explanation."

The researchers launched an underwater mission in the subduction zone off the northeastern coast of Japan in March, using a special vehicle equipped with cameras and going to depths of up to 7,700 metres (25,260 feet). They were now further analysing the samples to date these mooted earthquakes. "Once we get the age of these events, that will be an important contribution to hazard assessments because if you want to calculate the probability of the occurrence of earthquakes, you should know your occurrence pattern," said Strasser. Historic sources already mention a major tremor in the same region some 1,300 years ago.

The research mission also mapped out the seabed around the epicentre of the 9.0-magnitude quake that hit Japan on March 11, 2011, triggering a massive tsunami and a meltdown at the Fukushima nuclear plant, killing some 19,000 people.

Comparisons with measures taken before the quake confirmed with more precision data obtained by other means in March 2011, which showed that parts of the seabed moved up to 50 metres sideways near the fault zone following the tremor, while an area of 15,000 square kilometres (5,790 square miles) rose by five metres.

http://www.eurekalert.org/pub_releases/2012-04/cwru-doe042612.php

Discovery of earliest life forms' operation promises new therapies for key diseases

Bacteria provide a well-known playground for scientists and the evolution of these earliest life forms has shed important perspective on potential therapies for some of the most common, deadly diseases.

Researchers at Case Western Reserve University School of Medicine have now discovered that, the gas nitric oxide (NO), produced in all cells of the human body for natural purposes, plays a fundamental regulatory role in controlling bacterial function, via a signaling mechanism called S-nitrosylation (SNO), which binds NO to protein molecules. In addition, the researchers discovered a novel set of 150 genes that regulate SNO production and disruption of these genes created bacterial cell damage resembling the cell damage seen in many

common human diseases. Collectively these data point to new classes of antibiotics and several new disease treatments. The findings, which appear in the April 27 issue of the journal Science, are significant in that they establish a parallel between how bacteria and human cells behave, and, they shed new light on how diseases that entail the same mechanism found in the bacteria may be treated.

According to the traditional Primordial Soup Theory, the earliest forms of life, including bacteria, utilize nitrate (the fertilizer) as an energy source. Its byproduct, NO, previously thought to play no significant role, is now revealed to be important for bacterial function, as it is in humans. This discovery suggests that for billions of years, NO has served as a fundamental signaling mechanism; and important related functions have been conserved in the evolution of bacteria to man.

"The mechanism, which was known to exist in human cells, but not previously thought to occur in bacteria, controls cell function and operates very broadly," says Jonathan Stamler, MD, director, Institute for Transformative Molecular Medicine and the Robert S. and Sylvia K. Reitman Family Foundation Distinguished Chair in Cardiovascular Innovation, Case Western Reserve School of Medicine and University Hospitals Case Medical Center, and director, Harrington Discovery Institute, University Hospitals Case Medical Center. "Because the SNO mechanism can malfunction in ways that are characteristic of many diseases, what we learn from this research is immediately applicable to the development of new antibiotics and promises new insights and treatments to common diseases, including Alzheimer's, Parkinson's, heart disease, and cancer. It's not often that researchers get a big picture view of a fundamental process important to most cellular functions."

In humans, faulty NO processing contributes to many diseases, including cancer, Alzheimer's disease, Parkinson's disease, heart failure, and asthma. SNOs then build up on proteins creating specific signatures of disease. Similarly in the bacteria, the researchers found the absence of certain genes from the newly discovered set, contributed to a build-up of SNO on cell proteins. Knowing for the first time what genes are critically related to SNO build-up gives valuable insight into these disease processes. In addition, the turning on or off of the genes is a new opportunity to counter disease.

"The system we have today to control human cell function in the heart and brain evolved a billion years ago to work in bacteria. So a process that operates in bacteria is also the cause of many diseases. This offers the obvious opportunity to create new antibiotics but also therapeutic hope for multiple diseases."

The mechanism at the heart of the research is S-nitrosylation (SNO), a cellular process in which a nitric oxide (NO)-based molecule binds with a protein to activate cell signaling and fuel specific or more general cell activity.In the event such protein modifications go awry, forming too few or too many NO attachments, disease can result. Understanding SNO binding within bacteria provides a basis for developing new drugs to disable the errant protein attachments that may contribute to disease, Dr. Stamler says. Also, drugs that disrupt the SNO controlling proteins represent novel potential antibiotics.

What keeps nitrosylation under control in bacteria, the researchers discovered, is a group of 150 genes that is regulated by the transcription factor or protein OxyR. The genes controlled by OxyR prevent aberrant NO protein attachments from taking place and keep them from interfering with normal cell function. Specifically, the genes dictate how bacteria that breathe on an ancient substance called nitrate, which they use in place of oxygen, handle nitrosative stress, a condition that results when NO molecules bind uncontrollably with protein molecules, changing their shape and function. Prior to this research, OxyR was thought to operate only when oxygen was present. In fact, OxyR is a "master regulator" of protein S-nitrosylation that works to alleviate nitrosative stress, the new Science study shows. Relief of nitrosative stress is being sought by many companies and investigators to treat neurologic diseases, heart disease, and cancer.

Nitrosative stress is the primordial equivalent of oxidative stress, the harmful free radical injury caused by breathing in oxygen, which damages cells and contributes to aging and disease. The 150 genes identified by the Case Western Reserve researchers help manage the protein modifications that occur in bacteria as they breathe, and help eliminate NO when necessary, to avert potential cell damage or death. Without these genes, the bacteria cells would likely succumb to nitrosative stress.

Because nitrosative stress is characteristic of many diseases, including cancer and sepsis, what researchers learn about this state in bacteria can provide new perspective on these diseases and how to treat them, Dr. Stamler says. "We may be seeing disease evolution in its earliest form."

The new research builds upon Dr. Stamler's ongoing efforts to identify diseases in which protein modifications go awry, to provide a basis for the development of disease-specific drug therapies. He and his team are actively working to determine what the 150 genes identified in this research do, to isolate the genes that pertain to human diseases and spot opportunities to develop therapies to correct genetic malfunctions. Progress has already been made.

http://www.eurekalert.org/pub_releases/2012-04/bawh-bky042512.php

Berries keep your brain sharp

A new study from Brigham and Women's Hospital found that certain berries may delay memory decline in older women

Boston, MA—Berries are good for you, that's no secret. But can strawberries and blueberries actually keep your brain sharp in old age? A new study by researchers at Brigham and Women's Hospital (BWH) finds that a high intake of flavonoid rich berries, such as strawberries and blueberries, over time, can delay memory decline in older women by 2.5 years. This study is published by Annals of Neurology, a journal of the American Neurological Association and Child Neurology Society, on April 26, 2012.

"What makes our study unique is the amount of data we analyzed over such a long period of time. No other berry study has been conducted on such a large scale," explained Elizabeth Devore, a researcher in the Channing Laboratory at BWH, who is the lead author on this study. "Among women who consumed 2 or more servings of strawberries and blueberries each week we saw a modest reduction in memory decline. This effect appears to be attainable with relatively simple dietary modifications."

The research team used data from the Nurses' Health Study—a cohort of 121,700 female, registered nurses between the ages of 30 and 55—who completed health and lifestyle questionnaires beginning in 1976. Since 1980, participants were surveyed every four years regarding their frequency of food consumption. Between 1995 and 2001, memory was measured in 16,010 subjects over the age of 70 years, at 2-year intervals. Women included in the present study had a mean age of 74 and mean body mass index of 26.

Findings show that increased consumption of blueberries and strawberries was associated with a slower rate of memory decline in older women. A greater intake of anthocyanidins and total flavonoids was also associated with reduced memory decline. Researchers observed that women who had higher berry intake had delayed memory decline by up to 2.5 years.

"We provide the first epidemiologic evidence that berries appear to slow progression of memory decline in elderly women," notes Dr. Devore. "Our findings have significant public health implications as increasing berry intake is a fairly simple dietary modification to reduce memory decline in older adults."

This study was funded by grants from the National Institutes of Health (P01 CA87969) and the California Strawberry Commission. The study was independently controlled by the investigators who performed the data analysis.

http://news.discovery.com/earth/mosquitos-killed-two-killer-whales-120426.html

Mosquitoes Killed Two Killer Whales

Not just humans have to worry about mosquito-borne disease. Even the largest captive creatures is in danger from the pests.

Analysis by Tim Wall

The mosquito plague of summer is fast approaching and with it comes the threat of diseases, such as St. Louis encephalitis and West Nile virus. Not just human picnickers and campers have to worry about mosquito-borne disease. Even the largest of captive creatures is in danger from the tiny pests. Two orcas, or killer whales (Orcinus orca), kept in captivity have died from the two diseases mentioned above, reported the Whale and Dolphin Conservation Society (WDCS).

“I think it is safe to say that no one would have thought of the risks that mosquitoes might pose to orcas in captivity, but considering the amount of time they unnaturally spend at the surface in shallow pools at these facilities, it is yet another deadly and unfortunate consequence of the inadequate conditions inherent to captivity,” said Courtney Vail, campaigns manager for WDCS. In captivity, the aquatic predators can’t move around or dive as much as they do in the wild. The orcas spend time floating at the surface, especially while sleeping, and that makes them a tempting 6 ton blood smorgasbord for mosquitoes.

“Logging (floating at the surface) was commonly witnessed while I was at SeaWorld, especially at night, which provided a static landing platform for mosquitoes,” former Sea World orca trainer John Jett told the WDCS. “Free ranging orcas, conversely, are on the move and not exposed to mosquitoes. They don't remain still long enough and mosquitoes are weak fliers, limited to coastal areas.”

The two orca fatalities were:

Kanduke – The 25-year old orca died at SeaWorld Orlando due to St. Louis encephalitis in 1990.

Taku – The 14-year-old male died after being fatally infected with the West Nile Virus in 2007 at SeaWorld San Antonio.

The WDCS questions the ethics of keeping highly intelligent, social whales and dolphins in captivity and call for an end to the practice. They discourage tourists from visiting marine parks that hold cetaceans in captivity.

http://phys.org/news/2012-04-image-milky-billion-planets.html

Image: The Milky Way's 100 billion planets

This artist's illustration gives an impression of how common planets are around the stars in the Milky Way.

Phys.org - The planets, their orbits and their host stars are all vastly magnified compared to their real separations. A six-year search that surveyed millions of stars using the microlensing technique concluded that planets around stars are the rule rather than the exception. The average number of planets per star is greater than one. This means that there is likely to be a minimum of 1,500 planets within just 50 light-years of Earth.

The results are based on observations taken over six years by the PLANET (Probing Lensing Anomalies NETwork) collaboration, which was founded in 1995. The study concludes that there are far more Earth-sized planets than bloated Jupiter-sized worlds. This is based on calibrating a planetary mass function that shows the number of planets increases for lower mass worlds. A rough estimate from this survey would point to the existence of more than 10 billion terrestrial planets across our galaxy.

The results were published in the Jan. 12, 2012, issue of the British science journal Nature.

Provided by JPL/NASA

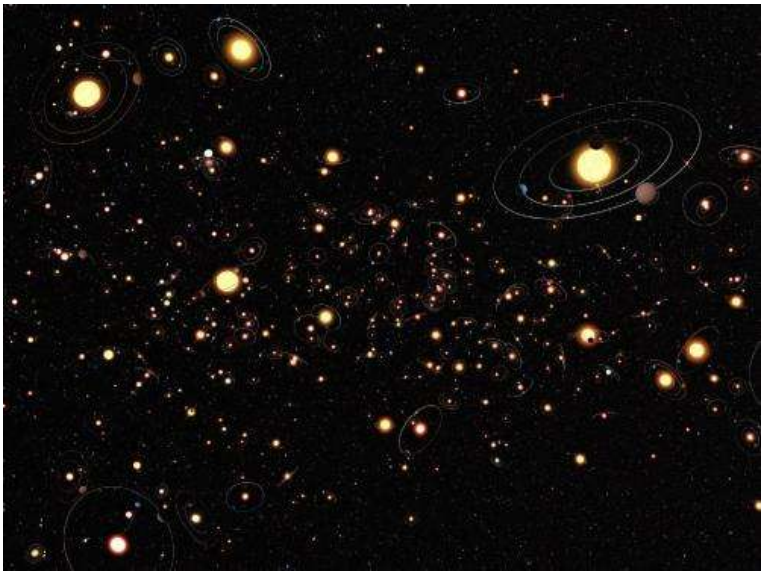


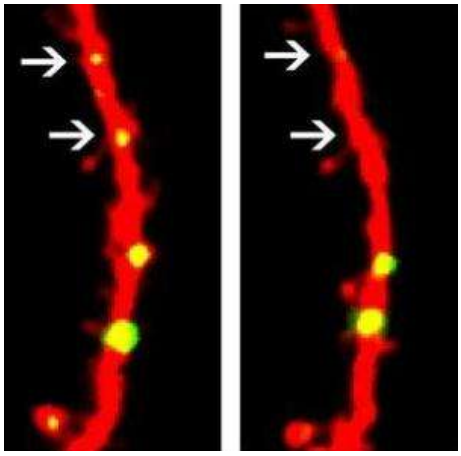
Image Credit: NASA, ESA, and M. Kornmesser (ESO)

http://www.sciencedaily.com/releases/2012/04/120426104851.htm

Learning Mechanism of the Adult Brain Revealed

Researchers have now discovered how the adult brain can adapt to new situations.

ScienceDaily - They say you can't teach an old dog new tricks. Fortunately, this is not always true. Researchers at the Netherlands Institute for Neuroscience (NIN-KNAW) have now discovered how the adult brain can adapt to new situations. The Dutch researchers' findings are published on April 25 in the journal Neuron. Their study may be significant in developing treatments of neurodevelopmental disorders.



Two inhibitory synapses (yellow) disappear from the process of a nerve-cell (red) during learning. **Image courtesy of Netherlands Institute for Neuroscience**

Ability to learn

Our brain processes information in complex networks of nerve cells. The cells communicate and excite one another through special connections, called synapses. Young brains are capable of forming many new synapses, and they are consequently better at learning new things. That is why we acquire vital skills -- walking, talking, hearing and seeing -- early on in life. The adult brain stabilises the synapses so that we can use what we have learned in childhood for the rest of our lives.

Disappearing inhibitors

Earlier research found that approximately one fifth of the synapses in the brain inhibit rather than excite other nerve-cell activity. Neuroscientists have now shown that many of these inhibitory synapses disappear if the adult brain is forced to learn new skills. They reached this conclusion by labelling inhibitory synapses in mouse brains with fluorescent proteins and then tracking them for several weeks using a specialised microscope. They then closed one of the mice's eyes temporarily to accustom them to seeing through just one eye. After a few days, the area of the brain that processes information from both eyes began to respond more actively to the open eye. At the same time, many of the inhibitory synapses disappeared and were later replaced by new synapses.

Regulating the information network

Inhibitory synapses are vital for the way networks function in the brain. "Think of the excitatory synapses as a road network, with traffic being guided from A to B, and the inhibitory synapses as the matrix signs that

regulate the traffic," explains research leader Christiaan Levelt. "The inhibitory synapses ensure an efficient flow of traffic in the brain. If they don't, the system becomes overloaded, for example as in epilepsy; if they constantly indicate a speed of 20 kilometres an hour, then everything will grind to a halt, for example when an anaesthetic is administered. If you can move the signs to different locations, you can bring about major changes in traffic flows without having to entirely reroute the road network."

Hope

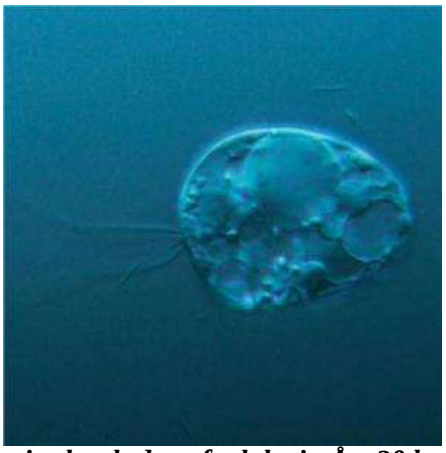
Inhibitory synapses play a hugely influential role on learning in the young brain. People who have neurodevelopmental disorders -- for example epilepsy, but also autism and schizophrenia -- may have trouble forming inhibitory synapses. The discovery that the adult brain is still capable of pruning or forming these synapses offers hope that pharmacological or genetic intervention can be used to enhance or manage this process. This could lead to important guideposts for treating the above-mentioned neurological disorders, but also repairing damaged brain tissue.

Daniëlle van Versendaal, Rajeev Rajendran, M. Hadi Saiepour, Jan Klooster, Laura Smit-Rigter, Jean-Pierre Sommeijer, Chris I. De Zeeuw, Sonja B. Hofer, J. Alexander Heimel, Christiaan N. Levelt. Elimination of Inhibitory Synapses Is a Major Component of Adult Ocular Dominance Plasticity. Neuron, 2012; 74 (2): 374 DOI: 10.1016/j.neuron.2012.03.015

http://www.sciencedaily.com/releases/2012/04/120426104853.htm

Rare Protozoan from Sludge in Norwegian Lake Does Not Fit On Main Branches of Tree of Life

Humankind's remotest relative is a very rare micro-organism from south-Norway.



Glimpse into primordial times: Genetic analyses of a micro-organism that lives in the sludge of a lake in Ås, 30 km south of Oslo in Norway, are providing researchers with an insight into what the first life on Earth looked like.
(Credit: UiO/MERG)

ScienceDaily - The discovery may provide an insight into what life looked like on earth almost one thousand million years ago. Biologists all over the world have been eagerly awaiting the results of the genetic analysis of one of the world's smallest known species, hereafter called the protozoan, from a little lake 30 kilometer south of Oslo in Norway.

When researchers from the University of Oslo, Norway compared its genes with all other known species in the world, they saw that the protozoan did not fit on any of the main branches of the tree of life. The protozoan is not a fungus, alga, parasite, plant or animal.

"We have found an unknown branch of the tree of life that lives in this lake. It is unique! So far we know of no other group of organisms that descend from closer to the roots of the tree of life than this species. It can be used as a telescope into the primordial micro-cosmos," says an enthusiastic associate professor, Kamran Shalchian-Tabrizi, head of the Microbial Evolution Research Group (MERG) at the University of Oslo.

His research group studies tiny organisms hoping to find answers to large, biological questions within ecology and evolutionary biology, and works across such different fields as biology, genetics, bioinformatics, molecular biology and statistics.

World's oldest creature

Life on Earth can be divided up into two main groups of species, prokaryotes and eukaryotes. The prokaryote species, such as bacteria, are the simplest form of living organisms on Earth. They have no membrane inside their cell and therefore no real cell nucleus. Eukaryote species, such as animals and humankind, plants, fungi and algae, on the other hand do.

The family tree of the protozoan from the lake near Ås starts at the root of the eukaryote species.

"The micro-organism is among the oldest, currently living eukaryote organisms we know of. It evolved around one billion years ago, plus or minus a few hundred million years. It gives us a better understanding of what early life on Earth looked like.," Kamran says to the research magazine Apollon.

How they move

The tree of life can be divided into organisms with one or two flagella. Flagella are important when it comes to a cell's ability to move. Just like all other mammals, human sperm cells have only one flagellum. Therefore, humankind belongs to the same single flagellum group as fungi and amoebae.

On the other hand it is believed that our distant relatives from the family branches of plants, algae and excavates (single-celled parasites) originally had two flagella.

The protozoan from Ås has four flagella. The family it belongs to is somewhere between excavates, the oldest group with two flagella, and some amoebae, which is the oldest group with only one flagellum.

"Were we to reconstruct the oldest, eukaryote cell in the world, we believe it would resemble our species. To calculate how much our species has changed since primordial times, we have to compare its genes with its nearest relatives, amoebae and excavates," says Shalchian-Tabrizi.

Caught with a tasty morsel

The protozoan is not easy to spot. It lives down in the sludge at the bottom of a lake. It is 30 to 50 micrometres long and can only be seen with a microscope. When Professor Dag Klaveness of MERG wants to catch the protozoan he sticks a pipe down into the lakebed, removes a column of sludge and pours a bile green algae mixture over it. The algae are such tempting morsels for the small protozoa that they swim up. "We can then pick them out, one by one, with a pipette," says Klaveness.

There are not many of them. And the University of Oslo biologists have not found them anywhere else other than in this lake. "We are surprised. Enormous quantities of environmental samples are taken all over the world. We have searched for the species in every existing DNA database, but have only found a partial match with a gene sequence in Tibet. So it is conceivable that only a few other species exist in this family branch of the tree of life, which has survived all the many hundreds of millions of years since the eukaryote species appeared on Earth for the first time."

Not very sociable

The protozoan lives off algae, but the researchers still do not know what eats the protozoan. Nor do they know anything about its life cycle. But one thing is certain: "They are not sociable creatures. They flourish best alone. Once they have eaten the food, cannibalism is the order of the day," notes Klaveness.

The protozoan has a special cell indentation. It looks like a groove.

"The species has the same intracellular structure as excavates. And it uses the same protuberances as amoebae to catch its food. This means that the species combines two characteristics from each family branch of the main eukaryote groups. This further supports the hypothesis that the species from this lake belongs to a primordial group. Perhaps it descended from the antecedents of both the excavates and amoeba?" asks Shalchian-Tabrizi.

The protozoan was discovered as early as 1865, but it is only now that, thanks to very advanced genetic analyses, researchers understand how important the species is to the history of life on Earth.

Breeding enormous quantities of the protozoan

Dag Klaveness has, together with research fellow Jon Bråte, managed to breed large quantities of the species. No one has done this before. Klaveness has spent the last 40 years specialising in breeding organisms that are difficult to breed or that are difficult to isolate from other species. Breeding is important if we want to analyse the creature's genes. More than just a few are needed for a genetic test. Researchers have needed to breed large quantities. The work is demanding and has taken many months.

The protozoan's favourite food is green algae, but since both the protozoan and the green algae are eukaryote species, i.e. species with real cell nuclei, it is easy to confuse the genes of the protozoan with those of its food in the gene sequencing. Therefore, Klaveness has chosen to feed the protozoan with blue green bacteria, which are genetically very different to the protozoan. Blue green bacteria are not exactly its favourite dish, but the protozoan can only choose between eating or dying.

Blue green bacteria are prokaryotes, i.e. species without membranes or real cell nuclei. This allows the researchers to differentiate between the genes of the protozoan and its food in the gene sequencing.

Klaveness has a number of vats of the protozoan in the laboratory. The algae mixture sinks to the bottom. The protozoan dives down when it wants to eat. In optimum conditions they divide every second day. However, with blue green bacteria on the menu, which is just as boring as if you only got carrots for several months and nothing else, the protozoan grows much more slowly.

When the protozoa have reproduced enough, they are centrifuged out and gene sequenced. The genes are then compared with equivalent gene sequences from other species. "We have gene sequenced 300,000 parts of the genome (the total genetic material), but we still do not know how large the genome is. We are currently only looking for the most important parts," explains Kamran Shalchian-Tabrizi.

Traces from primordial times

The problem is that DNA sequences change a lot over time. Parts of the DNA may have been wiped away during the passing of the years. Since the protozoan is a very old species, an extra large amount of gene information is required.

"It is often the case with such ancient organisms that features they share in common with other known species have been wiped away from the DNA sequence because of long-term mutations. You can compare it with tarmacing. If you tarmac a road enough times, you will no longer see the cobblestones. Therefore, you have to collect large gene sequences to find common traces from prehistoric times."

Research fellow Sen Zhao was responsible for the extensive, statistical calculations. In order to calculate the family link they have used information from the research group's own Bioportal in cooperation with the high performance computing group at the University of Oslo.

Resolving evolutionary mysteries

Kamran Shalchian-Tabrizi explains that the tree of life can provide fundamental answers to great evolutionary mysteries. "In order to understand what a species is today, we have to understand how they have changed genetically. The tree of life allows us to explain cellular change processes by connecting the genome and morphology (appearance) with its way of life."

Among other things, Shalchian-Tabrizi wants to use the protozoan to investigate when photosynthesis arose among eukaryote organisms. Photosynthesis takes place in chloroplast. Chloroplasts were originally free-living, blue green bacteria. If the researchers find genetic residues of these bacteria in the protozoan from Ås, this may indicate that photosynthesis arose earlier than supposed.

"There are many likely scenarios, but we still do not know the answer," acknowledges Shalchian-Tabrizi.

The researchers also want to question when other characteristics arose, e.g. mitochondria, which are the energy motors of our cells.

Purifying drinking water in Japan

In recent years researchers have found some apparently matching examples of the protozoan from Ås in Japan and South East Asia. A researcher from Japan arrived in Oslo with a glass of the species solely so that Klaveness could breed them. "We are now going to gene sequence these organisms, because it is not certain that the genes are the same, even if the morphology is similar," says Klaveness. The Japanese hope that the protozoan can be used to purify drinking water by removing toxic, blue green bacteria.

University of Oslo (2012, April 26). Rare protozoan from sludge in Norwegian lake does not fit on main branches of tree of life.

http://news.discovery.com/space/suns-twin-is-an-optimum-seti-target-120426.html

Sun's Twin Discovered -- the Perfect SETI Target?

There are 10 billion stars in the Milky Way galaxy that are the same size as our sun. Therefore it should come as no surprise that astronomers have identified a clone to our sun lying only 200 light-years away.

Analysis by Ray Villard

Still, it is fascinating to imagine a yellow dwarf that is exactly the same mass, temperature and chemical composition as our nearest star. In a recent paper reporting on observations of the star - called HP 56948 - astronomer Jorge Melendez of the University of San Paulo, Brazil, calls it "the best solar twin known to date."

His team combined observations from the Very Large Telescope (VLT), Keck Telescope, and Hobby Eberly Telescope to characterize the star and look for planets. Though fast orbiting large planets weren't found it still begs the question: could HP 56948 have a twin solar system too?

The majority of planetary systems discovered to date make our solar system look like the exception and not the rule. For example, the sun-like star 55 Cancri, only 41 light-years away, has a mix of close-in hot Jupiters, followed by terrestrial planets an then more Jupiters. In some systems the planets are in much more elliptical orbits than found around our sun. Epsilon Eridani for example has a planet that swings as close to the star as Venus is from our sun, and then climbs out to the orbital radius of Jupiter.

The good news is that astronomers have not detected the short-period wobble of HP 56948 that would indicate a hot Jupiter was tugging on it. This leaves the inner few million miles around the star safe territory for the presence of one or more terrestrial planets. Earth-mass worlds would pull so weakly on the star that they have not yet been detected. But the chemical composition of HP 56548 has unusual amounts of aluminum, calcium, magnesium, and silicon - by the same ratio as our sun has. In our solar system these elements are found locked away in interplanetary dust, meteorites and rocky planets like Earth.

This means terrestrial planets could exist around HP 56548. In fact, there is a reasonable chance that the star's planetary system has a solar system architecture with the massive outer worlds staying beyond the "frost line" where ices condense to form bloated worlds. And, a family of terrestrial planets huddled close to the star.

Simply put, the nearby presence of a twin star potentially offers a fascinating experiment in parallel evolution. Assuming that HP 56548 has at least one inhabitable planet, has life arisen and successfully evolved to higher forms over 4 billion years? If not, why not?

If 4 billion years is the typical time for the emergence of intelligent beings, then there is a civilization now orbiting HP 56548. If we dare to extrapolate even further, a technological civilization should have developed astronomy, which is at the root of modern physics. Their astronomers should have located our sun as easily as we found their star. They then might have been compelled to undertake a program of both monitoring and transmitting radio message to our solar system.

That said, it would not be surprising if SETI observations of the star came up empty handed. The system may not have an Earth-sized planet in its habitable zone. Even if there is one it may not be Earth-like with oceans and plate tectonics. And, even if there is a world flourishing with multi-cellular life, it may not have progressed to an intelligent species. Or, it has a civilization but it is not as technologically advanced as ours.

Keep in mind that any alien astronomers on such a planet would be studying Earth as it appeared in the early 1800s. That information, encoded in light, is just arriving at HP 56948 now. Our radio and television signal leaking into space won't reach the star for another 130 years. In the absence of such an electromagnetic signature extraterrestrials may overlook Earth and scout elsewhere. They nevertheless would speculate, as we are, whether our sun offers and abode for intelligent life. But the quarantine imposed by the physics of time and space keeps us forever apart.

http://www.sciencedaily.com/releases/2012/04/120426174110.htm

Scar Tissue Turned Into Heart Muscle Without Using Stem Cells

Scientists at Duke University Medical Center have shown the ability to turn scar tissue that forms after a heart attack into heart muscle cells using a new process that eliminates the need for stem cell transplant.

ScienceDaily- Scientists at Duke University Medical Center have shown the ability to turn scar tissue that forms after a heart attack into heart muscle cells using a new process that eliminates the need for stem cell transplant.

The study, published online April 26 in the journal Circulation Research, used molecules called microRNAs to trigger the cardiac tissue conversion in a lab dish and, for the first time, in a living mouse, demonstrating the potential of a simpler process for tissue regeneration.

If additional studies confirm the approach in human cells, it could lead to a new way for treating many of the 23 million people worldwide who suffer heart failure, which is often caused by scar tissue that develops after a heart attack. The approach could also have benefit beyond heart disease.

"This is a significant finding with many therapeutic implications," said Victor J. Dzau, MD, a senior author on the study who is James B. Duke professor of medicine and chancellor of health affairs at Duke University. "If you can do this in the heart, you can do it in the brain, the kidneys, and other tissues. This is a whole new way of regenerating tissue."

To initiate the regeneration, Dzau's team at Duke used microRNAs, which are molecules that serve as master regulators controlling the activity of multiple genes. Tailored in a specific combination, the microRNAs were delivered into scar tissue cells called fibroblasts, which develop after a heart attack and impair the organ's ability to pump blood. Once deployed, the microRNAs reprogrammed fibroblasts to become cells resembling the cardiomyocytes that make up heart muscle. The Duke team not only proved this concept in the laboratory, but also demonstrated that the cell conversion could occur inside the body of a mouse -- a major requirement for regenerative medicine to become a potential therapy.

"This is one of the exciting things about our study," said Maria Mirotsou, PhD, assistant professor of cardiology at Duke and a senior author of the study. "We were able to achieve this tissue conversion in the heart with these microRNAs, which may be more practical for direct delivery into cells and allow for possible development of therapies without using genetic methods or transplantation of stem cells."

The researchers said using microRNA for tissue regeneration has several potential advantages over genetic methods or transplantation of stem cells, which have been difficult to manage inside the body. Notably, the microRNA process eliminates technical problems such as genetic alterations, while also avoiding the ethical dilemmas posed by stem cells. "It's an exciting stage for reprogramming science," said Tilanthi M. Jayawardena, PhD, first author of the study. "It's a very young field, and we're all learning what it means to switch a cell's fate. We believe we've uncovered a way for it to be done, and that it has a lot of potential."

The approach will now be tested in larger animals. Dzau said therapies could be developed within a decade if additional studies advance in larger animals and humans. "We have proven the concept," Dzau said. "This is the very early stage, and we have only shown that is it doable in an animal model. Although that's a very big step, we're not there yet for humans."

In addition to Dzau, Mirotsou and Jayawardena, study authors include: Bakytbek Egemnazarov; Elizabeth A. Finch; Lunan Zhang; Kumar Pandya; J. Alan Payne; Zhiping Zhang; and Paul Rosenberg.

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Tilanthi M. Jayawardena, Bakytbek Egemnazarov, Elizabeth A. Finch, Lunan Zhang, J. Alan Payne, Kumar Pandya, Zhiping Zhang, Paul Rosenberg, Maria Mirotsou, and Victor J. Dzau. MicroRNA-Mediated In Vitro and In Vivo Direct Reprogramming of Cardiac Fibroblasts to Cardiomyocytes. Circulation Research, April 26 2012 DOI: 10.1161/CIRCRESAHA.112.269035

http://phys.org/news/2012-04-solution-ancient-puzzle-posited.html

Solution to ancient rock puzzle posited

A superplume could explain the puzzling reappearance of major iron formations long after the rise in atmospheric oxygen about 2.4 billion years ago

A superplume, or massive episode of volcanic eruptions that related to extensive melting of the Earth's mantle, could explain the puzzling reappearance of major iron formations long after the rise in atmospheric oxygen about 2.4 billion years ago, which should have prevented iron forming, according to a study published in Nature this week.

The research team, led by Professor Birger Rasmussen of Curtin University, includes Dr Janet Muhling from The University of Western Australia's Centre for Microscopy, Characterisation and Analysis.

Iron formations are unique sedimentary rocks composed of iron and silica and are unlike any modern rocks, the study noted. Most iron formations were deposited in the oceans before free oxygen first accumulated in Earth's atmosphere about 2.4 billion years ago (the so-called Great Oxidation Event). However, the re-occurrence of major iron formations nearly 500 million years later has been an enduring enigma for geologists.

Major iron formations about 1.9-1.8 billion years old occur in both North America and Australia. However, because the Australian iron formations were thought to be significantly younger than those in North America, it was uncertain whether they provided information about the composition of the global ocean or conditions in a restricted or closed basin. The new study has dated volcanic ash beds in the Australian iron formations, showing that they were deposited at the same time as those in North America.

"These results show that the deposition of iron formations from two different continents was synchronous 1.9 billion years ago and therefore probably reflects the composition of the global ocean," the study said. "The deposition of major iron formations shows a remarkable correlation in time with a short-lived but intense interval of global igneous activity, a possible mantle superplume event, which suggests that processes deep within the Earth radically changed the chemistry of the global ocean."

"We suggest that extensive basaltic magmatism related to the superplume released vast volumes of iron into the global ocean, overwhelming the supply of oxygen and promoting the deposition of iron formations across the world," Dr Muhling said. "The equally dramatic disappearance of iron formations some 40 million years later can be explained as a consequence of rapidly waning igneous (volcanic) activity that allowed the ocean to become dominated by seawater oxidants once more.

"Our findings not only explain the sudden appearance and disappearance of iron formations circa 1.9 billion years ago, but also provide an explanation for the preservation of an oxygen-rich atmosphere above an oxygen-poor ocean. The relationships between the chemistry of the hydrosphere and atmosphere, and deep Earth processes provide insights into significant events in the evolution of the Earth," Dr Muhling said.

Dr Muhling's co-researchers are from Curtin University, the WA Department of Mines and Petroleum's Geological Survey of WA, and the University of Manitoba in Canada. Provided by University of Western Australia

http://bit.ly/KqB7ET

Evolution re-run test to probe life's predictability

A 500-million-year-old bacterial gene got a second chance at evolution this year. The experiment may help biologists understand the extent to which evolution is predictable.

13:32 27 April 2012 by Bob Holmes

Biologists have long wondered whether life would evolve the same way again if we could rewind the tape. Eric Gaucher and Betül Arslan at Georgia Tech University in Atlanta hope to find out.

They focused on EF-Tu, a gene in Escherichia coli that plays a crucial role in protein synthesis. Gaucher had previously worked out what this gene's DNA sequence must have been 500 million years ago, by comparing the sequences of many modern bacteria and reasoning backwards.

Now Arslan has synthesised the ancient gene and inserted it into E. coli in place of the modern version. The bacteria with the old gene grew less than half as fast as usual. Arslan then let eight bacterial lines evolve independently for 1000 generations.

All eight lineages eventually grew faster - a sign that evolution had occurred. When Arslan sequenced their genomes, though, she found that EF-Tu was unchanged. What had evolved - differently in each lineage - were

the genes that interact with EF-Tu. She reported the work at NASA's Astrobiology Science Conference 2012 in Atlanta.

The sheer number of interacting genes in protein synthesis means that random mutations are more likely to hit one of EF-Tu's partners than EF-Tu itself. Eventually, though, EF-Tu may begin to evolve - either following the same path it began 500 million years ago or not. The experiment continues.

http://news.discovery.com/space/venus-bright-120427.html

See Dazzling Venus At Its Brightest This Week

Although Venus is always one of the brightest objects in the sky, this week it is at its brightest.

Content provided by Geoff Gaherty, Space.com

Step outside any night this week about an hour after sunset and have a look at the western sky. The first thing that will catch your eye is the brilliant planet Venus. Look a little more closely and you'll see that Venus is surrounded by bright stars. The sky map accompanying this story will help you identify them.

Although Venus is always one of the brightest objects in the sky, this week it is at its very brightest. That's because of a combination of circumstances.

The solar system's two innermost planets, Mercury and Venus, go through a series of phases similar to the moon, as they are lit from the side at different angles by the sun. Their apparent size also changes as they move from the far side of the sun to the near side.

Currently Venus is moving toward the Earth, so it is getting larger and brighter. Its phase is also narrowing as it moves in front of the sun, which makes it decrease in brightness. So we've got two opposing forces in action: Getting closer means getting brighter, and a narrowing crescent means getting fainter. This week the two balance out to make Venus as bright as it can possibly be.

Through a telescope this week, Venus will look like a miniature version of a five-day-old moon, except without any mountains, lava seas or craters. The view of Venus through a telescope is often disappointing and surprising; it doesn't seem like something so beautiful to the naked eye should be so bland when magnified.

Despite Venus' somewhat boring appearance, there is a lot going on beneath the planet's clouds. Its dense atmosphere and proximity to the sun make for an exaggerated greenhouse effect. The surface temperature on Venus is a hellish 860 degrees Fahrenheit (460 degrees Celsius). By way of comparison, the melting point of lead is 621 F (327 C).

Over the next few weeks, Venus will continue to approach the Earth, getting larger in size as its crescent continues to narrow. Even if you don't have a telescope, take a look at Venus with binoculars. Soon you will see it as a tiny crescent.

On June 5 (June 6 in Australia and Asia), something very special will happen: Venus will pass between the Earth and the sun, appearing as a black dot silhouetted against the sun. This event — known as a transit of Venus — happens on average only twice a century, and this will be the last chance to see such an event for the rest of your life. It won't happen again until the year 2117.

http://www.eurekalert.org/pub_releases/2012-04/bu-sny042512.php

Single nanomaterial yields many laser colors

Applications may include displays

PROVIDENCE, R.I. [Brown University] — Red, green, and blue lasers have become small and cheap enough to find their way into products ranging from BluRay DVD players to fancy pens, but each color is made with different semiconductor materials and by elaborate crystal growth processes. A new prototype technology demonstrates all three of those colors coming from one material. That could open the door to making products, such as high-performance digital displays, that employ a variety of laser colors all at once.

"Today in order to create a laser display with arbitrary colors, from white to shades of pink or teal, you'd need these three separate material systems to come together in the form of three distinct lasers that in no way shape or form would have anything in common," said Arto Nurmikko, professor of engineering at Brown University and senior author of a paper describing the innovation in the journal Nature Nanotechnology. "Now enter a class of materials called semiconductor quantum dots."

The materials in prototype lasers described in the paper are nanometer-sized semiconductor particles called colloidal quantum dots or nanocrystals with an inner core of cadmium and selenium alloy and a coating of zinc,

cadmium, and sulfur alloy and a proprietary organic molecular glue. Chemists at QD Vision of Lexington, Mass., synthesize the nanocrystals using a wet chemistry process that allows them to precisely vary the nanocrystal size by varying the production time. Size is all that needs to change to produce different laser light colors: 4.2 nanometer cores produce red light, 3.2 nanometer ones emit green light and 2.5 nanometer ones shine blue. Different sizes would produce other colors along the spectrum.

The cladding and the nanocrystal structure are critical advances beyond previous attempts to make lasers with colloidal quantum dots, said lead author Cuong Dang, a senior research associate and nanophotonics laboratory manager in Nurmikko's group at Brown. Because of their improved quantum mechanical and electrical performance, he said, the coated pyramids require 10 times less pulsed energy or 1,000 times less power to produce laser light than previous attempts at the technology.

Quantum nail polish

When chemists at QDVision brew a batch of colloidal quantum dots for Brown-designed specifications, Dang and Nurmikko get a vial of a viscous liquid that Nurmikko said somewhat resembles nail polish. To make a laser, Dang coats a square of glass — or a variety of other shapes — with the liquid. When the liquid evaporates, what's left on the glass are several densely packed solid, highly ordered layers of the nanocrystals. By sandwiching that glass between two specially prepared mirrors, Dang creates one of the most challenging laser structures, called a vertical-cavity surface-emitting laser. The Brown-led team was the first to make a working VCSEL with colloidal quantum dots.

The nanocrystals' outer coating alloy of zinc, cadmium, sulfur and that molecular glue is important because it reduces an excited electronic state requirement for lasing and protects the nanocrystals from a kind of crosstalk that makes it hard to produce laser light, Nurmikko said. Every batch of colloidal quantum dots has a few defective ones, but normally just a few are enough to interfere with light amplification.

Faced with a high excited electronic state requirement and destructive crosstalk in a densely packed layer, previous groups have needed to pump their dots with a lot of power to push them past a higher threshold for producing light amplification, a core element of any laser. Pumping them intensely, however, gives rise to another problem: an excess of excited electronic states called excitons. When there are too many of these excitons among the quantum dots, energy that could be producing light is instead more likely to be lost as heat, mostly through a phenomenon known as the Auger process.

The nanocrystals' structure and outer cladding reduces destructive crosstalk and lowers the energy needed to get the quantum dots to shine. That reduces the energy required to pump the quantum dot laser and significantly reduces the likelihood of exceeding the level of excitons at which the Auger process drains energy away. In addition, a benefit of the new approach's structure is that the dots can act more quickly, releasing light before Auger process can get started, even in the rare cases when it still does start.

"We have managed to show that it's possible to create not only light, but laser light," Nurmikko said. "In principle, we now have some benefits: using the same chemistry for all colors, producing lasers in a very inexpensive way, relatively speaking, and the ability to apply them to all kinds of surfaces regardless of shape. That makes possible all kinds of device configurations for the future."

In addition to Nurmikko and Dang, another author at Brown is Joonhee Lee. QD Vision authors include Craig Breen, Jonathan Steckel, and Seth Coe-Sullivan, a company co-founder who studied engineering at Brown as an undergraduate.

The US. Department of Energy, the Air Force Office for Scientific Research, and the National Science Foundation supported the research. Dang is a Vietnam Education Foundation (VEF) Scholar.

http://www.bbc.co.uk/news/health-17870315

'Brake gene' turned off in pancreatic cancer

Aggressive pancreatic tumours may be treatable with a new class of drugs, according to Cancer Research UK

Less than one in five people with this form of cancer are still alive a year after being diagnosed. A study, published in the journal Nature, showed that a gene was being switched off in the cancerous cells. The reseachers said drugs were already being tested which had the potential to turn the gene back on, to stop the spread of the cancer. Around 7,800 people in the UK are diagnosed with pancreatic cancer every year and it is the fifth most deadly cancer.

On/off

Studies in mice showed that a gene called USP9x, which normally stops a cell from dividing uncontrollably, is switched off in some pancreatic cancer cells. The gene is not mutated, but other proteins and chemicals become stuck to it and turn the gene off. Studies then showed that UPS9x was being turned off in human pancreatic cancer.

Prof David Tuveson, from the Cancer Research UK Cambridge Research Institute, said: "We suspected that the fault wasn't in the genetic code at all, but in the chemical tags on the surface of the DNA that switch genes on and off, and by running more lab tests we were able to confirm this. "Drugs which strip away these tags are already showing promise in lung cancer and this study suggests they could also be effective."

Dr David Adams, from the Wellcome Trust Sanger Institute, said: "This study strengthens our emerging understanding that we must also look into the biology of cells to identify all the genes that play a role in cancer." They argue that up to 15% of pancreatic cancers could be down the turning this one gene off.

Dr Julie Sharp, Cancer Research UK's senior science information manager, said: "These results raise the possibility that a class of promising new cancer drugs may be effective at treating some pancreatic cancers."

http://www.cbc.ca/news/canada/british-columbia/story/2012/04/29/bc-tsunami-debris-harley.html

Motorcycle washed up in B.C. may be Japanese tsunami debris

An estimated 1.5 million tonnes of flotsam believed to be headed to Canada

A beachcomber on British Columbia's Haida Gwaii islands has discovered what may be the first piece of debris from the Japanese tsunami to arrive in Canada. Peter Mark was riding his ATV, exploring an isolated beach on Graham Island on April 18, when he made a spectacular find. "You just never know what you're going to stumble upon when you go for a drive, and lo and behold you just come across something that's out of this world," he said.

The bike is a little rusty but amazingly intact. (Peter Mark/CBC)

Mark found a large white cube, like the back part of a moving truck, just below the high tide mark. "The door was ripped off it and I could see a motorcycle tire sticking out," he said. "So I went closer and looked inside and saw a Harley-Davidson motorcycle."

The bike was rusty, particularly on the wheels and handlebars, but the logo on the fuel tank was unmistakable.

"First I thought, this has got to be the craziest thing anyone has ever found," he said.

"Then I looked a little closer and the licence had Japanese writing on it. The wall of the trailer had Japanese print on the tags. And the first thing that popped into my head was this is likely from the Tsunami in Japan."

The motorcycle's licence plate shows it was registered in Miyagi Prefecture, and writing on the container matches photos of a commonly used Japanese moving van. Mark also found a few golf clubs, tools and camping equipment in the container. "It defies all logic," he said. "I cannot for the life of me figure out how that stuff stayed in there. The motorcycle was not strapped down. Everything was just laying loose on the bottom of the floor."

'Quite an eerie feeling'

Miyagi Prefecture was the worst hit part of Japan, with more than 11,000 people dead and missing. Video taken at the time of the tsunami shows numerous white trucks, similar to the cube that washed up on Haida Gwaii, getting washed away.

The Kuroshio ocean current runs in an almost direct path from Japan's east coast over to North America, passing right by the islands of Haida Gwaii.

Mark said seeing someone's possessions wash up on a beach 5,000 kilometres away was incredibly sobering.

"I gotta say, the first thing that popped into my mind when I was looking at the scene [was] I really wonder what happened to this person. I really hope this person is OK," he said. "It's quite a shock to actually see it and to actually walk into it … [It's] quite an eerie feeling, knowing what happened to Japan and to those people. It kind of hits home quite a bit."

The beach where the motorcycle washed up is remote - getting there requires an off-road vehicle and crossing several rivers — which is partly why Mark left everything where he found it. "I think the most important thing is that people treat the things they find with respect," he said. "These are parts of people's lives. Some people lost everything in the disaster, and I think people have to keep that in mind when they make a find like this."

The Japanese consulate in Vancouver has the licence plate number and is trying to determine who owned the items — and whether that person is still alive. "In many cases, I believe the original owners will welcome reuniting with their lost objects," said Hideki Ito, Japan's consul general in Vancouver.

Ito expects discoveries of personal items in the debris will be extremely rare, as most larger items will sink.

More than 1.5 million tonnes of tsunami debris is drifting across the Pacific Ocean toward Canada's West Coast, but until now only bottles, buoys and other small items have washed ashore.