Ancient DNA identifies donkey ancestors, people who domesticated them

Genetic investigators say the partnership between people and the ancestors of today's donkeys was sealed not by monarchs trying to establish kingdoms, but by mobile, pastoral people who had to recruit animals to help them survive the harsh Saharan landscape in northern Africa more than 5,000 years ago.

The findings, reported today by an international research team in Proceedings of the Royal Society B, paint a surprising picture of what small, isolated groups of people were able to accomplish when confronted with unpredictable storms and expanding desert.

"It says those early people were quite innovative, more so than many people today give them credit for," said senior author Connie J. Mulligan, Ph.D., an associate professor of anthropology at the University of Florida and associate director of the UF Genetics Institute. "The domestication of a wild animal was quite an intellectual breakthrough, and we have provided solid evidence that donkey domestication happened first in northern Africa and happened there more than once."

Sorting through the most comprehensive sampling of mitochondrial DNA ever assembled from ancient, historic and living specimens, scientists determined that the critically endangered African wild ass - which today exists only in small numbers in eastern Africa, zoos and wildlife preserves - is the living ancestor of the modern donkey.

What's more, researchers found evidence to suggest that a subspecies called the Nubian wild ass, presumed vanished late in the 20th century, is not only a direct ancestor of the donkey - it may still exist.

The ancestors of the domestic donkey were considered vital for collecting water, moving desert households and creating the first land-based trade routes between the ancient Egyptians and the Sumerians, according to study co-author Fiona B. Marshall, Ph.D., a professor of anthropology at Washington University in St. Louis.

An Old World prehistorian, Marshall has documented evidence of the donkey's domestic service by looking at skeletal wear and tear of animal remains found entombed near Egyptian pharaohs.

In the new study, scientists traced the family trees of the domestic donkey using samples from living animals, skeletons of African wild ass held in museums worldwide and isolated donkey bones from African archaeological sites.

"These were the first transport animals, the steam engines of their day," Marshall said. "Today domestic donkeys are often conceived of as animals of poor people, and little is known about their breeding. This is the first study to determine the African wild ass, which includes the Nubian strain, is the ancestor of the domestic donkey. That's important to know for efforts to preserve the species."

There are small numbers of the Somali subspecies of the African wild ass in zoos and wildlife preserves, and about 600 still exist in the wild in Eritrea and Ethiopia, but the Nubian subspecies was last seen in the Red Sea Hills of Sudan late in the 20th century.

Hope for its continued existence springs from a sample collected in northern Africa in the mid-1990s by co-author and biologist Albano Beja-Pereira of the University of Porto, Portugal. If any Nubian survivors are found, the possibility remains that the animals could be bred and reintroduced into the wild. The evidence reinforces the need for surveys and wildlife management plans in eastern Sudan and northern Eritrea, researchers say.

"The whole idea behind conservation is the need to maintain genetic variation," Mulligan said. "We don't know which elements are more or less important, but we think the whole range of diversity is important to the health of the species. Knowing the genetic makeup of the animals is essential to protect that diversity."

In addition, placing the domestication of the donkey in northern Africa helps scientists better understand the archaeological record and early culture of the area, researchers say.

"Knowing where a domestication event first occurred is important, because there are always cultural ramifications from being first," said Sandra Olsen, Ph.D., curator of anthropology at the Carnegie Museum of Natural History in Pittsburgh, who did not participate in the research. "With a nucleus of animals that can serve as either a food source, transportation or some other purpose, particular cultures acquire advantages that make them more successful than their neighbors. Consider that animals like the horse and the donkey were used for military purposes.

"From the point of view of a biologist or someone who studies animal husbandry, it is interesting to find the source for a species because it can even have veterinary ramifications," she said. "The work done in this project is extraordinary. They located very hard to find samples not common at all in museums, and the archeological specimens are difficult to obtain positive results from because the heat often destroys the organic material. They've made some considerable advances."

Besides revealing that the African wild ass is the living ancestor of today's domestic donkeys, the genetic evidence also reveals that the Somali wild ass is not a living ancestor as once suspected, but closer akin to a more modern cousin.

That leaves a question of a remaining, yet unidentified ancestor of modern donkeys believed to have sprung from a different branch of the family. Researchers suspect that ancestors of this animal are extinct, but they may have roamed the Maghreb of northeastern Africa, and possibly the coast of Yemen.

The research was initiated by funding from the National Science Foundation and also supported by the Wildlife Trust, St. Louis Zoo, Basel Zoo, Liberec Zoo and the Sea World and Busch Gardens Conservation Fund.

Conservation samples were collected by co-authors Patricia D. Moehlman of the International Union for Conservation of Nature, Hagos Yohannes of the Eritrea Ministry of Agriculture and Fanuel Kebede of the Ethiopian Wildlife Conservation Authority.

Additional authors include Birgitta Kimura of Santa Fe College, Shanyuan Chen and Sonia Rosenbom of the University of Porto, Noreen Tuross of Harvard University, Richard C. Sabin of the Natural History Museum of South Kensington, London; Joris Peters of Ludwig-Maximilian University, Munich; Barbara Barich of Sapienza University of Rome, Redae Teclai of the Eritrea Ministry of Agriculture and Fanuel Kebede of the Ethiopian Wildlife Conservation Authority.

Outsiders blamed for Easter Island's historic demise

An archaeologist studying a remote Pacific island, world famous for its strange stone statues, says outsiders - and not its ancestors - should be blamed for its historic demise hundreds of years ago.

Dr Karina Croucher from The University of Manchester says her research backs a growing body of opinion which casts new light on the people living on the island of Rapa Nui, named 'Easter Island' by its discoverers in 1722.

"Easter Islanders' ancestors have been unfairly accused by Westerners of being primitive and warlike, for toppling statues - or moai - and for over-exploiting the island's natural resources," she said.

But the art which adorns Easter Island's landscape, volcanoes and statues, body tattoos and carved wooden figurines, when examined together, show a different picture of what the islanders were like, according to Dr Croucher.

"The carved designs - including birds, sea creatures, canoes and human figures - mimic natural features already visible in the landscape and show their complex relationship to the natural environment," she said.

"They were a people who saw themselves as connected to the landscape, which they carved and marked as they did their own bodies and the moai statues. These people must have had a sophisticated and successful culture – until the Westerners arrived - and it is time we recognise that.

"Early expedition accounts repeatedly show the islanders produced a trading surplus – they were successful and self sufficient. It must have been quite a place to live: I imagine the sounds of the carvers dominating the soundscape as they worked on the rock."

Dr Croucher, whose research is funded by the British Academy, added: "There is a growing body of opinion which says history has been unkind to the Easter Islanders - and my research confirms and underlines that.

"Rather than a story of self-inflicted deprivation, I agree with the view that substantial blame has to rest with Western contact, ever since Easter Island's first sighting by Jacob Roggeveen in 1722.

"Visitors brought disease, pests and slavery, resulting in the tragic demise of the local population and culture. There is little archaeological evidence to support the history of internal warfare and collapse before contact with the outside world."

Easter Island's 19th Century history is a sad one: slave raids in 1862 reduced the Island's population A few islanders survived slavery and were returned home, bringing with them small pox and other diseases.

The missionaries converted the remaining population to Christianity, encouraging them to abandon their traditional beliefs.

Even then, several hundred inhabitants were driven off the island to work on sugar plantations in Tahiti. By 1877, a population of just 110 people was recorded.

The academic, based at The School of Arts, Histories and Cultures, said: "Explorer Thor Heyerdahl famously asserted that it was South Americans who built the moai.

"However, rather than relying on the arrival of a South American fleet of carvers and sculptors, it is clear the moai, rock art and tattooing are very much part of the same tradition, which has Polynesian roots.

"The statues and rock art, although difficult to date with certainty, are the result of a population which flourished on the island until outside contact set the tragic course for the Island's demise."

Notes for editors

Examples of rock art include intriguing 'Makemake' faces which appear to resemble lichen patterns and naturally-formed fissures in rock which are carved into fish-tails.

Cancer-causing bacterium targets tumor-suppressor protein

CHAMPAIGN, Ill. - Researchers have discovered a mechanism by which Helicobacter pylori, the only known cancer-causing bacterium, disables a tumor suppressor protein in host cells.

The new study, in the journal Oncogene, reports the discovery of a previously unknown mechanism linking H. pylori infection and stomach cancer, the second leading cause of cancer deaths worldwide.

About two-thirds of the world's population is infected with H. pylori, a bacterium that can survive in the harsh environment of the stomach. Most infected people never develop disease. For a significant minority, however, infection with H. pylori leads to inflammation, ulcers and in some cases, stomach (gastric) cancer.

H. pylori's ability to cause disease is closely associated with a virulence protein called CagA. Previous studies have found that CagA-positive strains are much more likely to cause inflammation and spur the abnormal cell division and growth of cells that lead to cancer.

H. pylori injects CagA into the epithelial cells that line the stomach. Within the cells, CagA is able to hijack various signaling pathways and disrupt proper cellular functions. Other studies have identified RUNX3 (pronounced RUNKS-three) as an important gastric cancer tumor suppressor.

Loss of expression of RUNX3 is causally associated with the development of gastric cancer, said University of Illinois medical biochemistry professor Lin-Feng Chen, who led the study. RUNX3 guards against tumor formation by spurring the production of factors that target unhealthy cells for destruction.

"Although emerging evidence suggests that RUNX3 is a tumor suppressor whose inactivation is involved in the initiation and progression of gastric cancer," the authors wrote, "the trigger for RUNX3 inactivation within gastric cells is largely unknown. The protein, RUNX3, is a transcription factor, so it activates different kinds of genes controlling cell growth and death," Chen said. "The first thing we wanted to see was whether H. pylori has any effect on the transcription activity of RUNX3."

Two graduate students in Chen's lab, Ying-Hung Nicole Tsang and Acacia Lamb, began the study by examining RUNX3 transcription activity in H. pylori-infected gastric epithelial cells. They found that infection with CagA-positive H. pylori inhibited the transcription activity of RUNX3 and reduced levels of the RUNX3 protein in cells. CagA-negative H. pylori had no effect on RUNX3 levels or activity. “In fact, CagA alone is sufficient to down-regulate the RUNX3 transcription activity and reduce the expression of RUNX3, further supporting the importance of this bacterial protein in the genesis of gastric disease," Chen said.

Further tests revealed that CagA and RUNX3 physically interact with each other in human epithelial cells. The researchers found that a newly identified domain within CagA, the WW domain, recognizes a sequence in the RUNX3 protein known as the "PY motif." They further showed that this interaction leads to the "tagging" of RUNX3 for degradation via a process called ubiquitination.

Previous studies found that there are several unique sequences within the carboxyl-terminal region of CagA that are vital to the protein's ability to interact with host proteins and disrupt normal cellular processes.

"This is the first time anybody has identified a unique domain within the amino-terminal region of the CagA protein, and it will help us to better understand how this oncogenic protein functions," Chen said. "This study has uncovered a new step in the initiation of H. pylori-induced gastric cancer."

The accumulation of many deleterious changes in cells leads to the development of cancer. RUNX3 helps cells react when cellular processes go awry, so H. pylori-induced degradation of RUNX3 "could produce conditions in which aberrant cellular changes are less inhibited," Chen said.

Chen's group is working to identify the molecular mechanism by which CagA targets RUNX3 for degradation. He and his colleagues hope to design small molecules that can specifically inhibit the interaction between RUNX3 and CagA and block the degradation of RUNX3. Such drugs may be used to prevent the gastric diseases induced by H. pylori.

Researchers from the Vanderbilt University School of Medicine; Nagasaki University, in Japan; and the Institute of Molecular and Cell Biology, in Singapore, contributed to the research.

Partial funding for this study was provided by the National Institute of Diabetes and Digestive and Kidney Diseases at the National Institutes of Health.

1 high-fat diet, 2 different outcomes: The path to obesity becomes clearer

Why is it that two people can consume the same high fat, high-calorie Western diet and one becomes obese and prone to diabetes while the other maintains a slim frame? This question has long baffled scientists, but a study by Yale School of Medicine researchers provides a simple explanation: weight is set before birth in the developing brain. The results are reported online the week of August 2 in the Proceedings of the National Academy of Sciences.

Led by Tamas Horvath, chair and professor of comparative medicine and professor of neurobiology and obstetrics & gynecology at Yale School of Medicine, the research team analyzed the same question in specific

groups of rats. These animals have been bred so that their vulnerability to diet-induced obesity is known before they would be put on high-fat, high-calorie diet diets.

Horvath said animals that become obese already had a significant difference in the feeding center of the brain. Neurons that are supposed to signal when you've eaten enough and when to burn calories, are much more sluggish in these animals because they are inhibited by other cells. In animals resistant to obesity, these satiety signaling neurons are much more active and ready to signal to the rest of the brain and peripheral tissues when enough food has been consumed.

"It appears that this base wiring of the brain is a determinant of one's vulnerability to develop obesity," said Horvath, who is also co-director of the Yale Program in Integrative Cell Signaling and Neurobiology of Metabolism. "These observations add to the argument that it is less about personal will that makes a difference in becoming obese, and, it is more related to the connections that emerge in our brain during development."

Horvath points to other unwanted consequences of these brain mechanisms. "Those who are vulnerable to diet-induced obesity also develop a brain inflammation, while those who are resistant, do not," he said. "This emerging inflammatory response in the brain may also explain why those who once developed obesity have a harder time losing weight."

Diet-induced obesity has become one of the most critical medical problems in the United States. In particular, the incidence of childhood obesity has reached unprecedented levels. Since genetics alone cannot explain the surge of obesity in society, investigators have been trying to determine the primary underpinnings of the vulnerability to develop obesity on a Western diet.

"What genetic, epigenetic and environmental factor determines this base wiring in the brain is a very important issue to address," said Horvath. "Specifically, the emerging view is that besides genetics, maternal impact on the developing brain is likely to be critical to imprint these feeding circuits thereby determining one's vulnerability or resistance to obesity."

The study was supported by the National Institutes of Health and the American Diabetes Association.
Other Yale authors include Beatrix Sarman, Peter Sotonyi, Marya Shanabrough, Erzsebet Borok and Sabrina Diano. The study also included authors from the following institutions: Monash University, University of Cincinnati, German Institute of Human Nutrition Potsdam-Rehbrücke, Department of Veterans Affairs New Jersey Health Care System and University of Medicine and Dentistry New Jersey.
Citation: PNAS doi/10.1073/pnas.1004282107

Brain may age faster in people whose hearts pump less blood

DALLAS - Keep your heart healthy and you may slow down the aging of your brain, according to a new study reported in Circulation: Journal of the American Heart Association.

In the study, people whose hearts pumped less blood had brains that appeared older than the brains of those whose hearts pumped more blood. Decreased cardiac index, the amount of blood that pumps from the heart in relation to a person's body size, was associated with decreased brain volume using magnetic resonance imaging (MRI).

Researchers observed the link even in those participants who did not have cardiovascular disease, such as heart failure or coronary heart disease. As the brain ages, it begins to atrophy (shrink) and has less volume. The decrease in brain volume is considered a sign of brain aging. More severe brain atrophy occurs in those with dementia, such as Alzheimer's disease.

"The results are interesting in that they suggest cardiac index and brain health are related," said Angela L. Jefferson, Ph.D., the study's lead author and associate professor of neurology at the Boston University School of Medicine. "The association cannot be attributed to cardiovascular disease because the relationship also was seen when we removed those participants with known cardiovascular disease from our analyses."

In the observational study, which cannot establish cause and effect, researchers examined brain and heart MRI information on 1,504 participants of the decades-long Framingham Offspring Cohort who did not have a history of stroke, transient ischemic attack or dementia. Participants were 34 to 84 years old and 54 percent were women.

Researchers measured cardiac output using MRI and normalized the data for each participant's body surface area. Brain volume was assessed using MRI. Participants were divided into three groups based on cardiac index values.

The participants who had the lowest cardiac index, or the least amount of blood pumping from the heart for their body size, showed almost two years more brain aging than the people with the highest cardiac index. The participants in the middle cardiac index group, who had low but still normal levels of blood pumping from the heart, also showed almost two years more brain aging than the people with the highest (or healthiest) cardiac index.

"We expected an association between the lowest levels of cardiac index and smaller brain volumes, but we were surprised to find people on the lower end of normal cardiac index also have smaller brain volumes when compared to people with very health cardiac index," Jefferson said.

Because only 7 percent of all participants in the study had heart disease, Jefferson and her colleagues also didn't expect 30 percent of participants would have low cardiac index.

"These participants are not sick people. A very small number have heart disease. The observation that nearly a third of the entire sample has low cardiac index and that lower cardiac index is related to smaller brain volume is concerning and requires further study."

As a group, participants with smaller brain volumes did not show obvious clinical signs of diminished brain function. "We observed cardiac index is related to structural changes in the brain but not cognitive changes," Jefferson said. "The structural changes may be early evidence that something is wrong. Investigators from Framingham will continue to follow these individuals to see how structural brain changes affect memory and cognitive abilities over time."

The exact cause for a link between heart function and brain volume is still not well understood, Jefferson said. "There are several theories for why reduced cardiac index might affect brain health. For instance, a lower volume of blood pumping from the heart might reduce blood flow to the brain, providing less oxygen and fewer nutrients needed for brain cells. It is too early to dole out health advice based on this one finding but it does suggest that heart and brain health go hand in hand."

Co-authors are Jayandra J. Himali, M.S.; Alexa S. Beiser, Ph.D.; Rhoda Au, Ph.D.; Joseph M. Massaro, Ph.D.; Sudha Seshadri, M.D.; Philimon Gona, Ph.D.; Carol J. Salton, B.A.; Charles DeCarli, M.D.; Christopher J. O'Donnell, M.D., M.P.H.; Emelia J. Benjamin, M.D., Sc.M.; Philip A. Wolf, M.D.; and Warren J. Manning, M.D. Author disclosures are on the manuscript. The National Institute on Aging and the National Heart, Lung, and Blood Institute funded the research.

Women attracted to men in red, research shows

What could be as alluring as a lady in red? A gentleman in red, finds a multicultural study published Aug. 2 in the Journal of Experimental Psychology: General.

Simply wearing the color red or being bordered by the rosy hue makes a man more attractive and sexually desirable to women, according to a series of studies by researchers at the University of Rochester and other institutions. And women are unaware of this arousing effect.

The cherry color's charm ultimately lies in its ability to make men appear more powerful, says lead author Andrew Elliot, professor of psychology at the University of Rochester. "We found that women view men in red as higher in status, more likely to make money and more likely to climb the social ladder. And it's this high-status judgment that leads to the attraction," Elliot says.

In several experiments, the shirt of the man in the photographs was digitally colored either red or another color. Participants rated the pictured man's status and attractiveness, and reported on their willingness to date, kiss and engage in other sexual activity with the person. **University of Rochester**

Why does red signal rank? The authors see both culture and biology at work. In human societies across the globe, red traditionally has been part of the regalia of the rich and powerful. Ancient China, Japan and sub-Saharan Africa all used the vibrant tint to convey prosperity and elevated status, and Ancient Rome's most powerful citizens were literally called "the ones who wear red." Even today, the authors note, businessmen wear a red tie to indicate confidence, and celebrities and dignitaries are feted by "rolling out the red carpet."

Along with this learned association between red and status, the authors point to the biological roots of human behavior. In non-human primates, like mandrills and gelada baboons, red is an indicator of male dominance and is expressed most intensely in alpha males. Females of these species mate more often with alpha males, who in turn provide protection and resources.

"When women see red it triggers something deep and probably biologically engrained," explains Elliot. "We say in our culture that men act like animals in the sexual realm. It looks like women may be acting like animals as well in the same sort of way."

To quantify the red effect, the paper analyzed responses from 288 female and 25 male undergraduates to photographs of men in seven different experiments. Participants were all self-identified as heterosexual or bisexual. In one color presentation, participants looked at a man's photo framed by a border of either red or white and answered a series of questions, such as: "How attractive do you think this person is?"

Other experiments contrasted red with gray, green, or blue. Colors were precisely equated in lightness and intensity so that test results could not be attributed to differences other than hue.

In several experiments, the shirt of the man in the photographs was digitally colored either red or another color. Participants rated the pictured man's status and attractiveness, and reported on their willingness to date, kiss, and engage in other sexual activity with the person. They also rated the man's general likability, kindness, and extraversion.

The researchers found that the red effect was limited to status and romance: red made the man seem more powerful, attractive, and sexually desirable, but did not make the man seem more likable, kind, or sociable. The effect was consistent across cultures: undergraduates in the United States, England, Germany, and China all found men more attractive when wearing or bordered by red.

And the effect was limited to women. When males were asked to rate the attractiveness of a pictured male, color made no difference in their responses.

Across all the studies, the influence of color was totally under the radar. "We typically think of color in terms of beauty and aesthetics," say Elliot. "But color carries meaning as well and affects our perception and behavior in important ways without our awareness."

In earlier work, Elliot documented that men are more attracted to women in red. But the red effect depends on the context. Elliot and others have also shown that seeing red in competitive situations, such as IQ tests or sporting events, leads to worse performance.

The paper was coauthored by Daniela Niesta Kayer, University of Rochester; Tobias Greitemeyer, University of Innsbruck; Stephanie Lichtenfeld, University of Munich; Richard H. Gramzow, University of Southampton; Markus A. Maier, University of Munich; and Huijun Liu, Tainjin Medical University.

The research was funded by the Alexander von Humboldt Foundation and an Excellence Guest Professorship at the University of Munich.

MIT researchers show silicon can be made to melt in reverse

Material that shows melting while cooling could lead to applications in solar cells, other devices

CAMBRIDGE, Mass. - Like an ice cube on a warm day, most materials melt - that is, change from a solid to a liquid state - as they get warmer. But a few oddball materials do the reverse: They melt as they get cooler. Now a team of researchers at MIT has found that silicon, the most widely used material for computer chips and solar cells, can exhibit this strange property of "retrograde melting" when it contains high concentrations of certain metals dissolved in it.

The material, a compound of silicon, copper, nickel and iron, "melts" (actually turning from a solid to a slush-like mix of solid and liquid material) as it cools below 900 degrees Celsius, whereas silicon ordinarily melts at 1414 degrees C. The much lower temperatures make it possible to observe the behavior of the material during melting, based on specialized X-ray fluorescence microprobe technology using a synchrotron - a type of particle accelerator - as a source.

The material and its properties are described in a paper just published online in the journal Advanced Materials. Team leader Tonio Buonassisi, the SMA Assistant Professor of Mechanical Engineering and Manufacturing, is the senior author, and the lead authors are Steve Hudelson MS '09, and postdoctoral fellow Bonna Newman PhD '08.

The findings could be useful in lowering the cost of manufacturing some silicon-based devices, especially those in which tiny amounts of impurities can significantly reduce performance. In the material that Buonassisi and his researchers studied, impurities tend to migrate to the liquid portion, leaving regions of purer silicon behind. This could make it possible to produce some silicon-based devices, such as solar cells, using a less pure, and therefore less expensive, grade of silicon that would be purified during the manufacturing process.

"If you can create little liquid droplets inside a block of silicon, they serve like little vacuum cleaners to suck up impurities," Buonassisi says. This research could also lead to new methods for making arrays of silicon nanowires - tiny tubes that are highly conductive to heat and electricity.

Buonassisi predicted in a 2007 paper that it should be possible to induce retrograde melting in silicon, but the conditions needed to produce such a state, and to study it at a microscopic level, are highly specialized and have only recently become available. To create the right conditions, Buonassisi and his team had to adapt a microscope "hot-stage" device that allowed the researchers to precisely control the rate of heating and cooling. And to actually observe what was happening as the material was heated and cooled, they drew upon high-power synchrotron-based X-ray sources at Lawrence Berkeley National Laboratory in California and at Argonne National Laboratory in Illinois (researchers from both national labs are co-authors of the paper).

The material for the tests consisted of a kind of sandwich made from two thin layers of silicon, with a filling of copper, nickel and iron between them. This was first heated enough to cause the metals to dissolve into the

silicon, but below silicon's melting point. The amount of metal was such that the silicon became supersaturated - that is, more of the metal was dissolved in the silicon than would normally be possible under stable conditions. For example, when a liquid is heated, it can dissolve more of another material, but then when cooled down it can become supersaturated, until the excess material precipitates out.

In this case, where the metals were dissolved into the solid silicon, "if you begin cooling it down, you hit a point where you induce precipitation, and it has no choice but to precipitate out in a liquid phase," Buonassisi says. It is at that point that the material melts.

Source: "Retrograde Melting and Internal Liquid Gettering in Silicon" by Steve Hudelson, Bonna K. Newman, Sarah Bernardis, David P. Fenning, Mariana I. Bertoni, Matthew A. Marcus, Sirine C. Fakra, Barry Lai, Tonio Buonassisi. Advanced Materials, 29 July, 2010.

New studies question vascular multiple sclerosis hypothesis and treatment

Concludes blood flow insufficiency not found to contribute to MS development

Two important new studies challenge the controversial hypothesis that venous congestion - chronic cerebrospinal venous insufficiency (CCSVI) - contributes to the development of multiple sclerosis (MS). This theory has resulted in many MS patients receiving experimental endovascular angioplasty, a treatment for MS unproven by clinical trials. The studies refuting the CCSVI theory with the first negative medical evidence on the subject, are available today in Annals of Neurology, a journal published by Wiley-Blackwell on behalf of the American Neurological Association.

For nearly 150 years it has been known that focal MS lesions tend to develop around cerebral veins that are thought to the portal by which inflammatory cells targeting myelin enter the brain. However, a 2009 study by Zamboni et al. offered an alternative theory suggesting that chronically impaired venous drainage (blood flow) from the central nervous system - a term that he labeled Chronic Cerebrospinal Venous Insufficiency or CCSVI - leads to MS development.1 Zamboni et al. also claimed that endovascular angioplasty was markedly effective in MS patients.2 Zamboni's work gained much attention in the press, especially their report that ultrasound diagnosis of CCSVI perfectly matched an MS diagnosis with 100% sensitivity and 100% specificity.

"These two papers should add a note of caution for MS patients and physicians who are contemplating interventions for possible venous abnormalities based on the findings of Zamboni. At this time, the theory must be considered unconfirmed and unproven. Such interventions carry risk, and several people have already been harmed by the inappropriate application of venous angioplasty and stenting for MS," says Stephen L. Hauser, M.D., the Robert A. Fishman Distinguished Professor and Chair of the Department of Neurology at the University of California, San Francisco, and editor-in-chief of the Annals of Neurology. A previously published review of the evidence in the Annals by Khan et al. noted that treatment procedures, based upon these findings, have included placing stents in the jugular veins of MS patients which led to serious injury in some cases.

In the current issue of the Annals, Florian Doepp, M.D., and colleagues in Germany performed an extended extra- and trans-cranial color-coded sonography study on 56 MS patients (36 female; 20 male) and 20 control subjects (12 female; 8 male). The analysis included extra-cranial venous blood volume flow (BVF), internal jugular vein (IJV) flow analysis during Valsalva maneuver (VM), as well as tests included in the CCSVI criteria.

Results showed that blood flow direction was normal in all participants, excluding one subject with relapsing-remitting MS. Furthermore, the research team noted that blood volume flow (BVF) in both groups were equal in the supine body position. In summary, the researchers determined that none of the study participants fulfilled more than one criterion for CCSVI.

"Our results call into question the existence of CCSVI in a large proportion of patients with MS," said Dr. Doepp. "We did not find supporting evidence that cerebral venous congestion plays a significant role in the development of MS. Further studies are needed to clarify the difference between MS patients and healthy subjects in blood volume flow regulation," concluded Dr. Doepp.

A second study by researchers at Umeå University in Sweden also concluded that CCSVI does not contribute to the development of MS. The Swedish research team led by Peter Sundström, M.D., Ph.D., tested the vital component of the CCSVI theory - the obstructed IJV flow - in 21 MS patients and 20 healthy controls using magnetic resonance imaging with phase contrast (PC-MRI).

"Using PC-MRI, we were not able to reproduce the findings by Zamboni et al. which suggest CCSVI contributes to the development of MS," said Dr. Sundström. The researchers found no significant differences between the MS group and control group relating to total IJV blood flow. "Our study found no support for using endovascular procedures such as angioplasty or stenting to treat MS patients," Dr. Sundström affirmed.

MS is an inflammatory disease of the central nervous system in which lesions (plaques) form in the white matter of the brain and destroy the myelin sheath around nerve fibers. Initial symptoms of MS - typically

blurred or double vision, muscle weakness, sensory changes, or difficulty with balance - usually appear between the ages of 20 and 40. The course can be relapsing-remitting or relentlessly progressive, and if untreated results in permanent neurologic disability in most affected individuals. MS affects 2.5 million individuals worldwide, making it one of the most common neurological disorders and causes of disability in young adults.

1. Zamboni P, Galeotti R, Menegatti E, et al. Chronic cerebrospinal venous insufficiency in patients with multiple sclerosis. J Neurol Neurosurg Psychiatry 2009;80:392.

2. Zamboni P, Galeotti R, Menegatti E, et al. A prospective openlabel study of endovascular treatment of chronic cerebrospinal venous insufficiency. J Vasc Surg 2009;50:1348.

This study is published in the August issue of the Annals of Neurology. Media wishing to receive a PDF of this article may contact healthnews@wiley.com

Full citations: "No cerebro-cervical venous congestion in patients with multiple sclerosis." Florian Doepp, Friedemann Paul, José M. Valdueza, Klaus Schmierer, and Stephan J. Schreiber. Annals of Neurology; Published Online: August 2, 2010 (DOI:10.1002/ana.22085); Print issue: August 2010.

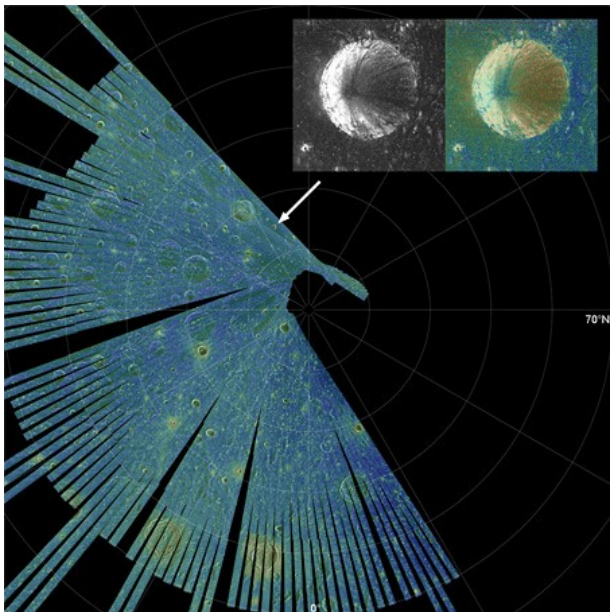
"Venous and cerebrospinal fluid flow in multiple sclerosis – a case-control study." Peter Sundström, Anders Wåhlin, Khalid Ambarki, Richard Birgander, Anders Eklund and Jan Malm. Annals of Neurology; Published Online: August 2, 2010 (DOI:10.1002/ana.22132); Print issue: August 2010.

"Chronic Cerebrospinal Venous Insufficiency and Multiple Sclerosis." Omar Khan, Massimo Filippi, Mark S. Freedman, Frederik Barkhof, Paula Dore-Duffy, Hans Lassmann, Bruce Trapp, Amit Bar-Or, Imad Zak, Marilyn J. Siegel and Robert Lisak. Annals of Neurology; Published Online: February 12, 2010 (DOI:10.1002/ana.22001); Print issue: March 2010.

Radar Images Reveal Tons of Water Likely at the Lunar Poles

by Nancy Atkinson

Radar has been used since the 1960s to map the lunar surface, but until recently it has been difficult to get a good look at the Moon's poles. In 2009, the Mini-SAR radar instrument on the Chandrayaan-1 spacecraft was able to map more than 95% of both poles at 150 meter radar resolution, and now the Mini-RF instrument on the Lunar Reconnaissance Orbiter - which has 10 times the resolution of the Mini-SAR - is about halfway through its first high-resolution mapping campaign of the poles. The two instruments are revealing there are likely massive amounts of water in the permanently shadowed craters at the poles, with over 600 million metric tons at the north pole alone. "If that was turned into rocket fuel, it would be enough to launch the equivalent of one Space Shuttle per day for over 2,000 years," said Paul Spudis, principal investigator for the Mini-SAR, speaking at the annual Lunar Forum at the Ames Research Center in July.



High-resolution view from LRO's Mini-RF of the Moon's north polar region, inset is an unusual crater , Rozhdestvensky (110 miles, or 177 kilometers in diameter). **Credit: NASA**

Both Spudis and Ben Bussey, principal investigator for LRO's Mini-RF shared images from their respective instruments at the Forum, highlighting polar craters that exhibit unusual radar properties consistent with the presence of ice.

They have found over 40 craters on the Moon's north pole that exhibit these properties.

Both instruments provide details of the interior of shadowed craters, not able to be seen in visible light. In particular, a measurement called the circular polarization ratio (CPR) shows the characteristics of the radar echoes, which give clues to the nature of the surface materials in dark areas. The instruments send pulses of left-polarized radio waves to measure the surface roughness of the Moon. While smooth surfaces send back a reversed, right-polarized wave, rough areas return left-polarized waves. Ice, which is transparent to radio waves, also sends back left-polarized waves. The instruments measure the ratio of left to right circular polarized power sent back, which is the CPR.

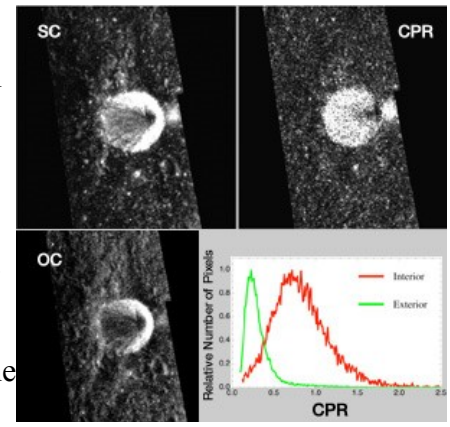
Few places – even in our solar system - have a CPR greater than 1 but such places have thick deposits of ice, such as Martian polar caps, or the icy Galilean satellites. They are also seen in rough, rocky ejecta around fresh, young craters, but there, scientists also observe high CPR outside the crater rim such as in this image, below of the Main L crater on the Moon.

Most of the Moon has low CPR, but dozens of anomalous north pole craters, such as a small 8 km crater within the larger Rozhdestvensky crater, had a high CPR on the inside, with a low CPR on the rims. That suggests some material within the craters, rather than surface roughness, caused the high CPR signal.

"Geologically, we don't expect rough, fresh surfaces to be present inside a crater rim but absent outside of it," Spudis said. "This confirms the high CPR in these anomalous craters is not caused by surface roughness, and we interpret this to mean that water ice is present in these craters."

Additionally, the ice would have to be several meters thick to give this signature. "To see this elevated CPR effect, the ice must have a thickness on the order of tens of wavelengths of the radar used," he said. "Our radar wavelength is 12.6 cm, therefore we think that the ice must be at least two meters thick and relatively pure."

Recent Mini-SAR images (top image) from LRO confirm the Chandrayaan-1 data, with even better resolution. The Mini-RF, Bussey said, is equivalent to a combination of the Arecibo Observatory and the Greenbank Radio telescope in looking at the Moon. "Our polar campaign will map from 70 degrees to the poles and so far we are very pleased with the coverage and quality of the data," Bussey said.



An "anomalous" crater on the floor of Rozhdestvensky, near the north pole of the Moon. The histogram of CPR values clearly shows that interior points (red line) have higher CPR values than those outside the crater rim (green line). Credit: NASA

Spudis said they are seeing less anamolous craters on the Moon's south pole, but both he and Bussey are looking forward to comparing more data between the two radar instruments to learn more about the permanently shadowed craters on the Moon. Additionally, other instruments on LRO will also provide insights into the makeup of these anomalous craters.

Mars site may hold 'buried life'

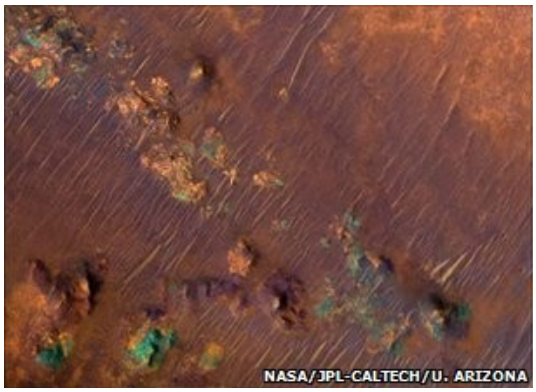
By Victoria Gill Science reporter, BBC News

Researchers have identified rocks that they say could contain the fossilised remains of life on early Mars.

The team made their discovery in the ancient rocks of Nili Fossae.

Their work has revealed that this trench on Mars is a "dead ringer" for a region in Australia where some of the earliest evidence of life on Earth has been buried and preserved in mineral form. They report the findings in the journal Earth and Planetary Science Letters.

The team, led by a scientist from the Search for Extraterrestrial Intelligence Institute (Seti) in California, believes that the same "hydrothermal" processes that preserved these markers of life on Earth could have taken place on Mars at Nili Fossae.



Nili Fossae trough on Mars (Image: NASA/JPL-Caltech/University of Arizona) Is Nili Fossae the site where life on ancient Mars was buried and preserved?

The rocks there are up to four billion years old, which means they have been around for three-quarters of the history of Mars. When, in 2008, scientists first discovered carbonate in those rocks the Mars science community reacted with great excitement; carbonate had long been sought as definitive evidence that the Red planet was habitable - that life could have existed there.

Carbonate is what life - or at least the mineral portion of a living organism - turns into, in many cases, when it is buried. The white cliffs of Dover, for example, are white because they contain limestone, or calcium carbonate. The mineral comes from the fossilised remains shells and bones and provides a way to investigate the ancient life that existed on early Earth.

In this new research, scientists have taken the identification of carbonate on Mars a step further.

Adrian Brown from the Seti Institute, who led the research, used an instrument aboard Nasa's Mars Reconnaissance Orbiter called Crism to study the Nilae Fossae rocks with infrared light.

Then he and his team used exactly the same technique to study rocks in an area in north-west Australia called the Pilbara. "The Pilbara is very cool," Dr Brown told BBC News. "It's part of the Earth that has managed to stay at the surface for around 3.5 billion years - so about three quarters of the history of the Earth. It allows us a little window into what was happening on the Earth at its very early stages."

And all those billions of years ago, scientists believe that microbes formed some distinctive features in the Pilbara rocks - features called "stromatolites" that can be seen and studied today. "Life made these features. We can tell that by the fact that only life could make those shapes; no geological process could."

This latest study has revealed that the rocks at Nili Fossae are very similar to the Pilbara rocks - in terms of the minerals they contain.

And Dr Brown and his colleagues believe that this shows that the remnants of life on early Mars could be buried at this site.

"If there was enough life to make layers, to make corals or some sort of microbial homes, and if it was buried on Mars, the same physics that took place on Earth could have happened there," he said. That, he suggests, is why the two sites are such a close match.

'Geological olympics'

Dr Brown and many other scientists had hoped that they would soon have the opportunity to get much closer to these rocks. Nili Fossae was put forward as a potential landing site for Nasa'a ambitious new rover, the Mars Science Laboratory, which will be launched in 2011.

The site was championed by other geologists, including John Mustard from Brown University in Rhode Island, whose team made the case to Nasa to have it included in the landing site shortlist for MSL.

But Nilae Fossae was eventually deemed too dangerous a landing site and it was finally removed from the list in June of this year.

"The rover is being landed remotely - so there's no human pilot involved; it's all up to the robot. And [that's] a very dangerous thing," said Dr Brown. "You need 20km of smooth terrain and unfortunately at this site it is pretty rocky - those ancient rocks are pretty weathered and the surface is rocky and uneven."

"It will be visiting another interesting site when it lands, but this is the place that we should be checking out for life on early Mars."

John Grant, a scientist from the Smithsonian Institution in Washington DC, and a member of the planetary sciences panel that advises Nasa on the MSL mission, spoke to BBC News earlier this year about the choice of landing site. He said that the objective of mission was a search for "habitability". It was not, he said, a life detection mission. "[It] entails looking at geologic environments that may not only have been habitable but where signals associated with that habitability have been preserved," he told BBC News in February.

But that does not alleviate the disappointment that many feel over having Nili Fossae and all its secrets taken off the table for the mission.

And what makes Mars Science Laboratory even more of a crucial mission for scientists is the fact that it will be the last rover to explore the surface of Mars until 2018 - partly because funding the mission has been so extraordinarily expensive.

Dr Brown described the experience of having his favoured landing site removed from the shortlist as the geological equivalent of having "your city's Olympic bid rejected". "I also see a race happening here," he said. "It might take us a couple of decades to build our capability to land [unmanned] rovers somewhere geologically interesting on Mars. "And in those decades, human space flight capabilities are going to develop and we could have the capability to send humans to Mars."

So in this race of the human versus the robots, which will win?

"It's my personal belief," said Dr Brown, "that by the time real human geologists get to go to Mars, the question of whether there is life on Mars will still be open."

Hear more from the researchers on Science in Action on the BBC World Service.

7 Hours Sleep Just Right

Sleeping more or fewer than seven hours a day can significantly increase the risk of developing cardiovascular disease.

Mon Aug 2, 2010 02:20 PM ET | content provided by Karin Zeitvogel, AFP

People who sleep more or fewer than seven hours a day, including naps, are increasing their risk for cardiovascular disease, the leading cause of death in the United States, a study published Sunday shows.

Sleeping fewer than five hours a day, including naps, more than doubles the risk of being diagnosed with angina, coronary heart disease, heart attack or stroke, the study conducted by researchers at West Virginia University's (WVU) faculty of medicine and published in the journal Sleep says.

And sleeping more than seven hours also increases the risk of cardiovascular disease, it says.

Study participants who said they slept nine hours or longer a day were one-and-a-half times more likely than seven-hour sleepers to develop cardiovascular disease, the study found.

The most at-risk group was adults under 60 years of age who slept five hours or fewer a night. They increased their risk of developing cardiovascular disease more than threefold compared to people who sleep seven hours.

Women who skimped on sleep, getting five hours or fewer a day, including naps, were more than two-and-a-half times as likely to develop cardiovascular disease. Short sleep duration was associated with angina, while both sleeping too little and sleeping too much were associated with heart attack and stroke, the study says.

A separate study, also published in Sleep, showed that an occasional long lie-in can be beneficial for those who can't avoid getting too little sleep.

In that study, David Dinges, who heads the sleep and chronobiology unit at the University of Pennsylvania school of medicine, found that 142 adults whose sleep was severely restricted for five days - as it is for many people during the work week - had slower reaction times and more trouble focusing.

But after a night of recovery sleep, the sleep-deprived study participants' alertness improved significantly, and the greatest improvements were seen in those who were allowed to spend 10 hours in bed after a week with just four hours' sleep a night.

"An additional hour or two of sleep in the morning after a period of chronic partial sleep loss has genuine benefits for continued recovery of behavioral alertness," Dinges said.

In the study about sleep and cardiovascular disease, researchers led by Anoop Shankar, associate professor at WVU's department of community medicine, analyzed data gathered in a national US study in 2005 on more than 30,000 adults. The results were adjusted for age, sex, race, whether the person smoked or drank, whether they were fat or slim, and whether they were active or a couch potato.

And even when study participants with diabetes, high blood pressure or depression were excluded from the analysis, the strong association between too much or too little sleep and cardiovascular disease remained.

The authors of the WVU study were unable to determine the causal relationship between how long a person sleeps and cardiovascular disease.

But they pointed out that sleep duration affects endocrine and metabolic functions, and sleep deprivation can lead to impaired glucose tolerance, reduced insulin sensitivity and elevated blood pressure, all of which increase the risk of hardening the arteries.

The American Academy of Sleep Medicine recommends that most adults get about seven to eight hours of sleep each night.

Shankar suggested that doctors screen for changes in sleep duration when assessing patients' risk for cardiovascular disease, and that public health initiatives consider including a focus on improving sleep quality and quantity.

Breeding Is Changing Dog Brains, Scientists Find

ScienceDaily (Aug. 2, 2010)

For the first time, scientists have shown that selective breeding of domestic dogs is not only dramatically changing the way animals look but is also driving major changes in the canine brain.

The brains of many short-snouted dog breeds have rotated forward as much as 15 degrees, while the brain region controlling smell has fundamentally relocated, researchers from the University of New South Wales and University of Sydney have found.

The large variations in dog skull size and shape follow more than 12,000 years of breeding for functional and aesthetic traits.

The discovery of such dramatic reorganisation of the canine brain raises important questions about impacts on dog behavior. The research is published this month in the Public Library of Sciences journal PLoS ONE.

Researchers from UNSW's Brain and Ageing Research Program and Sydney University's Faculty of Veterinary Science used magnetic resonance imaging (MRI) to look at brains across a range of breeds.

"We found strong and independent correlations between the size and shape of a dog's skull, and brain rotation and the positioning of the olfactory lobe," said study co-author, Dr Michael Valenzuela, from UNSW's School of Psychiatry "As a dog's head or skull shape becomes flatter - more pug-like - the brain rotates forward and the smell centre of the brain drifts further down to the lowest position in the skull," Dr Valenzuela said.

No other animal has enjoyed the level of human affection and companionship like the dog, nor undergone such a systemic and deliberate intervention in its biology through breeding, the authors note. The diversity suggests a unique level of plasticity in the canine genome.

"Canines seem to be incredibly responsive to human intervention through breeding. It's amazing that a dog's brain can accommodate such large differences in skull shape through these kinds of changes - it's something that hasn't been documented in other species," Dr Valenzuela said.

Health impacts from breed specific disorders - such as pug encephalitis and hip problems in German shepherds - are well documented; however, until now little had been known about the effects of human intervention on dogs' brains.

Co-author Associate Professor Paul McGreevy from the University of Sydney noted: "We think of dogs living in a world of smell - but this finding strongly suggests that one dog's world of smell may be very different from another's."

"The next obvious step is to try to find out if these changes in brain organisation are also linked to systematic differences in dogs' brain function," Dr Valenzuela said.

Relatives of Those with Autism Show Eye-Movement Deficits

Parents or siblings of people with autism are more likely to have some of the same visual-tracking problems that their affected relatives have

By Katherine Harmon

The tangled web of autism symptoms and genetic markers has left researchers searching for patterns and trends in unusual places. New work examining the subtle symptoms shared by close relatives has underscored the disease's heritability. Findings published online August 2 in Archives of General Psychiatry add to the growing list of familial clues about the disease: shared eye-movement deficits.

Researchers working at the University of Illinois at Chicago's (U.I.C.) Center for Cognitive Medicine have found a striking trend: those with autistic relatives are more likely to show disrupted eye movement similar to their afflicted relation.

Large-scale genetic studies have turned up nuanced and conflicting results about the genetic basis of autism and its myriad symptoms. Other research has discovered that many people with an autistic relative or child might themselves have some subtle behavior variant as well, such as obsessive-compulsive tendencies or communication problems.

Eye movement is easier to study neurologically than complex social and behavioral patterns - in large part because "we know a lot about what parts of the brain are involved," says Matthew Mosconi, an assistant professor of psychiatry at the U.I.C. and lead author of the new study. And the new findings examine basic deficits unclouded by social tendencies, such as the aversion many people with autism spectrum disorder have to looking at faces.

To monitor test subjects' eye movements, fluidity and response time, the researchers used exacting projection and recording equipment. They tested 57 people (ages eight to 54) with immediate family members who had autism and 40 volunteers who did not have a family history of mental disorder. None of the subjects were themselves autistic or had other developmental disorders.

Subjects were tested for their rapid eye movement that allows focus to shift on multiple objects in the field of vision (aka saccade) and ability to follow objects moving across the visual field, known as smooth-pursuit.

Although not everyone with autism exhibits eye-movement deficits - and not everyone has both of the types studied - those who do, display a very specific and measurable difference that is extremely rare in the general, unaffected population, Mosconi says. "So when you do see some subtle deviation, that's very important," he notes.

The oculomotor deficits are subtle enough to "require very sensitive lab tests" to detect them, Mosconi says. Other differences in behavior and communication that have been found in some first-degree nonafflicted relatives of people with autism are more noticeable and can sometimes be detected in casual conversation.

Family members' eye-movement capabilities were not strongly correlated with their scores on other cognitive or social-behavioral tests, a result that Mosconi calls "exciting." Although weak relationships are often a disappointment in disease research, he says, this trend was illuminating "because that tells us that we're getting at a different part of the puzzle" - to which "there are so many pieces," he notes.

Studying individuals and families who have these eye abnormalities might eventually be able to shed light on the genetics behind the affected parts of the brain, Mosconi notes. "We wanted to move even a step closer - to try to attach these broader characteristics to genes," he says. Evidence that eye-tracking trouble is prevalent in some autistic individuals and their families suggests that abnormalities in the cerebellum - which helps control motor skills, attention and language - might be to blame. And that would mean that researchers could next "look in a much more focused way [for] specific genes that might be involved in cerebellar development."

But with genetic or other profiles for autistic risk still far off, Mosconi notes that simple tests such as those for eye movements or cognitive deficits could be used in the meantime to indicate a couple's risk of having an autistic child. And he and his colleagues are looking into shoring up the specificity of odds; some of the eye-movement patterns were specific to autism whereas others had similarities to other disorders, such as schizophrenia.

Although this study was relatively small and not designed to develop theories about disorder heritability risk and eye-movement abnormalities, Mosconi notes that potentially "there would be greater risk [of having a child with autism] if both parents are showing it."

But more research needs to be done to home in on how these patterns correlate with risk. And because not all of those with autism exhibit eye-movement abnormalities, it would not be a universal test. Nevertheless, eye and other cognitive exams are highly practical. "They're quick and sensitive tests, which is exciting," Mosconi says.

Sisters Protect Siblings from Depression, Study Shows

ScienceDaily (Aug. 2, 2010) - Something about having a sister -- even a little sister - makes 10- to 14-year-olds a bit less likely to feel down in the dumps.

That's one of several intriguing findings from a new study on the impact siblings have on one another. Brigham Young University professor Laura Padilla-Walker is the lead author on the research, which also sorts out the influence of siblings and the influence of parents within families.

"Even after you account for parents' influence, siblings do matter in unique ways," said Padilla-Walker, who teaches in BYU's School of Family Life. "They give kids something that parents don't."

Padilla-Walker's research stems from BYU's Flourishing Families Project and will appear in the August issue of the Journal of Family Psychology. The study included 395 families with more than one child, at least one of whom was an adolescent between 10 and 14 years old. The researchers gathered a wealth of information about each family's dynamic, then followed up one year later. Statistical analyses showed that having a sister protected adolescents from feeling lonely, unloved, guilty, self-conscious and fearful. It didn't matter whether the sister was younger or older, or how far apart the siblings were agewise.

Brothers mattered, too. The study found that having a loving sibling of either gender promoted good deeds, such as helping a neighbor or watching out for other kids at school. In fact, loving siblings fostered charitable attitudes more than loving parents did. The relationship between sibling affection and good deeds was twice as strong as that between parenting and good deeds. "For parents of younger kids, the message is to encourage sibling affection," said Padilla-Walker. "Once they get to adolescence, it's going to be a big protective factor."

Many parents justifiably worry about the seemingly endless fighting between siblings. The study found hostility was indeed associated with greater risk of delinquency. Yet Padilla-Walker also sees a silver lining in the data: The fights give children a chance to learn how to make up and to regain control of their emotions, skills that come in handy down the road.

"An absence of affection seems to be a bigger problem than high levels of conflict," Padilla-Walker said.

Selenium makes more efficient solar cells

College Park, MD (August 3, 2010) -- Call it the anti-sunscreen. That's more or less the description of what many solar energy researchers would like to find -- light-catching substances that could be added to photovoltaic materials in order to convert more of the sun's energy into carbon-free electricity.

Research reported in the journal Applied Physics Letters, published by the American Institute of Physics (AIP), describes how solar power could potentially be harvested by using oxide materials that contain the element selenium. A team at the Lawrence Berkeley National Laboratory in Berkeley, California, embedded selenium in zinc oxide, a relatively inexpensive material that could be promising for solar power conversion if it could make more efficient use of the sun's energy. The team found that even a relatively small amount of selenium, just 9 percent of the mostly zinc-oxide base, dramatically boosted the material's efficiency in absorbing light.

"Researchers are exploring ways to make solar cells both less expensive and more efficient; this result potentially addresses both of those needs," says author Marie Mayer, a fourth-year University of California, Berkeley doctoral student based out of LBNL's Solar Materials Energy Research Group, which is working on novel materials for sustainable clean-energy sources.

Mayer says that photoelectrochemical water splitting, using energy from the sun to cleave water into hydrogen and oxygen gases, could potentially be the most exciting future application for her work. Harnessing this reaction is key to the eventual production of zero-emission hydrogen powered vehicles, which hypothetically will run only on water and sunlight. Like most researchers, Mayer isn't predicting hydrogen cars on the roads in any meaningful numbers soon. Still, the great thing about solar power, she says, is that "if you can dream it, someone is trying to research it."

The article, "Band structure engineering of ZnO1-xSex alloys" by Marie A. Mayer, Derrick T. Speaks, Kin Man Yu, Samuel S. Mao, Eugene E. Haller, and Wladek Walukiewicz will appear in the journal Applied Physics Letters. See: http://apl.aip.org/applab/v97/i2/p022104_s1

New inexpensive solar cell design

One of the most promising technologies for making inexpensive but reasonably efficient solar photovoltaic cells just got much cheaper. Scientists at the University of Toronto in Canada have shown that inexpensive nickel can work just as well as gold for one of the critical electrical contacts that gather the electrical current produced by their colloidal quantum dot solar cells.

The change to nickel can reduce the cell's already low material costs by 40 to 80 percent, says Lukasz Brzozowski, the director of the Photovoltaics Research Program in Professor Ted Sargent's group. They present their research in the July 12, 2010 issue of Applied Physics Letters, which is published by the American Institute of Physics (AIP).

Quantum dots are nanoscale bits of a semiconductor material that are created using low-cost, high-throughput chemical reactions in liquid solutions. Since their properties vary according to their size, quantum dots can be made to match the illumination spectrum. Half of all sunlight, for example, is in the infrared wavelengths, most of which cannot be collected by silicon-based solar cells. Sargent's group has pioneered the design and development of quantum dot solar cells that gather both visible and infrared light. They have reached a power-conversion efficiency as high as 5 percent and aim to improve that to 10 percent before commercialization.

At first, nickel did not appear to do the job. "It was intermixing with our quantum dots, forming a compound that blocked the current flow from the device," says Dr. Ratan Debnath, first author on the group's paper. Adding just one nanometer of lithium fluoride between the nickel and the dots created a barrier that stopped the contamination, and the cell's efficiency jumped back up to the expected level.

This is the latest of several recent solar-cell milestones by the Canadian researchers. "We have been able to increase dramatically the efficiency of our photovoltaics over the last several years and continue to hold the performance world records," Professor Sargent said.

The article, "Depleted-Heterojunction Colloidal Quantum Dot Photovoltaics Employing Low-Cost Electrical Contacts" by Ratan Debnath, Mark Theodore Greiner, Illan Kramer, Armin Fischer, Jiang Tang, Aaron Barkhouse, Xihua Wang, Larissa Levina, Z. H. Lu and Edward H. Sargent will appear in the journal Applied Physics Letters. See: http://apl.aip.org/applab/v97/i2/p023109_s1

Oral contraceptive use associated with increased risk of breast cancer

(Boston) - Investigators from the Slone Epidemiology Center at Boston University School of Medicine (BUSM) have reported that African American women who use oral contraceptives have a greater likelihood of developing breast cancer than nonusers. The study results, recently published on-line in Cancer Epidemiology Biomarkers and Prevention, were based on data from the Black Women's Health Study (BWHS), a large follow-up study of 59,000 African American women from across the U.S. conducted by investigators at the Slone Epidemiology Center since 1995.

The investigators followed 53,848 participants in the BWHS for 12 years, during which time 789 cases of breast cancer developed on which information on receptor status was obtained. The incidence of estrogen receptor negative cancer was 65 percent greater among women who had ever used oral contraceptives than among nonusers.

According to the BUSM researchers, the increase in risk was greatest for women who had used oral contraceptives within the previous five years and whose use had lasted 10 or more years, and the increase was greater for estrogen receptor negative than for estrogen receptor positive breast cancer. Estrogen receptor positive tumors have a better prognosis than estrogen receptor negative breast cancers.

Lead investigator Lynn Rosenberg, PhD, an associate director of the Slone Epidemiology Center and professor of epidemiology at BUSM, points out- that oral contraceptive formulations have changed over time, making it relevant to assess the effects of more recent formulations on breast cancer risk. "Some past studies found a stronger association with estrogen receptor negative breast cancer. This was the first assessment of the effect of oral contraceptive use on the incidence of breast cancer classified by receptor status among African American women," said Rosenberg who is also the principal investigator of the BWHS. "A mechanism to explain an adverse influence of oral contraceptives on development of estrogen receptor negative breast cancer is currently unknown," she added. *Funding for this study was provided by the National Cancer Institute.*

Personal Health

Be Sure Exercise Is All You Get at the Gym

By JANE E. BRODY

When you go to the gym, do you wash your hands before and after using the equipment? Bring your own regularly cleaned mat for floor exercises? Shower with antibacterial soap and put on clean clothes immediately after your workout? Use only your own towels, razors, bar soap, water bottles?

If you answered “no” to any of the above, you could wind up with one of the many skin infections that can spread like wildfire in athletic settings. In June, the National Athletic Trainers’ Association, known as N.A.T.A., issued a position paper on the causes, prevention and treatment of skin diseases in athletes that could just as well apply to anyone who works out in a communal setting, be it a school, commercial gym or Y.

The authors pointed out that “skin infections in athletes are extremely common” and account for more than half the outbreaks of infectious diseases that occur among participants in competitive sports. And if you think skin problems are minor, consider what happened to Kyle Frey, a 21-year-old junior and competitive wrestler at Drexel University in Philadelphia.

Mr. Frey noticed a pimple on his arm last winter but thought little of it. He competed in a match on a Saturday, but by the next morning the pimple had grown to the size of his biceps and had become very painful.

His athletic trainer sent him straight to the emergency room, where the lesion was lanced and cultured. Two days later, he learned he had MRSA, the potentially deadly staphylococcus infection that is resistant to most antibiotics.

Mr. Frey spent five days in the hospital, where the lesion was surgically cleaned and stitched and treated with antibiotics that cleared the infection. He said in an interview that he does not know how he acquired MRSA: “The wrestling mat might have been contaminated, or I wrestled with someone who had the infection.”

If it could happen to Mr. Frey, who said he has always been health-conscious in the gym and careful about not sharing his belongings, it could happen to you.

The Risks

Recreational athletes as well as participants in organized sports are prone to fungal, viral and bacterial skin infections. Sweat, abrasion and direct or indirect contact with the lesions and secretions of others combine to make every athlete’s skin vulnerable to a host of problems. While MRSA may be the most serious skin infection, athlete’s foot, jock itch, boils, impetigo, herpes simplex and ringworm, among others, are not exactly fun or attractive.

Athletes who are infected should be kept from competing in matches for a week or more until treatment renders them noninfectious. The authors of the trainers’ study warned against simply covering infections like herpes and active bacterial lesions in order to return to competition.

Likewise, people like you and me who work out at a facility or swim in a public pool should stay away until cleared by a doctor who is well versed in skin diseases.

Steven M. Zinder, a trainer at the University of North Carolina at Chapel Hill and chief author of the new paper, said in an interview that these recommendations are not esoteric.

“It’s what we all learned — or should have learned — in sixth-grade health class,” he said. “It’s all common sense. You need to keep yourself and your equipment clean. You never know who last used the equipment in a gym. It can be a great breeding ground for these bugs, some of which are pretty nasty.”

The report, published in the August issue of The Journal of Athletic Training, stated, “Athletes must shower after every practice and game with an antibacterial soap and water over the entire body.”

Dr. Zinder noted that after a workout, women tend not to shower at the facility, while men, who are more likely to shower, often fail to cleanse their entire bodies, including their feet. Well-equipped facilities should provide antibacterial liquid soap.

“You should be showering at the gym and putting on clean clothes that are kept separate from the dirty ones,” he said. In fact, he added, it’s best to have two bags, one only for clean clothes, and to wash the dirty-clothes bag now and then.

Assume Exposure

Jack Foley, athletic trainer and director of sports medicine at Lehigh University in Bethlehem, Pa., and co-author of the report, said athletes should always assume they are exposed to skin infections.

At any given time, he said in an interview, one person in three in the United States suffers from a skin disease that can be spread to others, even while in the incubation stage.

The report noted that there had been “an alarming increase in the prevalence of MRSA” in the noses of both healthy children and adults. Thus, sneezing into one’s hand or blowing one’s nose without washing with an antibacterial cleanser afterward may spread these dangerous bacteria to others.

While hand hygiene is most important over all , avoiding fungal infections requires a daily change of athletic socks and underwear; carefully drying the armpits and groin and between toes (perhaps blow-drying the feet on low heat); and using foot powder. Shower shoes can help prevent infection as long as they don’t keep you from soaping your feet.

A viral infection called molluscum contagiosum may not be on the popular tongue, but it is commonly seen in young children and , spread through skin-to-skin contact, is not uncommon among athletes, including swimmers, cross-country runners and wrestlers, the report stated.

Prevention of this highly contagious infection requires “meticulous hygiene” after contact with secretions from other athletes through benches, towels and mats.

If you plan to work out in a gym or use a locker room, Mr. Foley suggested that before choosing a facility, you quiz the management about the cleaning agents used (they should be approved by the Environmental Protection Agency) and daily cleaning schedule for all surfaces and equipment. If exercise mats are not cleaned between classes, he suggested bringing your own. Antibacterial wipes or spray bottles should be provided and used by everyone to clean equipment after a workout.

Expectations May Affect Placebo Response in Patients With Parkinson's Disease

ScienceDaily (Aug. 3, 2010) — Individuals with Parkinson's disease were more likely to have a neurochemical response to a placebo medication if they were told they had higher odds of receiving an active drug, according to a report in the August issue of Archives of General Psychiatry.

"The promise of symptom improvement that is elicited by a placebo is a powerful modulator of brain neurochemistry," the authors write as background information in the article. "Understanding the factors that modify the strength of the placebo effect is of major clinical as well as fundamental scientific significance." In patients with Parkinson's disease, the expectation of symptom improvement is associated with the release of the neurotransmitter dopamine, and the manipulation of this expectation has been shown to affect the motor performance of patients with the condition.

Sarah C. Lidstone, Ph.D., of Pacific Parkinson's Research Centre at Vancouver Coastal Health and the University of British Columbia, Vancouver, Canada, and colleagues studied 35 patients with mild to moderate Parkinson's disease undergoing treatment with the medication levodopa. On the first day of the study, a baseline positron emission tomographic (PET) scan was performed, participants were given levodopa and a second scan was performed one hour later to assess dopamine response. On the second day, patients were randomly assigned to one of four groups, during which they were told they had either a 25-percent, 50-percent, 75-percent or 100-percent chance of receiving active medication before the third scan; however, all patients were given placebo.

Patients who were told they had a 75-percent chance of receiving active medication demonstrated a significant release of dopamine in response to the placebo, whereas those in the other groups did not.

Patients' reactions to the active medication before the first scan was also correlated with their response to placebo. "Importantly, whereas prior medication experience (i.e., the dopaminergic response to levodopa) was the major determinant of dopamine release in the dorsal striatum, expectation of clinical improvement (i.e., the probability determined by group allocation) was additionally required to drive dopamine release in the ventral striatum," the authors write. Both areas have been shown to be involved with reward processing; in patients with a chronic debilitating illness who have responded to therapy in the past, expectation of therapeutic benefit in response to placebo has been likened to the expectation of receiving a reward.

"Our findings may have important implications for the design of clinical trials, as we have shown that both the probability of receiving active treatment -- which varies in clinical trials depending on the study design and the information provided to the patient -- as well as the treatment history of the patient influence dopamine system activity and consequently clinical outcome," the authors conclude. "While our finding of a biochemical placebo response restricted to a 75 percent likelihood of receiving active treatment may not generalize to diseases other than Parkinson's disease, it is extremely likely that both probability and prior experience have similarly profound effects in those conditions."

This study was funded by the Michael Smith Foundation for Health Research, the Canadian Institutes for Health Research and a TRIUMF Life Sciences Grant. Dr. Stoessl is supported by the Canada Research Chairs Program.

Alphavirus-Based Vaccine May Slow Some Cancers

ScienceDaily (Aug. 3, 2010) — An experimental vaccine based on a virus that causes encephalitis in the wild appears to block tumor growth in some cases of advanced cancer, according to researchers at Duke University Medical Center. Scientists say the vaccine is able to stimulate an immune response, even in the face of profound immune system suppression, a condition most patients with advanced cancer experience.

Scientists removed the genes that enable the Venezuelan equine encephalitis virus -- an alphavirus -- to replicate itself, and replaced them with genes that make the biomarker CEA, present in many malignant colon, breast and lung cells.

"Alphaviruses have been used before in designing treatments for infectious diseases, but we believe this is the first time one has been used in patients with cancer," said Michael Morse, MD, associate professor of medicine at Duke and the lead author of the study appearing online in the Journal of Clinical Investigation.

The Phase I/II study included 28 patients with advanced cases of lung, colon, breast, appendix or pancreatic cancers who had already been treated with multiple courses of chemotherapy, but whose cancers kept coming back.

Cancer vaccines, unlike traditional vaccines, are designed to boost the body's own immune system to recognize and destroy tumors, not prevent disease. Scientists often use genetically altered viruses as vaccines, stripping the virus of any harmful parts and inserting genes related to their anticancer strategy. But in many cases, the immune system still sees the incoming virus as a foreign invader and springs into action, generating antibodies and T cells that destroy it before it has a chance to do any good.

Based on earlier research, investigators at Duke believed that by using the alphavirus for Venezuelan equine encephalitis as a carrier they might be able to thwart that response.

"The beauty of alphaviruses is that they are naturally attracted to dendritic cells, cells that stimulate the production of large numbers of T cells and antibodies," says Morse. "Essentially, we were hoping that once infected, the dendritic cells would activate T cells and antibodies to go after anything that had the tumor antigen CEA on it -- in this case, the quickly growing cancer cells."

Participants received up to four injections plus booster shots of the vaccine over a period of three months. At the end of the study, two patients with no evidence of disease remained in remission; two patients were able to maintain stable disease, and one patient with pancreatic cancer saw a lesion in his liver disappear. The other patients in the trial did not respond to the therapy.

"Remember, these were patients with very advanced disease that nothing else had been able to stop," says Morse, a member of the Duke Comprehensive Cancer Center and a specialist in vaccine design. "We believe that in this small number of patients, the vaccine was able to stimulate the body's defense system to destroy significant numbers of cancer cells despite the presence of an army of neutralizing antibodies and regulatory T cells."

Morse says those who seemed to benefit the most were those who had the smallest amount of tumor. Because of this, he says his team is planning future trials that will test the vaccine in people with cancers that have been removed, but who are high risk of recurrence. Other trials will couple the vaccine with additional immune system stimulants such as interleukin-12 that may make the vaccine more powerful.

Grants from the National Cancer Institute and the Department of Defense supported the work.

Colleagues from Duke who helped with the study include senior author H. Kim Lyerly, director of the Duke Comprehensive Cancer Center; Amy Hobeika, Takuya Osada, Donna Niedzwiecki, Gayathri Devi, Bruce Burnett, and Timothy Clay. Additional co-authors include Peter Berglund and Sarah Negri, from Alphavax, Inc.; and Bolyn Hubby and Jonathan Smith, from Liquidia Technologies, Inc.

Lyerly is a member of the scientific advisory board of Alphavax.

Tracing Oil Reserves to Their Tiny Origins

By WILLIAM J. BROAD

In 1913, as the automobile zoomed into American life, The Outing Magazine gave its readers a bit of background on what fueled the new motorcars in “The Story of Gasoline.” After a brief vignette describing the death of “old Colonel Stegosaurus Ugulatus,” the article explained that “yesterday you poured the remains of the dinosaur from a measuring-can - which, let us hope, held five gallons, full measure - into your gasoline tank.”

The idea that oil came from the terrible lizards that children love to learn about endured for many decades. The Sinclair Oil Company featured a dinosaur in its logo and in its advertisements, and outfitted its gas stations with giant replicas that bore long necks and tails. The publicity gave the term “fossil fuels” new resonance.

But the emphasis turned out to be wrong.

Today, a principal tenet of geology is that a vast majority of the world’s oil arose not from lumbering beasts on land but tiny organisms at sea. It holds that blizzards of microscopic life fell into the sunless depths over the ages, producing thick sediments that the planet’s inner heat eventually cooked into oil. It is estimated that 95 percent or more of global oil traces its genesis to the sea.

“It’s the dominant theory,” said David A. Ross, scientist emeritus at the Woods Hole Oceanographic Institution on Cape Cod. The idea, he added, has been verified as geologists have roamed the globe over the decades and repeatedly found that beds of marine sediments are “a good predictor” of where to discover oil.

The theory also explains offshore drilling — why there is oil in many seabeds, why it is more often near shore than in the abyss, and why, despite the Deepwater Horizon disaster in the Gulf of Mexico, which killed 11 crewmen and caused the worst offshore oil spill in American history, oil experts say offshore drilling may increase, rather than cease.

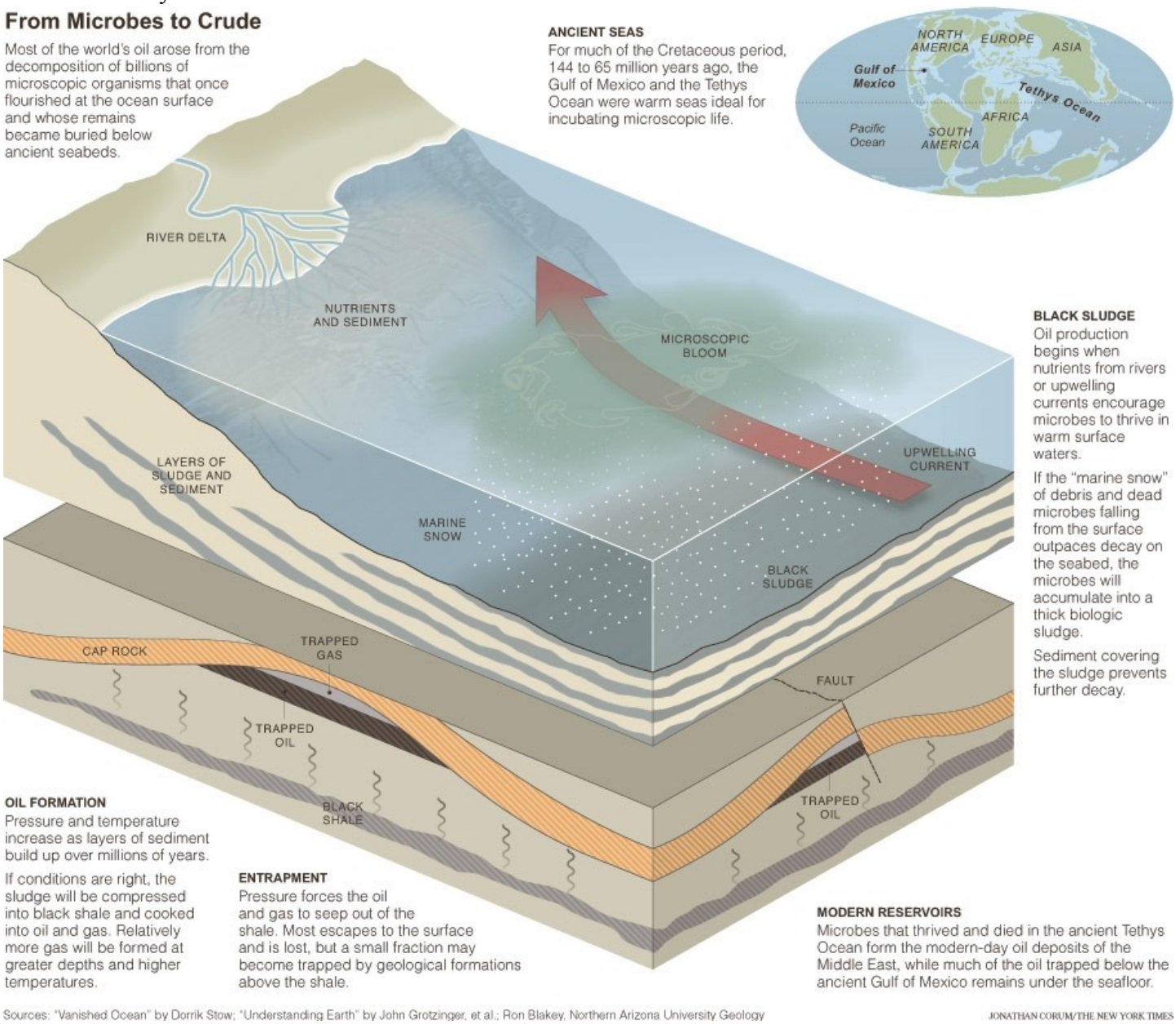
As land reservoirs dry up, oil geologists say, the high costs and potential risks of offshore drilling will seem less onerous and more acceptable. This, of course, is a matter of politics and economics as much as geology. Just because the oil is there doesn’t mean wells must be drilled. Many things could affect the frequency of offshore drilling, like the public interest in and commitment to the development of alternative energy sources, not only solar, wind, geothermal and other natural processes, but nuclear fission and even fusion.

Whatever the future importance of oil, offshore beds are the most likely new sources. “For most areas, offshore offers the greatest potential,” said William E. Galloway, an oil geologist at the University of Texas at Austin. “We’ve been drilling wells for a hundred years and most of those have been on land. So the volumes that remain unexplored are primarily offshore in areas that have previously been inaccessible.”

Some of the ancestral waters that made the planet's oil still exist, like the Gulf of Mexico, while others have long vanished, like the ocean that produced the massive oil fields of the Middle East. The bodies come and go because the earth's crust, through seemingly rigid, actually moves a great deal over geologic time, tearing apart continents and ocean basins and rearranging them like pieces of a giant jigsaw puzzle.

The secret of the oil story turned out to be understanding how the bygone oceans, ancient seas and smaller bodies of water produced complex environmental conditions that raised the prevalence of microscopic life and ensured its deep burial, producing what eventually became the earth's main oil reservoirs.

The clues accumulated over more than a century and included discoveries from geology, chemistry and paleontology. An early indication was that petroleum discoveries were always associated with ancient beds of sedimentary rock — the kind that forms when debris rains down through water for ages and slowly grows into thick seabed layers.



A breakthrough came in the 1930s. Alfred E. Treibs, a German chemist, discovered that oil harbored the fossil remains of chlorophyll, the compound in plants that helps convert sunlight into chemical energy. The source appeared to be the tiny plants of ancient seas.

By the 1960s and 1970s, oil samples were producing many fossil molecules. One class, the hopanoids, were seen as representing the remains of ancient microbes that fed on seabed detritus. A 2009 book, "Echoes of Life: What Fossil Molecules Reveal About Earth History" (Oxford University Press), says geologists found so many fossil molecules, and in such variety, that they began using them as fingerprints to identify the family relationships among pockets of deep oil.

A separate breakthrough came as paleontologists peering at oil came to recognize a host of microfossils. Often smaller than grains of sand, the fossils nonetheless spoke volumes. Many were foraminifera, minuscule

sea creatures with a bewildering array of shells. Oil geologists began using the foraminifera's shifting appearance as a reliable guide to geologic dating.

As the clues fell into place, so did the big picture. It was the dominant view by the 1970s.

The process typically starts in warm seas ideal for the incubation of microscopic life. The sheer mass is hard to imagine. But scientists note that every drop of seawater contains more than a million tiny organisms.

Oil production begins when surface waters become so rich in microscopic life that the rain of debris outpaces decay on the seabed. The result is thickening accumulations of biologic sludge.

Dorrik Stow, a petroleum geologist at Heriot-Watt University in Edinburgh, said the flow of nutrients into surface waters — partly from rivers and coastal regions, partly from the upwelling of bottom currents — determines the richness of the microscopic life and ultimately the oil abundance.

In his new book, "Vanished Ocean: How Tethys Reshaped the World" (Oxford University Press), Dr. Stow describes how these nutrient surges can engender "a biological orgy" of frenzied reproduction that ultimately ends in "black death." The black mud is riddled with the remains of life, and eventually form into sedimentary rock.

The history of the Gulf of Mexico shows how many environmental factors came together to produce huge oil reserves. Perhaps most important, the big rivers and waterways of North America sent rich flows of nutrients into the ancient gulf, much as the Mississippi River does today.

Scott W. Tinker, the state geologist of Texas, said the abundant flows of mud and sediment not only fed microscopic life but also formed rocky barriers that sealed off the organic remains from the outer world. A main barrier was shale, a sedimentary rock made of clay and silt.

"The organics got buried quickly because of the heavy sediment flow," Dr. Tinker said. "So they didn't get biodegraded as quickly. You preserved the organic richness."

He said the flow was so heavy that the growing accumulations keep pressing the lower sediment layers deeper into the earth, forcing them into hot zones where the organic material got transformed into oil. The process involves a long series of chemical reactions that slowly turn life molecules into inanimate crude. "The gulf has miles and miles of sediments," he said. "So that gets the source rocks down into the kitchen where they cook."

The standard temperature for oil formation is between 120 and 210 degrees Fahrenheit. The earth gets increasingly warm with increasing depth, the temperature eventually rising so high that rocks melt (and occasionally remerge at the surface in volcanic eruptions).

The gulf's environmental context also promoted oil formation. The ancient body was largely cut off from the diluting influences of the wider global sea, concentrating the nutrients and mud.

"It's always been restricted," said Dr. Galloway of the University of Texas. "One reason it works as a major world-class resource is that it's been mostly isolated from the world's oceans."

Restrictions on watery flows turn out to have played starring roles in determining where oil formed, scientists say. The Tethys Sea — an ancient ocean that girded the equator in the Cretaceous period, some 100 million years ago, in the heyday of the dinosaurs — became a sprawling factory.

Its most productive regions centered on shorelines, coastal regions and shallow seas, said Dr. Stow of Heriot-Watt University, whose new book describes the secret life of the Tethys. He identified "broad shelf areas" as some of the best "factories for biogenic proliferation." When the Tethys mostly closed up (its remnants include the Aral, Black, Caspian and Mediterranean Seas), its fertile southern shores formed the dozen or so nations of the Middle East that produce two-thirds of the world's oil.

Dr. Stow called their wealth "an accident of geology."

A similar accident took place when Africa and South America slowly pulled apart in the Cretaceous period, forming the narrow beginnings of the South Atlantic. Big rivers poured in nutrients. A biological frenzy on the western shores of the narrow ocean ended up forming the vast oil fields now being discovered and developed off Brazil in deep water. In June, Petrobras, the Brazilian state oil company, unveiled a $224 billion, five-year investment plan to tap deepwater fields and double its petroleum output.

Many countries and oil companies are now racing to exploit the geological happenstance of deep coastal waters. Hot spots include offshore areas of Angola, Azerbaijan, Congo, Cuba, Egypt, Libya and Tanzania, while countries like Canada and Norway, which have long pursued offshore drilling, are pushing ahead with new plans. Cambridge Energy Research Associates, a consulting firm, estimates that global deepwater extraction could roughly double by 2015, the output rivaling what Saudi Arabia produces on land.

"It's not about dinosaurs," said Kenneth E. Peters, a petroleum geochemist at Stanford University. "Any kind of organic material can contribute, yes. But if you look at the food chain, they're way at the top. It's the little guys that matter."