http://www.eurekalert.org/pub_releases/2014-07/uoe-dfv072414.php

Dinosaurs fell victim to perfect storm of events, study shows

Dinosaurs might have survived the asteroid strike that wiped them out if it had taken place slightly earlier or later in history, scientists say.

A fresh study using up-to-date fossil records and improved analytical tools has helped palaeontologists to build a new narrative of the prehistoric creatures' demise, some 66 million years ago.

They found that in the few million years before a 10km-wide asteroid struck what is now Mexico, Earth was experiencing environmental upheaval. This included extensive volcanic activity, changing sea levels and varying temperatures.

At this time, the dinosaurs' food chain was weakened by a lack of diversity among the large plant-eating dinosaurs on which others preyed. This was probably because of changes in the climate and environment.

This created a perfect storm in which dinosaurs were vulnerable and unlikely to survive the aftermath of the asteroid strike.

The impact would have caused tsunamis, earthquakes, wildfires, sudden temperature swings and other environmental changes. As food chains collapsed, this would have wiped out the dinosaur kingdom one species after another. The only dinosaurs to survive were those who could fly, which evolved to become the birds of today.

Researchers suggest that if the asteroid had struck a few million years earlier, when the range of dinosaur species was more diverse and food chains were more robust, or later, when new species had time to evolve, then they very likely would have survived.

An international team of palaeontologists led by the University of Edinburgh studied an updated catalogue of dinosaur fossils, mostly from North America, to create a picture of how dinosaurs changed over the few million years before the asteroid hit. They hope that ongoing studies in Spain and China will aid even better understanding of what occurred.

Their study, published in Biological Reviews, was supported by the US National Science Foundation and the European Commission. It was led by the Universities of Edinburgh and Birmingham in collaboration with the University of Oxford, Imperial College London, Baylor University, and University College London. The world's top dinosaur museums – The Natural History Museum, the Smithsonian Institution, the Royal Ontario Museum, the American Museum of Natural History and the New Mexico Museum of Natural History and Science – also took part.

Dr Steve Brusatte, of the University of Edinburgh's School of GeoSciences, said: "The dinosaurs were victims of colossal bad luck. Not only did a giant asteroid strike, but it happened at the worst possible time, when their ecosystems were vulnerable. Our new findings help clarify one of the enduring mysteries of science."

Dr Richard Butler of the School of Geography, Earth and Environmental Sciences at the University of Birmingham, said: "There has long been intense scientific debate about the cause of the dinosaur extinction. Although our research suggests that dinosaur communities were particularly vulnerable at the time the asteroid hit, there is nothing to suggest that dinosaurs were doomed to extinction. Without that asteroid, the dinosaurs would probably still be here, and we very probably would not."

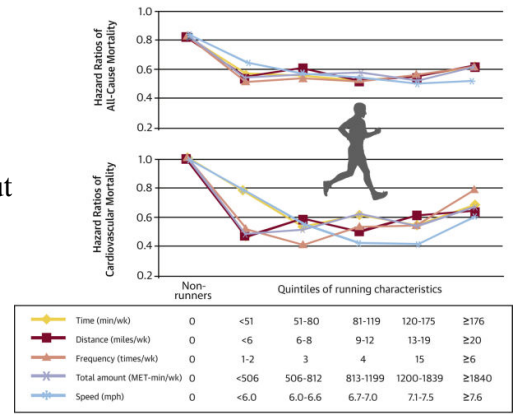
http://www.eurekalert.org/pub_releases/2014-07/acoc-rrr072414.php

Running reduces risk of death regardless of duration, speed

Running 5 minutes daily can reduce risk of cardiovascular disease-related death

Running for only a few minutes a day or at slow speeds may significantly reduce a person's risk of death from cardiovascular disease compared to someone who does not run, according to a study published today in the Journal of the American College of Cardiology.

Exercise is well-established as way to prevent heart disease and it is component of an overall healthy life, but it is unclear whether there are health benefits below the level of 75 minutes per week of vigorous-intensity activity, such as running, recommended by the U.S. government and World Health Organization.



A study published today in the Journal of the American College of Cardiology found that running for only a few minutes a day or at slow speeds may significantly reduce a person's risk of death from cardiovascular disease compared to someone who does not run. **Journal of the American College of Cardiology**

Researchers studied 55,137 adults between the ages of 18 and 100 over a 15-year period to determine whether there is a relationship between running and longevity. Data was drawn from the Aerobics Center Longitudinal Study, where participants were asked to complete a questionnaire about their running habits. In the study period, 3,413 participants died, including 1,217 whose deaths were related to cardiovascular disease. In this population, 24 percent of the participants reported running as part of their leisure-time exercise.

Compared with non-runners, the runners had a 30 percent lower risk of death from all causes and a 45 percent lower risk of death from heart disease or stroke. Runners on average lived three years longer compared to non-runners. Also, to reduce mortality risk at a population level from a public health perspective, the authors concluded that promoting running is as important as preventing smoking, obesity or hypertension. The benefits were the same no matter how long, far, frequently or fast participants reported running. Benefits were also the same regardless of sex, age, body mass index, health conditions, smoking status or alcohol use.

The study showed that participants who ran less than 51 minutes, fewer than 6 miles, slower than 6 miles per hour, or only one to two times per week had a lower risk of dying compared to those who did not run. DC (Duck-chul) Lee, Ph.D., lead author of the study and an assistant professor in the Iowa State University Kinesiology Department in Ames, Iowa, said they found that runners who ran less than an hour per week have the same mortality benefits compared to runners who ran more than three hours per week. Thus, it is possible that the more may not be the better in relation to running and longevity.

Researchers also looked at running behavior patterns and found that those who persistently ran over a period of six years on average had the most significant benefits, with a 29 percent lower risk of death for any reason and 50 percent lower risk of death from heart disease or stroke.

"Since time is one of the strongest barriers to participate in physical activity, the study may motivate more people to start running and continue to run as an attainable health goal for mortality benefits," Lee said. "Running may be a better exercise option than more moderate intensity exercises for healthy but sedentary people since it produces similar, if not greater, mortality benefits in five to 10 minutes compared to the 15 to 20 minutes per day of moderate intensity activity that many find too time consuming."

http://www.eurekalert.org/pub_releases/2014-07/uomh-lts072414.php

Learning the smell of fear: Mothers teach babies their own fears via odor, research finds

Research in rats may help explain how trauma's effects can span generations

ANN ARBOR, Mich. - Babies can learn what to fear in the first days of life just by smelling the odor of their distressed mothers, new research suggests. And not just "natural" fears: If a mother experienced something before pregnancy that made her fear something specific, her baby will quickly learn to fear it too - through the odor she gives off when she feels fear.

In the first direct observation of this kind of fear transmission, a team of University of Michigan Medical School and New York University studied mother rats who had learned to fear the smell of peppermint – and showed how they "taught" this fear to their babies in their first days of life through their alarm odor released during distress.

In a new paper in the Proceedings of the National Academy of Sciences, the team reports how they pinpointed the specific area of the brain where this fear transmission takes root in the earliest days of life.

Their findings in animals may help explain a phenomenon that has puzzled mental health experts for generations: how a mother's traumatic experience can affect her children in profound ways, even when it happened long before they were born.

The researchers also hope their work will lead to better understanding of why not all children of traumatized mothers, or of mothers with major phobias, other anxiety disorders or major depression, experience the same effects.

"During the early days of an infant rat's life, they are immune to learning information about environmental dangers. But if their mother is the source of threat information, we have shown they can learn from her and produce lasting memories," says Jacek Debiec, M.D., Ph.D., the U-M psychiatrist and neuroscientist who led the research.

"Our research demonstrates that infants can learn from maternal expression of fear, very early in life," he adds. "Before they can even make their own experiences, they basically acquire their mothers' experiences. Most importantly, these maternally-transmitted memories are long-lived, whereas other types of infant learning, if not repeated, rapidly perish."

Peering inside the fearful brain

Debiec, who treats children and mothers with anxiety and other conditions in the U-M Department of Psychiatry, notes that the research on rats allows scientists to see what's going on inside the brain during fear transmission, in ways they could never do in humans.

He began the research during his fellowship at NYU with Regina Marie Sullivan, Ph.D., senior author of the new paper, and continues it in his new lab at U-M's Molecular and Behavioral Neuroscience Institute.

The researchers taught female rats to fear the smell of peppermint by exposing them to mild, unpleasant electric shocks while they smelled the scent, before they were pregnant. Then after they gave birth, the team exposed the mothers to just the minty smell, without the shocks, to provoke the fear response. They also used a comparison group of female rats that didn't fear peppermint.

They exposed the pups of both groups of mothers to the peppermint smell, under many different conditions with and without their mothers present.

Using special brain imaging, and studies of genetic activity in individual brain cells and cortisol in the blood, they zeroed in on a brain structure called the lateral amygdala as the key location for learning fears. During later life, this area is key to detecting and planning response to threats – so it makes sense that it would also be the hub for learning new fears.

But the fact that these fears could be learned in a way that lasted, during a time when the baby rat's ability to learn any fears directly was naturally suppressed, is what makes the new findings so interesting, says Debiec.

The team even showed that the newborns could learn their mothers' fears even when the mothers weren't present. Just the piped-in scent of their mother reacting to the peppermint odor she feared was enough to make them fear the same thing.

And when the researchers gave the baby rats a substance that blocked activity in the amygdala, they failed to learn the fear of peppermint smell from their mothers.

This suggests, Debiec says, that there may be ways to intervene to prevent children from learning irrational or harmful fear responses from their mothers, or reduce their impact.

From animals to humans: next steps

The new research builds on what scientists have learned over time about the fear circuitry in the brain, and what can go wrong with it. That work has helped psychiatrists develop new treatments for human patients with phobias and other anxiety disorders – for instance, exposure therapy that helps them overcome fears by gradually confronting the thing or experience that causes their fear.

In much the same way, Debiec hopes that exploring the roots of fear in infancy, and how maternal trauma can affect subsequent generations, could help human patients. While it's too soon to know if the same odor-based effect happens between human mothers and babies, the role of a mother's scent in calming human babies has been shown.

Debiec, who hails from Poland, recalls working with the grown children of Holocaust survivors, who experienced nightmares, avoidance instincts and even flashbacks related to traumatic experiences they never had themselves. While they would have learned about the Holocaust from their parents, this deeply ingrained fear suggests something more at work, he says.

Going forward, he hopes to work with U-M researchers to observe human infants and their mothers -- including U-M psychiatrist Maria Muzik, M.D. and psychologist Kate Rosenblum, Ph.D., who run a Women and Infants Mental *Health clinic and research program and also work with military families. The program is currently seeking women and their children to take part in a range of studies; those interested in learning more can call the U-M Mental Health Research Line at (734) 232-0255.*

The research was supported by the National Institutes of Health (DC009910, MH091451), and by a, NARSAD Young Investigator Award from the Brain and Behavior Research Foundation, and University of Michigan funds. Reference: http://www.pnas.org/cgi/doi/10.1073/pnas.1316740111

http://www.eurekalert.org/pub_releases/2014-07/ucl-tbo072514.php

The bit of your brain that signals how bad things could be

An evolutionarily ancient and tiny part of the brain tracks expectations about nasty events

An evolutionarily ancient and tiny part of the brain tracks expectations about nasty events, finds new UCL research. The study, published in Proceedings of the National Academy of Sciences, demonstrates for the first time that the human habenula, half the size of a pea, tracks predictions about negative events, like painful electric shocks, suggesting a role in learning from bad experiences.

Brain scans from 23 healthy volunteers showed that the habenula activates in response to pictures associated with painful electric shocks, with the opposite occurring for pictures that predicted winning money.

Previous studies in animals have found that habenula activity leads to avoidance as it suppresses dopamine, a brain chemical that drives motivation. In animals, habenula cells have been found to fire when bad things happen or are anticipated.

"The habenula tracks our experiences, responding more the worse something is expected to be," says senior author Dr Jonathan Roiser of the UCL Institute of Cognitive Neuroscience. "For example, the habenula responds much more strongly when an electric shock is almost certain than when it is unlikely. In this study we showed that the habenula doesn't just express whether something leads to negative events or not; it signals quite how much bad outcomes are expected."

During the experiment, healthy volunteers were placed inside a functional magnetic resonance imaging (fMRI) scanner, and brain images were collected at high resolution because the habenula is so small. Volunteers were shown a random sequence of pictures each followed by a set chance of a good or bad outcome, occasionally pressing a button simply to show they were paying attention. Habenula activation tracked the changing expectation of bad and good events.

"Fascinatingly, people were slower to press the button when the picture was associated with getting shocked, even though their response had no bearing on the outcome." says lead author Dr Rebecca Lawson, also at the UCL Institute of Cognitive Neuroscience. "Furthermore, the slower people responded, the more reliably their habenula tracked associations with shocks. This demonstrates a crucial link between the habenula and motivated behaviour, which may be the result of dopamine suppression."

The habenula has previously been linked to depression, and this study shows how it could be involved in causing symptoms such low motivation, pessimism and a focus on negative experiences. A hyperactive habenula could cause people to make disproportionately negative predictions.

"Other work shows that ketamine, which has profound and immediate benefits in patients who failed to respond to standard antidepressant medication, specifically dampens down habenula activity," says Dr Roiser. "Therefore, understanding the habenula could help us to develop better treatments for treatment-resistant depression."

The research was funded by the Medical Research Council.

http://www.eurekalert.org/pub_releases/2014-07/asu-mmc072814.php

Mineral magic? Common mineral capable of making and breaking bonds

ASU team shows evidence for one mineral affecting the most fundamental process in organic chemistry: Carbon-hydrogen bond breaking and making

TEMPE, Ariz. - Reactions among minerals and organic compounds in hydrothermal environments are critical components of the Earth's deep carbon cycle, they provide energy for the deep biosphere, and may have implications for the origins of life. However, very little is known about how minerals influence organic reactions. A team of researchers from Arizona State University have demonstrated how a common mineral acts as a catalysts for specific hydrothermal organic reactions – negating the need for toxic solvents or expensive reagents.

At the heart of organic chemistry, aka carbon chemistry, is the covalent carbon-hydrogen bond (C‑H bond) — a fundamental link between carbon and hydrogen atoms found in nearly every organic compound.

The essential ingredients controlling chemical reactions of organic compounds in hydrothermal systems are the organic molecules, hot pressurized water, and minerals, but a mechanistic understanding of how minerals influence hydrothermal organic reactivity has been virtually nonexistent.

The ASU team set out to understand how different minerals affect hydrothermal organic reactions and found that a common sulfide mineral (ZnS, or Sphalerite) cleanly catalyzes a fundamental chemical reaction – the making and breaking of a C-H bond.

Their findings are published in the July 28 issue of the Proceedings of the National Academy of Sciences. The paper was written by a transdisciplinary team of ASU researchers that includes: Jessie Shipp (2013 PhD in Chemistry & Biochemistry), Ian Gould, Lynda Williams, Everett Shock, and Hilairy Hartnett.

The work was funded by the National Science Foundation.

"Typically you wouldn't expect water and an organic hydrocarbon to react. If you place an alkane in water and add some mineral it's probably just going to sit there and do nothing," explains first author Shipp. "But at high temperature and pressure, water behaves more like an organic solvent, the thermodynamics of reactions change, and suddenly reactions that are impossible on the bench-top start becoming possible. And it's all using naturally occurring components at conditions that can be found in past and present hydrothermal systems."

A mineral in the mix

Previously, the team had found they could react organic molecules in hot pressurized water to produce many different types of products, but reactions were slow and conversions low. This work, however, shows that in the presence of sphalerite, hydrothermal reaction rates increased dramatically, the reaction approached equilibrium, and only one product formed. This very clean, very simple reaction was unexpected.

"We chose sphalerite because we had been working with iron sulfides and realized that we couldn't isolate the effects of iron from the effects of sulfur. So we tried a mineral with sulfur but not iron. Sphalerite is a common mineral in hydrothermal systems so it was a pretty good choice. We really didn't expect it to behave so differently from the iron sulfides," says Hartnett, an associate professor in the School of Earth and Space Exploration, and in the Department of Chemistry and Biochemistry at ASU.

This research provides information about exactly how the sphalerite mineral surface affects the breaking and making of the C-H bond. Sphalerite is present in marine hydrothermal systems i.e., black smokers, and has been the focus of recent origins-of-life investigations.

For their experiments, the team needed high pressures (1000 bar - nearly 1000 atm) and high temperatures (300°C) in a chemically inert container. To get these conditions, the reactants (sphalerite, water, and an organic molecule) are welded into a pure gold capsule and placed in a pressure vessel, inside a furnace. When an experiment is done, the gold capsule is frozen in liquid nitrogen to stop the reaction, opened and allowed to thaw while submerged in dichloromethane to extract the organic products.

"This research is a unique collaboration because Dr. Gould is an organic chemist and you combine him with Dr. Hartnett who studies carbon cycles and environmental geochemistry, Dr. Shock who thinks in terms of thermodynamics and about high temperature environments, and Dr. Williams who is the mineral expert, and you get a diverse set of brains thinking about the same problems," says Shipp.

Hydrothermal organic reactions affect the formation, degradation, and composition of petroleum, and provide energy and carbon sources for microbial communities in deep sedimentary systems. The results have implications for the carbon cycle, astrobiology, prebiotic organic chemistry, and perhaps even more importantly for Green Chemistry (a philosophy that encourages the design of products and processes that minimize the use and generation of hazardous substances).

"This C-H bond activation is a fundamental step that is ultimately necessary to produce more complex molecules – in the environment those molecules could be food for the deep biosphere – or involved in the production of petroleum fuels," says Hartnett. "The green chemistry side is potentially really cool – since we can conduct reactions in just hot water with a common mineral that ordinarily would require expensive or toxic catalysts or extremely harsh – acidic or oxidizing – conditions."

http://bit.ly/UBbmf5

Ancient Earth fossils could be found on the moon

Signs of ancient life could be littered across the moon, just waiting for an intrepid explorer to find them.

16:06 28 July 2014 by Jacob Aron

That's according to physicists who tested what would happen if a chunk of rock containing microscopic fossils from Earth were to be launched into space and smash into the lunar surface. Finding one could give us a pristine glimpse into past life on Earth.

Meteorites found on Earth that were created by impacts on the moon and Mars suggest that cosmic bodies regularly chuck rocks at each other. A few researchers have claimed that some of these meteorites show signs of fossilised bacteria, the most famous being Mars rock ALH 84001. However, the evidence is shaky – and misses a more fundamental question, says Mark Burchell at the University of Kent, UK.

"No one ever seems to have asked, even if the fossils did exist in a rock, would they survive?" he says. To find out, Burchell and his colleagues tried to simulate the conditions that fossilised diatoms – microscopic algae with detailed shells – would face on a trip from here to the moon.

The team powdered rock containing these fossils then mixed it with water and froze it to replicate a meteoroid. They then fired it into a bag of water using a large gas-powered gun. The force of the gun mimics what happens when a nearby impact launches a rock into orbit, and the rapid deceleration and high pressures of hitting the water simulates smacking into the moon at high speeds.

Microbes on the moon

None of the fossils survived perfectly intact, and the team found fewer and fewer recognisable fragments as they ramped up the impact speed from around 500 metres a second to a likely meteorite impact speed, around 5 kilometres a second. But being able to recover anything at all is promising, says Burchell. Because Earth is so geologically active, some rocks on this planet containing evidence of past life have been destroyed, but any fossils found on the moon would be better preserved.

"There is a good chance even if you found fragments, there would be things you have not seen before," he says. Finding out how old they are could provide a wealth of information about Earth's past.

Robotic and human explorers have brought back hundreds of lunar samples, but so far no one has found an Earth meteorite on the moon. Christian Koeberl at the University of Vienna, Austria, points out that Earth's dense atmosphere and high gravity – compared with the moon and mars – makes it more difficult for rocks to leave, but it could happen. "Even if it happens rarely, it is not impossible."

It is a prize worth pursuing, says Kieren Torres Howard at the City University of New York. "The idea that fragments of Earth rocks littering the lunar surface could be preserving a fossil record spanning much of Earth's history is intriguing," he says. "Actually discovering them would be amazing – another reason we should hurry back to the Moon."

Journal reference: Philosophical Transactions of the Royal Society A, DOI: 10.1098/rsta.2013.0190

http://bit.ly/XexxcQ

Six Minor Meteor Showers Could Beat the Perseids This Summer

While a bright nearly-full moon will interfere with Perseid meteor observing, six other six lesser celestial displays will reach their peak in dark skies

Jul 28, 2014 |By Joe Rao and SPACE.com

Each summer, amateur astronomers from all over the world look forward to observing the famous Perseid meteor shower, but often overlook six lesser celestial fireworks displays that reach their peak between July 28 and Aug. 20. This year, a bright nearly-full moon will seriously interfere with Perseid meteor observing, so why not take this opportunity to try and view the other six, all but one of which will enjoy dark skies. That minor meteor shower sextet begins Monday (July 28), with the peak of the Delta Aquarid meteor shower.

The online Slooh community observatory will stream live views of the Delta Aquarids in a webcast Monday night (July 28) at 10 p.m. EDT (7 p.m. PDT/0200 GMT) featuring views from observatories in Arizona and the Canary Islands.

NASA, meanwhile, will provide a follow-up webcast on Tuesday night via all-sky cameras at the agency's Marshall Space Flight Center in Huntsville, Alabama.

Both the Slooh and NASA webcasts are dependent on weather conditions at their respective observing sites. You can watch the Delta Aquarid meteor shower webcasts on Space.com each night.

Minor meteor showers this summer

In general, the Earth encounters richer meteoric activity during the second half of the year. And you're more likely to see twice as many meteors per hour in the predawn hours as compared to the evening hours, weather permitting.

This is due to the fact that during the pre-midnight hours we are on the "trailing" side of the Earth, due to our orbital motion through space. So any meteoric particle generally must have an orbital velocity greater than that of the Earth to "catch" us. [Amazing Meteor Shower Photos by Stargazers]

However, after midnight when observers are looking up from the Earth's "leading" side, any particle that lies along the Earth's orbital path will enter our atmosphere as a meteor. As such objects collide with the Earth's atmosphere at speeds of 7 to 45 miles per second (11 to 72 km/second), their energy of motion rapidly dissipates in the form of heat, light, and ionization, creating short-lived streaks of light popularly referred to as "shooting stars."

Summertime meteors, occasionally flitting across your line of sight are especially noticeable between mid-July and the third week of August. And between Aug. 3 and Aug. 15, there are no fewer than six different minor displays that are active. These six are listed in the table included in this guide.

Shower name	Pd. of visibility	Peak date	Hourly rate	Remarks
S. Delta Aquarids	July 12 - Aug. 19	July 28	15	Faint, medium speed.
Alpha Capricornids	July 3 - Aug. 15	July 30	4-5	Slow, bright, a few fireballs.
S. Iota Aquarids	July 25 - Aug. 15	Aug. 4	1 - 2	Faint, medium speed
N. Delta Aquarids	July 15 - Aug. 25	Aug. 8	1 - 4	Faint, medium speed
Kappa Cygnids	Aug. 3 - Aug. 25	Aug. 18	1 - 3	Slow moving, sometimes brilliant
N. Iota Aquarids	Aug. 11 - 31	Aug. 20	1 - 3	Faint, medium speed

Patience and clear skies

The only equipment you'll need to see this summer's meteor showers are your eyes, a modest amount of patience, good weather and dark skies. The actual number of meteors a single observer can see in an hour depends strongly on sky conditions.

The rates given in the table are based on your ability to see stars as faint as magnitude +6.5 —considered to be the threshold of naked eye visibility — that you are an experienced observer, and an assumption that the radiant is directly overhead. The radiant is the place in the sky where the paths of shower members, if extended backward, would intersect when plotted on a star chart.

Your clinched fist held at arm's length is equal to roughly 10 degrees on the sky. So if the radiant is 30 degrees ("three-fists") above the horizon, the hourly rate is halved. At 15 degrees, it is cut to a third.

While the hourly rates from these other meteor streams are but a fraction of the numbers produced by the Perseids, combined, overall they provide a wide variety of meteors of differing colors, speeds and trajectories.

Among these are the Southern Delta Aquarids, which can produce faint, medium speed meteors; the Alpha Capricornids, described as "slow, bright, long trailed yellowish meteors" and the Kappa Cygnids which are classified as "slow moving and sometimes producing brilliant flaring fireballs." As such, if you stay out and watch long enough, you may be nicely rewarded for the time spent.

Note that five of the six showers listed in chart included in this guide, come from the region around the constellations of Aquarius and Capricornus. These constellations are currently highest in the southern sky between roughly 1 and 3 a.m. your local time.

The moon will have already set earlier in the evening, leaving the after-midnight skies dark for the Southern and Northern Delta Aquarids, Alpha Capricornids, and Southern Iota Aquarids.

As for the Kappa Cygnids and Northern Iota Aquarids, the moon will be waning in illumination, but will still shine at a relatively bright gibbous phase, which will unfortunately brighten the predawn morning sky. Of these six minor showers, the Kappa Cygnids are the most favorably placed for northern observers. The constellation Cygnus lies high overhead at around midnight making it favorably placed for viewing all night long.

http://www.eurekalert.org/pub_releases/2014-07/kcl-stw072814.php

Study tracks worldwide spread of beneficial blood cell gene variant

Two beneficial variants of a gene controlling red blood cell development have spread from Africa into nearly all human populations across the globe, according to a new study led by King's College London.

The international team studied the genomes of world populations to look for the origin of changes in a key regulator gene which stimulate fetal haemoglobin production into adulthood. Fetal haemoglobin is normally found in fetuses and infants, but some patients with inherited blood disorders who are able to keep making it as adults experience milder symptoms of their condition.

Sickle cell anaemia is an inherited blood disorder in which red blood cells behave abnormally and can clog blood vessels, leading to acute unpredictable painful spells called a sickle cell crisis which typically last a week. The recurrent sickle crises and chronic anaemia lead to serious complications in the joints, bones, lungs, eyes, brain, liver and kidneys, and early death. Thalassaemia is a group of inherited blood disorders where insufficient haemoglobin - the oxygen-carrier in blood cells - is produced, leading to anaemia. Symptoms of beta thalassaemia can range from moderate to severe, with the most severe form requiring blood transfusions for the rest of the person's life. The only 'cure' for both sickle cell anaemia and beta thalassaemia is a bone marrow transplant, but this option is only available to a small number of patients.

Studies have shown that carriers of these conditions are protected against malaria; having one copy of the sickle cell gene significantly increases your chances of surviving malaria. As a result, these blood disorders are more prevalent in parts of the world where malaria is common. However, sickle cell disease is rapidly emerging as a public health issue both globally and in the UK where it is the most common severe genetic disorder, affecting an estimated 13,000 people.

The new study, published in the Annals of Human Genetics, looked at genetic factors that can reduce the severity of these blood disorders. Typically, our bodies make fetal haemoglobin whilst in the womb, but then switch to another form of haemoglobin, adult haemoglobin, at birth. However, we continue to produce very small amounts of fetal haemoglobin in adulthood, some more than others. Patients who have the genetic factors that increase fetal haemoglobin production tend to have milder symptoms of their blood disorder.

While studying patients of African and of South Asian descent, the authors noticed that one such factor, a genetic variant controlling the red blood cell regulator gene MYB - 'MYB enhancer variant' - on Chromosome 6, is of similar genetic structure not only in both patient groups, but also in healthy individuals, including those of Northern European origin, where thalassaemia and sickle cell disease are rare. This led the authors to suspect that beneficial MYB enhancer variants, which promote fetal haemoglobin in the body, are a general feature of human populations across the world and that they might have a common origin.

To test this hypothesis, the team searched for genetic signatures of such variants in public genome data generated from world populations to see whether they existed in other ethnic groups. They found signatures for two different types of MYB enhancer variants, HMIP-2A and HMIP-B, in major human population groups and in nearly all ethnic groups covered by the data. Both variants occur in Sub-Saharan Africa, but only at low frequencies. In much of the rest of the world the alleles have combined, forming HMIP-2A-B, and this combination is relatively common in Europe, South Asia and China. HMIP-2B separately is common in Far-East Asian peoples and in Amerindians, illustrating their connection across the Bering Strait.

The team also tested recent genome sequence data from our extinct cousins, the Neanderthals and Denisovans, and from the Great Apes, but detected neither HMIP-2A nor HMIP-2B. From this, the authors conclude that MYB enhancer variants that modulate the severity of sickle cell and beta thalassaemia have arisen twice in modern humans, in Africa, and then spread to the rest of the world. However, this likely occurred long before inherited blood disorders became prevalent, and thus the environmental factors that favoured such variants in these early humans are not clear.

The next stage of the research will explore which selection pressures or benefits might have contributed to the present population distribution of the variants. Selection pressures could include nutritional factors, such as the availability of iron in the diet, or specific demands on red blood cell production, such as adaptation to high altitudes.

Dr Stephen Menzel, co-author from the Department of Molecular Haematology at King's College London, says: "Patients who have milder versions of blood disorders, thanks to their ability to keep producing fetal haemoglobin, carry genetic clues that are helping us to understand the function of the genes and biological pathways involved in these diseases."

Professor Swee Lay Thein, co-author and Consultant Haematologist at King's College Hospital NHS Foundation Trust, says: "King's Health Partners cares for the largest cohort of sickle cell patients in the UK, with an estimated 2,500 patients. Although a newborn in the UK can now expect to live to adulthood, in adults the disorder has evolved into a chronic debilitating disease with acute or

chronic pain and organ complications. We hope our research will help to develop biomarkers and ultimately, preventative treatments for inherited blood disorders."

The study, supported by funding from the Medical Research Council, was a collaboration of clinical and research expertise involving scientists and clinicians from international organizations and King's College London, King's College Hospital NHS Foundation Trust and Guy's and St Thomas' NHS Foundation Trust, part of King's Health Partners Academic Health Sciences Centre.

http://bit.ly/1pq6W5O

Ebola outbreak: What you need to know about its spread

The spread continues. The recent Ebola epidemic in West Africa has so far claimed more than 670 lives in what is now the worst outbreak of the disease.

12:38 29 July 2014 by Philippa Skett

Cases have already been recorded in Sierra Leone, Guinea and Liberia. Now it has reached Lagos in Nigeria. Patrick Sawyer seemed to be alright when he boarded a flight from Liberia on 20 July, but was showing symptoms of the disease by the time he arrived in Lagos. He died on Friday. With Lagos being Africa's largest city, boasting a population of around 21 million, an outbreak there could be disastrous. Many of the residents of the city live in cramped conditions, which could aid spread of the disease further.

So what is Ebola?

Ebola is a haemorrhagic virus; it causes extensive internal bleeding, and can lead to those infected dying from shock. Initially, those infected experience a sudden onset of fever, muscle pain, weakness, headaches, a sore throat and vomiting and diarrhoea. As the infection worsens, it leads to external and internal bleeding, as the virus breaks down the epithelial cell wall of blood vessels, causing them to leak fluid.

How does Ebola spread?

Ebola is highly contagious and can be transmitted even after those infected have died, because the virus is transmitted via bodily fluids. It has a 90% fatality rate. The virus is thought to be transmitted between species: fruit bats (Nature, doi:10.1038/438575a) may be the natural hosts of the virus, and may be the reason the virus has spread across Africa.

So how are people trying to stop its spread?

Liberia has announced it has closed all but its major crossings and is also quarantining all affected villages. Nigerian officials are now screening passengers arriving at the international airports. However, such mechanisms vary from simply asking people if they have experienced symptoms to taking traveller's temperatures: no diagnostic blood tests are being done despite symptoms being very similar to that of other diseases.

Daniel Bausch at Tulane University School of Public Health and Tropical Medicine in New Orleans, Louisiana, who has recently returned from Sierra Leone, says the priority should be to trace all contacts of the infected man. "Lagos is not a particularly international link, but nevertheless knowing where these other travellers could be is difficult. It seems simplistic, but logistics of tracing contacts of those infected is more complex," Bausch says.

How far could the virus spread?

Bausch thinks it is unlikely that the outbreak will spread through Europe or the US if someone infected gets on an international plane to these places. "Could it happen? I think it could. Would we get sustained transmission? I don't think we would. Screening at airports is important, but we don't have to panic about one case spreading as long as healthcare officials are taking the usual precautions."

Can the virus be treated?

Currently, there is no cure. Treatment generally involves simply relieving the symptoms of the disease.

How long will the outbreak last?

For a few more months at least, says Bausch. "The key challenges are to stop the spread of the disease is to ensure that we identify all the contacts of those infected and isolate them, although this requires both a lot of resources and a cooperative population," he says. "It is still difficult to put any sort of temporal prediction on this, as you simply can't model all of the factors involved in the spread, so you just have to hope you have it under control."

How are people in West Africa responding to the outbreak?

"It's been a very grim scene in Sierra Leone," says Bausch. "We've really been trying to fight a very difficult situation, but we haven't had adequate resources due to quite a number of healthcare workers infected, which is tough on people's morale."

It seems that there is a general mistrust of healthworkers in Sierra Leone. It has been reported that a woman who tested positive for the disease was removed from hospital by her family. The 32-year-old hairdresser was the first known case among residents in the capital city. She later died in the ambulance taking her back to hospital. Bausch says there are some nurses in Sierra Leone who have been told by landlords not to return home because they risk bringing the disease back with them. Not only that, but resources are scarce in the affected areas: one ward was reported as having 55 confirmed patients but only one nurse because some were on strike and others were infected.

Despite this, Bausch is optimistic. "Hopefully bringing in more external support in the next week or two will see an increase in scale of support of this outbreak to allow us to gradually gain control of the situation."

http://bit.ly/1tZOoLc

Farmers Say GMO Corn No Longer Resistant to Pests

Genetically modified corn seeds are no longer protecting Brazilian farmers from voracious tropical bugs, increasing costs as producers turn to pesticides, a farm group said

By Caroline Stauffer

SAO PAULO (Reuters) - Genetically modified corn seeds are no longer protecting Brazilian farmers from voracious tropical bugs, increasing costs as producers turn to pesticides, a farm group said on Monday.

Producers want four major manufacturers of so-called BT corn seeds to reimburse them for the cost of spraying up to three coats of pesticides this year, said Ricardo Tomczyk, president of Aprosoja farm lobby in Mato Grosso state.

"The caterpillars should die if they eat the corn, but since they didn't die this year producers had to spend on average 120 reais ($54) per hectare ... at a time that corn prices are terrible," he said.

Large-scale farming in the bug-ridden tropics has always been a challenge, and now Brazil's government is concerned that planting the same crops repeatedly with the same seed technologies has left the agricultural superpower vulnerable to pest outbreaks and dependent on toxic chemicals.

Experts in the United States have also warned about corn production prospects because of a growing bug resistance to genetically modified corn. Researchers in Iowa found significant damage from rootworms in corn fields last year.

In Brazil, the main corn culprit is Spodoptera frugiperda, also known as the corn leafworm or southern grassworm.

Seed companies say they warned Brazilian farmers to plant part of their corn fields with conventional seeds to prevent bugs from mutating and developing resistance to GMO seeds.

Dow Agrosciences, a division of Dow Chemical Company, has programs in Brazil to help corn farmers develop "an integrated pest management system that includes, among other things, the cultivation of refuge areas," it said in an email.

Another company, DuPont, said it had not received any formal notification from Aprosoja. The company's Pioneer brand has been working with producers to extend the durability of its seed technology and improve efficiency since Spodoptera worms were found to have developed resistance to the Cry1F protein, it said in a statement. The other two companies, Monsanto Co and Syngenta AG did not immediately respond to request for comment.

Tomczyk, who also spoke for Brazilian farmers during a dispute over seed royalty payments to Monsanto that ended last year, said Aprosoja encouraged the planting of refuge areas. But he said the seed companies have not given clear instructions.

"There are barely any non-GMO seeds available ... it is very uncomfortable that the companies are blaming the farmers," he said. Aprosoja hopes to reach a negotiated agreement with the seed companies, but if all else fails farmers may sue to get reparations for pesticide costs, he added.

Brazil is harvesting its second of two annual corn crops and expects to produce 78 million tonnes this crop year, slightly less than last season's record. Domestic prices recently hit their lowest in four years due to abundant supplies.

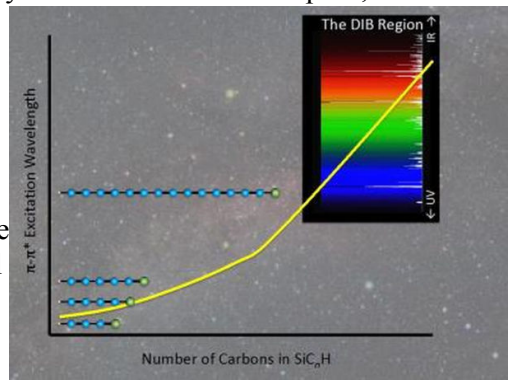
($1 = 2.223 reais)

http://www.eurekalert.org/pub_releases/2014-07/aiop-mmi072914.php

Mysterious molecules in space

Researchers at Harvard-Smithsonian Center for Astrophysics finger silicon-capped hydrocarbons as possible source of mysterious 'diffuse interstellar bands'

WASHINGTON D.C - Over the vast, empty reaches of interstellar space, countless small molecules tumble quietly though the cold vacuum. Forged in the fusion furnaces of ancient stars and ejected into space when those stars exploded, these lonely molecules account for a significant amount of all the carbon, hydrogen, silicon and other atoms in the universe. In fact, some 20 percent of all the carbon in the universe is thought to exist as some form of interstellar molecule.



This graph shows absorption wavelength as a function of the number of carbon atoms in the silicon-terminated carbon chains SiC_(2n+1)H, for the extremely strong pi-pi electronic transitions. When the chain contains 13 or more carbon atoms - not significantly longer than carbon chains already known to exist in space - these strong transitions overlap with the spectral region occupied by the elusive diffuse interstellar bands. **D. Kokkin, ASU**

Many astronomers hypothesize that these interstellar molecules are also responsible for an observed phenomenon on Earth known as the "diffuse interstellar bands," spectrographic proof that something out there in the universe is absorbing certain distinct colors of light from stars before it reaches the Earth. But since we don't know the exact chemical composition and atomic arrangements of these mysterious molecules, it remains unproven whether they are, in fact, responsible for the diffuse interstellar bands.

Now in a paper appearing this week in The Journal of Chemical Physics, from AIP Publishing, a group of scientists led by researchers at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass. has offered a tantalizing new possibility: these mysterious molecules may be silicon-capped hydrocarbons like SiC3H, SiC4H and SiC5H, and they present data and theoretical arguments to back that hypothesis.

At the same time, the group cautions that history has shown that while many possibilities have been proposed as the source of diffuse interstellar bands, none has been proven definitively.

"There have been a number of explanations over the years, and they cover the gamut," said Michael McCarthy a senior physicist at the Harvard-Smithsonian Center for Astrophysics who led the study.

Molecules in Space and How We Know They're There

Astronomers have long known that interstellar molecules containing carbon atoms exist and that by their nature they will absorb light shining on them from stars and other luminous bodies. Because of this, a number of scientists have previously proposed that some type of interstellar molecules are the source of diffuse interstellar bands -- the hundreds of dark absorption lines seen in color spectrograms taken from Earth.

In showing nothing, these dark bands reveal everything. The missing colors correspond to photons of given wavelengths that were absorbed as they travelled through the vast reaches of space before reaching us. More than that, if these photons were filtered by falling on space-based molecules, the wavelengths reveal the exact energies it took to excite the electronic structures of those absorbing molecules in a defined way.

Armed with that information, scientists here on Earth should be able to use spectroscopy to identify those interstellar molecules -- by demonstrating which molecules in the laboratory have the same absorptive "fingerprints." But despite decades of effort, the identity of the molecules that account for the diffuse interstellar bands remains a mystery. Nobody has been able to reproduce the exact same absorption spectra in laboratories here on Earth.

"Not a single one has been definitively assigned to a specific molecule," said Neil Reilly, a former postdoctoral fellow at Harvard-Smithsonian Center for Astrophysics and a co-author of the new paper.

Now Reilly, McCarthy and their colleagues are pointing to an unusual set of molecules — silicon-terminated carbon chain radicals — as a possible source of these mysterious bands.

As they report in their new paper, the team first created silicon-containing carbon chains SiC3H, SiC4H and SiC5H in the laboratory using a jet-cooled silane-acetylene discharge. They then analyzed their spectra and carried out theoretical calculations to predict that longer chains in this family might account for some portion of the diffuse interstellar bands.

However, McCarthy cautioned that the work has not yet revealed the smoking gun source of the diffuse interstellar bands. In order to prove that these larger silicon capped hydrocarbon molecules are such a source, more work needs to be done in the laboratory to define the exact types of transitions these molecules undergo, and these would have to be directly related to astronomical observations. But the study provides a tantalizing possibility for finding the elusive source of some of the mystery absorption bands -- and it reveals more of the rich molecular diversity of space.

"The interstellar medium is a fascinating environment," McCarthy said. "Many of the things that are quite abundant there are really unknown on Earth."

The article, "Optical Spectra of the Silicon-Terminated Carbon Chain Radicals SiCnH (n=3,4,5)," is authored by D. L. Kokkin, N. J. Reilly, R. C. Fortenberry, T. D. Crawford and M. C. McCarthy. It will be published in The Journal of Chemical Physics on July 29, 2014. After that date, it can be accessed at:
http://scitation.aip.org/content/aip/journal/jcp/141/4/10.1063/1.4883521
Authors of the paper are affiliated with Harvard University, Arizona State University, Virginia Tech, the University of Louisville and Georgia Southern University.

http://www.eurekalert.org/pub_releases/2014-07/cshl-rme072914.php

Research may explain how foremost anticancer 'guardian' protein learned to switch sides

Researchers at Cold Spring Harbor Laboratory (CSHL) have discovered a new function of the body's most important tumor-suppressing protein.

Cold Spring Harbor, NY -- Called p53, this protein has been called "the guardian of the genome." It normally comes to the fore when healthy cells sense damage to their DNA caused by stress, such as exposure to toxic chemicals or intense exposure to the sun's UV rays. If the damage is severe, p53 can cause a cell to commit preprogrammed cell-death, or apoptosis. Mutant versions of p53 that no longer perform this vital function, on the other hand, are enablers of many different cancers.

Cancer researcher Dr. Raffaella Sordella, a CSHL Associate Professor, and colleagues, today report in Proceedings of the National Academy of Sciences the discovery of a p53 cousin they call p53-psi (the Greek letter "psi"). It is a previously unknown variant of the p53 protein, generated by the same gene, called TP53 in humans, that gives rise to other forms of p53.

Sordella and colleagues observed that p53-psi, when expressed, reduces the expression of a molecular glue called E-cadherin, which normally keeps cells in

contact within epithelial tissue, the tissue that forms the lining of the lung and many other body organs. This is accompanied by expression of key cellular markers associated with tumor invasiveness and metastatic potential. (These are markers of EMT, or epithelial-to-mesenchymal transition.) Consistently, Sordella and her team found levels of p53-psi to be elevated in early-stage lung tumors with poor prognosis.

Careful investigation revealed that p53-psi generates pro-growth effects by interacting with a protein called cyclophillin D (CypD), at the membrane of the cell's energy factories, the mitochondria, and by spurring the generation of oxidizing molecules called reactive oxygen species (ROS).

p53-psi was found by the team to be inherently expressed in tumors but also in injured tissue. "This is intriguing," Sordella says, "because generation of cells bearing characteristics of those seen in wound healing has been seen previously, in tumors."

It is possible, Sordella says, that more familiar p53 mutants associated with tumor growth and metastasis may have "hijacked" those abilities from the program used by p53-psi; to promote healing during tissue injury. A cellular program, in other words, that evolved over eons to heal may have been hijacked by mutant p53 to enable cancers to spread out of control.

The team is currently investigating p53-psi in wound healing to help clarify its role. Confirmation would lend support to the theory that mutant p53 hijacks that function to help advance pro-metastatic processes in cancer.

The research discussed in this release was funded by a grant from the Damon Runyon Cancer Research Foundation.

"p53-psi is a transcriptionally inactive p53 isoform able to reprogram cells toward a metastatic-like state" appears online ahead of print the week of July 28, 2014 in Proceedings of the National Academy of Sciences. The authors are: Serif Senturk, Zhan Yao, Matthew Camiolo, Brendon Stiles, Trushar Rathod, Alice M. Walsh, Alice Nemajerova, Matthew J. Lazzara, Nasser K. Altorki, Adrian Krainer, Ute M. Moll, Scott W. Lowe, Luca Cartegni and Raffaella Sordella. The paper can be obtained at: http://www.pnas.org/content/early/recent

http://www.eurekalert.org/pub_releases/2014-07/uoia-tst072914.php

Team studies the social origins of intelligence in the brain

By studying the injuries and aptitudes of Vietnam War veterans who suffered penetrating head wounds during the war, scientists are tackling -- and beginning to answer -- longstanding questions about how the brain works.

CHAMPAIGN, Ill. - The researchers found that brain regions that contribute to optimal social functioning also are vital to general intelligence and to emotional intelligence. This finding bolsters the view that general intelligence emerges from the emotional and social context of one's life.

The findings are reported in the journal Brain.

"We are trying to understand the nature of general intelligence and to what extent our intellectual abilities are grounded in social cognitive abilities," said Aron Barbey, a University of Illinois professor of neuroscience, of psychology, and of speech and hearing science. Barbey (bar-BAY), an affiliate of the Beckman Institute and of the Institute for Genomic Biology at the U. of I., led the new study with an international team of collaborators.

Studies in social psychology indicate that human intellectual functions originate from the social context of everyday life, Barbey said.

"We depend at an early stage of our development on social relationships -- those who love us care for us when we would otherwise be helpless," he said.

Social interdependence continues into adulthood and remains important throughout the lifespan, Barbey said.

"Our friends and family tell us when we could make bad mistakes and sometimes rescue us when we do," he said. "And so the idea is that the ability to establish social relationships and to navigate the social world is not secondary to a more general cognitive capacity for intellectual function, but that it may be the other way around. Intelligence may originate from the central role of relationships in human life and therefore may be tied to social and emotional capacities."

The study involved 144 Vietnam veterans injured by shrapnel or bullets that penetrated the skull, damaging distinct brain tissues while leaving neighboring tissues intact. Using CT scans, the scientists painstakingly mapped the affected brain regions of each participant, then pooled the data to build a collective map of the brain.

The researchers used a battery of carefully designed tests to assess participants' intellectual, emotional and social capabilities. They then looked for patterns that tied damage to specific brain regions to deficits in the participants' ability to navigate the intellectual, emotional or social realms. Social problem solving in this analysis primarily involved conflict resolution with friends, family and peers at work.

As in their earlier studies of general intelligence and emotional intelligence, the researchers found that regions of the frontal cortex (at the front of the brain), the parietal cortex (further back near the top of the head) and the temporal lobes (on the sides of the head behind the ears) are all implicated in social problem solving.

The regions that contributed to social functioning in the parietal and temporal lobes were located only in the brain's left hemisphere, while both left and right frontal lobes were involved.

The brain networks found to be important to social adeptness were not identical to those that contribute to general intelligence or emotional intelligence, but there was significant overlap, Barbey said.

"The evidence suggests that there's an integrated information-processing architecture in the brain, that social problem solving depends upon mechanisms that are engaged for general intelligence and emotional intelligence," he said. "This is consistent with the idea that intelligence depends to a large extent on social and emotional abilities, and we should think about intelligence in an integrated fashion rather than making a clear distinction between cognition and emotion and social processing. This makes sense because our lives are fundamentally social -- we direct most of our efforts to understanding others and resolving social conflict. And our study suggests that the architecture of intelligence in the brain may be fundamentally social, too."

The U.S. National Institute of Neurological Disorders and Stroke supported this work, along with a grant from the U.S. Army Medical Research and Material Command administered by the Henry M. Jackson Foundation.

The paper, "Lesion mapping of social problem solving," is available online or from the U. of I. News Bureau (diya@illinois.edu).

http://nyti.ms/1nTJYpo

Sierra Leone: Leading Doctor Dies of Ebola

The doctor leading Sierra Leone's fight against the worst Ebola outbreak on record died from the virus on Tuesday, the country's chief medical officer said.

By REUTERSJULY 29, 2014

The death of Dr. Sheik Umar Khan, 39, highlights the dangers health workers face in trying to halt the disease's spread across West Africa. Ebola is believed to have killed 672 people in Guinea, Liberia and Sierra Leone since the outbreak began in February. The regional airline Asky has suspended flights to and from Sierra Leone and Liberia. Asky, which is based in Togo, also said passengers leaving Guinea's capital, Conakry, would be checked for symptoms before departure. Nigeria's largest carrier, Arik Air, has suspended flights to Liberia and Sierra Leone because of the Ebola risk.

http://www.eurekalert.org/pub_releases/2014-07/jhm-abt072814.php

A blood test for suicide?

Alterations to a single gene could predict risk of suicide attempt

Johns Hopkins researchers say they have discovered a chemical alteration in a single human gene linked to stress reactions that, if confirmed in larger studies, could give doctors a simple blood test to reliably predict a person's risk of attempting suicide.

The discovery, described online in The American Journal of Psychiatry, suggests that changes in a gene involved in the function of the brain's response to stress hormones plays a significant role in turning what might otherwise be an unremarkable reaction to the strain of everyday life into suicidal thoughts and behaviors.

"Suicide is a major preventable public health problem, but we have been stymied in our prevention efforts because we have no consistent way to predict those who are at increased risk of killing themselves," says study leader Zachary Kaminsky, Ph.D., an assistant professor of psychiatry and behavioral sciences at the Johns Hopkins University School of Medicine. "With a test like ours, we may be able to stem suicide rates by identifying those people and intervening early enough to head off a catastrophe."

For his series of experiments, Kaminsky and his colleagues focused on a genetic mutation in a gene known as SKA2. By looking at brain samples from mentally ill and healthy people, the researchers found that in samples from people who had died by suicide, levels of SKA2 were significantly reduced.

Within this common mutation, they then found in some subjects an epigenetic modification that altered the way the SKA2 gene functioned without changing the gene's underlying DNA sequence.

The modification added chemicals called methyl groups to the gene. Higher levels of methylation were then found in the same study subjects who had killed themselves. The higher levels of methylation among suicide decedents were then replicated in two independent brain cohorts.

In another part of the study, the researchers tested three different sets of blood samples, the largest one involving 325 participants in the Johns Hopkins Center for Prevention Research Study found similar methylation increases at SKA2 in individuals with suicidal thoughts or attempts. They then designed a model analysis that predicted which of the participants were experiencing suicidal thoughts or had attempted suicide with 80 percent certainty.

Those with more severe risk of suicide were predicted with 90 percent accuracy. In the youngest data set, they were able to identify with 96 percent accuracy whether or not a participant had attempted suicide, based on blood test results.

The SKA2 gene is expressed in the prefrontal cortex of the brain, which is involved in inhibiting negative thoughts and controlling impulsive behavior. SKA2 is specifically responsible for chaperoning stress hormone receptors into cells' nuclei so they can do their job. If there isn't enough SKA2, or it is altered in some way, the stress hormone receptor is unable to suppress the release of cortisol throughout the brain. Previous research has shown that such cortisol release is abnormal in people who attempt or die by suicide.

Kaminsky says a test based on these findings might best be used to predict future suicide attempts in those who are ill, to restrict lethal means or methods among

those a risk, or to make decisions regarding the intensity of intervention approaches.

He says that it might make sense for use in the military to test whether members have the gene mutation that makes them more vulnerable. Those at risk could be more closely monitored when they returned home after deployment. A test could also be useful in a psychiatric emergency room, he says, as part of a suicide risk assessment when doctors try to assess level of suicide risk.

The test could be used in all sorts of safety assessment decisions like the need for hospitalization and closeness of monitoring. Kaminsky says another possible use that needs more study could be to inform treatment decisions, such as whether or not to give certain medications that have been linked with suicidal thoughts.

"We have found a gene that we think could be really important for consistently identifying a range of behaviors from suicidal thoughts to attempts to completions," Kaminsky says. "We need to study this in a larger sample but we believe that we might be able to monitor the blood to identify those at risk of suicide."

Along with Kaminsky, other Johns Hopkins researchers involved in the study include Jerry Guintivano; Tori Brown; Alison Newcomer, M.Sc.; Marcus Jones; Olivia Cox; Brion Maher, Ph.D.; William Eaton, Ph.D.; Jennifer Payne, M.D.; and Holly Wilcox, Ph.D.

The research was supported in part by the National Institutes of Health's National Institute of Mental Health (1R21MH094771-01), the Center for Mental Health Initiatives, The James Wah Award for Mood Disorders, and The Solomon R. and Rebecca D. Baker Foundation.

http://www.hopkinsmedicine.org/profiles/results/directory/profile/5411152/zachary-kaminsky

http://www.hopkinsmedicine.org/news/media/releases/genetic_predictors_of_postpartum_depression_uncovered_by_johns_hopkins_researchers

http://phys.org/news/2014-07-mercury-magnetic-field-scientists-interior.html

Mercury's magnetic field tells scientists how its interior is different from Earth's

Earth and Mercury are both rocky planets with iron cores, but Mercury's interior differs from Earth's in a way that explains why the planet has such a bizarre magnetic field, UCLA planetary physicists and colleagues report.

Measurements from NASA's Messenger spacecraft have revealed that Mercury's magnetic field is approximately three times stronger at its northern hemisphere than its southern one. In the current research, scientists led by Hao Cao, a UCLA postdoctoral scholar working in the laboratory of Christopher T. Russell, created a model to show how the dynamics of Mercury's core contribute to this unusual phenomenon.

The magnetic fields that surround and shield many planets from the sun's energy-charged particles differ widely in strength. While Earth's is powerful, Jupiter's is more than 12 times stronger, and Mercury has a rather weak magnetic field. Venus likely has none at all. The magnetic fields of Earth, Jupiter and Saturn show very little difference between the planets' two hemispheres.

Within Earth's core, iron turns from a liquid to a solid at the inner boundary of the planet's liquid outer core; this results in a solid inner part and liquid outer part. The solid inner core is growing, and this growth provides the energy that generates Earth's magnetic field. Many assumed, incorrectly, that Mercury would be similar.

"Hao's breakthrough is in understanding how Mercury is different from the Earth so we could understand Mercury's strongly hemispherical magnetic field," said Russell, a co-author of the research and a professor in the UCLA College's department of Earth, planetary and space sciences.

"We had figured out how the Earth works, and Mercury is another terrestrial, rocky planet with an iron core, so we thought it would work the same way. But it's not working the same way."

Mercury's peculiar magnetic field provides evidence that iron turns from a liquid to a solid at the core's outer boundary, say the scientists, whose research currently appears online in the journal Geophysical Research Letters and will be published in an upcoming print edition.

"It's like a snow storm in which the snow formed at the top of the cloud and middle of the cloud and the bottom of the cloud too," said Russell. "Our study of Mercury's magnetic field indicates iron is snowing throughout this fluid that is powering Mercury's magnetic field."

The research implies that planets have multiple ways of generating a magnetic field.

Hao and his colleagues conducted mathematical modeling of the processes that generate Mercury's magnetic field. In creating the model, Hao considered many factors, including how fast Mercury rotates and the chemistry and complex motion of fluid inside the planet.

The cores of both Mercury and Earth contain light elements such as sulfur, in addition to iron; the presence of these light elements keeps the cores from being completely solid and "powers the active magnetic field–generation processes," Hao said.

Hao's model is consistent with data from Messenger and other research on Mercury and explains Mercury's asymmetric magnetic field in its hemispheres. He said the first important step was to "abandon assumptions" that other scientists make.

"Planets are different from one another," said Hao, whose research is funded by a NASA fellowship. "They all have their individual character."

http://phys.org/news/2014-07-important-twitch-earth.html

Copious corn growing in tiny backyard plots? Roses blooming in December?

Thanks to technology that the University of Wisconsin-Madison's Richard Vierstra has been developing for years, these things may soon be possible.

And now, new findings out of the genetics professor's lab promise to advance that technology even further.

For the first time, Vierstra and his team have revealed the structure of the plant phytochrome, a critical molecule that detects the light that tells plants when to germinate, grow, make food, flower and even age. Like eyes, the phytochrome is a light sensor that converts sunlight into chemical signals to get these jobs done. By manipulating it, the group can alter the conditions under which all plants grow and develop.

Vierstra's group published the structure in a recent issue of the journal Proceedings of the National Academy of Science. His team also presented its results this month at the annual meeting of the American Society of Plant Biologists in Portland, Oregon.

"It's the molecule that tells plants when to flower," says Vierstra. "Plants use the molecule to sense where they are in the canopy; they use the phytochromes for color vision—to sense whether they are above, next to or under other plants."

Vierstra previously determined the structure of a similar phytochrome from light-sensing bacteria, which guided his work in plants. He already has several patents on the technologies derived from these structures and has been in talks to commercialize them. The determination of a plant phytochrome three-dimensional structure will only accelerate improvements to the technology.

One of the biggest moves in agriculture, Vierstra says, is to be able to grow plants at higher density, allowing producers to plant more crops in a given area, thus saving space and other resources.

Currently, there is a limit to how closely plants can grow relative to their nearest neighbors. At high density, the leaves of one plant shade the other, signaling to the shaded plant it isn't receiving enough sunlight. These plants grow stems and stalks rather than fruits and seeds, becoming long and leggy as they reach for the sky.

That process begins with the phytochrome, which senses the wavelength of light shining on plants. Plants in full sun absorb red light while shaded plants receive only the leftover, far-red light. The type of light the phytochrome "sees" tells the plant whether to stretch out and become taller or to flower and make fruit. Based on the light available, the phytochrome cycles between an inactive and active state.

"Photoconversion between the active and inactive states of phytochromes is arguably the most important twitch on this planet, as it tells plants to become photosynthetic and consequently make the food we eat and the oxygen we breathe," says Vierstra.

Vierstra and his team found that by making specific changes to the light sensor, they can dupe it into staying in its active state longer.

"By mutating the phytochromes, we created plants that think they're in full sun, even when they're not," Vierstra says.

Three decades ago, while a postdoctoral researcher at UW-Madison, Vierstra was the first to purify the phytochrome protein. Now, his work has come full circle. He hopes the research team's findings become the scaffold for a toolkit others can use—one that might fundamentally alter agriculture.

In addition to growers, the research also has implications for other scientists, as the technology could be used to create new fluorescent molecules for detecting minuscule events inside cells, and in the field of optogenetics, which uses light as a tool to drive biological change.

http://bit.ly/1tt6cRo

Ebola's Deadly Jump From Animal to Animal

Ebola may be present in more animals than previously thought, according to researchers studying the deadly virus, which has already been detected in chimpanzees, gorillas, fruit bats, monkeys, antelopes, porcupines, rodents, dogs, pigs and humans.

by Jennifer Viegas

Humans and other primates appear to be particularly susceptible to at least certain strains of the virus. During the present outbreak ravaging Guinea, Sierra Leone and Liberia, Ebola has killed 670 people so far and infected more than 1,000.

"The close evolutionary relationship between humans, chimpanzees and gorillas makes their immune systems very similar," Peter Walsh, a primate expert at the University of Cambridge, told Discovery News.

According to the World Health Organization, humans can get Ebola through close contact with the blood, secretions, organs or other bodily fluids of infected animals (including other humans), so people who consume or otherwise handle certain bush meat are at particular risk. Eating infected non-human primates doesn't tell the whole story, however.

There is growing consensus that fruit bats are ground zero for the illness that kills up to 90 percent of humans who become infected. Most of the infected bats appear to come from the following three species: Hypsignathus monstrosus, Epomops franqueti and Myonycteris torquata.

"In general, Ebola researchers think that the natural host of Ebola virus are fruit bats, and that the virus is transmitted to non-human primates and then to humans through the bush meat trade," Purdue University's David Sanders, one of the world's leading experts on zoonotic diseases, told Discovery News. He added, "It is possible that there is direct transmission from fruit bats to humans."

Certain cultures in Africa do consume bat meat, such that Guinea earlier this year ordered a ban on consumption of these flying mammals in an effort to halt the epidemic's spread. As for how non-human primates might become infected, they often feast on fruits that the bats eat. They can also kill and eat bats, or scavenge meat from infected carcasses. Then the question remains: How did bats get the virus?

Sanders and his team found that the way Ebola infects human cells is nearly identical -- both structurally and biochemically -- to the way that similar viruses enter bird cells. This suggests that the proteins of the virus had a comparatively recent ancestor. "It is therefore possible that Ebola was at one time associated with a bird host and may even be so today," Sanders said, adding that the bird must hail from Central Africa. That is where the virus was first detected in 1976 and where outbreaks usually occur.

Even plants and insects could have played some role in the evolution of the virus, as Thomas Monath of the Harvard School of Public Health has proposed. Monath postulated that a nonpathogenic virus in insects and/or plants might have mutated, giving rise to Ebola in bats.

Blaming humans, bats, chimps or birds for the illness does not then take into account its full possible scope within the ecosystem. That, the present unprecedented epidemic, the potential for bioterrorism, and the fact that no vaccine is available for clinical use have scientists around the world paying greater attention to Ebola and to the animals it can infect.

Sanders and his colleagues continue to study birds and their possible role in Ebola's evolution and transmission. They are also attempting to determine what other animals might be added to the already long list of species that the virus and related viruses could impact.

http://bit.ly/1k7vqlj

Strong, Clear Bioplastic Containers Could Be Made from Rice

Using rice starch, researchers have made sustainable, biodegradable polymers that could be used in food packaging

Jul 30, 2014 |By William Bergius and ChemistryWorld

Researchers in Finland have transformed rice starch into a temporally stable, optically transparent, biodegradable plastic with a high degree of mechanical strength and good thermal resistance.

This important step towards bioplastics made from simple and sustainable resources has potential applications in food packaging and biomedical materials.

Starch is a polysaccharide consisting of two components: a linear glucose polymer called amylose and a highly branched glucose polymer called amylopectin.

Most green plants store their energy as starch and it is present in large quantities in grains such as maize, wheat and rice, in addition to tubers like potatoes.

A brittle polymer, starch can be treated with heat and water, via a technique called gelatisation, to make it suitable for traditional plastic processing techniques.

However, films prepared by this method rapidly recrystalise and degrade, leaving them amorphous and brittle again.

Many small molecules have been used as plasticisers that hydrogen bond with the glucose units in starch to prevent recrystallisation, however they are prone to migration and leeching, again degrading over time.

Unfortunately larger compounds are typically less effective plasticisers.

Virginia Nykänen and colleagues at Aalto University have devised a creative solution to this problem.

They used a star-shaped molecule called AEEP (aminoethoxy ethanol substituted phosphazene), the arms of which act as dynamic and mobile hydrogen bonding plasticiser molecules while being connected to a central core, effectively preventing migration and leeching of the starch molecules from the resulting plastic.

This material succeeds where both large and small molecules have failed, the net result being a clear biodegradable plastic with desirable mechanical properties, manufactured from a sustainable and natural resource.

'By producing new bioplastics we can provide more options and increase their application,' says Nykänen.

'Decreasing the production of non-degradable waste and using bioplastics instead will certainly benefit the environment in the middle term.'

'Starch has largely been overlooked as a building block,' comments Andy Abbott, a sustainable materials expert at the University of Leicester, UK.

'Importantly, in this study, the thermoplastic properties appear to be retained over a time-scale of several months which has been an issue with other starch-based plastics.'

Nykänen and co-workers are now testing AEEP within a range of biopolymers, in addition to investigating the self-healing properties of their starch-based plastic.

http://www.eurekalert.org/pub_releases/2014-07/uonh-ais073014.php

Antarctic ice sheet is result of CO2 decrease, not continental breakup

Climate modelers from the University of New Hampshire have shown that the most likely explanation for the initiation of Antarctic glaciation during a major climate shift 34 million years ago was decreased carbon dioxide (CO2) levels.

DURHAM, N.H. – The finding counters a 40-year-old theory suggesting massive rearrangements of Earth's continents caused global cooling and the abrupt formation of the Antarctic ice sheet. It will provide scientists insight into the climate change implications of current rising global CO2 levels.

In a paper published today in Nature, Matthew Huber of the UNH Institute for the Study of Earth, Oceans, and Space and department of Earth sciences provides evidence that the long-held, prevailing theory known as "Southern Ocean gateway opening" is not the best explanation for the climate shift that occurred during the Eocene-Oligocene transition when Earth's polar regions were ice-free.

"The Eocene-Oligocene transition was a major event in the history of the planet and our results really flip the whole story on its head," says Huber. "The textbook version has been that gateway opening, in which Australia pulled away from Antarctica, isolated the polar continent from warm tropical currents, and changed temperature gradients and circulation patterns in the ocean around Antarctica, which in turn began to generate the ice sheet. We've shown that, instead, CO2-driven cooling initiated the ice sheet and that this altered ocean circulation."

Huber adds that the gateway theory has been supported by a specific, unique piece of evidence—a "fingerprint" gleaned from oxygen isotope records derived from deep-sea sediments. These sedimentary records have been used to map out gradient changes associated with ocean circulation shifts that were thought to bear the imprint of changes in ocean gateways.

Although declining atmospheric levels of CO2 has been the other main hypothesis used to explain the Eocene-Oligocene transition, previous modeling efforts were unsuccessful at bearing this out because the CO2 drawdown does not by itself match the isotopic fingerprint. It occurred to Huber's team that the fingerprint might not be so unique and that it might also have been caused indirectly from CO2 drawdown through feedbacks between the growing Antarctic ice sheet and the ocean.

Says Huber, "One of the things we were always missing with our CO2 studies, and it had been missing in everybody's work, is if conditions are such to make an ice sheet form, perhaps the ice sheet itself is affecting ocean currents and the climate system—that once you start getting an ice sheet to form, maybe it becomes a really active part of the climate system and not just a passive player."

For their study, Huber and colleagues used brute force to generate results: they simply modeled the Eocene-Oligocene world as if it contained an Antarctic ice sheet of near-modern size and shape and explored the results within the same kind of coupled ocean-atmosphere model used to project future climate change and across a range of CO2 values that are likely to occur in the next 100 years (560 to 1200 parts per million).

"It should be clear that resolving these two very different conceptual models for what caused this huge transformation of the Earth's surface is really important because today as a global society we are, as I refer to it, dialing up the big red knob of carbon dioxide but we're not moving continents around."

Just what caused the sharp drawdown of CO2 is unknown, but Huber points out that having now resolved whether gateway opening or CO2 decline initiated glaciation, more pointed scientific inquiry can be focused on answering that question.

Huber notes that despite his team's finding, the gateway opening theory won't now be shelved, for that massive continental reorganization may have contributed to the CO2 drawdown by changing ocean circulation patterns that created huge upwellings of nutrient-rich waters containing plankton that, upon dying and sinking, took vast loads of carbon with them to the bottom of the sea.

The article is available to download here:
http://www.nature.com/nature/journal/v511/n7511/full/nature13597.html.
The National Science Foundation provided funding for the project and the computing was carried out using clusters at Purdue University's Rosen Center for Advanced Computing.

http://www.eurekalert.org/pub_releases/2014-07/whf-csp072814.php

CT scans provide evidence of atherosclerosis in wide range of ancient populations

Although atherosclerosis is widely thought to be a disease of modern times, computed tomographic (CT) evidence of atherosclerosis has been found in the bodies of a large number of mummies.

In a paper published in Global Heart (the journal of the World Heart Federation) the authors review the findings of atherosclerotic calcifications in the remains of ancient people—humans who lived across a very wide span of human history and over most of the inhabited globe. The paper is by Dr Randall Thompson, Saint Luke's Mid-America Heart Institute, University of Missouri-Kansas City, MO, USA, and Professor Jagat Narula, Editor-in-Chief of Global Heart and Associate Dean for Global Health at Icahn School of Medicine at Mount Sinai, New York, USA, and colleagues.

The paper discusses a range of ancient peoples, including mummies from ancient Egypt, ancient Peru, and from the Aleutian Islands, continental North America, east Asia, and Europe, including the much studied 'Iceman'. The authors state: "These people had a wide range of diets and lifestyles and traditional modern risk factors do not thoroughly explain the presence and easy detectability of this disease. Non-traditional risk factors such as the inhalation of cooking fire smoke and chronic infection or inflammation might have been important factors contributing to atherosclerosis in ancient times. Study of the genetic and environmental risk factors for atherosclerosis in ancient people may offer insights into this common modern disease."

The authors note that: "Many people are surprised when they learn that ancient people had atherosclerosis. There is such a large (and appropriate) public health effort to educate citizens about healthy cardiovascular lifestyle choices that many seem to conclude that the condition must be completely avoidable and completely caused by our unhealthy modern diet and factors such as cigarette smoking, trans-fats, and inactivity."

They explain that, although atherosclerosis is widely thought to be a disease caused by modern lifestyles, CT evidence of atherosclerosis has been found in the bodies of a substantial number of mummies from various locations. Atherosclerotic calcifications, which appear virtually identical to CT findings in modern patients, have been detected in all major arteries in ancient mummies.

The authors conclude: "These people had a wide range of diets and lifestyles, and traditional modern risk factors do not thoroughly explain the presence and easy detection of this disease. We have hypothesised that non-traditional risk factors such as the inhalation of cooking fire smoke and chronic infection or inflammation might have been important factors contributing to atherosclerosis in ancient times. Further study of the genetic and environmental risk factors for atherosclerosis in ancient people may offer insights into this common modern disease."

http://www.eurekalert.org/pub_releases/2014-07/uoc--tfg072514.php

Tidal forces gave moon its shape, according to new analysis

The shape of the moon deviates from a simple sphere in ways that scientists have struggled to explain.

A new study by researchers at UC Santa Cruz shows that most of the moon's overall shape can be explained by taking into account tidal effects acting early in the moon's history.

The results, published July 30 in Nature, provide insights into the moon's early history, its orbital evolution, and its current orientation in the sky, according to lead author Ian Garrick-Bethell, assistant professor of Earth and planetary sciences at UC Santa Cruz.

As the moon cooled and solidified more than 4 billion years ago, the sculpting effects of tidal and rotational forces became frozen in place. The idea of a frozen tidal-rotational bulge, known as the "fossil bulge" hypothesis, was first described in 1898. "If you imagine spinning a water balloon, it will start to flatten at the poles and bulge at the equator," Garrick-Bethell explained. "On top of that you have tides due to the gravitational pull of the Earth, and that creates sort of a lemon shape with the long axis of the lemon pointing at the Earth."

But this fossil bulge process cannot fully account for the current shape of the moon. In the new paper, Garrick-Bethell and his coauthors incorporated other tidal effects into their analysis. They also took into account the large impact basins that have shaped the moon's topography, and they considered the moon's gravity field together with its topography.

Efforts to analyze the moon's overall shape are complicated by the large basins and craters created by powerful impacts that deformed the lunar crust and ejected large amounts of material. "When we try to analyze the global shape of the moon using spherical harmonics, the craters are like gaps in the data," Garrick-Bethell said. "We did a lot of work to estimate the uncertainties in the analysis that result from those gaps."

Their results indicate that variations in the thickness of the moon's crust caused by tidal heating during its formation can account for most of the moon's large-scale topography, while the remainder is consistent with a frozen tidal-rotational bulge that formed later.

A previous paper by Garrick-Bethell and some of the same coauthors described the effects of tidal stretching and heating of the moon's crust at a time 4.4 billion years ago when the solid outer crust still floated on an ocean of molten rock. Tidal heating would have caused the crust to be thinner at the poles, while the thickest crust would have formed in the regions in line with the Earth. Published in Science in 2010, the earlier study found that the shape of one area of unusual topography on the moon, the lunar farside highlands, was consistent with the effects of tidal heating during the formation of the crust.

"In 2010, we found one area that fits the tidal heating effect, but that study left open the rest of the moon and didn't include the tidal-rotational deformation. In this paper we tried to bring all those considerations together," Garrick-Bethell said.

Tidal heating and tidal-rotational deformation had similar effects on the moon's overall shape, giving it a slight lemon shape with a bulge on the side facing the Earth and another bulge on the opposite side. The two processes left distinct signatures, however, in the moon's gravity field. Because the crust is lighter than

the underlying mantle, gravity signals reveal variations in the thickness of the crust that were caused by tidal heating.

Interestingly, the researchers found that the moon's overall gravity field is no longer aligned with the topography, as it would have been when the tidal bulges were frozen into the moon's shape. The principal axis of the moon's overall shape (the long axis of the lemon) is now separated from the gravity principal axis by about 34 degrees. (Excluding the large basins from the data, the difference is still about 30 degrees.)

"The moon that faced us a long time ago has shifted, so we're no longer looking at the primordial face of the moon," Garrick-Bethell said. "Changes in the mass distribution shifted the orientation of the moon. The craters removed some mass, and there were also internal changes, probably related to when the moon became volcanically active."

The details and timing of these processes are still uncertain. But Garrick-Bethell said the new analysis should help efforts to work out the details of the moon's early history. While the new study shows that tidal effects can account for the overall shape of the moon, tidal processes don't explain the topographical differences between the near side and the far side.

In addition to Garrick-Bethell, the coauthors of the paper include Viranga Perera, who worked on the study as a UCSC graduate student and is now at Arizona State University; Francis Nimmo, professor of Earth and planetary sciences at UCSC; and Maria Zuber, a planetary scientist at the Massachusetts Institute of Technology. This work was funded by the Ministry of Education of Korea through the National Research Foundation.

http://www.eurekalert.org/pub_releases/2014-07/nrao-ybs072914.php

Young binary star system may form planets with weird and wild orbits

Unlike our solitary Sun, most stars form in binary pairs -- two stars that orbit a common center of mass.

Though remarkably plentiful, binaries pose a number of questions, including how and where planets form in such complex environments.

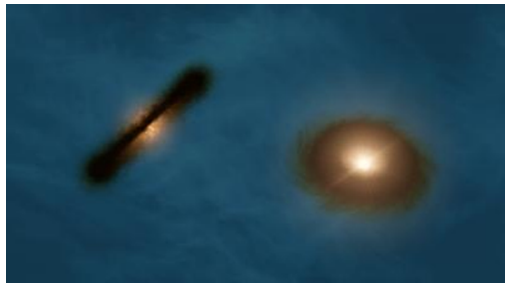
While surveying a series of binary stars with the Atacama Large Millimeter/submillimeter Array (ALMA), astronomers uncovered a striking pair of wildly misaligned planet-forming disks in the young binary star system HK Tau. These results provide the clearest picture ever of protoplanetary disks around a double star and could reveal important details about the birth and eventual orbit of planets in a multiple star system.

"ALMA has given us an unprecedented view of a main star and its binary companion sporting mutually misaligned protoplanetary disks," said Eric Jensen, an astronomer at Swarthmore College in Pennsylvania. "In fact, we may be seeing the formation of a solar system that may never settle down."

The two stars in this system, which is located approximately 450 light-years from Earth in the constellation Taurus, are less than 5 million years old and separated by about 58 billion kilometers, or 13 times the distance of Neptune from the Sun. This system's companion star, dubbed HK Tau B, appears fainter to astronomers on Earth because its disk of dust and gas blocks out much of the starlight. The disk itself, however, can be easily observed by the starlight that it scatters at optical and near-infrared wavelengths.

The disk around the main star, HK Tau A, is tilted in such a way that the light from its host star shines through unobscured, making it difficult for astronomers to see the disk optically. This is not a problem for ALMA, however, which can readily detect the millimeter-wavelength light emitted by the dust and gas that comprise the disk.

With its unprecedented resolution and sensitivity, ALMA was able to fully resolve the rotation of HK Tau A's disk for the first time. This clearer picture enabled the astronomers to calculate that the disks were misaligned – meaning they were out of sync with the orbit of their host stars -- by as much as 60 degrees or more.



This is an artist's impression of the misaligned protoplanetary disks around the binary stars in HK Tau. **R. Hurt (NASA/JPL-Caltech/IPAC)**

"This clear misalignment has given us a remarkable look at a young binary star system," said Rachel Akeson of the NASA Exoplanet Science Institute at the California Institute of Technology in Pasadena, California. "Though there have been hints before that this type of misaligned system exists, this is the cleanest and most striking example."

Stars and planets form out of vast clouds of dust and gas. As material in these clouds contracts under gravity, it begins to rotate until most of the dust and gas falls into a flattened protoplanetary disk swirling around a growing central protostar. Despite forming from a flat, regular disk, planets can end up in highly eccentric orbits, and may be misaligned with the star's equator. One theory for how planets can migrate to these unusual orbits is that a binary companion star can influence them — but only if its orbit is initially misaligned with the planets.

"Our results demonstrate that the necessary conditions exist to modify planetary orbits and that these conditions are present at the time of planet formation,

apparently due to the binary formation process," noted Jensen. "We can't rule other theories out, but we can certainly rule in that a second star will do the job."
Since ALMA can see the otherwise invisible dust and gas of protoplanetary disks, it allowed for never-before-seen views of this young binary system. "Because we're seeing this in the early stages of formation with the protoplanetary disks still in place, we can see better how things are oriented," noted Akeson. "You can simply see gas better than you can see planets."
Looking forward, the researchers want to determine if this type of system is typical or not. They note that this is a remarkable individual case, but additional surveys are needed to determine if this sort of arrangement is common throughout our Galaxy.
The results will appear in the journal Nature on July 31, 2014.

http://bit.ly/1prA9gQ

Driverless cars could be on UK streets in six months

Vince Cable announced that the law is to be changed to allow driverless cars to ply Britain's roads by January 2015

- **18:08 30 July 2014 by Paul Marks**

Without a change in the law, driverless cars being tested on UK roads might need a guard walking ahead of them, the mayor of Milton Keynes told *New Scientist* in January. The idea has echoes of early 20th century, when men carried red flags ahead of the first cars.
But guards won't be necessary after all. The UK business secretary Vince Cable announced on 30 July that the law is to be changed to allow driverless cars, like those famously pioneered by Google, to ply Britain's roads by January 2015.
Cable told the Motor Industry Research Association in Nuneaton that the law "will be reviewed" soon to take account of two types of possible driverless car operations: one in which a qualified driver can take control of the car if necessary, and another scenario in which the car is always fully autonomous.
In addition, the government is asking UK cities to bid to be the first to host driverless car trials – and three successful municipalities will share a prize fund of £10 million to stage them. Each project will last between 18 and 36 months and will kick off in January.
Making self-driving cars street legal has been welcomed both by councillors and researchers in autonomous technology.
"It's a great step forward. There is finally a recognition by government that this is the 21st century and that cars are able to guide themselves," says John Bint, a councillor in Milton Keynes who has helped spearhead the city's plan to roll out two-person autonomous taxi "pods" in the city centre by 2017.
Meanwhile, at the University of Oxford's mobile robotics department, where much of the UK's driverless car research is centred, researcher Ingmar Posner says gaining the freedom to use the roads as a testbed is great news.
"It will be really helpful as we look at how autonomous vehicles could help to ease traffic congestion and deliver a safer and more pleasant driving experience," he says.
Oxford's work is sponsored in part by Japanese car-maker Nissan – and a driverless version of the company's Leaf electric car is thought to be in design there, alongside an autonomous military jeep. The Oxford team are also working on the laser and radar sensing technology for the Milton Keynes autonomous pods – small vehicles like the "Johnny Cabs" in the original *Total Recall* movie, without the android drivers. They are being built by the automotive engineering firm RDM Group in Coventry.
With Google steaming ahead with its autonomous vehicle programme – having already revealed an early passenger-friendly design for a driverless car – the UK has been lagging behind the US, where California, Nevada and Arizona already allow driverless operation, albeit with safety drivers at the ready. Google's cars have already completed more than 480,000 kilometres of tests.
The driverless roads initiative is the second, innovation-related joint announcement from the government's business and transport departments in as many weeks: on 15 July, they announced plans for a UK spaceport for space tourism operations which, like the driverless plan, is designed to seize early-mover advantage for UK high-tech firms as demand takes off.

http://www.eurekalert.org/pub_releases/2014-07/m-moa073114.php

Monoamine oxidase A: Biomarker for postpartum depression

Postpartum mood swings correlated with high monoamine oxidase A binding

Many women suffer from baby blues after giving birth. Some even develop full-blown postpartum depression in the weeks that follow. Monoamine oxidase A, an enzyme responsible for the breakdown of neurotransmitters like dopamine and serotonin, plays an important role in this condition. In comparison to healthy women, women who experience postpartum depression present strongly elevated levels of the enzyme in their brains. This was discovered by a Canadian-German research team including Julia Sacher from the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig. Their findings could help in the prevention of postpartum depression and in the development of new drugs for its treatment.
For most women, the birth of their baby is one of the most strenuous but also happiest days in their lives. However, joy and happiness are often followed by fatigue and exhaustion. The vast majority of women experience a temporary drop

in mood for a few days after birth. These symptoms of "baby blues" are not an illness; however, in some cases they can represent early signs of an imminent episode of depression: in 13 percent of mothers, the emotional turmoil experienced after childbirth leads to the development of a full-blown postpartum depression. Postpartum depression is harmful not only to the mother, but also to the baby. It is difficult to treat this condition effectively, as its precise neurobiological causes have remained unidentified to date.

The new study shows that postpartum depression is accompanied by strongly elevated monoamine oxidase A in the brain, particularly in the prefrontal cortex and in the anterior cingulate cortex. In women with postpartum depression, the values recorded were 21 percent higher than those of women who were not plagued by negative feelings after giving birth. Women who did not develop full-blown depression but found themselves crying more often than usual due to depressed mood, also presented moderately elevated values.

"Therefore, we should promote strategies that help to reduce monoamine oxidase A levels in the brain, and avoid everything that makes these values rise," explains Sacher. Such factors include heavy smoking, alcohol consumption and chronic stress, for example when the mother feels neglected and abandoned by her partner and family. "My ultimate goal is to provide women and their families with very concrete lifestyle recommendations that will enable them to prevent postpartum depression," explains the psychiatrist.

A new generation of long-established drugs could also play an important role in the treatment of postpartum depression in future. Up to now, depressed mothers are mainly given drugs that increase the concentration of serotonin in the brain. However, because monoamine oxidase A breaks down not only serotonin but also other monoamines like dopamine and noradrenaline, a treatment that directly targets monoamine oxidase A could have a higher success rate, particularly in very serious cases: this alternative is provided by selective and reversible monoamine-oxidase- A inhibitors. "The first monoamine oxidase inhibitors often had severe side effects, for example hypertensive crises, which necessitated adherence to a strict diet," explains Sacher. "However, the new selective and reversible drugs are better tolerated," she adds. In the next stage of this research involving clinical trials, the scientists intend to test the effectiveness of these reversible monoamine oxidase A inhibitors in the treatment of postpartum depression.

Because the measurement of this enzyme in the brain requires complex technology, it is not suitable for routine testing. Thus, the researchers are also looking for a peripheral marker of this enzyme that can be detected in saliva or blood.

Four years ago, Julia Sacher and her colleagues at the Centre for Addiction and Mental Health CAMH in Toronto already succeeded in showing that, in the first week postpartum, the concentration of the enzyme monoamine oxidase A in the brain is on average 40 percent higher than in women who had not recently given birth. "The monoamine oxidase A values behave in the opposite way to oestrogen levels. When oestrogen levels drop acutely after childbirth, the concentration of monoamine oxidase A rises. This drastic change also influences serotonin levels, known as the happiness hormone," explains Dr. Sacher. In most women, the values quickly return to normal. In others, they remain raised – and thereby promote the development of depression.

Original publication: Julia Sacher, P. Vivien Rekkas, Alan A. Wilson, Sylvain Houle, Leslie Romano, Jinous Hamidi, Pablo Rusjan, Ian Fan, Donna E. Stewart, Jeffrey H. Meyer
Relationship of Monoamine Oxidase A Distribution Volume to Postpartum Depression and Postpartum Crying
Neuropsychopharmacology, 30 July 2014 (doi: 10.1038/npp.2014.190)

http://www.eurekalert.org/pub_releases/2014-07/asfm-cdv073114.php

C. difficile vaccine proves safe, 100 percent effective in animal models

An experimental vaccine protected 100 percent of animal models against the highly infectious and virulent bacterium, Clostridium difficile, which causes an intestinal disease that kills approximately 30,000 Americans annually.

The research is published ahead of print in Infection and Immunity.

In the study, the vaccine protected the mice and non-human primates against the purified toxins produced by C. difficile, as well as from an orogastric spore infection, a laboratory model that mimics the human disease, after only two immunizations.

"Animals that received two immunizations did not get sick or show signs of C. difficile-associated disease," says corresponding author Michele Kutzler, of Drexel University College of Medicine, Philadelphia.

"While our research was conducted in animal models, the results are very translatable to the clinic," says Kutzler. "In some cases, patients who acquire C. difficile can develop serious complications including severe diarrhea, toxic megacolon, bowel perforation, multi-organ failure, and death. Once fully developed, our DNA vaccine could prevent the deadly effects of C. difficile infection when administered to hospital patients at risk of acquiring C. difficile."

The protection following just two immunizations is especially important since the time window in humans between colonization with C. difficile and the onset of disease symptoms can be a mere 10-14 days, says Kutzler.

The vaccine protects against the bacterial toxins by mustering anti-toxin neutralizing antibodies, says Kutzler.

The cost of fighting the half million C. difficile infections that occur annually in the US is estimated to be nearly $10 billion, most of which could be saved by a successful preventive vaccine, says Kutzler. Morbidity and mortality have risen over the last decade, likely due to increased prevalence of relapsing disease, and hypervirulent strains, she adds.

Treating the disease is especially difficult, as the bacterial spores persist in the hospital environment, where most infections occur. There is no standard, effective treatment for recurrent disease, but a small number of experimental fecal transplants for C. difficile have had a very high success rate, with no adverse reactions.

"Since our vaccine was safe, effective after only two immunizations, and performed exceptionally well, we feel that this success warrants further studies using human patients," says Kutzler.

The manuscript can be found online at http://bit.ly/asmtip0714j. The final version of the article is scheduled for the October 2014 issue of Infection and Immunity.

http://www.eurekalert.org/pub_releases/2014-07/asu-aas073114.php

Asteroid attacks significantly altered ancient Earth

Early Earth battered by giant asteroids, according to NASA research

TEMPE, Ariz. – New research shows that more than four billion years ago, the surface of Earth was heavily reprocessed – or mixed, buried and melted – as a result of giant asteroid impacts. A new terrestrial bombardment model based on existing lunar and terrestrial data sheds light on the role asteroid bombardments played in the geological evolution of the uppermost layers of the Hadean Earth (approximately 4 to 4.5 billion years ago). An international team of researchers published their findings in the July 31, 2014 issue of Nature.

"When we look at the present day, we have a very high fidelity timeline over the last about 500 million years of what's happened on Earth, and we have a pretty good understanding that plate tectonics and volcanism and all these kinds of processes have happened more or less the same way over the last couple of billion years," says Lindy Elkins-Tanton, director of the School of Earth and Space Exploration at Arizona State University.

But, in the very beginning of Earth's formation, the first 500 million years, there's a less well-known period which has typically been called the Hadean (meaning hell-like) because it was assumed that it was wildly hot and volcanic and everything was covered with magma – completely unlike the present day.

Terrestrial planet formation models indicate Earth went through a sequence of major growth phases: accretion of planetesimals and planetary embryos over many tens of millions of years; a giant impact that led to the formation of our Moon; and then the late bombardment, when giant asteroids, dwarfing the one that presumably killed the dinosaurs, periodically hit ancient Earth.

While researchers estimate accretion during late bombardment contributed less than one percent of Earth's present-day mass, giant asteroid impacts still had a profound effect on the geological evolution of early Earth. Prior to four billion years ago Earth was resurfaced over and over by voluminous impact-generated melt. Furthermore, large collisions as late as about four billion years ago, may have repeatedly boiled away existing oceans into steamy atmospheres. Despite heavy bombardment, the findings are compatible with the claim of liquid water on Earth's surface as early as about 4.3 billion years ago based on geochemical data.

A key part of Earth's mysterious infancy period that has not been well quantified in the past is the kind of impacts Earth was experiencing at the end of accretion. How big and how frequent were those incoming bombardments and what were their effects on the surface of the Earth? How much did they affect the ability of the now cooling crust to actually form plates and start to subduct and make plate tectonics? What kind of volcanism did it produce that was different from volcanoes today?"

"We are increasingly understanding both the similarities and the differences to present day Earth conditions and plate tectonics," says Elkins-Tanton. "And this study is a major step in that direction, trying to bridge that time from the last giant accretionary impact that largely completed the Earth and produced the Moon to the point where we have something like today's plate tectonics and habitable surface."

The new research reveals that asteroidal collisions not only severely altered the geology of the Hadean Earth, but likely played a major role in the subsequent evolution of life on Earth as well.

"Prior to approximately four billion years ago, no large region of Earth's surface could have survived untouched by impacts and their effects," says Simone Marchi, of NASA's Solar System Exploration Research Virtual Institute at the Southwest Research Institute. "The new picture of the Hadean Earth emerging from this work has important implications for its habitability."

Large impacts had particularly severe effects on existing ecosystems. Researchers found that on average, Hadean Earth could have been hit by one to four impactors that were more than 600 miles wide and capable of global sterilization, and by three to seven impactors more than 300 miles wide and capable of global ocean vaporization.

"During that time, the lag between major collisions was long enough to allow intervals of more clement conditions, at least on a local scale," said Marchi. "Any

life emerging during the Hadean eon likely needed to be resistant to high temperatures, and could have survived such a violent period in Earth's history by thriving in niches deep underground or in the ocean's crust."

http://www.eurekalert.org/pub_releases/2014-07/nu-grm073114.php

Groundbreaking research maps cultural history

New research from Northeastern University has mapped the intellectual migration network in North America and Europe over a 2,000-year span.

The team of network scientists used the birth and death locations of more than 150,000 intellectuals to map their mobility patterns in order to identify the major cultural centers on the two continents over two millennia.

In the new paper, to be published Friday in the journal Science, the researchers found how locations such as Rome, London, and Paris have emerged as cultural hubs as more intellectuals died in these cities than elsewhere—regardless of where they were born. Additionally, the findings reveal that the distance between the birth and death locations of notable individuals has not increased much over the span of eight centuries—a remarkable showcase of human mobility patterns—despite the fact that colonization and transportation improvements have increased long-distance travel.

"By tracking the migration of notable individuals for over two millennia, we could for the first time explore the boom and bust of the cultural centers of the world," said Albert-László Barabási, Robert Gray Dodge Professor of Network Science and director of Northeastern's Center for Complex Network Research. "The observed rapid changes offer a fascinating view of the transience of intellectual supremacy."

In their paper, Maximilian Schich, the lead author and former visiting research scientist in the center, Barabási, and their co-authors presented a variety of new findings. For example, despite the arts' dependence on money, the cultural hubs that attracted the most intellectuals were not necessarily economic hubs.

In addition, they found that by the 16th century, Europe appeared to be characterized by two radically different cultural regimes: a "winner-takes-all" regime with countries where an individual city attracts a substantial and constant flow of intellectuals (i.e.: Paris, France) and a "fit-gets-richer" regime with cities within a federal region (i.e.: Germany) competing with each other for their share of intellectuals, only being able to attract a fraction of that population in any given century.

The team also found that there is no such thing as an average cultural center or average attractiveness consistent among locations. In fact, they scale and fluctuate heavily over time due to a variety of factors.

For example, while intellectuals have always flocked to New York City in great numbers, it was an even bigger source of talent in the 1920s, being the birthplace of a significant portion of individuals in the data set.

Additionally, locations like Hollywood, the Alps, and the French Riviera, which have not produced a large number of notable figures, have become, at different points in history, major destinations for intellectuals, perhaps initially emerging for reasons such as the location's beauty or climate.

The research has not only uncovered fascinating aspects of intellectual migration over two millennia, it also broke new ground in terms of its data-driven approach to understanding cultural history. The team used data going back several centuries to quantify qualitative knowledge and consulted vast amounts of literature.

They relied on large data sets, including the curated General Artist Lexicon that consists exclusively of artists and includes more than 150,000 names and Freebase with roughly 120,000 individuals, 2,200 of whom are artists. Through this novel approach, they identified a clear set of geographical patterns that would not be recognized using traditional quantitative historical methods. The third data set, the Getty Union List of Artist Names, was used to validate the results of the other two.

"We're starting out to do something which is called cultural science where we're in a very similar trajectory as systems biology for example," said Schich, now an associate professor in arts and technology at the University of Texas at Dallas. "As data sets about birth and death locations grow, the approach will be able to reveal an even more complete picture of history. In the next five to 10 years, we'll have considerably larger amounts of data and then we can do more and better, address more questions."

In addition to Schich and Barabási, the research team includes Dirk Helbing, chair of Sociology, Modeling, and Simulation at ETH Zurich in Switzerland; Chaoming Song; Yong-Yeol Ahn; Mauro Martino; and Alexander Mirsky —several of whom worked on this project while still at Northeastern.

http://bit.ly/1qFZNxh

FDA Debates Secrecy Surrounding Experimental Drugs

Drug regulators are weighting the merits of disclosing preliminary results from experiments to justify a drug's federal approval and then monitor its safety

Jul 31, 2014 |By Heidi Ledford and Nature magazine

Despite a trend towards increased transparency in clinical-trial data, the US Food and Drug Administration (FDA) is asking whether there are times when participants and researchers should be kept in the dark. As pharmaceutical companies push for studies that first justify a drug’s approval, then monitor safety once it reaches the market, the agency fears that publicizing the early data could bias the final results.

In raising the matter, the FDA could energize the debate about a long-standing clinical conundrum, says Iain Chalmers, coordinator of the James Lind Initiative, a group based in Oxford, UK, that aims to improve clinical trials. "There hasn't been much discussion about this," he says. "There needs to be much more."

On August 11, the FDA will hold a public hearing in Silver Spring, Maryland, to discuss situations in which preliminary results from clinical trials should be kept confidential. The FDA is obliged to release a summary of the data that it uses to approve a drug. But the public rarely sees the data given to safety committees to decide whether a trial should continue. Even if those data are not definitive but lean one way or another, making them public may spook study participants or bias investigators towards a particular outcome, the agency fears.

Science over subjects

The practice of confidentiality has been debated by researchers and ethicists for some time, and FDA memos arguing in favor of withholding some interim data have not convinced everyone. Although the memos have pointed out many possible negative consequences for a trial if such data are divulged, they have ignored the ethical ramifications of keeping information from participants, says Michael Carome, director of the health-research group at Public Citizen, a non-profit consumer advocacy group in Washington DC. "The agency wants to get an answer to scientific questions," he says. "The question is: in order to get their wish, are they perhaps putting human subjects at risk?"

Changes to the drug-approval process have made that question trickier than ever. In the past, sponsors rarely submitted interim data to the FDA. But in 2007, researchers found signs that a popular diabetes drug may have been increasing deaths due to cardiovascular events such as heart attacks or strokes. As a result, the agency began to demand large, prolonged safety trials of some diabetes drugs (see 'Mum's the word'). Pharmaceutical companies are typically allowed to market those drugs once they have showed that it raises the risk of cardiovascular events by no more than 80% relative to the control group; then they are asked to do a post-approval study demonstrating that the drug boosts that risk by no more than 30%.

Increasingly, companies are petitioning to combine the two studies into one large trial, and use interim data to clear the first hurdle. One such case came to the FDA in 2011, when it evaluated alogliptin, a diabetes drug made by Takeda Pharmaceuticals in Osaka, Japan. Interim analyses of the drug's heart risks were conducted once 81 cardiovascular events had been seen in study participants, says William White, a specialist in preventive cardiology at the University of Connecticut School of Medicine in Farmington, who led the study. Those data showed that the drug did not greatly affect the rate of cardiovascular events, White says, but could have been misinterpreted to suggest that the drug actually lowered the risk.

Early release

Rather than releasing those data when it approved alogliptin in January 2013, the FDA simply announced that the findings showed that the trial was safe enough to proceed. In a March 2013 memo, Mary Parks, head of endocrinology products at the FDA's Center for Drug Evaluation and Research in Silver Spring, argued that the secrecy was necessary so that long-term safety data could be obtained in a timely fashion.

White, who says that even he did not see the data until the study was finished, says that secrecy was key to successful completion of the trial because investigators might have refused to put patients on placebo had they seen the interim data. The final results, published in October, confirmed that the drug had no significant effect on cardiovascular risk (W. B. White et al.N. Engl. J. Med. 369, 1327–1335; 2013).

The release of interim results might also prompt patients to abandon a trial, but that should be their choice, says Richard Lilford, chair of public health at the University of Warwick, UK. He argues that trial designers too often default to secrecy, and risk sacrificing their obligation to participants in the process. Instead, he advocates that the data be shared from the start. "Among the trial fraternity, this idea is terribly unpopular," he says. "They think that clinical trials must run until they've got a clear answer."

Paul Armstrong, a cardiologist at the University of Alberta in Canada, has served on more than 30 safety boards and says that it is standard to keep interim data confidential. But sometimes, he says, boards do decide that the benefits of revealing the data outweigh the risks. "We always ask ourselves, 'could we go and get consent for the next patient and feel confident they were adequately informed about participating in the trial?'. That is the bottom line."

http://bit.ly/WVrSZo

Dinosaurs shrank for 50 million years to become birds

It took 50 million years of continual shrinking to turn massive, lumbering dinosaurs into the first small flying birds.

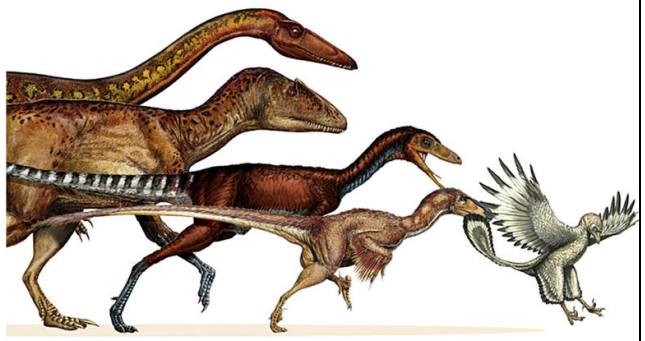
- **19:00 31 July 2014 by Andy Coghlan**

"No other dinosaur group has undergone such a long and extended period of miniaturisation," says Mike Lee of the South Australian Museum in Adelaide. "Statistically this trend was far stronger than by chance, analogous to flipping a coin a dozen times and getting all heads."

Lee and his colleagues have performed the most comprehensive analysis yet of fossil theropods, the two-footed meat-eating dinosaurs, like *Velociraptor*, from

which birds evolved. They have charted how 224-million-year-old dinosaurs weighing 238 kilograms evolved into proto-birds, including *Archaeopteryx*, that weighed just 0.8 kg.

The analysis reveals that the ancestors of birds shrank without interruption. "What was impressive was the consistency of the size change along the dinosaur-to-bird transition, with every descendant smaller than its ancestor," says Lee. Getting smaller must have offered advantages at every turn.



From left to right: a neotheropod, a tetanuran, a coelurosaur, a paravian and Archaeopteryx **Davide Bonnadonna**

Incredible shrinking raptor

Lee tracked how 1549 skeletal features changed in 120 species of theropod from all over the world, spanning the 50-million-year period over which theropods evolved into *Archaeopteryx* and modern birds. He identified 12 major evolutionary steps when groups of theropods split to form new kinds of dinosaur. At each of these break points, the theropods that ended up as birds shrank. They also changed four times as fast as other theropods that did not become birds.

"This study provides compelling evidence that the iconic small size of birds results from a chance but sustained pattern of selection for smaller body size spanning millions of years," says Gregory Erickson of Florida State University in Tallahassee.

Good to be small

Lee says each wave of shrinkage added survival traits we now see in birds. "The gradual evolution of smaller and smaller body size would have allowed the bird predecessors to explore novel niches and body plans off limits to their larger relatives," he says. "It would have permitted them to chase insects, climb trees, leap and glide, and eventually develop powered flight."

One crucial change happened in theropods called Tetanurae, which include famous predators like *Allosaurus*. They evolved an obliquely angled thigh bone. This shifted their centre of gravity forward, pushing their bodies into a tilted posture like that of modern birds and ensuring that their wings were near the centre of gravity. "It paves the way for flight, and would not have been possible at a larger body size," says Lee.

While their bodies got smaller, theropods' skulls stayed relatively large. That meant they could carry larger brains relative to their body size. Smaller dinosaurs were also more likely than large ones to develop insulating feathers, enabling them to hunt at night.

"Size reduction, whatever processes drove it, certainly seems to have allowed the bird lineage to fill niches that small-bodied animals can, and to undergo a fairly extensive radiation into these," says Bhart-Anjan Bhullar of Yale University.

Their small size may also have helped birds survive the mass extinction that wiped out all the other dinosaurs 65 million years ago, says Bhullar. "We have mounting evidence that the end-Cretaceous extinction simply took out all landlocked animals above a certain size, say a few kilograms," he says. "Birds happened to be among those dinosaurs that were small, and were lucky to boot."

Journal reference: Science, DOI: 10.1126/science.1252243

http://nyti.ms/1sjHyjh

Having More Than One Set of DNA Carries Legacy of Risk

The family seemed to defy the rules of genetics.

Carl Zimmer

When Meriel M. McEntagart, a geneticist at St. George's University of London, met the family in May 2012, she suspected that three of the children had a rare genetic disorder called Smith-Magenis syndrome. They had many of the symptoms of the disease, such as trouble sleeping through the night. Dr. McEntagart confirmed that diagnosis with a genetic test. The children were all missing an identical chunk of a gene known as RAI1.

One of the children had a different father from the other two, and so the mother could be the only source of their altered gene. But when Dr. McEntagart ran a standard blood test on the mother, the results were not nearly so straightforward: The woman had a normal version of RAI1. Dr. McEntagart and her colleagues suspected that the answer to this puzzle was that the mother was a genetic mosaic.

We tend to think of ourselves as having just one set of genetic material, which exists in identical form in every one of our cells. But sometimes, people have two or more significantly different genomes. As our cells divide, some may go through a major mutation. So some individuals end up with groups of cells that have very different DNA from the rest of them.

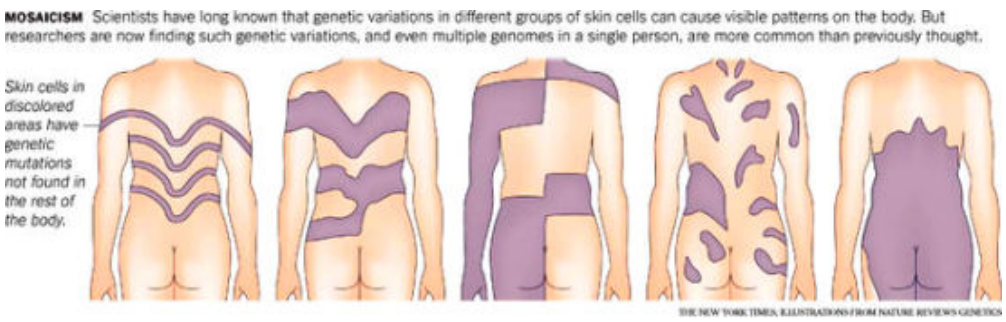
Dr. McEntagart said that she suspected that the mother she encountered had a normal version of RAI1 in some cells but an altered version in other cells, including her eggs. "We wanted to understand if there was a way to demonstrate that she was a mosaic," Dr. McEntagart said.

Dr. McEntagart got wind that researchers at Baylor College of Medicine in Houston were developing new methods for pinpointing mosaics, and they

confirmed that the mother was indeed a mosaic. Some of her cells carried the Smith-Magenis syndrome mutation.

Scientists have known about mosaicism for decades, but they've studied it mostly on a case-by-case basis. As a result, it has been hard to tell if the kind of mosaicism Dr. McEntagart encountered was a fluke, or if it was common enough to be medically important.

In a study released Thursday in the American Journal of Human Genetics, the Baylor team and its colleagues describe the biggest search for cases in which



mosaic parents passed down disease-causing mutations to their children. It turns out to be far from a fluke. "This happens a surprising amount of the time," said Chad A. Shaw, a co-author of the new study.

Michael Snyder, a geneticist at Stanford University who was not involved in the study, said it showed that mosaicism could have a significant effect on not just people's own health, but on their children as well.

"We will have to be on the lookout for these types of events," he said.

In order to solve the Smith-Magenis mystery, Dr. Shaw and his colleagues had to create a sensitive test that could distinguish between normal blood cells and cells with the altered RAI1 gene.

First, they examined the DNA of the three children and determined the precise sequence of the DNA surrounding the missing chunk of the RAI1 gene. Then they could look for the same sequence in the mother's blood cells.

The majority of the mother's blood cells had intact copies of the RAI1 gene, the scientists found. But 25 percent of the cells lacked the same piece that was missing from the children's genes.

The scientists argue that there's only way to explain these strange results: The mother became a mosaic when she was a tiny clump of embryonic cells.

As the cells divided, one of them lost part of its RAI1 gene. It then passed down the mutation to subsequent generations of cells. Only later did the embryo change from identical cells into different tissues. As a result, the line of cells with the defective RAI1 gene gave rise to some of the mother's eggs, some of her blood and perhaps some of her other tissues as well.

Having developed this method for detecting mosaic parents, the scientists decided to conduct a larger study to see how common mosaicism is. They began searching for families that would be willing to participate. Each family had to have a child that had a genetic disorder caused by the deletion of some DNA. And they had to have taken a standard genetic test that had failed to find the deletion in either parent's genes.

Eventually, the scientists were able to study 100 families. They searched for cases in which the parents were mosaics and had the same mutation as their children.

"We thought going into this study we'd find maybe one or two if we were lucky," said Ian M. Campbell, the lead author of the study. "And then we found four."

Mr. Campbell and his colleagues were surprised to find that many mosaic parents. And they suspect that the true number of mosaics among the 100 families was even higher. For one thing, their method lets them detect only genetic deletions, but other kinds of mutations can cause genetic disorders, too.

James R. Lupski, another co-author on the study, points to a second limitation of the study. "It only tells you what you see in the blood," he said. If the scientists could have examined muscle or other tissues, they might have found even more mosaic cells.

The results suggest that some people can have serious genetic diseases without any symptoms. That's because they have the defective version of a gene in only some of their cells, and their other cells compensate for them.

But such people are unknowingly at risk of having children with full-blown versions of their diseases, if the mutation appears in their reproductive cells. Dr. Lupski said that as technology improved, clinical geneticists should test people for this hidden risk. "Couples are going to want some answers," he said.

http://bit.ly/1p3CyiT

NASA announces the instruments for the next Mars rover

Sample return, organic chemical search, and future human habitation feature.

by John Timmer - Aug 1 2014, 7:45am TST

When NASA announced its plans for future explorations of Mars, there was a sense of disappointment in some quarters, since it featured a rover much like Curiosity. But NASA made clear that it was only using the proven technology of the vehicle itself; the instruments it carried would be all new and shaped by both the advancement of technology and the experience of past missions.

Today NASA announced exactly what instruments the mission—currently called Mars 2020—will carry. They included hardware capable of making a more directed search for organic chemicals on the red planet, which could be evidence

that life existed there in the past. And it will also carry an experiment designed to test our ability to produce oxygen for future manned explorations of Mars. The rover will also gather and cache samples to be picked up and returned to Earth by a future mission.

NASA had received nearly 60 proposals for instruments to fly on the Mars 2020 mission. From that list, it has selected seven, which it expects will cost a total of roughly $130 million to develop and build. Once again, the rover will be equipped with a mastcam (Mastcam-Z in this iteration) that includes panoramic and stereo imaging. The rover will also carry an instrument to track the wind, temperature, and the properties of Mars' persistent dust.

There are two instruments that have the potential to pick up indications that Mars once hosted life. One is a camera dedicated to studying minerals (SuperCam), which will also be able to detect organic chemicals. That will be joined by Scanning Habitable Environments with Raman & Luminescence for Organics and Chemicals (SHERLOC), which can study the composition of samples using a UV-laser and detect organic compounds. An X-ray fluorescence spectrometer called PIXL (Planetary Instrument for X-ray Lithochemistry) will provide another way of assessing the chemicals on the surface of Martian rocks.

If past life is a major focus of Mars 2020, future life also gets a slot on the rover. An experiment called MOXIE will attempt to split carbon dioxide, the most abundant gas in Mars' atmosphere, which could provide a local source of oxygen for future manned missions.

I've saved the instrument that seems most intriguing to me for last: the Radar Imager for Mars' Subsurface Exploration, which will provide maps of the subsurface of Mars with resolution down to a centimeter. There have been plenty of indications of subsurface ices and even possible water flows near some of Mars' craters. Getting a better sense of what's down there could provide a much clearer picture of what niches might be able to support an ecosystem on the current planet.

The sample return portion of the mission will involve a drill for core samples of rocks and a container that can hold 31 of them. To understand the requirements beyond the basic outline, NASA will probably first have to design the hardware for the return trip. After many years of talk, it's nice to know that the Mars sample return has become a priority.

One other noteworthy aspect of announcement is the number of countries involved with the Mars 2020 mission. Of the seven instrument packages, three will come from France, Norway, and Spain. The rover will also be able to use the European Space Agency's ExoMars orbiter (scheduled for later this decade) as a data relay and will be sharing the red planet's surface with an ESA rover.

http://www.eurekalert.org/pub_releases/2014-08/wuso-sro073114.php

Study reveals one reason brain tumors are more common in men

New research at Washington University School of Medicine in St. Louis helps explain why brain tumors occur more often in males and frequently are more harmful than similar tumors in females.

For example, glioblastomas, the most common malignant brain tumors, are diagnosed twice as often in males, who suffer greater cognitive impairments than females and do not survive as long.

The researchers found that retinoblastoma protein (RB), a protein known to reduce cancer risk, is significantly less active in male brain cells than in female brain cells.

The study appears Aug. 1 in The Journal of Clinical Investigation.

"This is the first time anyone ever has identified a sex-linked difference that affects tumor risk and is intrinsic to cells, and that's very exciting," said senior author Joshua Rubin, MD, PhD. "These results suggest we need to go back and look at multiple pathways linked to cancer, checking for sex differences. Sex-based distinctions at the level of the cell may not only influence cancer risk but also the effectiveness of treatments."

Rubin noted that RB is the target of drugs now being evaluated in clinical trials. Trial organizers hope the drugs trigger the protein's anti-tumor effects and help cancer patients survive longer.

"In clinical trials, we typically examine data from male and female patients together, and that could be masking positive or negative responses that are limited to one sex," said Rubin, who is an associate professor of pediatrics, neurology and anatomy and neurobiology. "At the very least, we should think about analyzing data for males and females separately in clinical trials."

Scientists have identified many sex-linked diseases that either occur at different rates in males and females or cause different symptoms based on sex. These distinctions often are linked to sex hormones, which create and maintain many but not all of the biological differences between the sexes.

However, Rubin and his colleagues knew that sex hormones could not account for the differences in brain tumor risk.

"Male brain tumor risk remains higher throughout life despite major age-linked shifts in sex hormone production in males and females," he said. "If the sex hormones were causing this effect, we'd see major changes in the relative rates of brain tumors in males and females at puberty. But they don't happen then or later in life when menopause changes female sex hormone production."

Rubin used a cell model of glioblastoma to prove it is easier to make male brain cells become tumors. After a series of genetic alterations and exposure to a growth

factor, male brain cells became cancerous faster and more often than female brain cells.

In experiments designed to identify the reasons for the differences in the male and female cells, the team evaluated three genes to see if they were naturally less active in male brain cells. The genes they studied - neurofibromin, p53 and RB - normally suppress cell division and cell survival. They are mutated and disabled in many cancers.

The scientists found RB was more likely to be inactivated in male brain cells than in female brain cells. When they disabled the RB protein in female brain cells, the cells were equally susceptible to becoming cancers.

"There are other types of tumors that occur at different rates based on sex, such as some liver cancers, which occur more often in males," Rubin said. "Knowing more about why cancer rates differ between males and females will help us understand basic mechanisms in cancer, seek more effective therapies and perform more informative clinical trials."

This work was supported by the National Institutes of Health (NIH) (R01 CA136573) and the Children's Tumor Foundation Young Investigator Award.

Sun T, Warrington NM, Luo J, Brooks M, Dahiya S, Snyder SC, Sengupta R, Rubin JB. Sexually dimorphic RB inactivation underlies mesenchymal glioblastoma prevalence in males. The Journal of Clinical Investigation, online Aug. 1, 2014.

http://www.eurekalert.org/pub_releases/2014-08/du-sbw080114.php

Society bloomed with gentler personalities and more feminine faces

Technology boom 50,000 years ago correlated with apparent reduction in testosterone

DURHAM, N.C. -- Modern humans appear in the fossil record about 200,000 years ago, but it was only about 50,000 years ago that making art and advanced tools became widespread. A new study appearing Aug. 1 in the journal Current Anthropology finds that human skulls changed in ways that indicate a lowering of testosterone levels at around the same time that culture was blossoming.

"The modern human behaviors of technological innovation, making art and rapid cultural exchange probably came at the same time that we developed a more cooperative temperament," said lead author Robert Cieri, a biology graduate student at the University of Utah who began this work as a senior at Duke University.

The study, which is based on measurements of more than 1,400 ancient and modern skulls, makes the argument that human society advanced when people started being nicer to each other, which entails having a little less testosterone in action.

Heavy brows were out, rounder heads were in, and those changes can be traced directly to testosterone levels acting on the skeleton, according to Duke anthropologist Steven Churchill, who supervised Cieri's work on a senior honors thesis that grew to become this 24-page journal article three years later.

What they can't tell from the bones is whether these humans had less testosterone in circulation, or fewer receptors for the hormone.

The research team also included Duke animal cognition researchers Brian Hare and Jingzhi Tan, who say this argument is in line with what has been established in non-human species.

A composite image shows the facial differences between an ancient modern human with heavy brows and a large upper face and the more recent modern human who has rounder features and a much less prominent brow. The prominence of these features can be directly traced to the influence of the hormone testosterone. **Robert Cieri, University of Utah**

In a classic study of Siberian foxes, animals that were less wary and less aggressive toward humans took on a different, more juvenile appearance and behavior after several generations of selective breeding.

"If we're seeing a process that leads to these changes in other animals, it might help explain who we are and how we got to be this way," said Hare, who also studies differences between our closest ape relatives -- aggressive chimpanzees and mellow, free-loving bonobos.

Those two apes develop differently, Hare said, and they respond to social stress differently. Chimpanzee males experience a strong rise in testosterone during puberty, but bonobos do not. When stressed, the bonobos don't produce more testosterone, as chimps do, but they do produce more cortisol, the stress hormone. Their social interactions are profoundly different and, relevant to this finding, their faces are different, too. "It's very hard to find a brow-ridge in a bonobo," Hare said.

Cieri compared the brow ridge, facial shape and interior volume of 13 modern human skulls older than 80,000 years, 41 skulls from 10,000 to 38,000 years ago, and a global sample of 1,367 20th century skulls from 30 different ethnic populations.

The trend that emerged was toward a reduction in the brow ridge and a shortening of the upper face, traits which generally reflect a reduction in the action of testosterone.

There are a lot of theories about why, after 150,000 years of existence, humans suddenly leapt forward in technology. Around 50,000 years ago, there is widespread evidence of producing bone and antler tools, heat-treated and flaked flint, projectile weapons, grindstones, fishing and birding equipment and a command of fire. Was this driven by a brain mutation, cooked foods, the advent of language or just population density?

The Duke study argues that living together and cooperating put a premium on agreeableness and lowered aggression and that, in turn, led to changed faces and more cultural exchange.

"If prehistoric people began living closer together and passing down new technologies, they'd have to be tolerant of each other," Cieri said. "The key to our success is the ability to cooperate and get along and learn from one another."

This research was supported by the National Science Foundation (SBR-9312567), the Leakey Foundation and the University of Iowa Orthodontics Department.

CITATION: "Craniofacial Feminization, Social Tolerance and the Origins of Behavioral Modernity," Robert Cieri, Steven Churchill, Robert Franciscus, Jingzhi Tan and Brian Hare. Current Anthropology, Aug. 2014. DOI: 10.1086/677209

http://bit.ly/1oqlseu

A Superplume Is the Reason Africa Is Splitting Apart

Primordial gases confirm the cause of the East African Rift

Jul 15, 2014 |By Erin Biba

Africa is splitting in two. The reason: a geologic rift runs along the eastern side of the continent that one day, many millions of years in the future, will be replaced with an ocean. Scientists have argued for decades about what is causing this separation of tectonic plates. Geophysicists thought it was a superplume, a giant section of the earth's mantle that carries heat from near the core up to the crust. As evidence, they pointed to two large plateaus (one in Ethiopia and one in Kenya) that they said were created when a superplume pushed up the mantle.

Geochemists were not able to confirm that theory. Instead they thought there might be two small, unrelated plumes pushing up the plateaus individually. The theories did not align, says David Hilton, a geochemist at the Scripps Institution of Oceanography in La Jolla, Calif. “There was a mismatch between the chemistry and the physics.”

So in 2006 and 2011 Hilton headed to East Africa to see whether he could lay the argument to rest. He and his team decided to use gases emanating from the rift to determine how it was created. Donning gas masks, they hiked to the tops of volcanoes in Tanzania and Ethiopia and climbed into mazuku (the Swahili word for “evil wind”)—geothermal vents and depressions where deadly gases accumulate and often kill animals. At these locations, the team collected samples of rocks deposited during eruptions, including olivines, crystals that trap volcanic gases like a bottle.

Back home in California, Hilton crushed the rocks inside a vacuum to release their gases. He was looking for helium 3, an isotope of helium present when the planet was forming that was trapped in the earth's core. Hilton figured that if rocks around both the Ethiopian and Kenyan plateaus contained this primordial gas, that would at least confirm that underground mantle plumes created them. The readings showed that, indeed, both plateaus contained helium 3. But Hilton and his group still had to wonder: Was one superplume behind it all? Or were there a couple of lesser plumes?

To answer this question, they turned to another primordial gas trapped in the mantle: neon 22. They found that neon 22 existed in both plateaus and that the ratios of helium to neon in those locations matched, results published in April in Geophysical Research Letters. That meant that the plume underneath both plateaus was of the same material and of the same age. Hence, there was one common superplume. The geophysicists, it turns out, had been right all along.

“The ‘naysayers’ who claim that the rifting and plume activity are unconnected—and some who would even deny a mantle plume is present—no longer have a leg to stand on,” says Pete Burnard, a geochemist at the French National Center for Scientific Research, who was not involved in the latest work.

The African superplume will provide scientists with easier access to study the earth's inner workings (another lies underneath the Pacific Ocean). Hilton and his team are now measuring how much carbon the mantle in East Africa is releasing, how old it is and if it has been recycled from carbon originally captured on the surface billions of years ago. This information, Hilton says, will help geologists figure out how the earth's layers interact on a longer time scale, including the hundreds of millions of years it takes for continents to form—and split.

http://bit.ly/1zMtNNA

How close are we to having a drug to treat Ebola?

Ebola is continuing to kill people across West Africa, but there is still no cure.

- **18:38 31 July 2014 by Clare Wilson**

Available treatments only ease the symptoms of the disease. People with Ebola are given supportive care, such as intravenous fluids to combat the dehydration caused by bleeding, vomiting and diarrhoea.

Several potential drugs and vaccines are working their way through animal studies and clinical trials, but progress has been slow. On-the-ground trials are almost impossible to conduct, largely because outbreaks in Africa are sporadic and unpredictable. "It is difficult to do conventional clinical trials," says Thomas

Geisbert of the University of Texas Medical Branch at Galveston, who is developing vaccines and therapies.

Stopping replication

The only treatment to have reached human trials works through a technique called RNA interference. The approach uses RNA molecules – which can block DNA from making proteins – to stop the Ebola virus from replicating.

The drug, called TKM-Ebola, protected monkeys when it was given to them within 30 minutes of being injected with the virus. Safety studies in human volunteers have been paused, however, while the manufacturer gets more information to the US Food and Drug Administration about how the immune system responds to high doses.

Another approach is to inhibit a viral enzyme that is vital to the microbe's survival. A compound that seems to do this, called BCX4430, is currently being tested in animals infected with Ebola.

Even better would be a vaccine against the virus. Perhaps the most promising – also still in animal studies – are those made from a relatively harmless microbe called vesicular stomatitis virus (VSV). The VSV is genetically altered so that a protein on its surface is switched for one of Ebola's proteins. This tricks the body's immune system into thinking it has seen Ebola, and triggers the production of antibodies against the virus. The idea is that, if the immune system encounters the real virus later, it is primed and ready to attack it.

Vaccine as treatment

A vaccine could even be used as a treatment after someone is exposed to Ebola, in the same way that rabies vaccine is used therapeutically. That's because these viruses are incubated for several days before they cause symptoms, so there is time for the vaccine to kick in.

Indeed, in 2009, one of the VSV-based vaccines was given to a German researcher who accidentally pricked her finger with a needle carrying the virus. She survived the incident, but there is no way to know if the virus really entered her body.

Such a strategy would need the vaccine to be given as soon as possible after exposure. "If someone comes in with the full-blown symptoms of haemorrhagic virus, they don't have long, maybe 24 to 48 hours," says Geisbert.

Unfortunately, none of these treatment approaches are close enough to receiving regulatory approval – or even passing the first stage of human safety trials – to be used in Africa now. They may be ready for the next epidemic, though, says Geisbert.

http://bit.ly/1oldpuW

Largest Ever Ebola Outbreak Is Not a Global Threat

Although the virus is exerting a heavy toll in West Africa, it does not spread easily

Aug 2, 2014 |By Declan Butler and Nature magazine

Deadly Ebola probably touched down in Lagos, Nigeria, the largest city in Africa, on July 20. A man who was thought to be infected with the virus had arrived there on a flight from Liberia, where, along with Guinea and Sierra Leone, the largest recorded Ebola outbreak is currently raging. The Lagos case is the first to be internationally exported by air travel and today the UK foreign secretary announced that he would chair a government meeting on Ebola. As long as the virus continues to infect people in Liberia, Guinea and Sierra Leone, there is a small risk of more long-distance exports of the disease. But, as Nature's Declan Butler explains, Ebola does not pose a global threat.

Is it worrying that the virus reached the largest city of the most populous African country?

The World Health Organization still considers the Lagos case a "probable" infection because it has not yet confirmed that the 40-year-old Liberian man had Ebola. He was quarantined upon arrival at the airport and taken to hospital, where he died on July 25. Assuming he had Ebola, if proper control measures were taken at the airport and at the hospital, the risk that health-care workers or others will become infected as a result of contact with him is low.

The European Center for Disease Prevention and Control classifies people sharing public transport with someone infected as having a "very low" risk of catching the virus. Healthcare workers and doctors, several of whom have now been infected and died as a result of caring for people in the current outbreak, are at much higher risk and the WHO advises that they take strict precautions, which greatly lowers the risk.

What about the risk of air travellers exporting the virus to other cities?

The ECDC also says the probability of an infected person getting on a flight in the first place is low, given the small overall number of Ebola cases. Moreover, functional health systems should be able to prevent onward spread from any exported cases.

Overall, the World Health Organisation estimates that there is a high risk of spread to countries bordering those with existing outbreaks, a moderate risk to countries further afield in the sub-region, but that there is little chance of spread overseas. There is no reason to assume that an exported case — be it to Lagos, a city of 17 million people, or any other place — will spark new outbreaks, because Ebola is not highly contagious.

Wait, Ebola is hard to catch?

Though the strain of Ebola in the current outbreak appears to kill 56% of the people it infects, to become infected in the first place, a person's mucous membranes, or an area of broken skin, must come into contact with the bodily fluids of an infected person, such as blood, urine, saliva, semen or stools, or materials contaminated with these fluids such as soiled clothing or bed linen. By contrast, respiratory pathogens such as those that cause the common cold or flu are coughed and sneezed into the air and can be contracted just by breathing or touching contaminated surfaces, such as door knobs. A pandemic flu virus can spread around the world in days or weeks and may be unstoppable whereas Ebola only causes sporadic localized outbreaks that can usually be stamped out.

So why is the outbreak continuing in Guinea, Sierra Leone and Liberia?

In principle, it should be straightforward to bring an Ebola outbreak under control via public health measures alone, namely, identifying all people who have been infected and isolating them, monitoring all those that they have been in contact with for 21 days (the maximum incubation period), as well as promoting basic infection control measures. What's more, since people infected with Ebola do not infect others until they have symptoms, it is easier to trace their contacts than it is for some other diseases. Ebola is out of control in these countries because the sheer size of the outbreak is stretching response teams, and also because of local sociocultural factors.

What kind of sociocultural factors?

Local health authorities and international organisations such as WHO and Médecins Sans Frontières (also known as Doctors Without Borders) are struggling to control the spread in these areas because of a lack of trust and cooperation among the affected populations. Doctors and health workers have sometimes been blocked from accessing affected places because of opposition from villagers who fear the medics will bring the disease. According to the WHO, not all people who are infected are getting or seeking care, and so are passing the virus on to family and other close contacts. Another major driver of new infections is that families are often continuing to perform traditional burial rites that involve mourners having direct contact with the bodies of the dead – and unfortunately all too often Ebola.

Is the size of the outbreak unusual?

It is larger than any other outbreak in recorded history. The WHO reports that as of July 23, there were 814 lab-confirmed infections, including 456 deaths. If 'probable' and 'suspected' cases are included, these numbers rise to 1,201 infections, including 672 deaths — but some of these may have been caused by other diseases. Only 7 other of the few dozen past outbreaks have involved more than 100 cases, and before now, the largest outbreak was in Uganda between 2000 and 2001, in which 425 people were infected and 224 died.

Since Ebola first appeared in 1976, only 19 outbreaks have had more than 10 victims, and around 2,000 people in total have died from the disease. By comparison, malaria kills some 3,200 people a day, and diarrheal diseases some 4,000. Snakes and other venomous animals cause some 55,000 deaths a year — 27 times more than the entire number of people killed by Ebola in 38 years.

Are there any drugs or vaccines for Ebola?

There are no licensed drugs or vaccines for Ebola, although candidates are in development. New treatments would help reduce the high mortality rate of the disease – which has ranged in past outbreaks from 25% to 89%, with an average of around 62%. Jeremy Farrar, head of the UK Wellcome Trust in London, has argued for the use of experimental, unapproved drugs in the current outbreak. But other scientists have said that with distrust of health workers already hampering efforts to bring the outbreak under control, such measures could be counterproductive by creating suspicion and so further undermining trust.

What needs to be done to bring the outbreak under control?

Outreach, in particular involving local community leaders, will be vital to persuade people to trust health workers and to follow public-health advice. Authorities need to win over public trust, persuade people to bury their dead safely, and continue to step up local and regional efforts to trace and isolate people who are infected and their contacts.

http://nyti.ms/WVBvqU

Ebola Virus Is Outpacing Efforts to Control It, World Health Body Warns

Ebola is moving faster than efforts to curb it, with potentially catastrophic consequences

By ADAM NOSSITER and ALAN COWELL AUG. 1, 2014

ABUJA, Nigeria - In an ominous warning as fatalities mounted in West Africa from the worst known outbreak of the Ebola virus, the head of the World Health Organization said on Friday that the disease was moving faster than efforts to curb it, with potentially catastrophic consequences, including a "high risk" that it will spread.

The assessment was among the most dire since the outbreak was identified in March. The outbreak has been blamed for the deaths of 729 people, according to W.H.O. figures, and has left over 1,300 people with confirmed or suspected infections.

Dr. Margaret Chan, the W.H.O. director general, was speaking as she met with the leaders of the three most affected countries — Guinea, Liberia and Sierra Leone

— in Conakry, the Guinean capital, for the introduction of a $100 million plan to deploy hundreds more medical professionals in support of overstretched regional and international health workers.

"This meeting must mark a turning point in the outbreak response," Dr. Chan said, according to a W.H.O. transcript of her remarks. "If the situation continues to deteriorate, the consequences can be catastrophic in terms of lost lives but also severe socioeconomic disruption and a high risk of spread to other countries."

She said the outbreak was "caused by the most lethal strain in the family of Ebola viruses."

What you need to know about the Ebola outbreak

The gathering in Conakry came a day after West African leaders seemed to quicken the pace of efforts to combat the disease, in what some analysts depicted as a belated acknowledgment that the response so far had been inadequate.

Before the meeting started, there were indications of discord. The leader of Guinea's Ebola task force said that emergency measures in Liberia, where schools have been closed, and Sierra Leone could set back efforts to control the worst outbreak of the virus since it was identified almost four decades ago.

"Currently, some measures taken by our neighbors could make the fight against Ebola even harder," Aboubacar Sidiki Diakité, the Ebola task force leader, told Reuters. "When children are not supervised, they can go anywhere and make the problem worse. It is part of what we will be talking about."

Sierra Leone's emergency measures include house-to-house searches for infected people and the deployment of the army and the police.

One person, traveling from Liberia, died in Nigeria, Africa's most populous nation, which introduced airport screening of travelers from the stricken reg Thursday.

Dr. Chan said that the virus seemed to be spreading in ways never seen bef "It is taking place in areas with fluid population movements over porous bo and it has demonstrated its ability to spread via air travel," she said.

Making matters worse, health workers have been hit particularly hard. Top doctors in Sierra Leone and Liberia have died, and two American aid work have contracted Ebola and were due to be flown back to the United States f further treatment at Emory University in Atlanta.

The two Americans will be flown in a private air ambulance specially equip isolate patients with infectious diseases. The first patient is expected to arri soon as Saturday, an Emory spokeswoman said.

"We feel that we have the environment and expertise to safely care for thes patients and offer them the maximum opportunity for recovery from these infections," said Dr. Bruce S. Ribner, an infectious disease specialist at Em a news conference on Friday.

According to the W.H.O., the $100 million plan "identifies the need for sev hundred more personnel to be deployed in affected countries to supplement overstretched treatment facilities."

Hundreds of international aid workers and W.H.O. specialists "are already supporting national and regional response efforts," the statement said. "But are urgently required. Of greatest need are clinical doctors and nurses, epidemiologists, social mobilization experts, logisticians and data managers

As the alarm about the outbreak has grown, so, too, have concerns that the will be carried farther afield by travelers from the stricken countries, despit official efforts to tamp down such fears. The African Union, for instance, announced on Friday that it was postponing a routine rotation of its peacek force in Somalia for fear that new soldiers arriving from Sierra Leone coul infected.

The Philippines said Friday that it would screen travelers from Guinea, Sier Leone and Liberia when they arrived and monitor them for a month. Leban reported to have suspended work permits for residents of the same three co news reports said. Emirates, an airline based in Dubai, said it was suspendi flights to Conakry as of Saturday.

At the Commonwealth Games in Glasgow, Moses Sesay, a cyclist from Sie Leone, told the British tabloid The Daily Mirror that he had been quarantin four days and tested for Ebola after feeling ill. He has since been pronounce healthy.

"I was sick. I felt tired and listless," he said. "All the doctors were in special suits to treat me — they dressed like I had Ebola. I was very scared."

Jackie Brock-Doyle, a spokeswoman for the games, told reporters on Friday: "Just to be really clear, there is no Ebola in the athletes' village. There is no Ebola virus in Scotland."

Only weeks after the beginning of the outbreak, the Italian authorities tightened health checks at airports and on ships from West Africa. But epidemiologists in Italy suggested there was little risk that the hundreds of unauthorized migrants who reach southern Italy every day were carrying the virus.

"Migrants cross the desert in journeys that take weeks, if not months, before getting on a boat to Europe," Dr. Massimo Galli, a specialist in infectious diseases at the University of Milan, said in a telephone interview. "They would manifest the disease long before arriving."

Adam Nossiter reported from Abuja, and Alan Cowell from London. Gaia Pianigiani contributed reporting from Rome, Alan Blinder from Atlanta, and Denise Grady from New York.

http://www.bbc.com/news/health-28564607

The man who helped save 50 million lives

A solution of sugar, salts and water, many of which can be found in a kitchen cupboard, can be all it takes to save a child's life - and it has saved an estimated 50 million people.

By Lin Lin Ginzberg BBC Health Check

But finding the right balance was crucial - and Dr Norbert Hirschhorn played a key part. After two days suffering from diarrhoea the three-month-old Egyptian boy was too weak even to hold his head up to suckle at his mother's breast. Doctors feared the worst when he was brought to a rehydration centre in Alexandria: severe diarrhoea is a major killer in the developing world. But little more than four hours later he was well enough to resume breastfeeding - all thanks to a cheap solution of sugars and salts.

Dr Hirschhorn says the transformation oral rehydration therapy brings is incredible. "You come into a room and the child - or an adult - is near death. They have sunken eyes. they're breathing very rapidly - their skin and their fingernails are bluish - and in children the soft spot on the top of their head is sunken."

Seeing someone recover from such life-threatening illness is "like seeing Lazarus come back from the dead - a miracle," he says.

Quest for 'balance'

Dr Hirschhorn became involved in the research into oral rehydration therapy in 1964. He was on military service with the US Public Health Service - and was sent to Bangladesh, then known as East Pakistan, where there was a serious cholera outbreak. Cholera causes severe diarrhoea, and patients quickly lose too much water and, crucially, salts - and become extremely dehydrated and can go into shock - and can die in just a few hours.

In East Pakistan up to 40% of villagers with untreated cholera were dying. At the time rehydration treatment was given intravenously in hospital. It was expensive, and often unavailable to those who needed it most. So the aim was to find a way of giving the treatment orally - so that many more could be helped.

There had been previous attempts to find the right balance of sugar, salts and water to give in an oral treatment. Indeed, one of of the people Dr Hirschhorn was working with in East Pakistan - Captain Robert Phillips - had run his own unsuccessful trial some years earlier - in which several patients died. It meant he was very cautious about letting Dr Hirschhorn run his own research.

"He had tried the solution when he was was with the navy in Taiwan and the Philippines but he got the physiology wrong - it was too concentrated and it made things worse," says Dr Hirschhorn. He says Dr Phillips was a "military man who ran a tight ship", adding "he really had to trust you to let you do something as outlandish as this trial seemed at the time".

Precautions

"Phillips was very reluctant to let anybody try it again until I was able to show him what had gone wrong with his patients and to show him that if we used a solution that was comparable to blood concentrations of these elements, that we would be fine. "He would lock the documents up in his office, I had to gain his trust and all precautions had to be taken. "We had to sleep right alongside the patients; we had to have the emergency intravenous treatment ready to go."

Hirschhorn's work built on both what Dr Phillips had done, and the work of another colleague David Sachar. Sachar had shown that the body could still transport sodium when glucose was added - something key in fighting dehydration. Proportions were key - too much or too little of any of the ingredients and not only might the solution not work, but it could also cause severe harm.

Dr Hirschhorn said: "The proof of concept was that they would absorb the fluid and diminish the amount of diarrhoeal fluid coming out. "The proportions are crucial. In order to get the optimal absorption of water you need the same amount of glucose and sodium. "Moreover the proportions of electrolytes need to be close enough to the body's own fluid composition so that it can adjust and keep balance."

It was a small study, of just eight patients in which the rehydration therapy was given straight into the intestine using naso-gastric tubes - but it proved that specific combination worked.

Hospital - and home

However the introduction of the therapy wasn't simple, even then.

Dr Hirschhorn says there was disbelief something so simply could be so effective and outperform the carefully-dosed, hospital-administered IV therapy "Its simplicity was its own enemy. But it took a long time; it took a very long time to convince paediatricians that this was safe, to convince them that you could get out there and reach mothers, reach the community directly."

The Lancet has described oral rehydration therapy as "potentially the most important medical advance" of the 20th century with UNICEF adding that no other medical innovation of the century "has had the potential to prevent so many deaths over such a short period of time and at so little cost". Now the effectiveness is well known and it is used around the world administered by doctors in clinics as well as at home by parents of children.

But the World Health Organization (WHO) warns diarrhoeal disease is the second leading cause of death in children under five, and is responsible for killing around 760 000 children every year.

And what does it feel like to know that your efforts have led to over 50 million people being saved? He tells the story of a trip to Egypt, many years after his clinical work. Travelling in a cab he got chatting to the driver. It turned out the cab driver's own son was saved by oral rehydration when he was a child, and that he was now a young man pursuing his own scientific studies in the USA. "That exchange" says Hirschhorn, still visibly moved, "made as much of an impact on me as all the statistics".

http://www.eurekalert.org/pub_releases/2014-08/uow-sam080114.php

Self-assembling anti-cancer molecules created in minutes

Like a self-assembling 'Lego Death Star,' says lead researcher

Researchers have developed a simple and versatile method for making artificial anti-cancer molecules that mimic the properties of one of the body's natural defence systems.

The chemists, led by Professor Peter Scott at the University of Warwick, UK, have been able to produce molecules that have a similar structure to peptides which are naturally produced in the body to fight cancer and infection.

Published in Nature Chemistry, the molecules produced in the research have proved effective against colon cancer cells in laboratory tests, in collaboration with Roger Phillips at the Institute for Cancer Therapeutics, Bradford, UK.

Artificial peptides had previously been difficult and prohibitively expensive to manufacture in large quantities, but the new process takes only minutes and does not require costly equipment. Also, traditional peptides that are administered as drugs are quickly neutralised by the body's biochemical defences before they can do their job.

A form of complex chemical self-assembly, the new method developed at Warwick addresses these problems by being both practical and producing very stable molecules. The new peptide mimics, called triplexes, have a similar 3D helix form to natural peptides.

"The chemistry involved is like throwing Lego blocks into a bag, giving them a shake, and finding that you made a model of the Death Star" says Professor Scott. "The design to achieve that takes some thought and computing power, but once you've worked it out the method can be used to make a lot of complicated molecular objects."

Describing the self-assembly process behind the artificial peptides Professor Scott says: "When the organic chemicals involved, an amino alcohol derivative and a picoline, are mixed with iron chloride in a solvent, such as water or methanol, they form strong bonds and are designed to naturally fold together in minutes to form a helix. It's all thermodynamically downhill. The assembly instructions are encoded in the chemicals themselves."

"Once the solvent has been removed we are left with the peptide mimics in the form of crystals", says Professor Scott. "There are no complicated separations to do, and unlike a Lego model kit there are no mysterious bits left over. In practical terms, the chemistry is pretty conventional. The beauty is that these big molecules assemble themselves. Nature uses this kind of self-assembly to make complex asymmetric molecules like proteins all the time, but doing it artificially is a major challenge."

Whilst the peptide mimics created by the process have been successful in laboratory tests on colon cancer cells they will require further research before they can be used in clinical trials on patients. Nevertheless they are made of simple building blocks and in early tests the team have shown that they have very low toxicity to bacteria. "This is very unusual and promising selectivity," says Professor Scott.

http://phys.org/news/2014-08-comet-chaser-nears-prey-billions-miles.html

Comet-chaser nears prey after crossing billions of miles

After a decade-long quest spanning six billion kilometres (3.75 billion miles), a European probe will come face to face Wednesday with a comet, one of the Solar System's enigmatic wanderers.

The moment will mark a key phase of the most ambitious project ever undertaken by the European Space Agency (ESA) - a 1.3 billion euro ($1.76 billion) bid to get to know these timeless space rovers. More than 400 million km from where it

was launched in March 2004, the spacecraft Rosetta will finally meet up with its prey, Comet 67P/Churyumov-Gerasimenko.

To get there, Rosetta has had to make four flybys of Mars and Earth, using their gravitational force as a slingshot to build up speed, and then entering a 31-month hibernation as light from the distant Sun became too weak for its solar panels.

It was awakened in January. After braking manoeuvres, the three-tonne craft should on Wednesday be about 100 km from the comet—a navigational feat that, if all goes well, will be followed by glittering scientific rewards.

"It's taken more than 10 years to get here," said Sylvain Lodiot, spacecraft operations manager. "Now we have to learn how to dock with the comet, and stay with it for the months ahead."

Blazing across the sky as they loop around the Sun, comets have long been considered portents of wonderful or terrible events—the birth and death of kings, bountiful harvests or famines, floods or earthquakes. Astrophysicists, though, see them rather differently. Comets, they believe, are clusters of the oldest dust and ice in the Solar System—the rubble left from the formation of the planets 4.6 billion years ago. These so-called dirty snowballs could be the key to understanding how the planets coalesced after the Sun flared into life, say some. Indeed, one theory—the "pan-spermia" hypothesis—is that comets, by bombarding the fledgling Earth, helped kickstart life here by bringing water and organic molecules.

Until now, though, explorations of comets have been rare and mainly entailed flybys by probes on unrelated missions snatching pictures from thousands of kilometres away. Exceptions were the US probe Stardust, which brought home dust snatched from a comet's wake, while Europe's Giotto ventured to within 200 km of a comet's surface.

On November 11, the plan is for Rosetta to inch to within a few kilometres of the comet to send down a 100-kilogramme (220-pound) refrigerator-sized robot laboratory, Philae. Anchored to the surface, Philae will carry out experiments in cometary chemistry and texture for up to six months. After the lander expires, Rosetta will accompany "C-G" as it passes around the Sun and heads out towards the orbit of Jupiter.

'Duck' in space

Before November's landing, though, Rosetta's operators have a mountain of work to do. The first few weeks will be a get-to-know-you exercise, as the spacecraft gingerly carries out elongated loops around the comet, scanning its surface. The probe will have to avoid ice crystals and dust particles that are stripped from the comet's outer layers as it nears the Sun—a trail that is reflected in solar rays as its wake. And it will have to look for a suitable landing site for Philae.

Last month, as Rosetta came ever closer to the comet, its cameras revealed that the target body, far from being shaped like a potato as many had expected, rather resembled a duck—two lobes, one big and the other small, connected by a "neck".

"That was a bit of a surprise," said Philippe Lamy of the Astrophysics Laboratory of Marseille, southern France. "Several theories have already been aired to explain this shape, but the likeliest in my book is that it came from two bodies which fused while the Solar System was being formed."

The unexpected shape will limit the choice of a landing site, Lamy said. "You can reasonably argue that it will impose additional constraints."

Comets: Frozen wanderers

- Comets are bodies of ancient ice and dust that orbit the Sun and are believed to be almost pristine material left over from the Solar System's formation some 4.6 billion years ago. One theory is that they hold complex carbon molecules that helped seed life on an infant Earth.

- As a comet nears the Sun, some of the ice is melted and transformed into gusts of gas, the bright "coma" around its head. The gassy wake, and dust loosened by the melting ice, creates a spectacular tail that is reflected in the Sun's rays and may stretch across millions of kilometres (miles) in space. The word for comet comes from "stella cometa," Latin for "long-haired star".

- Like solar eclipses, comets have been associated with great events of history, good and bad. The birth of Jesus and Napoleon, the eruption of Vesuvius in 79 AD that destroyed Pompeii, and the Great Plague of 1665 that ravaged London have been linked to comets. "The celestial phenomena called comets (excite) wars, heated and turbulent dispositions in the atmosphere, and in the constitutions of men, with all their evil consequences," warned the first-century Egyptian astronomer and astrologer Ptolemy.

- Approximately 2,000 comets have been observed and recorded over the past 2,500 years. They follow elliptical orbits, with a return taking anything from a few years to as many as 40,000 years. Some scientists estimate there could be billions of comets, only a tiny fraction of which have ever been seen.

- The most famous comet is named after British astronomer Edmond Halley, who was the first to prove that comets orbit the Sun and return regularly. He showed that a comet of 1682, now called Halley's Comet, was identical with two that had appeared in 1607 and 1531, and he successfully predicted the comet's next return, which occurred in 1758, 16 years after his death. Halley's Comet last swung by Earth in 1986.

- Comet 67P/Churyumov-Gerasimenko, the target for Europe's Rosetta space probe, orbits the Sun once every 6.6 years. In July, images from the spacecraft as it neared the comet showed the target to be shaped rather like a duck, with a large body and a head connected by a neck. The comet is named after two Soviet astronomers, Klim Churyumov and Svetlana Gerasimenko, who first identified it, separately, in 1969.

- The head of a comet can be bigger than a planet, but most are just a few cubic kilometres (miles) in size. For all its celestial splendour, Halley's Comet is only about 15 kilometres long by four kilometers wide (nine by 2.5 miles). Churyumov-Gerasimenko is believed to measure about four kms across.

- Astronomers once believed that comets were born in interstellar space, but the consensus now is that they are created at two locations on the fringes of the Solar System. So-called long-period comets—ones which take at least 200 years to return—are believed to originate in the Oort Cloud, an accumulation of gas and debris beyond the orbit of Pluto. Short-period comets like Churyumov-Gerasimenko are believed to come from a ring of debris beyond Neptune's orbit called the Kuiper Belt.

- Comets pose a risk, albeit a very small one, to life on Earth. A collision by a comet or large asteroid 65 million years ago inflicted climate change that probably ended the reign of the dinosaurs. In 1992, the comet Shoemaker-Levy 9 was torn into 21 large fragments as it entered Jupiter's gravitational field. In July 1994, the fragments smashed into Jupiter at speeds of about 210,000 kph (130,000 mph), releasing energy that triggered fireballs larger than the Earth.

http://www.eurekalert.org/pub_releases/2014-08/aafc-ers073014.php

Eating resistant starch may help reduce red meat-related colorectal cancer risk

Consumption of a type of starch that acts like fiber may help reduce colorectal cancer risk associated with a high red meat diet

PHILADELPHIA — Consumption of a type of starch that acts like fiber may help reduce colorectal cancer risk associated with a high red meat diet, according to a study published in Cancer Prevention Research, a journal of the American Association for Cancer Research.

"Red meat and resistant starch have opposite effects on the colorectal cancer-promoting miRNAs, the miR-17-92 cluster," said Karen J. Humphreys, PhD, a research associate at the Flinders Center for Innovation in Cancer at Flinders University in Adelaide, Australia. "This finding supports consumption of resistant starch as a means of reducing the risk associated with a high red meat diet."

"Total meat consumption in the USA, European Union, and the developed world has continued to increase from the 1960s, and in some cases has nearly doubled," added Humphreys.

Unlike most starches, resistant starch escapes digestion in the stomach and small intestine, and passes through to the colon (large bowel) where it has similar properties to fiber, Humphreys explained. Resistant starch is readily fermented by gut microbes to produce beneficial molecules called short-chain fatty acids, such as butyrate, she added.

"Good examples of natural sources of resistant starch include bananas that are still slightly green, cooked and cooled potatoes [such as potato salad], whole grains, beans, chickpeas, and lentils. Scientists have also been working to modify grains such as maize so they contain higher levels of resistant starch," said Humphreys.

After eating 300 g of lean red meat per day for four weeks, study participants had a 30 percent increase in the levels of certain genetic molecules called miR-17-92 in their rectal tissue, and an associated increase in cell proliferation. Consuming 40 g of butyrated resistant starch per day along with red meat for four weeks brought miR-17-92 levels down to baseline levels.

The study involved 23 healthy volunteers, 17 male and six female, ages 50 to 75. Participants either ate the red meat diet or the red meat plus butyrated resistant starch diet for four weeks, and after a four-week washout period switched to the other diet for another four weeks.

This study was funded by the National Health and Medical Research Council of Australia, the Commonwealth Scientific and Industrial Research Organization (Preventative Health Flagship), and the Flinders Medical Center Foundation. Humphreys declares no conflicts of interest.