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Extensive Care

Steps for Pressure Ulcer

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Science Tests Idea | Science Speaks Truth | Science Makes Difference
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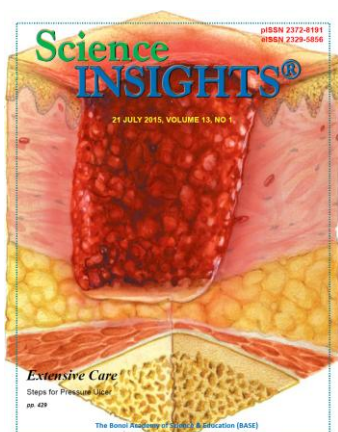
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COMMON SCIENCE

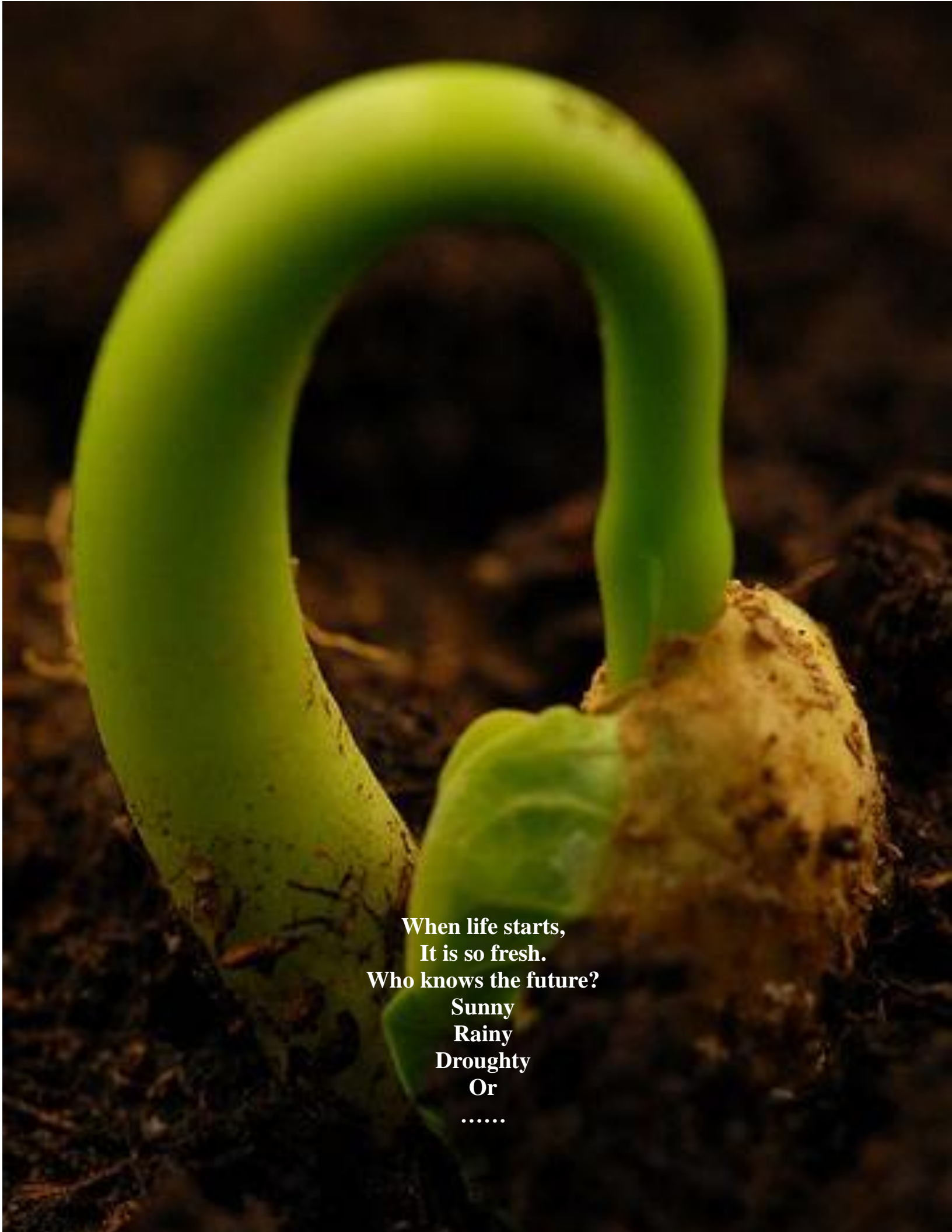
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COVER

The nursing interventions of the experiment can be considered as an effective method of decreasing the incidence of pressure ulcer in patients undergoing combined hysteroscopy and laparoscopy. Those strategies that start in the preadmission areas and continue through the intraoperative to postoperative periods can have a noticeable impact on patient's outcomes. See page 452.

Image: BASE illustrating group

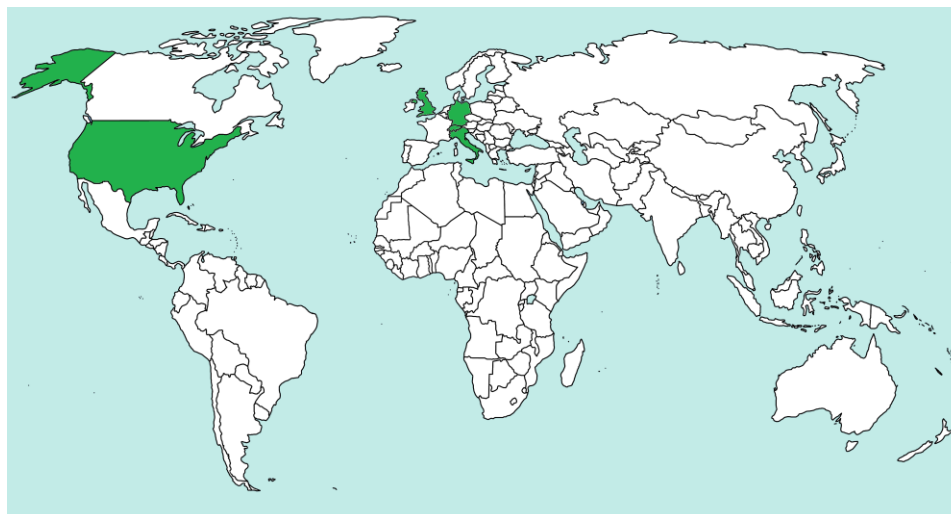
A young green plant with a curved stem and a root ball, growing in dark soil. The stem is bright green and arches over the root ball. The root ball is light brown and textured. The background is dark and out of focus.

**When life starts,
It is so fresh.
Who knows the future?
Sunny
Rainy
Droughty
Or
.....**

Llandudno, UK

Earth Heading for “Mini Ice Age” in Just 15 Years

Solar scientists, armed with the best data yet regarding the activities of the sun, say the Earth is headed for a "mini ice age" in just 15 years -- something that hasn't happened for three centuries. Professor Valentina Zharkova, of the University of Northumbria, presented the findings at the National Astronomy Meeting in Wales. Researchers, saying they understand solar cycles better than ever, predict that the sun's normal activity will decrease by 60 percent around 2030 – triggering the “mini ice age” that could last for a decade. The last time the Earth was hit by such a lull in solar activity happened 300 years ago, during the Maunder Minimum, which lasted from 1645 to 1715. Scientists say there are magnetic waves in the sun's interior that fluctuate



between the body's northern and southern hemispheres, resulting in various solar conditions over a period of 10 to 12 years. Based on that data, researchers say they are now better able to anticipate the sun's activity – which has led to the Zharkova team's prediction. "Combining both [magnetic] waves together and comparing to real data for the current solar cycle, we found that our predictions showed an accuracy of 97 percent," Zharkova said. If the "mini ice age" does indeed arrive, scientists say it will be accompanied by bitter cold winters --

frigid enough to cause rivers, like the Thames in London, to freeze over. By Doug G. Ware.

Bristol, UK

Cancer Surgery or Biopsy Collection Could Influence Disease Progression

Scientists at Bristol studying the body's inflammatory response to wounds following cancer surgery or biopsy have found that these procedures may cause growth signals to be delivered to any remaining cancer or pre-cancerous cells which may negatively influence disease progression. Tissue damage has been implicated as a possible trigger in the development of various cancers. Until now, little was known about how local wounding, following cancer surgery, biopsy collection or ulceration, might impact on disease progression. The study, led by researchers from the Universities of Bristol and Aarhus in Denmark and published in the *EMBO Journal*, investigated how inflammatory cells react to cancerous wounds. The





team first used zebrafish larvae - a well-established translucent organism to study cancer cell biology - that were genetically modified to sporadically produce pre-cancerous cells in their skin. They found that their inflammatory cells, primarily a type called neutrophils, were rapidly diverted from wounds to the pre-cancerous cells and this led to increased growth at the pre-cancerous site. Their results showed the process was dependent upon these inflammatory immune cells and was, at least in part, due to the release of a factor called prostaglandin-E2 derived from the immune cells promoting cancer cell growth, which is, interestingly, a key target of the anti-inflammatory action of aspirin. In an adult Zebrafish

model of chronic wounding, they also showed that repeated wounding led to a greater incidence of local melanoma formation. To extend these findings to cancer patients, clinical researchers at Aarhus University compared the inflammatory response in human melanoma samples that were either intact or had 'ulcerated' open wounds. They uncovered a strong correlation between neutrophil presence at sites of melanoma ulceration and cancer cell division, which, in turn, was associated with a poor prognostic outcome in those patients. The findings have clear implications for clinicians involved in cancer surgery and biopsy collection, as the inflammatory response surrounding the surgery site may inadvertently

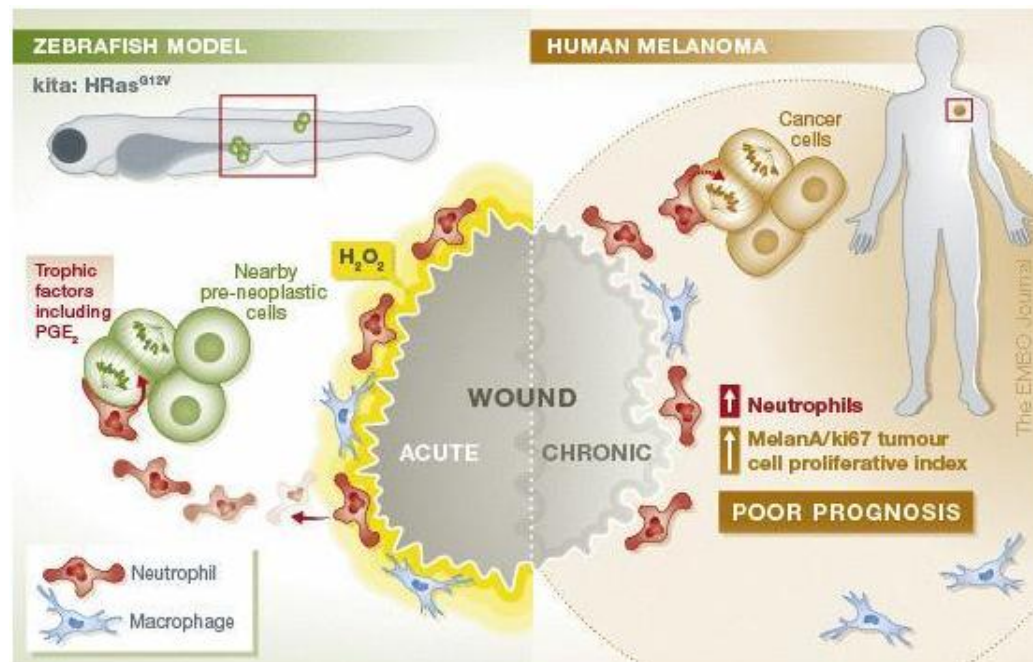
support growth of any remaining cancer. Professor Paul Martin, who led the project from Bristol's Schools of Biochemistry and Physiology and Pharmacology, said: "All surgery and biopsy collections carry an element of risk and this study reveals a further potential risk for clinicians to consider. For the first time we can now watch the interplay between inflammatory cells visiting wounds and nearby cancer cells, and use this to determine why and how this occurs and how we might learn to prevent it." Dr Nicole Antonio, one of the study's lead authors from Bristol's School of Biochemistry, added: "There is a longstanding association between wound healing and cancer, with cancer often described as a 'wound that

does not heal'. Surgery is a key cancer therapy and is still the most effective method to treat human solid cancers that have not yet metastasized. However tissue damage has been previously linked to cancer development and progression. Therefore it is important that we understand the dynamic molecular mechanisms for this process and uncover how clinicians can minimise the risks for cancer patients." Dr Emma Smith, senior science information officer at Cancer Research UK, said: "Surgery plays a vital role in helping thousands of people survive cancer every year – whether it's used to remove a tumour or take a small sample to help doctors understand a patient's cancer. This study, mostly in zebrafish, suggests that the immune response caused by wounds may encourage cancer cells to grow, but there's no proof yet that having surgery causes the same thing in patients. If the immune response triggered by surgery is linked to cancer growth, then understanding this relationship could lead to ways of blocking it."

Bristol, UK

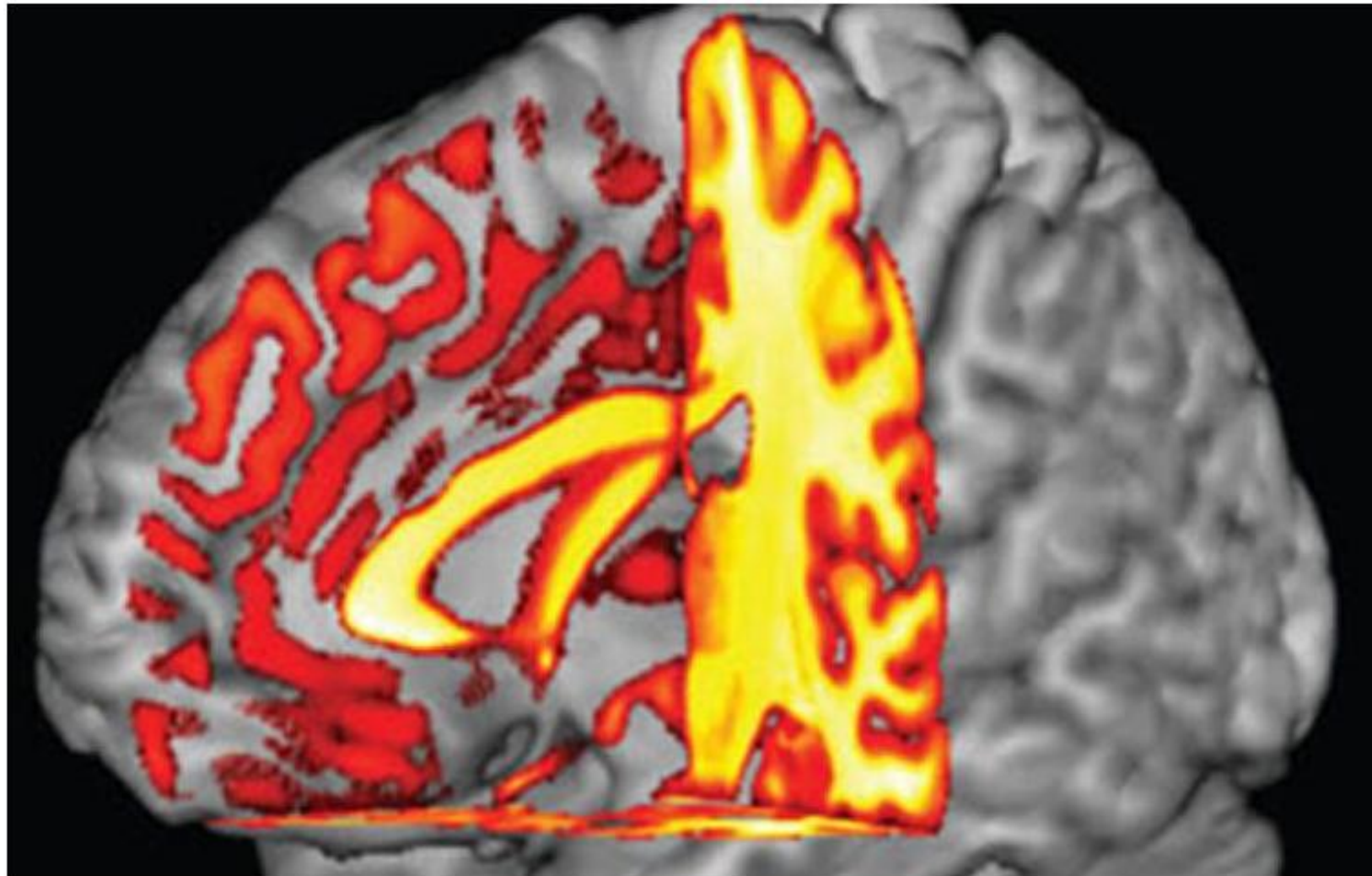
Direct Link between Wound Healing and Skin Cancer

Researchers have found that inflammatory cells sent by the immune system to the site of a wound for healing are redirected to pre-cancerous cells they help grow. While tissue damage and cancer have been linked before, research-



ers have now seen inflammatory cells called neutrophils be diverted from wounds to pre-cancerous cells in adult zebrafish. "There is a longstanding association between wound healing and cancer, with cancer often described as a 'wound that does not heal,'" said Dr. Nicole Antonio, of the School of Biochemistry at Bristol University, in a press release. "Surgery is a key cancer therapy and is still the most effective method to treat human solid cancers that have not yet metastasized. However, tissue damage has been previously linked to cancer development and progression. Therefore it is important that we understand the dynamic molecular mechanisms for this process and uncover how clinicians can minimise the risks for cancer patients." Researchers started off with zebrafish larvae that had been genetically modified to produce pre-cancerous cells, watching as neutrophils sent by the immune system to heal a wound were diverted away

to nearby pre-cancerous cells, helping them grow. This growth is caused by the release of a signaling molecule called prostaglandin-E₂, which is released by the immune cells. The same process was then shown to happen in adult zebrafish models, where repeated wounding led to an increase in melanoma formation. "Our results provide direct visual evidence of a physical link between wound-associated inflammation and the development of skin cancer," says EMBO Member Paul Martin, professor at Bristol University and the University of Cardiff. "White blood cells, in particular neutrophils, that typically serve as part of the body's built-in immune system are usurped by nearby precancerous skin cells in a way that leads to the proliferation of tumour cells in our zebrafish model experimental system of human melanoma." The researchers then compared the inflammatory response in human melanoma samples that were either intact or had "ulcerated" open



BASE BASE

wounds. A strong presence of neutrophils was seen at the sites of melanoma ulceration and cancer cell division, raising researchers' concerns that an inflammatory response to cancer surgery, or even biopsy collection, could cause growth of remaining cancer. "Surgery plays a vital role in helping thousands of people survive cancer every year," said Dr. Emma Smith, senior science information officer at Cancer Research UK. "This study, mostly in zebrafish, suggests that the immune response caused by wounds may encourage cancer cells to grow, but there's no proof yet that having surgery causes the same thing in patients. If the immune response triggered by surgery is linked to cancer growth, then understanding this relationship could lead to

ways of blocking it." By Stephen Feller.

Sheffield, UK
Venice, ITALY

Blood Type Help Protect You from Cognitive Decline

A research, carried out in collaboration with the IRCCS San Camillo Hospital Foundation in Venice, shows that people with an 'O' blood type have more grey matter in their brain, which helps to protect against diseases such as Alzheimer's, than those with 'A', 'B' or 'AB' blood types. Research fellow Matteo De Marco and Professor Annalena Venneri, from the Department of Neuroscience, University of Sheffield, made the discovery after analysing the results of 189 Mag-

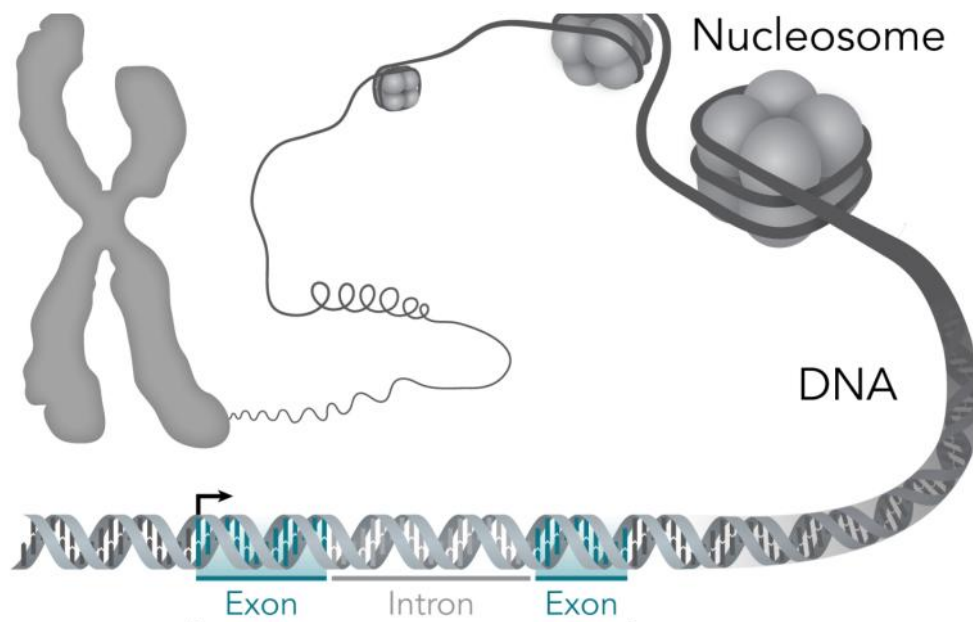
netic Resonance Imaging (MRI) scans from healthy volunteers. The researchers calculated the volumes of grey matter within the brain and explored the differences between different blood types. The results, published in *The Brain Research Bulletin*, show that individuals with an 'O' blood type have more grey matter in the posterior proportion of the cerebellum. In comparison, those with 'A', 'B' or 'AB' blood types had smaller grey matter volumes in temporal and limbic regions of the brain, including the left hippocampus, which is one of the earliest part of the brain damaged by Alzheimer's disease. These findings indicate that smaller volumes of grey matter are associated with non-'O' blood types. As we age a reduction of grey matter volumes is

normally seen in the brain, but later in life this grey matter difference between blood types will intensify as a consequence of ageing. "The findings seem to indicate that people who have an 'O' blood type are more protected against the diseases in which volumetric reduction is seen in temporal and mediotemporal regions of the brain like with Alzheimer's disease for instance," said Matteo DeMarco. "However additional tests and further research are required as other biological mechanisms might be involved." Professor Annalena Venneri added: "What we know today is that a significant difference in volumes exists, and our findings confirm established clinical observations. In all likelihood the biology of blood types influences the development of the nervous system. We now have to understand how and why this occurs." From the Neuroscience News.

Cambridge, UK

Reprogramming of DNA in Human Germ Cells

A team of researchers led by the University of Cambridge has described for the first time in humans how the epigenome - the suite of molecules attached to our DNA that switch our genes on and off - is comprehensively erased in early primordial germ cells prior to the generation of egg and sperm. However, the study, published today in the journal *Cell*, shows some regions of our DNA - including those



associated with conditions such as obesity and schizophrenia - resist complete reprogramming. Although our genetic information - the 'code of life' - is written in our DNA, our genes are turned on and off by epigenetic 'switches'. For example, small methyl molecules attach to our DNA in a process known as methylation and contribute to the regulation of gene activity, which is important for normal development. Methylation may also occur spontaneously or through our interaction with the environment - for example, periods of famine can lead to methylation of certain genes - and some methylation patterns can be potentially damaging to our health. Almost all of this epigenetic information is, however, erased in germ cells prior to transmission to the next generation. Professor Azim Surani from the Wellcome Trust/Cancer Research UK Gurdon Institute at the University of Cambridge, explains: "Epigenetic information is important for regulating our

genes, but any abnormal methylation, if passed down from generation to generation, may accumulate and be detrimental to offspring. For this reason, the information needs to be reset in every generation before further information is added to regulate development of a newly fertilised egg. It's like erasing a computer disk before you add new data." When an egg cell is fertilised by a sperm, it begins to divide into a cluster of cells known as a blastocyst, the early stage of the embryo. Within the blastocyst, some cells are reset to their master state, becoming stem cells, which have the potential to develop into any type of cell within the body. A small number of these cells become primordial germ cells with the potential to become sperm or egg cells. In a study funded primarily by the Wellcome Trust, Professor Surani and colleagues showed that a process of reprogramming the epigenetic information contained in these primordial germ cells is initiated around two weeks into the embryo's de-

velopment and continues through to around week nine. During this period, a genetic network acts to inhibit the enzymes that maintain or programme the epigenome until the DNA is almost clear of its methylation patterns. Crucially, however, the researchers found that this process does not clear the entire epigenome: around 5% of our DNA appears resistant to reprogramming. These 'escapee' regions of the genome contain some genes that are particularly active in neuronal cells, which may serve important functions during development. However, data analysis of human diseases suggests that such genes are associated with conditions such as schizophrenia, metabolic disorders and obesity. Walfred Tang, a PhD student who is the first author on the study, adds: "Our study has given us a good resource of potential candidates of regions of the genome where epigenetic information is passed down not just to the next generation but potentially to future generations, too. We know that some of these regions are the same in mice, too, which may provide us with the opportunity to study their function in greater detail." Epigenetic reprogramming also has potential consequences for the so-called 'dark matter' within our genome. As much as half of human DNA is estimated to be comprised of 'retroelements', regions of DNA that have entered our genome from foreign invaders including bacteria and plant DNA. Some of these regions can be beneficial and

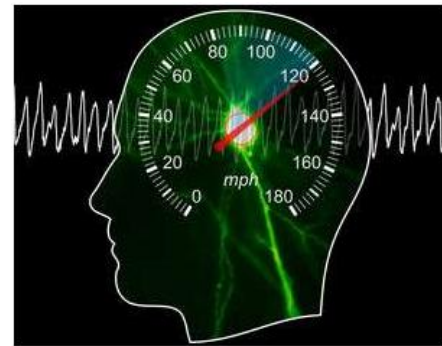
even drive evolution - for example, some of the genes important to the development of the human placenta started life as invaders. However, others can have a potentially detrimental effect - particularly if they jump about within our DNA, potentially interfering with our genes. For this reason, our bodies employ methylation as a defence mechanism to suppress the activity of these retroelements.

"Methylation is effective at controlling potentially harmful retroelements that might harm us, but if, as we've seen, methylation patterns are erased in our germ cells, we could potentially lose the first line of our defence," says Professor Surani. In fact, the researchers found that a notable fraction of the retroelements in our genome are 'escapees' and retain their methylation patterns - particularly those retroelements that have entered our genome in our more recent evolutionary history. This suggests that our body's defence mechanism may be keeping some epigenetic information intact to protect us from potentially detrimental effects.

Bonn, GERMANY

Speedometer in the Brain Was Found

Researchers in Bonn have identified neural circuits in the brains of mice that are pivotal for movement and navigation in space. These nerve cells that are presumed to exist in a similar form in humans, give the start signal for locomotion



and also supply the brain with speed-related information. Scientists at the German Center for Neurodegenerative Diseases (DZNE) and the University of Bonn led by Prof. Stefan Remy report on this in the journal *Neuron*. Their investigations give new insights into the workings of spatial memory. Furthermore, they could also help improve our understanding of movement related symptoms associated with Parkinson's disease. In a familiar environment our movements are purposeful. For example, if we leave our office desk for a coffee break, we naturally follow a predefined route that has been stored in our memory: Through the office door, left into the hall, past the windows. To keep us on track, our brain has to process varying sensory impressions quickly. "This is a fundamental issue our brain has to deal with. Not just on our way to the coffee machine, but any time we move in space. For example when we are on a bike or in a car," explains Remy. With increasing speed, the data rate also increases, he emphasizes: "The faster we move, the less time the brain has to take in environmental cues and to associate them with a location on our memorized spatial map. Our perception therefore has to

keep pace with the speed of movement so that we remember the right way to go. Otherwise we end up at the copy machine instead of the coffee machine." It has been known for some time that the hippocampus - the part of the brain that controls memory, particularly spatial memory - adjusts to the speed of locomotion. "The electrical activity of the hippocampus undergoes rhythmic fluctuations. The faster we move, the faster certain nerve cells are activated," says Remy. "This increased activation rate sensitizes the brain. It becomes more receptive to the changing sensory impressions that have to be processed when moving." But how does the brain actually know how fast a movement is? Previously there was no answer to this question. Now, Remy and his colleagues have decoded the mechanism. For this, they stimulated specific areas within the mouse brain and recorded the ensuing brain activity and the mice's locomotion. "We have identified the neural circuits in mice that link their spatial memory to the speed of their movement. This interplay is an important foundation for a functioning spatial memory," says Remy. "We assume that humans have similar nerve cells, as the brains of mice and humans have a very similar structure in these regions." The cells in question are located in the "medial septum", a part of the brain directly connected to the hippocampus. They make up a relatively small group comprising a few thousand cells. "They gather

information from sensory and locomotor systems, determine the speed of movement and transmit this information to the hippocampus. In this way, they tune the spatial memory systems for optimized processing of sensory stimuli during locomotion," explains Remy. However, these circuits have even more functions. "We have found that they also give the start signal for locomotion and that they actively control its speed. Until now, this control function was almost exclusively ascribed to the motor cerebral cortex." These newly discovered nerve cells are linked with areas of the brain that are affected by Parkinson's in humans. This disease is associated with movement-related symptoms and can cause dementia. "In this respect, our results go beyond the workings of spatial memory; they also have the potential to provide new insights into how memory systems and the execution of movements are affected in Parkinson's disease," says Remy.

Geneva, SWITZERLAND

Child-Friendly Formulation of WHO-Recommended HIV Treatment Approved By FDA

Infants and young children living with HIV will finally have access to an improved formulation of an antiretroviral (ARV) treatment, following the U.S. Food and Drug Administration's (FDA) tentative ap-

proval last week of lopinavir/ritonavir (LPV/r) oral pellets developed by the Indian generic company Cipla. "The announcement of tentative FDA approval of the lopinavir/ritonavir oral pellet formulation is an important step forward in increasing access to World Health Organization-recommended antiretroviral treatment for children under three years of age," said Ambassador Deborah L. Birx, M.D., U.S. Global AIDS Coordinator and U.S. Special Representative for Global Health Diplomacy. "This supports the goals of key PEPFAR initiatives to improve paediatric HIV/AIDS services, including the Accelerating Children's HIV/AIDS Treatment Initiative and the Global Pediatric ARV Commitment to Action". Until now, the only available version of this combination treatment was a harsh-tasting syrup that required refrigeration and contained 40% alcohol. Only a quarter of children with HIV are currently on treatment and the lack of child-adapted formulations contributes to this unacceptable situation. "UNITAID and its partners in the Paediatric HIV Treatment Initiative (PHTI) also welcome the approval of these oral pellets, which brings us a step nearer to closing the shameful treatment gap for the 3.2 million children living with HIV around the world," said Lelio Marmora, Executive Director of UNITAID which is funding the development of paediatric formulations for HIV. Importantly, intellectual property issues around access to future

LPV/r combinations will be reduced, thanks to a licensing agreement the Medicine Patent Pool (MPP) signed in December 2014 with AbbVie, the patent holder for LPV/r. "This is a crucial licence for paediatric programmes as it benefits low- and middle-income countries where 99% of children with HIV in the developing world live," said Greg Perry, Executive Director of the MPP. As part of its programme to develop improved HIV medicines for children, the Drugs for Neglected Diseases initiative (DNDi) is working with Cipla to ensure the new pellets are registered and adopted through a large "implementation study" that will be carried out in several sub-Saharan African countries. In 2013, UNITAID gave an important grant to DNDi for its work in this area. "Within a few weeks, the first batches of the new pellets will be shipped to Kenya, and DNDi and our partners on the ground will quickly introduce them along with other needed ARVs so that children can benefit immediately," said Dr Marc Lallemand, Head of DNDi's Paediatric HIV Programme. Last week's FDA approval is an important step towards developing what children with HIV really need to live healthily. Supported by UNITAID, DNDi and Cipla aim as the next stage to develop two "4-in-1" fixed-dose combinations of LPV/r with other key ARVs (zidovudine/lamivudine and abacavir/lamivudine) that are recommended by the World Health Organization (WHO). Taste-masked versions of the-

se combinations will be even easier to take than the new pellets and should enable large-scale expansion of access to treatment for infants and young children with HIV. "In 2006 only 70,000 children were receiving HIV treatment, but with the partnership of UNITAID we've been able to work hand in hand with national governments to put more than 760,000 children on antiretroviral therapy," said Dr Nandita Sugandhi, Senior Clinical Officer at the Clinton Health Access Initiative (CHAI). "But there remain thousands of children who are still not accessing treatment and our efforts must continue to ensure that children living with HIV are not left behind."

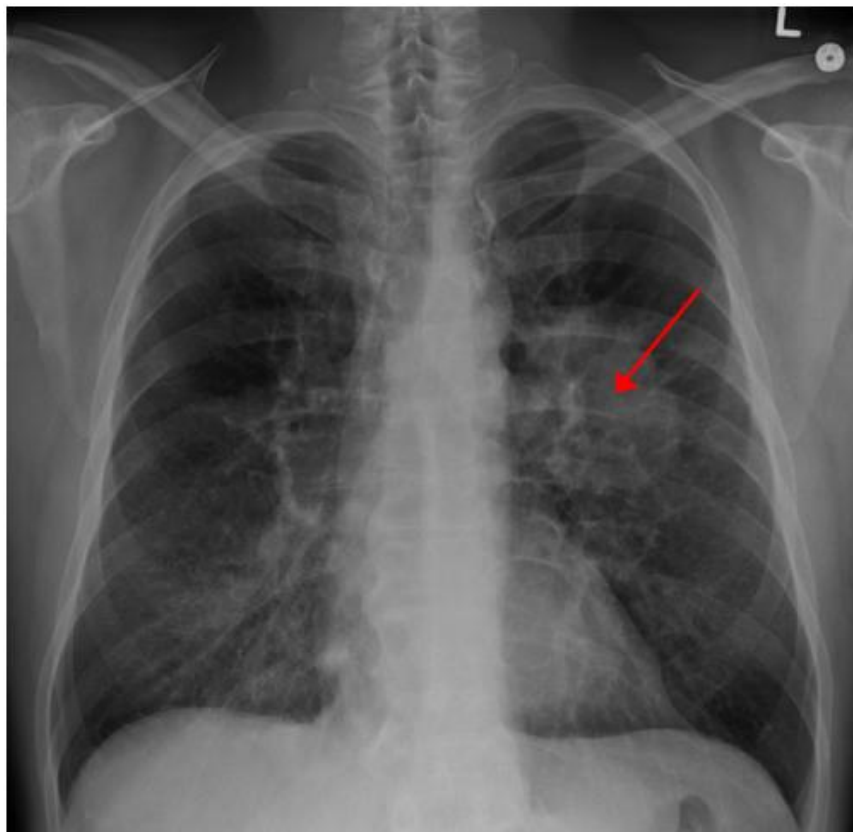
Philadelphia, USA

"Highly Effective" New Biomarker for Lung Cancer

Survival rates for patients with lung cancer increase dramatically the earlier the disease is diagnosed, underscoring the need for effective biomarkers that can be used for detection. Now, scientists at The Wistar Institute have found a protein that circulates in the blood that appears to be more accurate at detecting non-small cell lung cancer (NSCLC) than currently available methods used for screening. The findings were published online by the journal *Oncotarget*. If the accuracy of this biomarker can be confirmed in a larger trial, this could lead to the development of a simple blood test that could be used for annual

screening. The authors of the study believe that this blood test would be easier to use, more accurate and less invasive than low-dose computed tomography (LDCT) scans, the method for lung cancer screening currently recommended by the U.S. Preventive Services Task Force (USPSTF). Because of its accuracy, it could also better distinguish between benign lung tumors that do not pose a threat and malignant tumors that have the potential to grow and spread. Lung cancer is the leading cause of cancer deaths in both men and women in the United States. However, the five-year survival rate increases dramatically if the disease is caught and treated early. According to the American Cancer Society, if NSCLC is caught in its earliest stage, the five-year survival rate is 49 percent. However, patients who are diagnosed when the disease has metastasized - meaning that it has spread to other organs - have only about a 1 percent chance of achieving survival after five years. In 2013, the USPSTF recommended annual screening to patients at least 55 years old who had a history of smoking and are therefore considered at high risk for developing lung cancer. This method of screening is considered invasive and relatively expensive while not being highly accurate or widely available on a global scale. "There are many people who stand to benefit from a better diagnostic test for lung cancer," said Qihong Huang, M.D., Ph.D., associate professor in the Tumor Microenvi-

ronment and Metastasis Program at The Wistar Institute and lead author of the study. "If we can develop a simple blood test that's more accurate than low-dose CT scans, we can detect the cancer earlier with a less expensive, less invasive and more accurate blood test. Everyone stands to gain from such a test becoming available." In this study, Huang



and his colleagues focused on cancer testis antigens (CTAs), since they are often found in tumor cells that circulate in the blood. After analyzing 116 different CTAs, the researchers identified the protein AKAP4 as a potential biomarker that could effectively distinguish between patients with and without NSCLC. The researchers then tested AKAP4 as a biomarker in a pilot cohort that contained 264 blood samples from patients with NSCLC and 135 control samples. Of the 264 NSCLC samples, 136 samples were from patients who received a stage I diagnosis. The researchers analyzed the effectiveness of the biomarker by looking at the area under the curve (AUC), a method that calculates the ability of the test to distinguish those with disease from those without it. An AUC value of 1 means that the test perfectly

distinguishes between the patients who have and don't have a particular disease. In this study, when the researchers compared all 264 of the NSCLC samples with the 135 control samples, the AUC was 0.9714. When the researchers looked at only the 136 samples with known stage I disease, the AUC was 0.9795. While the researchers noted that the presence of AKAP4 increased with the stage of the disease, AKAP4 was still detectable in the samples with early stage disease. "The results of this study exceeded our expectations," Huang said. "AKAP4 appears to be a highly effective biomarker for the detection of non-small cell lung cancer. If we are able to confirm these results in a more robust study, then we have the potential for a new, more accurate screening method that could help save many, many lives." With the positive results

of this study, Huang said that Wistar will conduct a larger study with a goal of analyzing at least 800 samples. Multiple hospitals have agreed to provide blood samples for analysis to Wistar for this next study. "Qihong and his colleagues have found a target that could result in a more accurate test than any method that's been used to screen for non-small cell lung cancer to date," said Dario C. Altieri, M.D., President

and CEO of The Wistar Institute and director of Wistar's Cancer Center. "With the government recommending annual screening for high-risk populations, the identification of a promising target like AKAP4 comes at a critical time. Early detection is needed in order to have a meaningful impact on this devastating disease." This is the second time Wistar has identified a potential method for creating a blood test to screen for lung cancer. Researchers at the Institute are also currently analyzing more than 600 blood samples to develop a blood test that identifies a 29-gene "signature" that distinguishes patients with NSCLC from those without the disease. Positive interim data for this test was recently presented at the American Thoracic Society International Conference. ■



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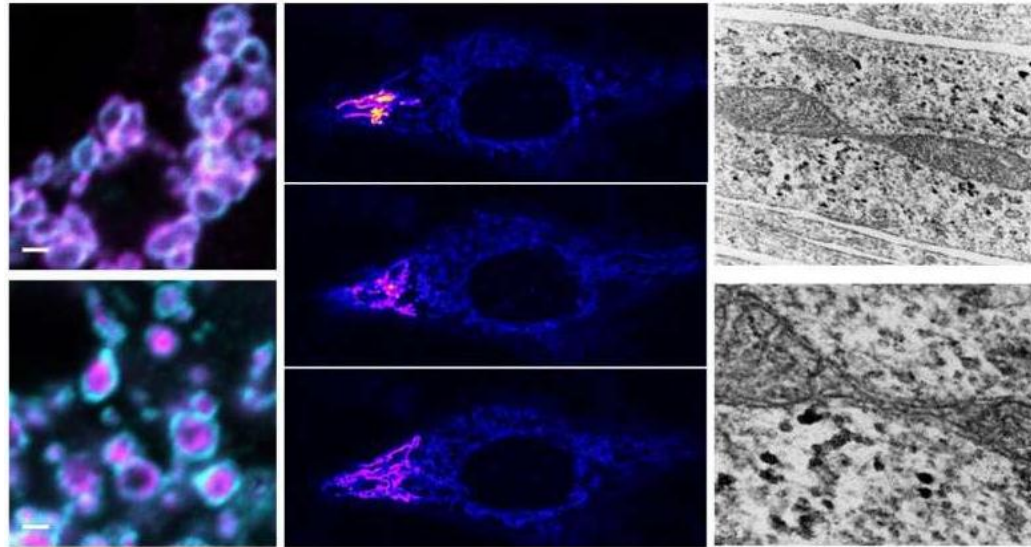
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NEUROSCIENCE, USA

A Novel Disease Gene Causing Neurodegenerative Disorders

Researchers at the University of Miami (UM) have discovered and characterized a previously unknown disease gene linked to the degeneration of optic and peripheral nerve fibers. The study titled "Mutations in SLC25A46, encoding a UGO1-like protein, cause an optic atrophy spectrum disorder" is published in the journal *Nature Genetics*. Patients with mutations in this gene present symptoms similar to optic atrophy and Charcot-Marie-Tooth Type 2 (CMT2), including vision loss and weakening of the lower leg and foot muscles beginning in the first decade of life. The novel variants occur in a gene called SLC25A46 that functions in mitochondria, organelles inside animal cells known as the "cellular engines." They transform food into fuel that allow cells to carry out energy-demanding functions. "Mitochondria play a large role in human health," said Alexander Abrams, Ph.D. student in Neuroscience at the UM Miller School of Medicine and first author of the study. "Although we study rare diseases such as CMT2 and optic atrophy, the implications encompass all forms of neurodegeneration including Lou Gehrig's and Parkinson's Diseases." Mitochondria constantly undergo fusion and fission to respond to cellular energy demands. By changing their size and connectivity through fusion and fission, mi-



tochondria can travel to regions in cells where they are needed. "Our study reveals that disrupting SLC25A46 causes mitochondria to become both more highly interconnected and improperly localized in cells," said Julia E. Dallman, assistant professor of Biology in the UM College of Arts and Sciences and a senior author of the study. "These data support a critical role for SLC25A46 and mitochondrial dynamics in the establishment and maintenance of neuronal processes." SLC25A46 encodes an atypical protein in the SLC25 family. SLC25 family members act like a channel, transporting molecules across the bilayer membranes inside mitochondria. But unlike the majority of human SLC25 family members (there are 53) that transport molecules across the inner mitochondrial membrane, SLC25A46 settles on the outer mitochondrial membrane where it regulates mitochondrial dynamics. Mutations in the genes associated with mitochondria dynamics OPA1 and MFN2 are linked to similar mitochondrial disorders. Homologous genes in baker's

yeast, work in combination with a gene called UGO1, which has ancestral similarities to SLC25A46. The new findings suggest that the SLC25A46 and Ugo1 proteins may play similar roles. Given the similarities between the diseases caused by mutations in OPA1, MFN2 and SLC25A46, these genes could be involved in common pathological mechanisms of neurodegeneration, the study says. "This finding builds on our discovery of MFN2 as a major disease gene in this area over 10 years ago," said Dr. Stephan Züchner, professor and chair of the Dr. John T. Macdonald Foundation Department of Human Genetics, at UM's Miller School of Medicine, and a senior author of the study. "Only through the new genome sequencing methods and active global data exchange were we able to solve this puzzle."

MEDICINE, USA

New Diabetes Treatment

A cellular defect that can impair the body's ability to handle high

Pancreatic cells exposed to sugar



calcium flux

glucose levels and could point the way to a potential new treatment for diabetes has been identified by Columbia University Medical Center (CUMC) researchers. The CUMC team found that ryanodine receptor type 2 (RyR2) calcium channels in insulin-producing cells play an important and previously underappreciated role in glucose balance. RyR2 channels control intracellular calcium release. When leaky, they were found to reduce insulin release from the pancreas, resulting in high blood sugar levels in a test that measures the ability to regulate glucose. The researchers also demonstrated, in a mouse model of diabetes, that these leaks can be stopped and glucose levels normalized with an experimental drug called Rycal. The findings were published today in the online edition of the *Journal of Clinical Investigation*. "We've known that calcium in the pancreatic beta cells plays a significant

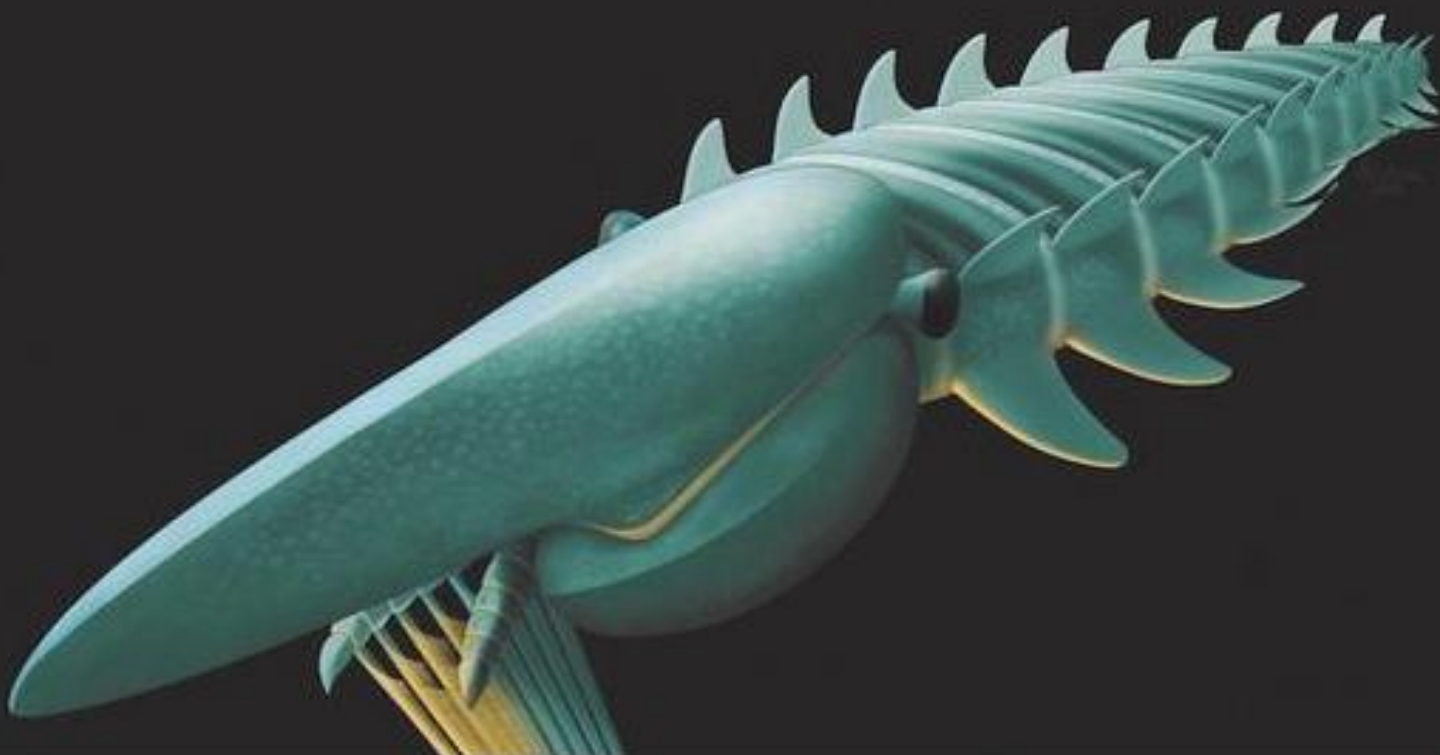
role in regulating insulin secretion, but calcium levels were thought to be controlled largely by the entry of calcium into the cell," said senior author Andrew R. Marks, MD, professor and chair of physiology and cellular biophysics. "It turns out that there's another mechanism in pancreatic beta cells that also controls calcium. This mechanism involves RyR2 channels, and leaks in these channels can lead to impaired glucose tolerance. These findings open up a whole new area of research into the molecular underpinnings of prediabetes and diabetes and point to potential therapeutic targets."

PALEONTOLOGY, USA

Rare Fossils of 400-Million-Year-Old Sea Creatures Uncovered

Morocco's vast, rocky deserts were once covered with oceans

teeming with life during the Ordovician period, about 485 million to 444 million years ago, a new study finds. But these stunning animals, now fossilized in mineralized splotches of violet, yellow and orange in the desert rock, would be unknown were it not for the tenacious work of a Moroccan fossil collector and a broke graduate student. The Moroccan formation, known as the Fezouata Biota, holds some of the oldest known marine animals on Earth. It's home to more than 160 genera, including an armored, wormlike creature and a giant, filter-feeding arthropod. During the past few years, these new-found Fezouata fossils have rewritten evolutionary textbooks. A batch of horseshoe crab fossils show that the critters are about 25 million years older than was previously thought. What's more, the horseshoe crab fossils are incredibly complex, suggesting their ancestors evolved far earlier, said study



lead researcher Peter Van Roy, a paleontologist at Yale University. In other cases, the Fezouata Biota shows that some animals survived the Cambrian, a period that lasted from about 541 million to 485 million years ago. For example, it was thought that anomalocaridids, an ancestor of modern-day arthropods such as butterflies and spiders, lived and died during the Cambrian. Given the scarcity of Ordovician fossils, the Fezouata Biota sheds light on life that swam around during that period of ancient history, Van Roy said. In fact, fossil findings hint that two well-known events — the Cambrian explosion, the sudden emergence of animals and the great Ordovician biodiversification event, — in which animals diversified and the number of marine genres quadrupled — may be the same event. "What is emerging now is that actually these are not separate events, but that

they are just two pulses in the same large-scale diversity dynamic," Van Roy said. By Laura Geggel, the original article from the LiveScience.

PSYCHIATRY, USA

New Compounds That May Treat Depression Rapidly with Few Side Effects

A new study by researchers at University of Maryland School of Medicine has identified promising compounds that could successfully treat depression in less than 24 hours while minimizing side effects. Although they have not yet been tested in people, the compounds could offer significant advantages over current antidepressant medications. The research, led by Scott Thompson, PhD, Professor and Chair of the Department of Physiology at the University of Maryland School

of Medicine (UM SOM), was published this month in the journal *Neuropsychopharmacology*. "Our results open up a whole new class of potential antidepressant medications," said Dr. Thompson. "We have evidence that these compounds can relieve the devastating symptoms of depression in less than one day, and can do so in a way that limits some of the key disadvantages of current approaches." Currently, most people with depression take medications that increase levels of the neurochemical serotonin in the brain. The most common of these drugs, such as Prozac and Lexapro, are selective serotonin reuptake inhibitors, or SSRIs. Unfortunately, SSRIs are effective in only a third of patients with depression. In addition, even when these drugs work, they typically take between three and eight weeks to relieve symptoms. As a result, patients often suffer for months



before finding a medicine that makes them feel better. This is not only emotionally excruciating; in the case of patients who are suicidal, it can be deadly. Better treatments for depression are clearly needed. Dr. Thompson and his team focused on another neurotransmitter besides serotonin, an inhibitory compound called GABA. Brain activity is determined by a balance of opposing excitatory and inhibitory communication between brain cells. Dr. Thompson and his team argue that in depression, excitatory messages in some brain regions are not strong enough. Because there is no safe way to directly strengthen excitatory communication, they examined a class of compounds that reduce the inhibitory messages sent via GABA. They predicted

that these compounds would restore excitatory strength. These compounds, called GABA-NAMs, minimize unwanted side effects because they are precise: they work only in the parts of the brain that are essential for mood. The researchers tested the compounds in rats that were subjected to chronic mild stress that caused the animals to act in ways that resemble human depression. Giving stressed rats GABA-NAMs successfully reversed experimental signs of a key symptom of depression, anhedonia, or the inability to feel pleasure. Remarkably, the beneficial effects of the compounds appeared within 24 hours - much faster than the multiple weeks needed for SSRIs to produce the same effects. "These compounds pro-

duced the most dramatic effects in animal studies that we could have hoped for," Dr. Thompson said. "It will now be tremendously exciting to find out whether they produce similar effects in depressed patients. If these compounds can quickly provide relief of the symptoms of human depression, such as suicidal thinking, it could revolutionize the way patients are treated." In tests on the rats' brains, the researchers found that the compounds rapidly increased the strength of excitatory communication in regions that were weakened by stress and are thought to be weakened in human depression. No effects of the compound were detected in unstressed animals, raising hopes that they will not produce side effects in human patients. "This work under-

scores the importance of basic research to our clinical future," said Dean E. Albert Reece, MD, PhD, MBA, who is also the vice president for Medical Affairs, University of Maryland, and the John Z. and Akiko K. Bowers Distinguished Professor and Dean of the School of Medicine. "Dr.

Thompson's work lays the crucial groundwork to transform the treatment of depression and reduce the tragic loss of lives to suicide."

MEDICINE, UK

New Drug Combo Could Make Cancer More Sensitive to Chemotherapy

Combining chemotherapy with new drugs that target a protein that helps cancer cells to withstand chemotherapy could drastically improve treatment, according to research published in *Cancer Cell*. Researchers at the University of Manchester carefully studied a network of proteins that kick into action when cancer cells in the lab are treated with a class of chemotherapy drugs called taxanes. These drugs are commonly used to treat several cancers - including breast,



ovarian and prostate cancers. But not all cancers respond to them, and it's difficult to predict which patients will benefit. The Cancer Research UK-funded scientists measured the strength of this network in a range of cancers to try and find out why some are more likely to respond to taxane-based chemotherapy and why some are more likely to be resistant. The team identified one particular component of this network - a protein called Bcl-xL - which helps the cancer cells survive treatment by blocking the self-destruct process that normally kills cells when treated with chemotherapy drugs. Drugs to block Bcl-xL are already available and, by combining them with taxanes, the researchers showed in the lab that the combination of treatments killed far more cancer cells than taxanes alone. Study leader Professor

Stephen Taylor, Cancer Research UK Senior Research Fellow and Leech Professor of Pharmacology at the University of Manchester, said: "This important research shows us there's potential to boost the cancer-fighting power of chemotherapy - and do more with less. "This new combination could 'soften-up' cancer cells, making it easier for chemotherapy to deliver the final blow and destroy the tumour. And the good news

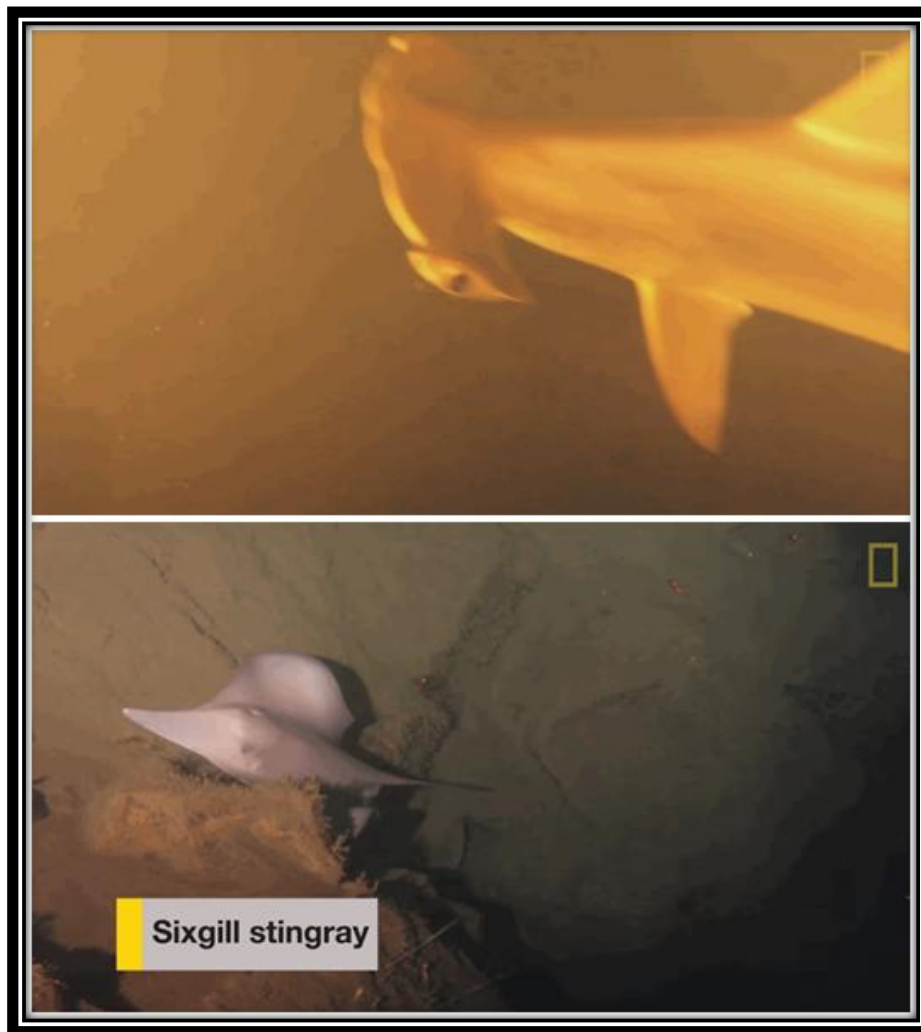
is that drugs targeting Bcl-xL are already out there and being tested in clinical trials. "Using this combination of drugs could improve treatment for patients receiving taxanes and lower their chemotherapy dose, which would also help to reduce side-effects." Dr Emma Smith, senior science information officer at Cancer Research UK, said: "Predicting which patients will benefit most from chemotherapy is essential if we're going to make cancer treatments more effective and kinder. "In cases where chemotherapy doesn't seem to work straight away, we could add drugs that target Bcl-xL and hopefully see a real difference. It's still early days for this research but, if the results are confirmed in clinical trials, it has the potential to improve treatment for thousands of cancer patients." ■

Love the Wave
Love the Earth



Sharks Swimming in Scalding Waters around a Volcano

By Tanya Lewis (USA, 2015)



Brennan Phillips and some colleagues were recently on an expedition to Kavachi volcano, an active underwater volcano near the Solomon Islands in the South Pacific. But they weren't prepared for what they saw deep inside the volcanic crater: Sharks! Hammerheads and silky sharks, to be specific, contentedly swimming around despite the sizzling water temperatures and biting acidity. Volcanic vents such as these can release fluids above 800 degrees Fahrenheit and have a similar acidity to vinegar, according to the Marine Education Society of Australasia. "The idea of there being large animals like sharks hanging out and living inside the caldera of the volcano conflicts with what we know about Kavachi, which is that it erupts," Phillips, a biological oceanography Ph.D. student at the University of Rhode Island. This brings up some perplexing questions about what the animals do if the volcano decides to wake up: "Do they leave?" Phillips asks. "Do they have some sign that it's about to erupt? Do they blow up sky-high in little bits?" The volcano wasn't erupting when Phillips' team arrived, meaning it was safe to drop an 80-pound camera into the water to take a look around. After about an hour of recording, the team fished the camera out and watched the video. First, the video showed some jellyfish, snappers, and small fish. Then, a hammerhead swam into view, and the scientists erupted in cheers. They also saw a cool-looking stingray. By Tanya Lewis. The original article is from [Business Insider](#).



**When you face the eruption
Do you feel the ending of the world?**



Nursing Steps to Prevent Surgery-Related Pressure Ulcers in Patients Undergoing Combined Hysteroscopy and Laparoscopy: A Double-Blind, Randomized, and Controlled Trial

Dong Ying Fu, Bi Chao Wang, Wen Jia Guo, Jia Nan Jiang

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Nursing Steps to Prevent Surgery-Related Pressure Ulcers in Patients Undergoing Combined Hysteroscopy and Laparoscopy: A Double-Blind, Randomized, and Controlled Trial

Dong Ying Fu,^{*,Δ} Bi Chao Wang,^{*} Wen Jia Guo,^{*} Jia Nan Jiang^{*}

OBJECTIVE To evaluate the preventive effect of perioperative nursing interventions on acute pressure ulcer in patients undergoing combined hysteroscopy and laparoscopy.

METHODS A total of 144 patients who undergoing combined hysteroscopy and laparoscopy were randomly divided into an experimental group and a control group. The patients of the experiment were implemented by new interventions throughout the perioperative period. The patients in the control were provided only routine care. Assessment for skin integrity and pressure ulcer risk factors carried out during three periods. The outcomes including the patients' feedback, the incidence and the stage of pressure ulcer were collected.

RESULTS The incidence of pressure ulcer in the experiment was significantly less than that in the control group. The experimental group was placed in positions that they were able to tolerate comfortably. The score of their satisfaction is significantly higher than those in the control group. The patients of both groups developed stage I pressure sores, but no statistical difference.

CONCLUSION The nursing interventions of the experiment can be considered as an effective method of decreasing the incidence of pressure ulcer in patients undergoing combined hysteroscopy and laparoscopy. Those strategies that start in the preadmission areas and continue through the intraoperative to postoperative periods can have a noticeable impact on patient's outcomes. ■

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Keywords: Pressure ulcer – Nursing interventions – Operating room

Acute pressure ulcers are caused by excessive pressure, which occludes the flow of the arterioles at the capillary level, therefore tissue necrosis occurs. A number of contributing factors are associated with pressure ulcer and prolonged pressure is one of the main factors (1) that cause surgical position-related pressure sore. Cinsdile and colleagues (2) showed that tissue when subjected to 9.33kPa pressure for 2 hours began to show irreversible damage. Surgical patients present a unique challenge in preventing pressure ulcer because they are immobile and unable to perceive the discomfort of long-term pressure. The incidence of pressure ulcer in this high risk group reached 4.7%-66% (2). Hysteroscopy and laparoscopy as minimally invasive approaches are now available for almost all gynecological diseases. The patients undergoing combined hysteroscopy and laparoscopy will be in the lithotomy position. This position poses significant risks for pressure ulcers at ankle support sites, obturator nerve injury and common peroneal nerve injury (3). This study explored a series of nursing interventions provided from the preoperative period to the postoperative period to diminish ulcer risk and protect skin from ulcer in such group of patients.

METHODS

Ethical Considerations

The study was conducted at a tertiary teaching hospital in Nanjing, China, after approval by the Institutional Ethics Committee. One hundred forty four Chinese adult patients who had combined hysteroscopy and laparoscopy had provided informed consent for study participation from February to December, 2014.

Study Design

The experimental group had been provided a series of nursing interventions from the day before surgery to postoperative phase. The control

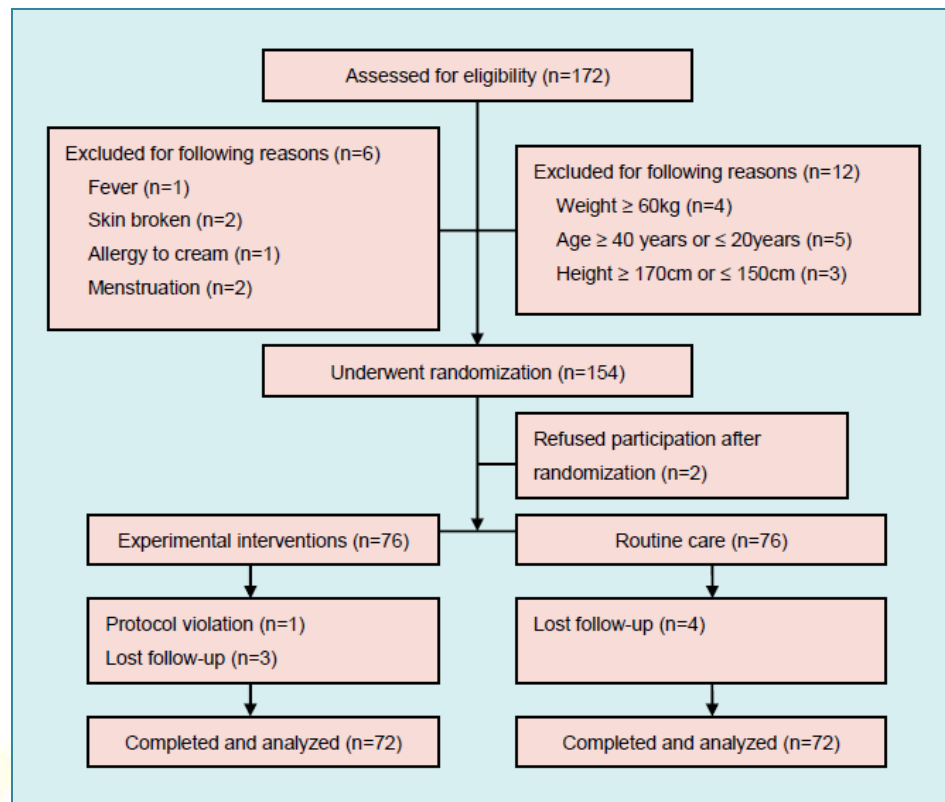


Figure 1. The study flowchart of the patient recruitment.

Flow chart shows that two patients refused to participate in this study for private reasons. Seven patients lost follow-up, because they were transferred to other hospitals. Eighteen patients were excluded for medical reasons and special demographic characteristics.

group had been provided routine nursing interventions depending on nurses' experience.

The Experimental

The Day before Surgery:

- (i) Circulation nurse visited the patients and explained all the details of the procedure in common words (4).
- (ii) RN can obtain the general information according to the skin assessment. Nurses may train patients how to do the positioning to make them familiar with the surgical position if necessary. The patients are informed that they might feel uncomfortable in this lithotomy position.
- (iii) Nurses should teach patients skills about preventing pressure ulcer.
- (iv) The humidity in the operating room should be maintained at 40%-60%.

The Day of Surgery:

(i) Preoperative period:

The patients were kept warming when they arrived at the holding bay. Preadmission nurses applied the normal cream to the skin surface of limbs and backs of the patients, and then gave them a three minutes period massage on their limbs and backs to make muscles relax (5).

(ii) Intraoperative period:

(a) The patients were placed in low lithotomy position in this procedure. Patient's thighs are elevated approximately 45 degrees according to the individual legs length and the feelings of patients (3). Nurses should communicate with the patients regarding potential areas of discomfort and possible remedies. They explained the steps and the importance of positioning to ensure that patients can cooperate with the optimal exposure and the access to the surgical site. The nurses make a promise that they will care patients with their best

Table 1. Demographic data of the patients.

Variable	Experimental Group (n=72)	Control Group (n=72)
Age – yr	24.1 ± 6.1	24.3 ± 7.2
Height – cm	161.5 ± 7.2	162.4 ± 8.7
Weight – kg	52.4 ± 5.0	51.1 ± 6.1
Time of operation – h	2.4 ± 0.4	2.3 ± 0.5

Data are presented as Mean ± standard deviation (SD).

effort during the operation. This maximally relieves the patient's anxiety. Smooth and soft pads are available on the stirrups to protect skin and to keep warm (6). The buttocks should be padded with Akton gel pads to reduce the localized pressure. The legs are raised to remain horizontal (3). The stirrup straps are used after nurses making sure that patients are able to tolerate comfortably.

(b) All of the positioning would be done before induction, so that the patients were able to tolerate uncomfortable feelings caused by surgical position during the postanesthesia period (7).

(c) The patients are vulnerable because the general anesthesia can alter cognitive function. Nurses monitored physiologic effects of position changes. They provided warmth to maintain normothermia and ensured that no equipment or personnel create pressure on the patient.

(d) The sterile plastic sheets were placed on the sterile drapes to prevent pooling of fluids under dependent areas in this procedure (3).

(iii) Postoperative period:

The patients were provided massage to their legs in order to relax muscles and prevent reperfusion injury (8).

The Next Day:

Circulation nurses started the regular visiting. They communicated with the patients to get the feedback of the interventions and their experi-

ence (4). Nurses also required patients to score their satisfaction on the surgical positioning in order to improve their job.

The Control

Preoperative visiting was carried out the day before surgery to obtain the information and plan individual care. Nurses provided routine care. Surgical position was placed after anesthesia procedure and depended on nurses' experience. Circulation nurse provided postoperative visiting to understand patients' feelings.

Data Collection

The length of the procedure, the stage of pressure ulcer, the number of pressure ulcer in each group and the score of patient's satisfaction were collected (the range of score: from complain 0 to fully satisfied 100). The trained nurses examined all patients and collected the feedback from circulation nurses' perioperative visiting. Nurses used wound and skin assessment tool translated from Harvey C: Wound healing (5) to do pressure ulcer assessment.

Data Analysis

Data were analyzed using the GraphPad Prism version 5.0 (GraphPad Software Inc., San Diego, CA). In the univariate analysis, the Chi-square test and independent t-test method were adopted to assess the differences of the mean value of categorical and continuous variables, respectively. The paired t-test was adopted for dependent sample. A *P*

value of less than 0.05 was considered statistically significant.

RESULTS

Sample Selection

This was a randomized, double-blind, controlled study. A total of 144 patients with the clinical diagnosis of infertility were randomly divided into experimental group and control group (Figure 1). Table 1 shows no significant difference between two groups regarding the age, the height, the weight and the lengths of surgeries. There was no difference between two groups in their BMI and the preadmission Braden score. No taking sedative and hypnotic drugs. None of them has the history of mental illness, diabetes, fracture and other conditions related to pressure ulcer. There was no statistically significant difference between two groups ($P > 0.05$).

Outcomes

As the bar showed in the Figure 2, the incidence of stage I acute pressure ulcer in the experimental group was lower than in the control group, the incidence had statistical significant difference between two groups ($P < 0.05$).

As showed in the Figure 3, the score of the patient's satisfaction was higher in the experimental group than in the control group ($P < 0.05$). The patients of the experiment experienced greater satisfaction than the patients of control group.

DISCUSSION

Pressure ulcer has multiple factors that include physical forces and OR conditions, such as pressure, shear, friction, moisture and temperature. This study focused on essential risk factors in order to carry out the appropriate interventions to prevent the surgery-related pressure ulcer. The preoperative visiting that focus on the concerns is the opportunity to identify patients at risk as soon as possible, so that a collaborative strategy and management can be achieved to reduce the risk factors (9).

The general anesthesia is administered for the procedure of combined hysteroscopy and laparoscopy. There are several risks factors of pressure ulcer related to the general anesthesia, such as immobilization, absence of skin sensitivity, changes in tissue perfusion and the patient's response to pain. If the patients under anesthesia are placed uncomfortably, the physical forces that establish and maintain a surgical position can damage the skin and nerves (3). In this study, nurses placed patients before the induction to ensure that patients can tolerate comfortably. The surgery-related skin and nerve injury can be minimized (3). Postoperative visiting showed that experimental group experienced greater satisfaction than the patients of control group. The incidences of pressure ulcer and nerve damage in the experimental group were lower than in the control group. The interventions implemented in the experimental group improved the quality of care for the patients undergoing this procedure. There was no difference between two groups in the stage of pressure ulcer which is the stage I and this result is the same with the Karadag' study (9).

In this surgery, liquid media can be used to distend the uterine cavity and maceration may occur. Adams (10) and Derler (11) report

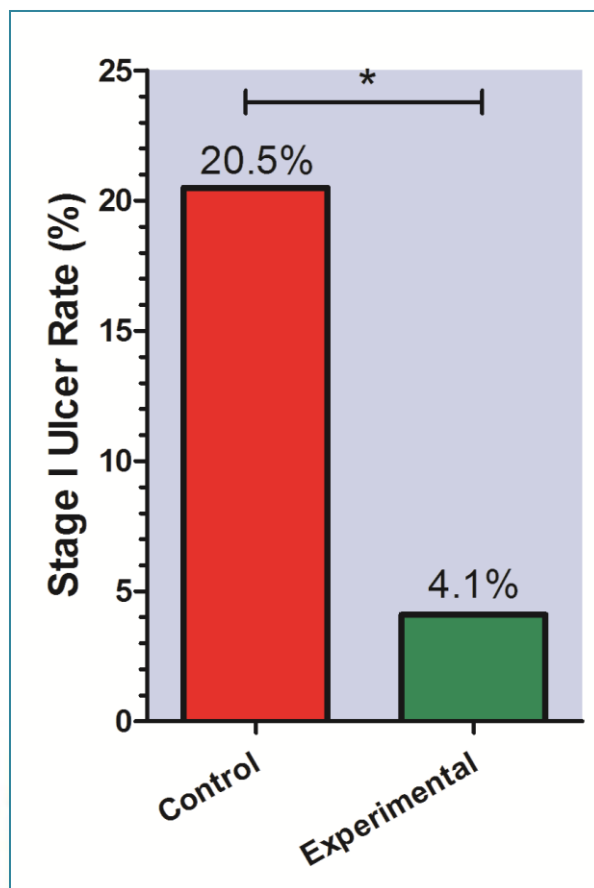


Figure 2. Comparison of pressure ulcer incidence.

The results of experimental group reveal a lower pressure ulcer incidence compared to control group. Only three patients (4.1%) suffered OR-induced pressure ulcer in the experimental group, compared with fifteen patients (20.5%) in the control group. This result can indicate that all these interventions, such as massaging high-risk areas before surgery, positioning before anesthesia and water-proof draping can remarkably diminish incidence of pressure ulcer.

that skin resistance to pressure from shearing force can be reduced by moisture and if friction occurs on macerated skin, skin becomes more vulnerable and weakened. In this study, applying the cream on the skin with massage can relax the muscles and promote the tissue perfusion. The cream is a water-repellent lubricant, so that maceration can be avoided and the impact of friction can be decreased. Furthermore, nurses provided water-proof sheet to avoid moisture. Compared with the control group, fewer patients in the experimental group suffered from OR – induced pressure ulcer. Applying the cream with massage and water-proof draping can reduce the incidence.

Fear of the unknown and anxiety are the common feelings for patients, so the physical, psychological and emotional preparation should be involved before surgery. Being familiar with the procedures and positioning can increase patients' confidence and bring better outcomes. Preoperative and postoperative visit-

ing contributed significantly to the patient's satisfaction. Nurses provided appropriate interventions to meet the physical, psychological and emotional needs for the experimental patients before, during, and after surgery. So the patient's feedback showed that the care interventions can fully satisfy them.

CONCLUSION

The purpose of this study is to explore some new strategies to diminish the surgery-associated pressure ulcer. Implementing the holistic interventions at all phases of surgical care can significantly reduce the incidence of pressure ulcer and the risk for intraoperatively acquired neuropathies in patients undergoing combined hysteroscopy and laparoscopy. Nursing actions in positioning should reflect an individualized plan of care designed to ensure injury prevention, while maintaining optimal surgical access, patient comfort, and physiologic support (3). Our study shows multiple interventions,

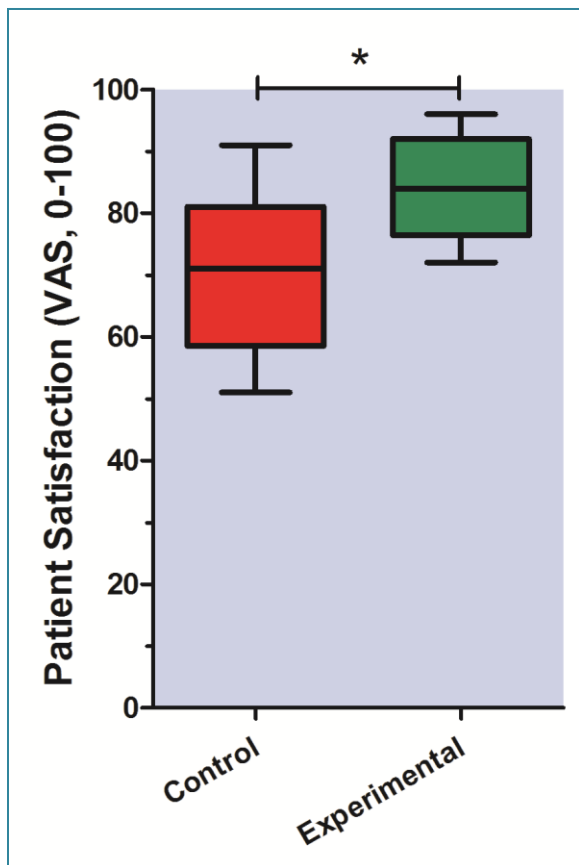


Figure 3. Patients' satisfaction score.

The comparison of the score of patient's satisfaction for the positioning between two groups with a mean score of 84 (84 ± 12) versus 71 (71 ± 20) and $P < 0.05$ can be considered significant. RN gave the preoperative education to develop patients' skills of preventing surgical complications. Furthermore, they communicated with patients about how to modify the positioning to make patients feel better before induction. Patients may better understand and cooperate with medical staff during procedure. In addition, they facilitated patients to establish a positive attitude towards treatment during postoperative visiting. Those strategies may explain why the mean score (84) in the experimental group was higher than the control group.

such as massaging high-risk areas before surgery, positioning before anesthesia, water-proof draping and perioperative education, those strategies going through all the periods of procedure can remarkably diminish incidence of OR induced pressure ulcer and increase the patient's satisfaction. Due to the limitations of demographic characteristics, further studies may need to be conducted among the patients of different ethnic groups.

Conflict of Interest

None

Acknowledgement

We would like to thank all the participating nurses and statisticians.

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Who feeds us?

help those in need...



Stop wasting foods

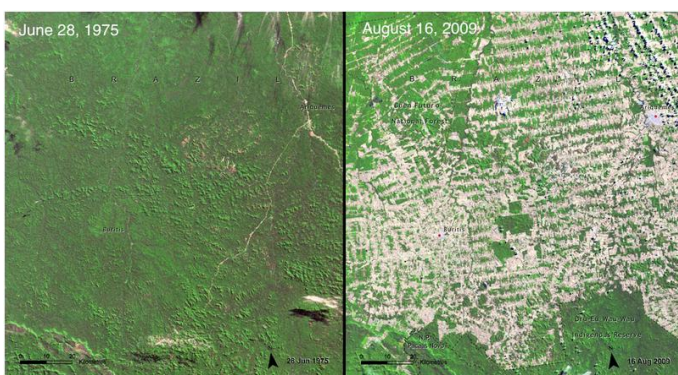


Fourteen Before-And-After Images That Show How We're Transforming the Planet

By Brad Plumer (USA)

HUMAN beings have replaced nature as the dominant force shaping Earth. We've cleared away forests, dammed up mighty rivers, paved vast roads, and transported thousands of species around the world. "To a large extent," two scientists recently wrote, "the future of the only place where life is known to exist is being determined by the actions of humans." So what does this look like? In recent decades, NASA has been tracking the major transformations we've wrought via satellite. In its "Images of Change" series, the agency has posted a number of before-and-after images showing the exact same rainforest or glacier or city years or decades apart. The differences are often breathtaking. Here are 14 of the most revealing changes:

1. Rainforests Get Swallowed by Farms in Brazil

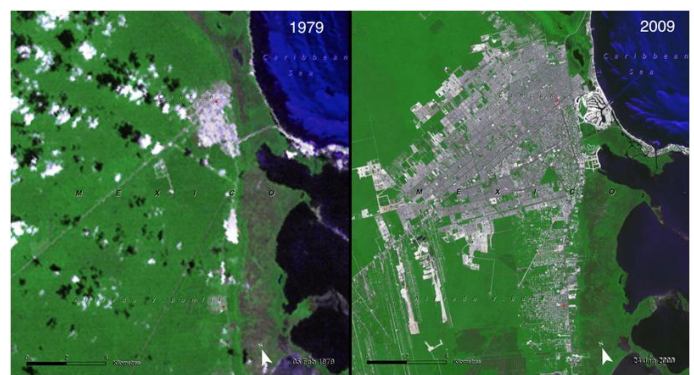


Satellite images of Rondônia in Western Brazil, taken in 1975 (left) and 2009 (right). (NASA, Images of Change)

Humans have been clearing forests to make way for farms and pastures for at least 7,000

years. And as the world's population soars past 7 billion, the pressure for cropland is only growing. The image above shows the state of Rondônia in western Brazil, one of the most deforested parts of the Amazon. In 1978, 2 percent of the state's rainforest had been cleared. By 2008, that was up to 34 percent — an area the size of West Virginia. You can see a more detailed progression in these images: new roads protrude into the forests like fishbones, with nearby trees vanishing soon after. The newly cleared land can only sustain crops for a few years until heavy rains erode the soil, at which point it's turned over for cattle. Then repeat. Deforestation has all sorts of troubling side effects, from shrinking habitats for forest species to increased global warming via a reduction in carbon-dioxide-absorbing trees. Brazil has tried to protect its rainforests in the last decade, but pressure to clear away trees has risen again since 2013.

2. Cancún Expands at A Stunning Rate



Cancún, Mexico, seen in 1979 and 2009. (NASA, Images of Change)

Cities and towns have been around for thousands of years, but the growth of urbanization has been astonishing over the past century. More than 3.9 billion people and counting now live in urban areas. The images above show the rapid growth of Cancún, Mexico. In the 1970s, this area was lightly inhabited, home to artisanal fishermen and empty beaches. But the government pushed to turn the area into a tourist hotspot, and today it's home to 722,000 people. That's been a huge economic boon, though it's also meant a loss of biodiversity and polluted water. The fact that more people now live on Mexico's coast also increases their vulnerability to hurricanes — one reason why the cost of natural disasters keeps rising worldwide.

3. Dubai Builds A Chain of Artificial Islands



Dubai, United Arab Emirates, seen in 2001 and 2011. (USGS and NASA)

Some cities have gotten creative about urban growth, reclaiming land from the sea. These images show the rapid growth of Dubai, in the United Arab Emirates, between 2000 and 2011. To promote beach tourism, the city built hundreds of artificial islands along the coast using sand dredged from the seashore. Rocky barriers were put in place to protect them from erosion. The two most famous islands are shaped like palm trees. As the images above show, the growth of Dubai on land has been no less dra-

matic, with barren desert replaced by irrigated land and roads.

4. The Oil-Sands Boom in Alberta, Canada

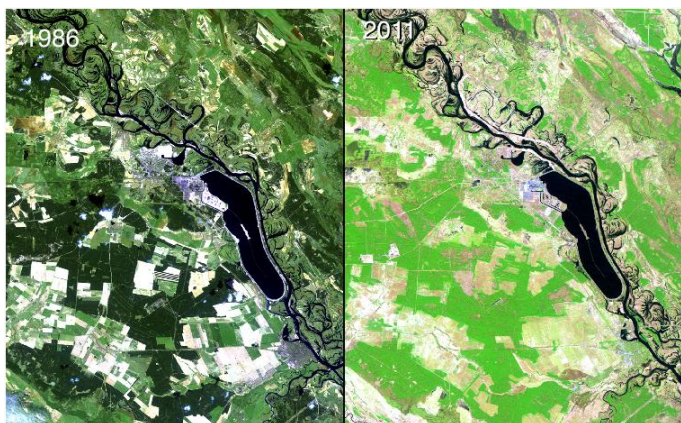


Open pit mines near Fort McMurray in Alberta, Canada, seen in 2000 and 2007. (NASA, Images of Change)

In the 2000s, global demand for oil kept surging, but conventional wells weren't keeping up. So companies cast an eye on the vast oil sands buried beneath the boreal forests in Alberta, Canada. These sands contain bitumen, a gooey petroleum that can be extracted for fuel. The images above show the growth of oil sands mining near the Athabasca River during the 2000s. Once the sand is mined, it's rinsed with hot water to separate out the bitumen. The sand and water are then dumped in tailings ponds, which can be seen as smooth tan squares in the images. These mines have had a profound impact on the landscape around them. Forests have to be cleared to make way for the mines — more than 256 square miles as of 2011. The tailings ponds themselves can be toxic to birds. As such, Canada's regulators have required companies to restore the land after they finish mining. Another NASA satellite photo here shows a reclaimed area after a pond was drained and planted over, though the grasses have not yet grown. Meanwhile, because it takes so much energy to extract oil from the sands, this type of fuel is worse for global warming than regular crude oil. That's a

big reason the Keystone XL pipeline, which would help bring Alberta's oil to market, has been so controversial in the United States.

5. Ukraine's Landscape Recovers after Chernobyl



Chernobyl Nuclear Power Plant, seen in 1986 and 2011. (NASA, Images of Change)

Human activity doesn't always expand relentlessly. Occasionally, nature reclaims the land. The images above show the evolution of the area around the Chernobyl Nuclear Power Plant after a reactor explosion in 1986.

On the left, you see the area in 1986, just before the accident. There are cultivated fields (in light colors), small towns (in blue and purple), and old forests (dark green). Then, on April 26, radiation began leaking out of Chernobyl's reactor number four and people fled the area. As of 2011, things look very different. The abandoned towns are decaying. The farms have now reverted to grasslands (bright green). The forests were bulldozed by the government and replanted (younger trees are seen as lighter green). Intriguingly, plant and animal populations have actually grown within the exclusion zone since the accident. Animals are still adversely affected by the radiation, but they are also thriving in the absence of humans.

6. A Man-Made Fire Rages in Namibia

Etosha National Park in Namibia. The white area is the Etosha Pan, a salt-encrusted lake bot-

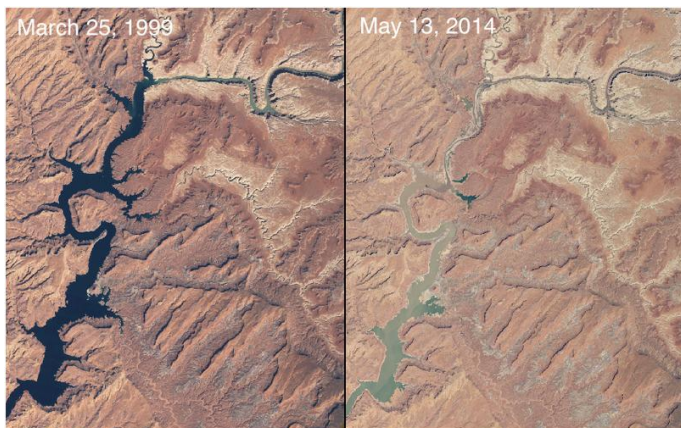


tom. The dark brown area shows where a fire burned in June 2012. (NASA, World of Change)

For much of the 20th century, as human settlements expanded, we thought we knew how to deal with large-scale wildfires: prevent them at all cost. The US Forest Service adopted this strategy in the forests of the American West. And Namibia's forest managers used this strategy in Etosha National Park, which opened in 1907 and serves a key reserve for rhinos, elephants, and lions. This turned out to be a bad idea. Wildfires were a crucial part of the ecosystem. Before humans came along, Namibia's savannahs would burn about once per decade. When park managers suppressed these periodic wildfires, that only led to really massive fires later, as vegetation built up. So now, in Namibia, the park managers periodically try to set smaller fires themselves. Occasionally, though, these fires can get out of hand, as happened in June 2012, shown by the satellite image above. On June 9 and 10, winds picked up and the fire rapidly spread west. Fortunately, no animals were harmed — in contrast to an out-of-control fire in 2011 that killed 30 rhinos.

7. Efforts to Tame the Colorado River Hit A Snag

The Colorado River begins in the Rocky Mountains and courses through the American Southwest. During the 20th century, Americans built a complex system of dams and reservoirs to tame the river, providing a steady source of freshwater for farms and cities like Phoenix and Las Vegas. Water from the river is divvied up among states under an elaborate set of rules.



Lake Powell, seen on March 25, 1999, and May 13, 2014. (NASA, Images of Change)

But we can't entirely control nature. The images above show Lake Powell, a reservoir on the border of Arizona and Utah that was created after the construction of the Glen Canyon Dam. Back in 1999, the lake was filled high, with plenty of water for nearby counties. But in the early 2000s, a brutal drought arrived and water levels began dropping. As of May 2014, the lake was only at 42 percent capacity. The communities around the region have tried to adapt through efficiency and conservation. Still, some experts have argued that the Southwest is unprepared for future droughts — which are expected to become more frequent with global warming. That will raise the risk of shortages in reservoirs like Lake Powell.

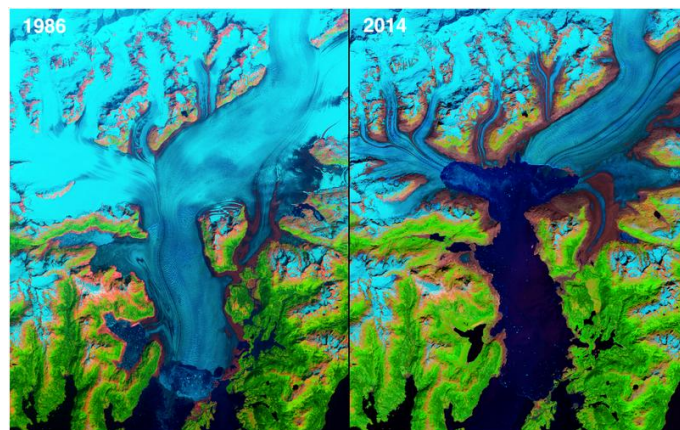
8. The Aral Sea, Once Massive, Nearly Vanishes



The Aral Sea, seen in 2000 and 2014. (NASA, Images of Change)

The Aral Sea, tucked between Kazakhstan and Uzbekistan, was once the fourth-largest lake in the world. Today, after decades of being drained for irrigation, it's nearly gone. What happened? In the 1960s, the Soviet Union diverted the Syr Darya and Amu Darya rivers that fed the lake — via a network of dams and canals — for use in cotton fields and other agriculture. The surrounding desert bloomed for a period, but it eventually led to disaster. Here's NASA: "As the lake dried up, fisheries and the communities that depended on them collapsed. The increasingly salty water became polluted with fertilizer and pesticides. Blowing, salty dust from the exposed lakebed became a public health hazard and degraded the soil. Croplands had to be flushed with larger and larger volumes of river water." By the 2000s, the Aral Sea was roughly 10 percent of its original size. The area's once-vital fishing industry had been eradicated, leaving entire communities unemployed.

9. Alaska's Columbia Glacier Recedes Rapidly



Alaska's Columbia Glacier, seen on July 28, 1986 and July 2, 2014. (NASA, Images of Change)

One of the most dramatic ways we're transforming the planet is through global warming. And a great place to see its effects is through the melting of glaciers and ice sheets around the world. The images above show the Columbia

Glacier in Alaska, which flows directly into the sea. The glacier had stayed more or less fixed in place between its discovery in 1794 and 1980, but then suddenly began shrinking. Between 1986 and 2014, its nose had retreated 12 miles north, making it one of the fastest-receding glaciers in the world. NASA's Earth Observatory explains that the retreat of Columbia Glacier is only partly a result of warmer air and water temperatures: "Climate change may have given the Columbia an initial nudge off of the moraine, but what has accelerated its disintegration has more to do with mechanical processes than warming temperatures." Global warming is having a similar impact elsewhere: all told, the world's glaciers are now losing 226 gigatons of ice per year.

10. Antarctica's Larsen B Ice Shelf Disintegrates

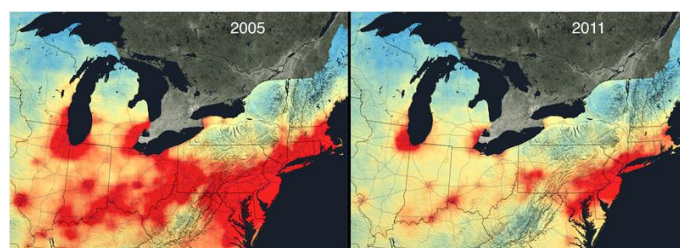


Larsen-B ice shelf in Antarctica, seen on January 31, 2002 and February 17, 2002. (NASA, World of Change)

Receding glaciers are one thing. But the massive ice sheets atop Greenland and Antarctica are an even bigger deal. As the world keeps warming, these ice sheets are starting to melt into the ocean, a change that is expected to raise global sea levels significantly. Scientists witnessed a dramatic example of this in 2002, when the Larsen B ice shelf in Antarctica — an area of 1,250 square miles — simply disintegrated into the ocean in the span of a month. The collapse was precipitated by a series of unusually warm summers, which created melt ponds during the warmer months that acted as

wedges, hastening the shelf's disintegration. By itself, the collapse of an ice shelf won't raise global sea levels, since ice shelves are already floating in the sea. But those shelves do help contain the massive ice sheets on the land behind them, so when a shelf disintegrates, all that ice can flow to the sea more quickly. And that helps raise sea levels. You can see that flow of land ice in these images after the collapse of Larsen B. And here's troubling news: Scientists have found that a number of Antarctica's other ice shelves are also rapidly thinning.

11. The US Cleans Up Its Air Pollution

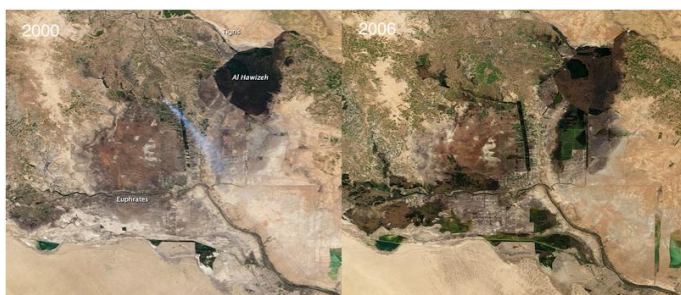


Images show concentrations of nitrogen dioxide in 2005 and 2011, from low (blue) to high (red) (NASA, Images of Change)

Not all of the ways we're transforming the planet are negative. Here's some good news: Satellite data from NASA, shown above, revealed a huge reduction in nitrogen dioxide pollution from cars, trucks, power plants, in the United States between 2005 and 2011. Nitrogen dioxide is produced when gasoline gets burned in cars or coal gets burned in power plants. It's been linked to a variety of respiratory problems, and can combine with other pollutants to form smog. It's also a good proxy for pollution more generally. The EPA first began cracking down on nitrogen dioxide in 1971, and concentrations have fallen sharply over time. Power plant operators have installed scrubbers to remove pollutants from their smokestacks, and car manufacturers have adopted catalytic converters to curtail nitrogen oxides and other emissions. More recently, since 2005, many electric utilities

have been switching from coal to natural gas in order to generate electricity.

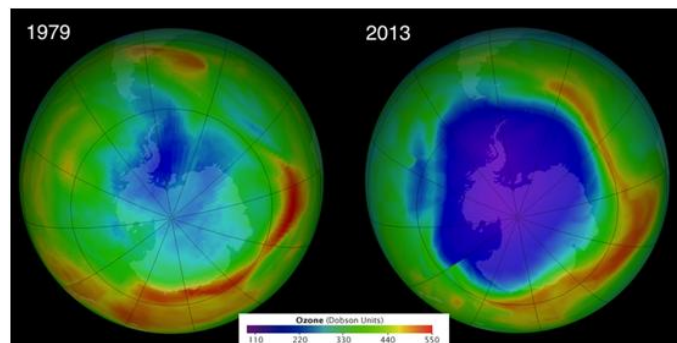
12. Iraq's Marshes Recover after Saddam Hussein



The wetlands of Mesopotamia in 2000 and 2006. The map shows standing irrigated crops (light green), standing water (dark blue), vegetation (dark green), and bare ground (brown). (NASA, World of Change)

Here's a change that actually restored nature — at least temporarily. During the 20th century, Iraq's lush wetlands between the Tigris and Euphrates rivers had mostly dried up because of a series of dams that had been constructed for electricity, as well as a deliberate strategy by Saddam Hussein to drain the wetlands and punish the region's Marsh Arabs for rebelling. But as the images above show, things changed significantly after the Second Gulf War. After the fall of Saddam Hussein, Iraqis tore down many of the canals that had drained the marshes. The wetlands were once again fed by the rivers in the spring, and vegetation had returned by 2006 — shown in dark green on the right-hand side. The UN found that the marshes were back up to around 58 percent of their historic levels, and native birds and fish were rebounding. But it's not clear if the wetlands will survive in the future. NASA explains that new dams were being built upstream as of 2010. The fate of nature is, once again, largely in our hands.

13. The Ozone Layer Thins — But Then Starts Healing

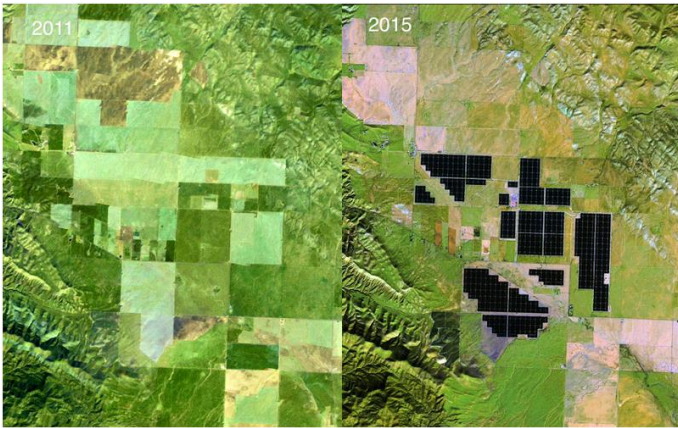


(NASA Earth Observatory)

Sometimes it's possible to stop an environmental catastrophe before it's too late. Back in the 1970s, scientists first realized that we were rapidly depleting Earth's stratospheric ozone layer, which protects us from the sun's harmful ultraviolet rays. The culprit? Chlorofluorocarbons (CFCs) — chemicals that were widely used in refrigerators and air conditioners. As the NASA images above show, between 1979 and 2013 these chemicals had chewed a massive "hole" in the ozone layer above Antarctica, and the damage was poised to spread further north. Without the ozone layer's protection, more and more people would be exposed to UV rays, and skin cancer rates in many places might have soared. Happily, this apocalyptic scenario never came to pass. Scientists uncovered the problem in time. Under the 1987 Montreal Protocol, world leaders agreed to phase out CFCs, and eventually the hole in the ozone layer stopped expanding. In 2014, a UN assessment found that the ozone layer is just now starting to heal — and should be back to its 1980 levels by 2050 or so.

14. Solar Farms Sprout Up in California

The next big environmental challenge is global warming, which will likely prove much harder to stop than the hole in the ozone layer. It will entail revamping our entire energy system, switching away from fossil fuels like coal, oil, and natural gas and seeking out cleaner sources. Some places are already taking steps along those lines. The image above shows the growth of the Topaz Solar Farm in central California, a



550-megawatt plant consisting of 9 million panels across 9.5 square miles. It's a modest step in shifting the state toward cleaner energy. Even so, some environmentalists have opposed the project, arguing that solar farms need a lot of land and fences, hindering the movement of the federally protected San Joaquin kit fox. It's a reminder that even efforts to reduce our environmental footprint in one area can lead to unexpected impacts elsewhere. ■

The Topaz Solar Farm in California, seen in 2011 and 2015. (NASA, World of Change)

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TODAY'S WORLD

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FREEDOM



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