Hope for New Arthritis Treatment

Inhibiting a single enzyme may be enough to block the development of arthritis, research suggests. According to BBC News website, scientists prevented the gradual loss of protective cartilage around the joints that leads to arthritis by modifying a gene for a key enzyme.

The US and Australian teams hope their work could lead to treatments to combat osteoarthritis and possibly inflammatory arthritis.

Cartilage contains a crucial component called aggrecan, which functions like a shock absorber, helping the tissue bear load and resist compression.

Normal healthy cartilage has lots of aggrecan, but in arthritis aggrecan is destroyed by a family of enzymes called the aggrecanases, and the cartilage loses its shock-absorbing capacity.

The researchers, from US company Wyeth and Australia's University of Melbourne and Murdoch Children's Research Institute, have discovered one particular member of the aggrecanase family, aggrecanase-2, plays a crucial role in this destructive process.

They genetically engineered mice that lacked a part of one such enzyme, aggrecanase-2.

They found that these animals were largely protected from cartilage destruction.

Mass Extinction Came in Phases

The greatest mass extinction recorded in Earth history did not occur as a result of one single cataclysmic event.

A joint UK-Chinese team tells Nature magazine the disaster that befell the planet 250 million years ago must have happened in phases.

Their conclusion is based on the abundance of "organic fossils" found in rocks at Meishan in southern China.

These suggest there were at least two episodes to the mass die-off that saw up to 95% of life forms disappear.

"And this fits with a growing body of literature that now points to a complex sequence of changes on Earth," Richard Pancost, from the University of Bristol, UK, told the BBC News website.

Some scientists have proposed the idea that the "great dying" at the boundary of the Permian and Triassic Periods could have occurred quite abruptly - the result of environmental changes brought on by the impact of a giant space rock.

It is a similar argument to the one put forward to explain the demise of the dinosaurs at the much later date of 65 million years ago.

A geological structure, known as the Bedout High, in the seabed off what is now Australia, has even been suggested as the possible crater remains from the impactor.

But it is an argument that has struggled to find favor.

The prevailing theory is that several factors--including supervolcanism and extensive climate warming--combined over thousands of years to strangle the planet's biodiversity.

Earth may well have been hit by extraterrestrial objects, but it is unlikely there was some killer punch from space.

Music Can Reduce Pain

Scientists say music can reduce pain and relieve stress, ananova.com reported. Volunteers in Glasgow were asked to try to keep their hands in icy cold water while listening to music, doing sums or watching comic Billy Connolly.

The people listening to music were able to tolerate the pain the longest - sometimes up to five times as long reports The Sun.

Dr Laura Mitchell at Caledonian University said, "Music appeared to be the most effective strategy in combining distraction and feeling of control. It may explain why it can help in the gym."

Why Some People Can't Stop Worrying

Researchers at The University of Manchester's Faculty of Medical and Health Sciences are studying the relationship between the biology of the nervous system, anxiety symptoms and behavioral problems. In particular they are interested in generalized anxiety disorder (GAD) and anti-social personality disorder (ASPD), Science Daily online reported.

The study will use recent advances in magnetic resonance imaging (MRI scanning) to observe the effect of brain chemicals like serotonin on brain function, with the aim of finding effective treatments for anxiety and anti-social behavior. It is led by Professor Bill Deakin and Dr. Ian Anderson of the Faculty's Neuroscience and Psychiatry Unit.

Anxiety disorders like GAD, which involve excessive worrying, are due to changes in the activity of the brain circuits involved in anxiety. Abnormalities in brain serotonin influence these circuits and are therefore targeted by anti-anxiety drugs.

Conditions like ASPD may be the reverse side of the coin, and it is already known that the brain activity of people with problems like this differs from that of healthy volunteers. The team believes that this may also be due to subtle disturbances in the brain's serotonin function.

Previous tests on healthy people relating to impulsiveness, reward and reactions to facial emotions have activated particular networks that are part of the brain's anxiety circuits. The team will therefore use the MRI techniques to watch the brain functioning during such tasks in healthy, anxious and anti-social subjects, to observe differences between the groups and find out how they are affected by changes in serotonin activity.

The team is looking for male volunteers aged 18 ' 60 who are either healthy or suffering from excessive anxiety. The study is based at Manchester Royal Infirmary and participants will be asked to attend the hospital for three consultations, with up to £115 reimbursement available for time and travel commitments. Volunteers will also be entered into a prize draw.

Chondrules, by Jove!

Dynamic simulations of the early solar system show giant shock waves surfing across the protoplanetary disk from the orbit of Jupiter and striking circling dust grains with enough speed to fuse them. The result is chondrules, millimeter-size beads that make up the bulk of rocky meteorites and play an important role in planet formation, astronomy.com said.

For more than a century, astronomers and meteoriticists have debated how chondrules formed. These simulations from two independent research groups go a long way toward solving that 130-year old riddle. Recently, melting by shock waves emerged as the leading theory. What the theory lacked was a convincing mechanism for generating those waves.

The missing mechanism has now surfaced in state-of-the-art simulations of the rotating disk of gas and dust that spawned the solar system. Teams led by Alan Boss at the Carnegie Institution of Washington and Richard H. Durisen at Indiana University performed the studies, which appear together in the March 10, 2005, issue of The Astrophysical Journal.

In both models, spiral arms and massive clumps of gas form in a gravitationally unstable zone near Jupiter's orbit. These clumps create enormous waves that spiral across the surface of the protoplanetary disk. In the inner disk the waves pile up into shock fronts, like breakers hitting a beach.

When dust grains "slam into the backside" of these shock waves at orbital speed--around 20,000 miles per hour (32,000 km/h)--they are flash-heated and fuse into chondrules.

Cosmic Rays Enter Dark Age

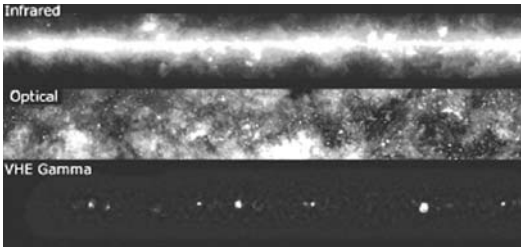
Eight new sources of very high energy gamma rays have been found in the centre of our galaxy, including two "dark" sources that have never been seen before at other wavelengths, PhysicsWeb.org said.

The discovery was made by an international team of astrophysicists who used the HESS array of telescopes in Namibia in Africa to conduct the most sensitive ever survey of the Milky Way at such short wavelengths. The results could help shed more light on the origins of cosmic rays in the universe.

Cosmic rays are high-energy particles from outer space that continually bombard the Earth. Although they were first detected in 1912, astrophysicists still don't know where the most energetic cosmic rays come from or how they are accelerated to such high energies. However, the acceleration of cosmic rays and the production of very high energy gamma-rays are thought to be connected.

Very high energy gamma rays have energies of 1011 eV or more and are thought to be produced by supernovae explosions, pulsars, quasars and massive star forming regions. However, these rays are quite rare and strike the Earth's atmosphere only about once per month per square metre. The High Energy Stereoscopic System (HESS) measures the Cerenkov radiation--short flashes of blue light--that is produced when the gamma rays are absorbed in the air. This light is collected by the four telescopes in HESS and is then used to create images of astronomical objects as they appear in gamma rays (see figure).

Of the eight sources detected, at least two have no counterparts at radio, optical or X-ray wavelengths. According to the team, these sources could be a new class of "dark" cosmic accelerators. Moreover, the main particles accelerated in these objects are nucleons rather than electrons as in the more conventional sources.



The "galactic plane" as seen in different wavebands in the centre of our galaxy.

Phononic Crystals Go Hypersonic

Scientists in the US, Germany and Greece have shown that "hypersonic crystals" can be used to control phonons--which are quantized sound waves--at high frequencies.

Taras Gorishnyy and colleagues at the Massachusetts Institute of Technology, the Max Planck Institute for Polymer Research in Mainz and the University of Crete say their results could be important for designing novel acousto-optical devices.

A phononic or sonic crystal is the acoustic equivalent of a photonic crystal. Just as the periodic variation of the refractive index in a photonic crystal means that only certain wavelengths of light are able to pass through it, a periodic variation in the acoustic properties of a phononic crystal means that only phonons with frequencies outside the phononic band gap can propagate.

Such crystals are made by embedding cylinders of one material in a different background medium, with the properties of the phononic band gap depending on the size and periodicity of the cylinders.

As the periodicity of the crystal become smaller the gap moves to higher frequencies, and at hypersonic frequencies--between 1 and 100 gigahertz-- the period becomes comparable with the wavelength of visible light. This means that such crystals should exhibit both phononic and photonic band gaps. However, hypersonic crystals are difficult to fabricate and characterise.

The MIT-lead team has now developed a complete "tool set" for designing and making hypersonic crystals, and for studying the motion of phonons in them. Gorishnyy and colleagues used a technique called holographic interference lithography to grow high-quality, defect-free single crystals that consisted of triangular arrays of cylindrical air holes in an epoxy polymer matrix about 6 microns thick.

The team measured the phononic band gaps in the materials and followed the movement of phonons through them with a technique called Brillouin light scattering.

Controlling phonons in sonic crystals could be used to reduce noise in electronic circuits, control heat flow in nanostructures and enhance the interactions between light and sound waves in materials.

"Acousto-optical interactions in hypersonic crystals are predicted to lead to a number of intriguing effects, such as optical cooling and shock-wave-mediated light frequency shifts," Gorishnyy told PhysicsWeb.

"Our results suggest a novel way to design a variety of acousto-optical devices, such as optical modulators and optically pumped acoustic oscillators."