

Healthy Bones

There are more than 200 bones in the body. Their strength, density and mobility are vital to enable physical movement and protect internal organs.

Lack of exercise, poor diet, and hormonal and genetic factors can all affect bone strength and contribute to bone thinning, known as osteoporosis. So bbc.co.uk has come up with some useful tips for having healthy bones:

- * Eat a diet high in calcium, which is found in nuts, seeds, soya produce, wholegrains, vegetables, fish and dairy produce.
- * Increase your intake of essential fatty acids (EFAs) as these facilitate calcium absorption and may slow down calcium excretion and bone loss. EFAs are found in oily fish and various nut and seed oils.
- * Limit your intake of fizzy drinks, tea, coffee, sugar and bran, which can all inhibit calcium absorption.
- * Calcium absorption requires the presence of other minerals, especially vitamin D, magnesium and phosphorus. These are abundant in nuts, seeds, soya produce and wholegrains.

* Include lots of phytoestrogens in your diet. These plant oestrogens help to slow bone loss and are found in soya produce, sesame, sunflower and pumpkin seeds, chickpeas, linseeds, alfalfa and the herb red clover.

* If you're taking a calcium supplement, take it in the evening. Calcium has a soporific effect and the uptake of calcium into the bones is greater at night.

* Get regular exposure to sunlight. This increases production of vitamin D, which aids calcium absorption.

* Take regular weight-bearing exercise. Walking, skipping, swimming, rebounding, racket sports and jogging are ideal.

* Don't drink alcohol and stop smoking, as both contribute to nutrient loss.

Universal Light Source Pinned Down

We live in a universe filled with light, but astronomers have long wondered how much of the light comes from visible stars and galaxies, and how much of it is near-infrared afterglow leftover from the early days of the universe.

Now, a team of researchers led by scientists at the Max Planck Institut has developed a way to tease apart these two types of light, writes space.com.

The universe's near-infrared light comes from a combination of observable galaxies and stars and also very ancient objects like the first stars ever formed. The sum of this light, which is the light emitted from all objects throughout the universe's history, is called the extragalactic background light (EBL).

In addition, "foreground light" is emitted by dust in the solar system, which radiates light in the same wavelength and makes it difficult for scientists to figure out how much light comes from each source. The trick is to measure the star light in the space between galaxies, where there is no foreground light.

The researchers looked at the emission from two blazar galaxies roughly two billion light-years from Earth. Blazars produce high-energy radiation from very violent processes.

The gamma rays produced by blazars become slightly dimmed as they make their way to Earth. The researchers installed four large telescopes in the grasslands of Namibia in 2004 to these detect faint flashes of blue light emitted when high-energy gamma rays hit our atmosphere.

Since then, they have accumulated over 80 hours of observation on the two blazars. By considering the maximum possible brightness of each blazar, the researchers were able to estimate the dimming of their emitted gamma rays.

Knowing the amount of dimming makes it possible for scientists to estimate the EBL between the blazar and Earth and thus figure out the amount of starlight.

Through this process, the study concludes that most of the EBL comes not from the earliest stars but from the local galaxies, a group of about 30 galaxies that includes our galaxy, the Milky Way.

Probiotics May Ease Gut Disorders

Probiotics may help ease gut disorders linked to long-term stress such as Crohn's disease, a research suggests.

A team at Canada's McMaster University analyzed gut tissue taken from rats put in stressful situations. Animals fed drinking water containing probiotic bacteria showed less signs that harmful bugs were mobilizing to cause damage. The gut study suggests probiotic bacteria literally crowd out their harmful peers.

According to bbc.co.uk, chronic stress is known to be implicated in the development of irritable bowel syndrome and in the worsening of symptoms of inflammatory bowel disease, such as Crohn's and ulcerative colitis. It also sensitizes the gut, producing allergies to certain food-stuffs.

The researchers designed their experiments to try to produce psychological stress in rats similar to that seen in humans. This was done by placing the animals on small platforms surrounded by water.

Half the rats were fed drinking water containing probiotic bacteria in the form of *Lactobacillus helveticus* and *Lactobacillus rhamnosus* for a period of seven days before and during the stress sessions.

Analysis showed that exposure to stress made the animals' guts leaky, and increased the amount of potentially harmful bacteria sticking to the cells lining the gut wall.

Harmful bacteria were also detected in the mesenteric lymph nodes, which drain fluid coming from the intestine, indicating that bacteria had entered the body and activated the immune system.

However, probiotic treatment minimized the changes in chemical signaling and prevented bacterial 'stickiness' and movement to the mesenteric lymph nodes.

The researchers believe that probiotics probably compete for space with harmful bacteria, helping to dampen down inflammatory responses.

They say their use offers a potentially promising approach to the management of intestinal problems caused by stress.

Self-Destructing Comet To Flash Close By

Astronomers will soon be treated to a close-up celestial show, with a fragmenting comet streaming across the sky in more than 30 chunks.

Comet 73P/Schwassmann-Wachmann 3 has been breaking up since 1995, but between 12 and 14 May will come closer to the Earth than any comet since 1983, reports science.com.

Fortunately no threat is posed to Earth since, even at its closest, the nearest of the pieces will be twenty times more distant than the Moon. But astronomers around the world will take advantage of the relatively close pass. The Hubble and Spitzer Space Telescopes will join with dozens of ground-based facilities for the observation campaign.

And scientists expect the brightest comet pieces to be visible through binoculars and possibly, faintly, to the naked eye.

By studying the materials exposed by the break-up, astronomers hope to learn more about the interior of comets, where pristine ingredients from the solar system's earliest days are thought to be preserved. For that reason, some astronomers view the event as a free version of NASA's comet-busting Deep Impact mission.

They also hope to gain insight about how and why such comets become



Comet 73P/Schwassmann-Wachmann 3 is breaking up and will make a close approach to Earth beginning 12 May.

fragmented. For largely unknown reasons, Comet 73P broke into as many as five pieces in 1995. Gravitational forces are known to tear apart some comets, such as the famous Comet Shoemaker-Levy 9 which ended its existence with a spectacular crash into Jupiter. But Comet 73P follows a 5.4-year solar orbit that does not bring it close enough to Jupiter or the Sun for gravitational tugs to be the culprit.

The initial trigger that

set Comet 73P's fragmentation process in action in 1995 is still a matter of speculation.

Robo-Turtle Answers Flippery Questions

Robotic turtle could help engineers build better autonomous underwater vehicles and answer fundamental questions about how prehistoric beasts swam. The robot, called Madeleine, is already helping researchers understand when it is best to swim with four flippers and when to use two.

According to newscientist.com, Madeleine is similar in size and weight to a Kemp's Ridley or Olive Ridley sea turtle, measuring 80 centimeters by 30 cm and weighing 24 kilograms. The robot also has a comparable power output, between 5 and 10 watts per kilogram, depending on how hard it is working.

The robot's polyurethane flippers have the same stiffness as a real turtle's, but are operated by electric motors connected to an onboard computer. These motors rotate each flipper so that its back lifts up, before rapidly sweeping it down again to generate propulsion. The robot is con-

trolled remotely but has several sensors including video cameras, sonar and altimeter and accelerometer. See a short video of Madeleine swimming along here.

By imitating the design of a turtle, the researchers hope to build more efficient ocean robots, with flippers. "The thinking is that if nature did it, it must be good," explains John Long, one of Madeleine's makers from Vassar College, in New York, US.

Long and colleagues used their robo-turtle and a swimming pool to experiment with different forms of flipper propulsion. They showed that four flippers are best for acceleration and stopping, while two flippers are more efficient for simply cruising along.

On average, Madeleine could stop in 44 percent less space using four flippers, and could reach a cruising speed of 0.7 meters per second 20 percent faster by using two.

HIV Drug Creates Resistance

Giving a single dose of the anti-retroviral drug, nevirapine, to HIV-infected mothers to prevent them infecting their babies at birth can cause drug resistance in about one-fifth of women, a new study suggests.

Anti-retroviral drugs stop the maternal transmission of HIV, and ideally pregnant women with HIV should get full-time therapy with several drugs, as this prevents the virus becoming resistant to any one drug. But where women cannot afford this, clinics give a one-off treatment with the

powerful drug nevirapine. Previous studies suggested that drug-resistant HIV "fades" or disappears from the mothers soon after.

But when Sarah Palmer and colleagues at the National Institutes of Health in Maryland, US, looked more carefully for specific nevirapine-resistance mutations in the HIV in 22 women given the treatment in Soweto, South Africa, they found that 5 women (23 percent) had some drug-resistant HIV one year later.

The problem is that viral infections consist of a swarm of mutant strains. But standard tests for drug

resistance do not detect mutants that make up less than 30% of the swarm, Palmer told newscientist.com, and the drug-resistant strains detected in her study were just such a minority.

So if the woman takes nevirapine again, to treat her own disease or protect another child, it may not work - and such drug failures may already be happening in women treated years earlier. "But if that's the woman's only option, what can you do?" says Palmer. "We need more effective interventions that are available to everyone."

Senses Explained By Mathematical Model

The individual cells responsible for responding to sensory inputs - the strong scent of a flower, the light touch of a spring breeze - can cope with only a small amount of input. Yet the human ear can hear and process sounds ranging from a pin drop to the roar of a jet engine. Scientists have struggled to account for how this individually narrow range combines in a network to produce the wide range of sensed experience. Now physicists have shown how the

mathematical models that describe phase transitions in physical systems might also explain our capacity to hear, see, smell, taste and touch.

According to sciam.com, Mauro Copelli and Osame Kinouchi of the University of Sao Paulo in Brazil used a mathematical formula to show how a random network of "excitable elements," such as neurons or axons, have a collective response that is both exquisitely sensitive and broad in scope. When

subtle stimuli hit the network, sensitivity is improved because of the ability of one neuron to excite its neighbor. When strong stimuli hit the network, the response is similarly strong, following what are known as power laws - mathematical relationships that do not vary with scale.

But although a mathematical model seems to fit a natural phenomenon it does not necessarily follow that the two are actually related, according to some scientists.

Black Holes Are Green

A new study finds that the supermassive black holes at the hearts of some galaxies are the most fuel efficient engines in the universe.

"If you could make a car engine that was as efficient as one of these black holes, you could get about a billion miles out of a gallon of gas," said study team leader Steve Allen of the Kavli Institute for Particle Astrophysics and Cosmology at Stanford University. "In anyone's book, that would be pretty green."

The finding is giving scientists insights into how supermassive black holes generate energy and how they affect the galaxies where they make their homes, reports space.com.

Black holes are regions of space where gravity is so strong that matter and light can't escape once they pass the event horizon, a spherical boundary surrounding the black hole.

However, inflowing matter that hasn't yet passed this point of no return can - through friction and interaction with the black hole's strong magnetic field - release energy in the form of either diffuse light or focused jets of energy.

"Once gas comes within a distance about a million times larger than the event horizon of the black hole, it becomes gravitationally captured," Allen explained. "At this point the gas becomes fuel for the black hole engine."

The new study looked at nine supermassive black holes at the centers of elliptical galaxies; each one was about a billion times more massive than our Sun. The black holes were relatively old and generated much less energy than the fiercely luminous and rapidly growing supermassive black holes known as "quasars."

The researchers found that these "quiet" black holes released about 1,000 times more energy as jets than as light. The reasons for this are still unclear.

Most of the energy in the jets is being emitted as radio waves, but in at least one of the black holes studied, the energy was in the form of more energetic X-rays. The energy in these jets is absolutely huge, about a trillion trillion trillion watts.

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