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In The News

A Genius Has Left Us

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The world lost the Icon of the century, Stephen Hawking, on March 14, 2018. A British scientist, Stephen Hawking, professor and author, was born on 8th January, 1942, in Oxford, UK. Stephen, as a schoolboy, was a bright but not an exceptional student. Enjoying the company of his friends, he showed creativity in designing different games, models of airplanes and boats. Inspired by a Mathematics teacher he, along with his friends, built a computer from clock parts, an old telephone switchboard and other recycled components.

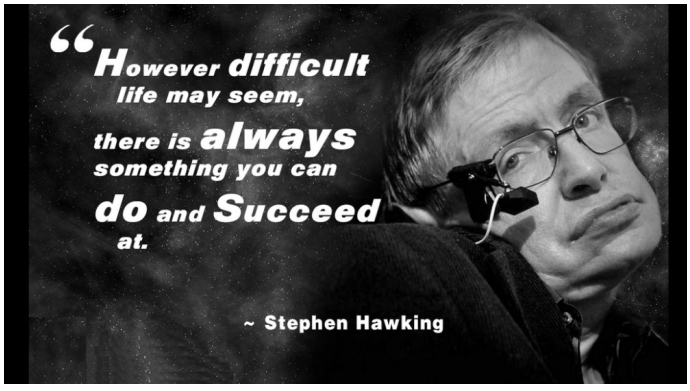
He acquired a BA degree, with first class, in natural science from University College, Oxford. In 1962, he joined Trinity Hall, Cambridge, for studying Cosmology. In 1963, at the age of 21, he was diagnosed with motor neuron disease. The nerves that controlled his muscles were shutting down. He was then told that he had just 2 years to live. The disease progressed slower than predicted by the doctors. Also, the love of a young girl friend, Jane Wilde, prevented him from going into complete depression. With the encouragement of his teacher, Prof Dennis Sciama, Hawking started working for his PhD.

The Big Bang model says that the universe emerged from an extremely hot and dense state, like a compressed gas. (Hartle and Hawking proposed that before the big bang, time did not exist; so the universe had no 'beginning'.) From there it expanded, cooled and kept becoming less dense overall. But the cooling also gave rise to matter and, because of gravity, to star formation. A massive star can literally collapse. This happens when it exhausts its nuclear fuel and cannot generate gas pressure. Gravity forces it to contract. As it squeezes itself beyond the Chandrasekhar limit, gravity becomes so strong that even light cannot come out. The star becomes invisible, a *black hole*. Can nothing escape a black hole? No. Hawking showed in 1974 that according to quantum mechanics, black holes are not entirely black. They must emit a form of radiation, known as Hawking radiation, which makes them lose all energy until they eventually vanish.

The Indian physicist A. K. Raychaudhuri formulated a mathematical equation that paved the path for work that led to the powerful Hawking-Penrose singularity theorems that proved the inevitability of black holes. Work by C. V. Vishveshwara, popularly known as the 'black hole man of India', contributed to the recent detection of black holes through gravitational radiation. In science, the building up of knowledge is collaborative. The final celebrated outcome is after many wise minds have thought hard about the same problem from different points of view.

Professor Stephen Hawking had thirteen honorary degrees and was awarded a number of prestigious prizes. Books written by Hawking helped to make science accessible to everyone. Hawking's first book, *The Large Scale Structure of Space-Time,* written with George Ellis, was published in 1973. For a popular audience, he wrote the best-seller *A Brief History of Time* in 1988 and *The Universe in a Nutshell* in 2001. In 2007, Hawking and his daughter Lucy published *George's Secret Key to the Universe*, a children's book designed to explain theoretical physics in an accessible fashion.

At the turn of the century, he and eleven other luminaries signed the *Charter for the Third Millennium on Disability*, which called on governments to prevent disability and protect the rights of the disabled.



Insight

What's in a Name?

Katie Bagli,

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Naming a new-born generally sends all the family members into a tizzy referring to the astrological correctness or going through atrociously long lists of names, and what have you. But let us step into the animal and plant kingdom. It may interest you to know the names of some of our flora and fauna, their origins and their implications.

For instance, there is this bird commonly called Wryneck which may have been so named as it has a comical way of stretching its slender neck and beak upwards and moving its head from side to side when it is surprised or frightened or under stress. The torque which it brings about upon its own neck led a scientist to name it Jynx torquilla. And that is how the word 'jinx' came into use.

When we talk of someone being a 'sniper' we mean one who can shoot slyly at long range from a hiding place. A sniper could also be one who makes a sly or petty verbal attack. This is because long ago it was considered a sport to flush out the Painted Snipe birds from their home - the reeds - and shoot at them. Unfortunately for the bird, they were an easy target as they have a slow flight.

The Stone Curlew bird, in my opinion, got its name because of its staring, unblinking, stony yellow eyes. But it has also got another rather unflattering common name – Thick-knee. The poor bird has all the grace of a ballerina with its long slender legs, but for the knees that are absurdly thick!

The delectable chocolate which young and old, all enjoy and find irresistible, owes its popularity to the cocoa tree Theobroma cacao of Central and South America. 'Theobroma' in Greek language means the food of the Gods. The Aztec tribes of the plant's native country made beverages and all kinds of 'heavenly' concoctions out of its seeds. In fact, the cocoa beans were even used as currency, so valuable they were considered to be. Much later Switzerland, where ironically these trees did not grow, mixed cocoa powder with milk and began producing chocolate.

The Jungli Badam tree – tall, imposing and rather attractive when, after having shed all its leaves, it sprouts tiny star-like blossoms – has been given the scientific name Stercula foetida. The genus name Stercula was adopted from the Roman god of manure and dung and the species name foetida to reiterate the fact that you may want to cover your nose when passing by it. Indeed, its beautiful flowers smell unpleasantly foetid. The reason? Nature has a reason for everything. The rotting smell attracts flies – its pollinators!

Thus, one can go on and on, the list is endless. But having gone through it, do you believe the name of a being lends a certain character to it? Or are you one of those who believe a rose is a rose, call it by whatever name?

Science In Daily Life

Sleep: An Unsolved Mystery!

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As we know everyone needs to sleep and we spend about one third of our life just sleeping! Interestingly, though we appear inactive and immobile, our brain and body stay remarkably active while we sleep. While scientists are now beginning to understand what happens in our brain during sleep, a lot more questions emerge. Before we address some of these questions, here is a brief introduction to a simple but interesting aspect of sleep -- a sleep cycle. If you carefully watch a sleeping friend you can easily identify two major stages of sleep : one in which the eye ball in moving under the closed eyelids , the Rapid Eye Movement or REM sleep and the other when no such movement of eyeballs is happening, the Non REM sleep. Each sleep cycle has REM and Non REM states of sleep and here is what really happens.

NON-REM Sleep is the period of sleep where you start feeling drowsy due to decreased metabolic activities and reduced blood pressure. Your muscles seem to be most relaxed and you head towards your deep sleep. Non REM sleep is further classified into three different stages.

The Stage 1 of Non-Rem sleep is a short period of light sleep. As wakefulness changes to sleep, our heartbeat, breathing and eye movement slow down. Muscles too relax though occasional twitches occur. Slower brain waves can be recorded during this sleep as compared to wakefulness.

The Stage 2 of Non-REM sleep is a period just before setting in of deeper sleep. The heartbeat and breathing are slow. The muscles relax even further and the movement of the eyes stops. . Interestingly, there is a drop in your body temperature too. Bursts of electrical activity marks this stage, though the brain waves are still slow. You spend most of our sleep time in this stage as sleep cycle is repeated.

The Stage 3 Non-REM sleep is the period of deep sleep. The heartbeat and breathing is at their lowest levels with muscles so relaxed that it may be difficult to wake up. Slow brain waves are recorded during

this stage. This is the part of the sleep cycle that occurs during first half of the night for long periods.

REM sleep: This is an interesting part of your sleep with lot of activity in the brain similar to what is record from the brain when you are awake. Eyes move from side to side behind closed eyelids, rapidly. The heart rate and blood pressure increases, accompanied with faster breathing. You dream mostly during REM sleep and sometimes in non-REM sleep as well. Limb muscles muscles become temporarily paralyzed during this stage so that you can never enact your dreams!

Both REM and non-REM sleep contribute to a good sleep. Have you ever wondered that sleep is such a complicated thing? Just think, why do we even sleep? Why do we get a feeling that we are falling from a cliff in our sleep? Why do we sleepwalk or bedtalk? Why salivation takes place during sleep? Why do we dream? Why do the elderly sleep less? So many questions need to be answered, a challenge for neurobiologists! Though some questions do have answers, sleep is indeed a mystery waiting to be solved.

www.webmd.boots.com/sleep-disorders/guide

https://www.livescience.com/32469-why-do-we-sleep.html

Stimulate Your Grey

Guess What ?

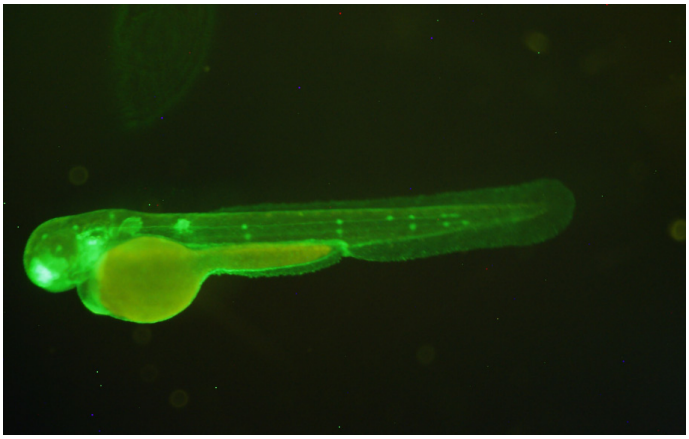
Here are the national flags of Australia, Papua New Guinea and New Zealand.

All show a constellation of stars. It is the smallest of the 88 constellations, but one of the most prominent constellation in the southern sky. It has helped navigators in the southern hemisphere for centuries to find their way around. We can technically see it from Mumbai at some times of the year, but it is almost impossible because of the light polluted skies, especially near the horizon.

What constellation is this?

Quiz courtesy Dr. Arnab Bhattacharya

Through the Lens



A fish paint to understand biology : This is a two day larva of zebrafish with its parts flourescing green. The green fluorescence is because this fish has a gene that makes the green fluorescent protein (GFP) attached to one of its own genes (let's call it X) so that wherever 'X'protein is made the GFP will also be made and appear green when seen under an ultraviolet light. In this fish the tiny green dots you see are sensory hair cells which help the fish sense water movement.

Image courtesy Dr. Yasmin Khan, Sophia College, Mumbai.

Long, Long Ago

Indigo – The Dye To Die For

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The colour 'blue' evokes feelings of calm and peace in us, reminding us of the sky and the sea. A world with no blue fabrics or objects would be hard to imagine. However, prehistoric man had only reds and yellows from flowers and other vegetation to colour his attire until he discovered indigo, the third primary colour, from the plant genus *Indigofera*. Archaeologists have found seeds of the Indigo plant and pieces of cloth dyed with indigo at excavation sites of the Indus Valley civilisation. Indigo was one of the most valuable commodities traded by the people of the Indus valley, first with other early civilisations and later with Europe. It became so famous that the Greeks called it 'indikon' or colour from India and it was such a prized trading commodity that it was referred to as 'Blue Gold', a regal colour. The extraction process of indigo from the plant was both tedious and complicated but was a closely guarded secret handed down from generation to generation.

Export of indigo from India to Europe from the 16th

century was so lucrative that peasants of Bengal were forced to grow the indigo plant at the cost of much needed food crops leading to food shortage and much suffering. A peasant revolt in 1859-60 virtually halted indigo production and export from India. In 1878, Adolf von Baeyer, a German chemist discovered a synthesis of indigo and the much cheaper synthetic dye quickly replaced natural indigo. Later, during World War I, German synthetic 'indigo' was not available and export of natural indigo from India became profitable once more. Poor tenant farmers especially in Bihar, were forced by the terms of their tenancy to grow indigo subjecting them to untold suffering including food shortage. This moved Gandhiji to lead them in the Champaran Satyagraha of 1917 which besides ending the exploitation of the farmers had far reaching consequences for the power of satyagraha and the nationalist movement.

Indigofera and a piece of indigo plant dye from India
https://en.wikipedia.org/wiki/Indigo_dye

Later, commercial dyeing started using synthetic indigo almost exclusively. Indigo, once a luxury dye for royalty was now used extensively to dye 'blue jeans' a symbol of the common man and produced in great quantity. However, increased awareness of the toxicity and environmental pollution associated with synthetic dyes and intermediates led to a renewed interest in natural dyes and indigo plantations started in parts of Bengal and south India. Although cultivation, extraction and processing of natural indigo is costly, it has become popular as it is safe and natural and no new synthetic alternative can match the aesthetic beauty of hand-dyed natural indigo.

Answer to quiz

Put one red marble in jar 1, and the other 99 in jar 2

Probability of finding a red marble in jar 1 = 1
Probability of picking jar 1 at random= 0.5

Therefore probability of finding a red marble and picking jar 1 = 1 * 0.5 = 0.5

Probability of finding a red marble in jar 2 = 49/99 (Number of red marbles/total number of marbles) = 0.4949
Probability of picking jar 2 at random = 0.5

Therefore probability of finding a red marble and picking jar 2 = 0.4949 * 0.5 = 0.2474

Total probability of picking a red marble at random = (Probability of picking a red marble in jar 1) + (Probability of picking a red marble in jar 2) = 0.7474

And this is the highest probability of all the arrangements.

Thought Byte

"It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us.

Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved."

— Charles Darwin, The Origin of Species, 1859.

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