

VIGYAN PRASAR

DREAM

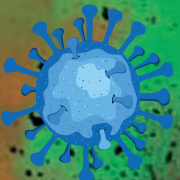
2047

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WOMEN AFTER
FORTY: SOME
BONY ISSUES



CORONAVIRUS
OUTBREAK
2019-20



GENOMEINDIA:
CATALOGUING THE
GENETIC VARIATION
IN INDIANS



LET'S
PLAY
A SAFE &
ECO-FRIENDLY
HOLI



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EDITOR'S WORD

NAKUL PARASHAR

Towards the quantum leap

EVERY

year March plays an important role in every Indian's life. This year too, it wouldn't be different. It's about the budget, the national budget. This year science & technology has a much bigger say in it. Rs. 8400 crores have been set aside for research & development in the area of quantum technology. Quantum technology, what is it and how come has it gotten so much of attention, that too all of a sudden!

Just to recall, last October Google had announced its lead quantum technology. Its 54-qubit (qubit is quantum bit, the basic unit of quantum information) Sycamore-processor performed a task which the most powerful supercomputer of today would have taken 10,000 years. Unbelievable, isn't it! Countries are racing ahead to embrace this technology. China claimed that it had built a quantum computer and had launched a quantum satellite into space in 2018. Thus, to boost our efforts, the government has provisioned a significant investment into it. Mid-nineties, if you remember, had gotten us the Param, our supercomputer and with it the architect of our supercomputing mission – Dr Vijay Bhatkar. With the kind of impetus being put in to get our quantum computer, while we speak, surely a number of quantum computer-architects would-be-in-making, on-the-job, in various laboratories within the nation. After all, it's all about being poised for the quantum leap.

A few days ago, I bumped into a bunch of research scholars working in chemistry at a

highly sophisticated laboratory in Chennai. I visited the lab with a group of visiting school students. The first question young students posed to the lab attendants was about the Bunsen Burner. Being an advanced lab, there were other methods to heat the compounds but the Bunsen Burner was missing. That's what made me realise how important is a single clean and a controlled hot flame – still much required as a tool by modern chemistry laboratories. Robert Bunsen, inventor of the famous Bunsen Burner, was born in March (March 30th, 1811). March thus, every year is proud of being the month when a number of scientific luminaries were born. Albert Einstein was born, 141 years ago on March 14th, 1879 in Ulm, Germany. Discoverer of Oxygen, Joseph Priestley, was also born in March.

From chemistry lab to something about our health, our wellbeing. In this issue of Dream 2047, we bring to you some facts about osteoporosis. With no prior symptoms, osteoporosis is not known until the first fracture happens. Thus, it might prove helpful to know about it. After all, why not, prevention is always better than cure!

One of the popular festivals of our country – Holi – falls in March this year. Known as the festival of colours, Holi has been witnessing a number of discussions about kinds of colours to play with, colours to choose from. Our cover story this time focuses on it.

Wishing all our readers a very Happy Holi.

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RECENT DEVELOPMENTS IN SCIENCE AND TECHNOLOGY

BEST-EVER IMAGES OF SOLAR SURFACE HERALD NEW ERA

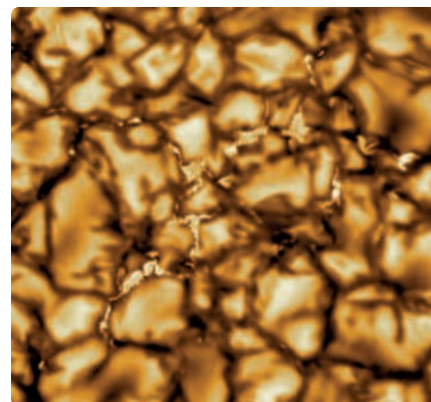
The world's newest and largest solar telescope – the 4-metre-wide Daniel K. Inouye Solar Telescope (DKIST), run by the National Science Foundation of the US, on the summit of Haleakala on the Hawaiian island of Maui – has produced the most detailed image of the Sun till date. The new images reveal small magnetic structures in incredible detail. The images, released on 29 January 2020, reveal features on the Sun's surface just 30 kilometres across, or about three times as small as anything yet seen. The images show a pattern of turbulent, “boiling” gas that covers the



Haleakala Observatory in the summit area of Haleakala volcano in Hawaii. (Credit: Wikimedia Commons)

entire Sun. The DKIST is designed to study magnetic structures that may lead to new insights into why the corona, the Sun's outer atmosphere, is millions of degrees hotter than the surface, and what drives space weather that occasionally interferes with technology on Earth. In combination with NASA's Parker Solar Probe and European Space Agency's Solar Orbiter, data and images from the DKIST are expected to throw new light on how the Sun works and tell us how the space weather it creates affects Earth.

Scientists have been trying to understand the solar wind and the blazing heat of the corona for long. They both play a role in space weather and solar storms and according to them understanding the solar wind could enable better prediction of space weather. Solar wind and the corona's temperature also impact ejections of mass from the corona, which can impact the global power grid and telecommunications on Earth, as well as astronauts on the International Space Station. The energised and accelerated particles streaming away from the Sun in the solar wind are also responsible for the northern and southern lights (auroras) we see on Earth. The Parker Solar Probe, by repeatedly flying close to the Sun over the next five years at record-setting speeds of nearly 700,000 kilometres per hour, will be able to measure pristine material ejected from our star and it is already providing invaluable data from its early passes. But space weather is hard to predict, something scientists are hoping to change with the trio of Sun-focussed missions, including the DKIST.



The Daniel K. Inouye Solar Telescope (DKIST) has produced the highest resolution image of the Sun's surface ever taken. In this picture, taken at 789 nanometres (nm), features as small as 20 kilometres in size can be seen for the first time ever. The image shows a pattern of turbulent, “boiling” gas that covers the entire Sun. (Credit: NSF)

DKIST's five instruments are designed to both image the Sun and probe its magnetic field, allowing scientists to discern the field's strength and orientation. Scientists hope to use these data to help resolve the long-standing mystery of why the Sun's corona – its halo-like outer atmosphere – is up to millions of degrees hotter than its surface. Data from DKIST will also allow researchers to probe the magnetic fields of the vast structures that arc and loop between these two regions.

The Sun's magnetic field and plasma also experience entanglement, which can release solar storms that temporarily impact our power grids. The DKIST has the capability to measure the magnetic field with more detail, leading to a greater understanding of solar activity.

The construction of the Inouye Solar Telescope started in 2012 and is still continuing. Although still incomplete, the telescope captured the

newly released image on 10 December 2019. Only a single instrument, the Visible Broadband Imager (VBI), was operational at that time. The VBI takes extremely high-resolution images of the solar surface and lower atmosphere.

The observatory's second instrument, the Visible Spectro-polarimeter (VISP), began operation on 23 January 2020. Like a prism, the VISP splits light into its component colours to provide precise measurements of its characteristics along multiple wavelengths. The remaining instruments will be turned on as construction continues on the 13-story building, with full operations planned to begin in July 2020.

INSECT-SIZED FLYING ROBOT CREATED

Insect-sized robots have many advantages over conventional robots because of their tiny size and

ease of manoeuvrability. They have the potential for improved performance relative to larger robots in tasks that benefit from the small size or large deployment numbers. Examples include gas leak detection, assisted agriculture or an operation around humans without impact hazard.

But in the past, such small robots were difficult to fabricate because of their tiny size. Now, researchers at the University of Washington in USA have come out with a new design of a 74-mg flapping-wing insect-sized robot with a wingspan of 3 cm, which they call RoboFly that dramatically reduces the number of parts and simplifies fabrication. RoboFly is a flapping-wing micro-robot inspired by flying insects. As reported in a paper pre-published on arXiv, RoboFly was built using fewer components than a normal insect-sized robot, thereby simplifying the construction process (arxiv.org/abs/2001.02320).

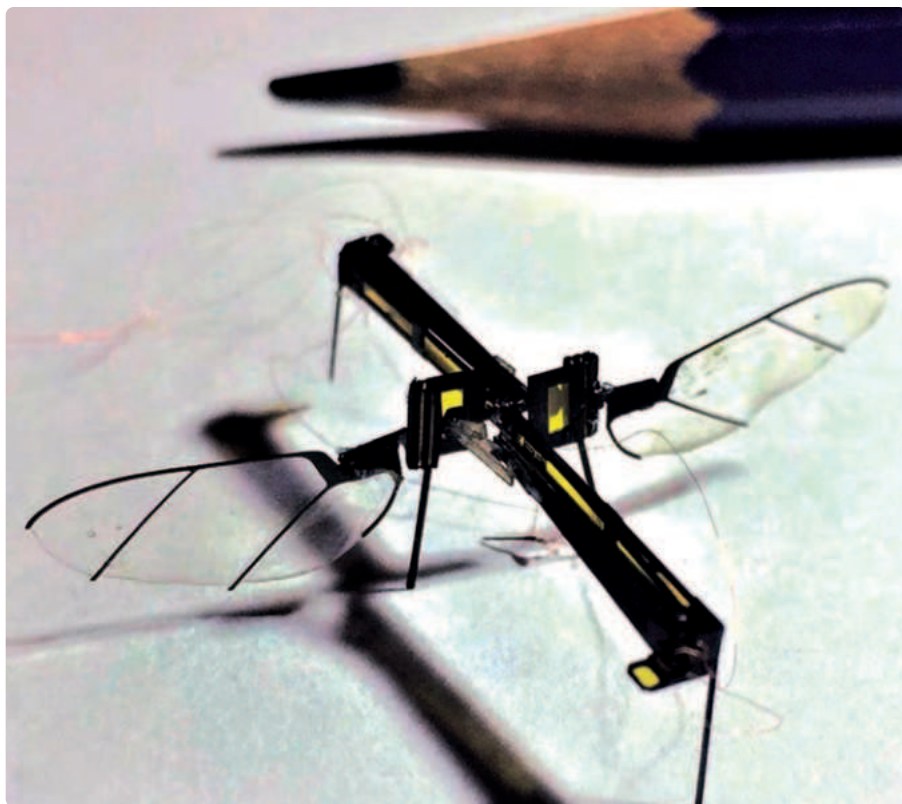
Yogesh M. Chukewad, a member

of the research team, says, "Currently, most insect-size robots are built under a microscope and assembled carefully by hand, as they have many separate microscopic parts. If you accidentally drop a part in a busy lab, you're never going to see it again!"

To simplify the fabrication of RoboFly, the researchers created a new design, in which the robot's chassis is made up of a single, folded laminate sheet. This helped to build the robot without having to assemble many microscopic parts. The chassis is also lower and thus closer to the ground, which enables three different types of locomotion. It is fitted with thin hinges of plastic in its carbon fibre body. RoboFly is equipped with balanced control system commands that give the rotational motions of its wings – each wing is controlled independently in real-time and flaps at a rate of 170 times per second. "RoboFly makes use of its two flapping wings driven by piezoelectric actuators to fly and hover, like some insects do", says Chukewad.

Many flying insects can walk and some of them can also skim on the water surface. The unique thing about the RoboFly is that like real insects, apart from flying, it can also move and steer on the ground by making use of the same set of flapping wings. Because of its light-weight property, if modified with a set of three foot-like appendages, it can land on water surfaces. Once landed, the robot can then move and steer on water using the same principle that is used to move on the ground.

According to the researchers, the RoboFly could be far more effective than existing flying robots in avoiding obstacles, as it can simply switch to a different mode of locomotion (e.g., flying or moving on water if it detects obstacles on the ground). RoboFly could have several potential uses, for instance, "helping human users to detect gas leaks or assisting volunteers on search and rescue missions. It could also be deployed in large numbers on water surfaces to search for pollutants or leaks of potentially hazardous fluids (e.g., fuel from a tanker or a plane crash)".



The University of Washington RoboFly. Each wing measures 13 mm in length and is driven by a separate piezoelectric cantilever actuator. The entire robot weighs 74 mg. The tip of a standard pencil is shown in the background for scale. (Credit: researchgate.net)

SCIENTISTS RECREATE 'VOICE' OF 3,000-YEAR-OLD MUMMY

A team of scientists in the UK have successfully recreated the voice of an Egyptian priest named Nesyamun (as given in the inscriptions on his coffin) who died 3,000 years ago, using his mummy. The work is part of the “Voices of the Past” project involving Royal Holloway, University of London, the University of York, Leeds Museums and Galleries, and the Leeds General Infirmary (LGI). The scientists used three-dimensional CT scans to map the mummy’s entire vocal tract, and then re-created it in plastic using a 3D printer. They used a computer synthesised artificial larynx used in modern speech synthesis to run air through the 3D printed vocal cords,



3D-printed vocal tract of the mummified body of Nesyamun. (Credit: David Howard)



Nesyamun, a 3,000-year-old mummy, at the Leeds City Museum. (Courtesy: Leeds Museums and Galleries)

creating a single vowel sound in the dead Egyptian’s voice (Scientific Reports, 23 January 2020 | doi.org/10.1038/s41598-019-56316-y). The researchers say the sound is based on the position of Nesyamun’s vocal tract at the moment of his death. The same approach cannot be used to simulate other sounds. In other words, researchers cannot create sentences in Nesyamun’s voice.

According to the scientists, since the restoration of an exact vocal sound requires the perfect preservation of the soft tissues, this is impossible for individuals whose remains are only skeletal. Even where soft tissue does survive, for example in mummified remains, the vocal tract can either be missing or distorted. The process is only feasible when the relevant soft tissue is reasonably intact, as in the present case.

The ‘Voices from the Past’ Project was set up to investigate the possibility for those long dead in cases where their remains are sufficiently well preserved, after it was established that it is possible to recreate a 3-D printed vocal tract unique to a living individual. With the need for optimum preservation of the vocal tract as an essential requirement, combined with the practical necessity for precise CT-imaging in close

proximity to the individual selected, the mummified body of Nesyamun was a highly appropriate choice, according to the researchers. The three-dimensional CT images of the mummy confirmed that a significant part of the structure of Nesyamun’s larynx and throat remains in situ as a result of the elaborate mummification process, which enabled the vocal tract shape to be measured.

The mummified remains of Nesyamun is currently displayed in Leeds City Museum and the current project is only the most recent to examine Nesyamun. The recent success is just the latest archaeological breakthrough involving Nesyamun, whose mummy has been studied in various ways for nearly 200 years. It was unwrapped for a multi-disciplinary investigation in 1828 and was more recently used to create a 3D bust of what Nesyamun would have looked like when he was alive. These combined studies have revealed that Nesyamun had died in his mid-50s.

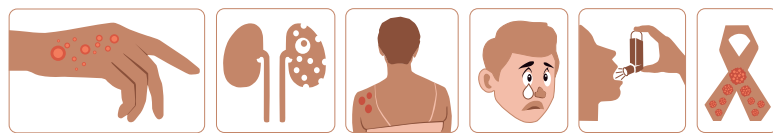
The study authors say their work is a proof of concept, and they hope the same approach can be used for other subjects in the future.

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LET'S PLAY A SAFE & ECO-FRIENDLY HOLI

Playing Holi with synthetic colours has serious health and environmental implications. We should start using natural sources to make Holi colours to save ourselves and the Mother earth.



Holi is a festival of colours, fun and harmony. It is also popularly known as the festival of spring and DolJatra or Basantotsav in West Bengal, Tripura and Assam. It is mentioned in the Puranas, Dasakumara Charita and by in many kavyas of noted Sanskrit poet Kalidasa of the 4th century. Celebration of Holi has also been mentioned in the famous Sanskrit drama Ratnavali composed by Sri Harsha in the seventh century and by the European traders in the 17th century. This festival is celebrated at the end of the winter season on the last full moon day of the lunar month of Phalguna which falls in February or March. It welcomes the 'spring' season. Here the transition of two seasons occurs: winter comes to an end and summer gets started. This festival also signifies good harvest. We all are aware of the legend of Holika (the sister of demon king Hiranyakashipu) who was killed in the fire.

India has a very rich tradition of using natural colours and dyes. In ancient time, colours for Holi were prepared using nature sources. Different parts of trees such as flowers, leaves and fruits were the source of colours. It is reported in literature that natural colours extracted from keshu, palash or tesu (the flame of the forest), marigold, Indian coral tree (parijat), henna (mehndi), turmeric (haldi) and beetroot have been used for playing Holi. In the middle of 19th century, synthetic colours and dyes came into the market, and slowly the practice of making natural colours died down.

Chemistry of synthetic colours and their impact on health

It is a great irony that nowadays Holi is celebrated with toxic and unhealthy chemicals. Synthetic colours are cheap and bright but they are extremely dangerous to our health and environment. The commonly used ingredients of these colours include heavy metals, acids, alkalis, mica, chalk

CHEMICALS PRESENT IN HOLI COLOURS AND THEIR HARMFUL EFFECTS ON HEALTH

COLOUR	CHEMICAL	HEALTH EFFECTS
Blue	Prussian blue [$Fe_7(CN)_{18}$]	Dermatitis
Black	Lead oxide (PbO)	Renal disorder, memory disability
Red	Mercury sulphide (HgS)	Skin cancer, Minamata disease
Green	Copper sulphate ($CuSO_4$)	Eye allergies, temporary blindness
Purple	Chromium iodide (CrI_2)	Bronchial asthma, respiratory allergies
Silver	Aluminium bromide (Al_2Br_6)	Different forms of cancer

powder and finely ground glass. Glass powders add extra shine to the colours. The way people play Holi is also very dangerous. Some people add little amount of water in dry colours to make a thick paste. When this mixture is applied on the face, fine glass particles present in the dry colour often get into the eyes of the victim which causes irritation, swelling or pain in the eyes. People often rub dry colours or gual on each other's face. This quite often results in mild skin disorders such as itching, irritation, rashes, allergies, eye infections and hair roughness. Severe effects of Holi colours include impaired vision, respiratory disorders and even cancer.

Holi colours are produced in three forms: pastes, dry colours and water-soluble colours. Nowadays,

manufacturers use oxidised metals or industrial dyes and engine oil to produce such colours. Adding oil to these synthetic colours enhances the toxicity level. On the other hand, this admixture becomes more permeable to human skin. The fast colours sold in market during Holi are made from chemicals or dyes which are meant for paint and dyeing purposes. These are extremely injurious to our eyes and skin.

Rhodamine B (bright reddish violet), Auramine (yellow), Malachite green series (green), Methyl violet (violet), and Methylene blue (blue) are a few more examples of synthetic dyes which are used as Holi colours. Most of these colours have harmful effects on our eyes, bones, lungs and other vital organs. Rhodamine B causes genetic disorder

DRY COLOURS AND THEIR HEALTH EFFECTS

CHEMICALS USED AS DRY COLOURS	HEALTH EFFECTS
Copper	Skin and eye allergies, disorders related to liver, kidney and respiratory system
Silica	Skin dryness
Asbestos	Carcinogenic
Zinc	Fever
Iron	Skin allergy
Lead	Affects reproductive and nervous systems, extremely toxic for children, leads to learning disability, anaemia, osteoporosis
Cadmium	Fragile bones
Chromium	Allergy, bronchial asthma
Mercury	Affects liver, kidney and nervous system, carcinogenic

and dysfunction of liver, kidney, spleen and urinary bladder. Auramine produces skin itching, eye allergies and blurred vision. It also causes renal disorder, liver tumour and growth impairment. Malachite dye causes fatal effects on eyes, bones and lungs. It is also responsible for cancer of the breast, kidney, liver, spleen, testis, ovary and urinary bladder.

Water-soluble colours: Hazardous to health

A very common and easily available water-soluble colour used in Holi is Gentian violet. This is a hazardous and highly toxic chemical substance. Severe skin disorders and eye-related allergies are major outcomes of exposure to these colours. Gentian violet causes skin discolouration, dermatitis and allergy in mucous membrane. Harmful chemical solutions such as ink, methylene blue, iodine solution, mercurochrome and potassium permanganate are also used as water colours in Holi.

Dry colours

Dry colours are used all over the world

in various festivals and household decoration. A large quantity of these dry colours is used in Holi. At present, almost all the blended dry colours (gulal) used in any form are synthetic colours. Clay, sand, chalk, starch, dolomite, etc., are the main ingredients of such dry colours. Mica powder is also used in dry gulal which causes severe eye disorders.

Usually, gulal is a deadly combination of toxic heavy metal compounds and asbestos or silica. Heavy metals are known to be systemic toxins which produce adverse impact on the metabolic functions of human body. These toxins affect vital organs like liver, kidney and bones. Silica and asbestos are also harmful for the respiratory system. Lead is another heavy metal which mainly affects the reproductive and nervous systems in human beings. Headache, anaemia, old age osteoporosis and learning disability are some prominent outcomes of lead exposure. If a pregnant woman is exposed to lead, major gynaecological disorders like abortion, miscarriage, nervous damage to the foetus and premature birth may occur. Red colours often contain mercury,

which is a toxic heavy metal. Mercury in Holi colours may cause headache, itching, increased heart rate, fall in blood pressure, severe cough or even pneumonia. It is also a causal factor for skin cancer.

Banning of these injurious and fatal dyes and colours is the best way to protect our health. Germany was the first country which imposed a legal ban on the manufacture of dyes containing heavy metals. India has also banned the use of specific dyes under the Environment (Protection) Act 1986. Many of the manufacturers, shopkeepers and end users are unaware about the severe and adverse health effects of certain colours and gulal. Hence, it is essential to make everyone aware about the ingredients of Holi colours and their health effects.

Effects of synthetic colours on environment

The harmful effects of colours used in Holi on our environment are rarely publicised. You can imagine the after-effects of tons of toxic chemicals and heavy metals upon our water bodies, soil system and environment. Colours

INDIA'S TRADITIONAL METHODS FOR PREPARING NATURAL COLOURS

COLOUR	NATURAL SOURCES	METHOD OF PREPARATION
Green	Mehendi, dried leaves of Gulmohur tree, spinach	By boiling in water
Orange-red	Dry henna leaves	By mixing dry henna leaves powder with water
Yellow powder	Turmeric powder (haldi), Chick pea flour (besan)	By mixing turmeric powder with besan
Yellow liquid	Marigold and tesu flowers	By boiling marigold and tesu flowers in water
Pink and purple	Beetroot	By soaking slices of beetroot in water
Blue	Indigo, Indian berries, grapes, blue hibiscus	By mixing source materials in water
Brown	Dried tea leaves, kattha, red maple leaves	By mixing dried tea leaves and kattha in water
Black	Grapes and amla	By mixing grapes and amla in boiled water

in the festival give us a feeling of delight and pleasure, but they act as pollutants as their ingredients are dyes and heavy metals. Discharge of synthetic colours in the soil and water body has a dangerous effect. These colours not only kill the microorganisms and degrade the soil fertility, but they also contaminate the water resources. Moreover, these synthetic colours are not readily degradable under natural conditions. Also, these are not easily removed from waste water by conventional waste water treatment methods. The presence of chemical colours in water even at very low concentrations is completely undesirable. When this chemical-contaminated water enters the natural water body, they usually upset the biological activity and the entire ecosystem. These colourful pollutants not only pollute the surface water body, but they also affect the ground water systems through leaching from the soil.

Alternatives to synthetic colours

In ancient India, people were aware of the environmental values of eco-friendly colours. Those colours were

traditionally made of neem, haldi, kumkum, etc. In Vrindavan (Uttar Pradesh), Holi is still played with real flowers. The best alternative to protect us from toxic synthetic colours is to play Holi with natural colours prepared from different parts of the plant.

A number of government institutes, laboratories and NGOs are endeavouring to produce natural and eco-friendly colours. CSIR-National Botanical Research Institute (NBRI), Lucknow has developed the process technology for the preparation of herbal gulal which is composed of natural dyes. This technology has already been transferred to a private company for its commercial large-scale production. CSIR-Indian Toxicology Research Centre (ITRC), Lucknow has developed vegetable dyes prepared from various plant extracts which are excellent alternatives to chemical colours. This is the high time to encourage people to go for such non-toxic and safe natural colours.

To celebrate an eco-friendly Holi, we should follow our ancient traditional practices. We may prepare natural

colours at home with least efforts and resources from natural products like turmeric, palash, neem, etc. In Table 3, simple tips of some old methods for the preparation of eco-friendly and natural colours are given.

Keeping in view the hazardous effects, use of toxic and synthetic colours should be discouraged. There is an urgent need to inspire colour manufacturers to follow the guidelines issued by the Bureau of Indian Standards and Food and Drug Cosmetic Act. Regular inspection and quality check of these synthetic colour manufacturing industries are also needed. There must be provisions not to sell chemical colours, gulal and dyes openly without information regarding their chemical nature and toxicity. Doctors should also caution people against using these harmful colours. Let's pledge that we will say 'No' to unholy colours and will play Holi this time with natural colours or herbal gulal.

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Decreasing bone strength is a very common health hazard for women over forty-forty five years of age. It is painful and crippling. This is called "Osteoporosis" or "Porous Bones" which is never considered a disease but a normal and routine degradation for a woman or a discredit of being a woman, especially in rural India.

Why should you at all fear osteoporosis?

Besides being a painful and crippling condition, chances of bone fractures increase considerably in osteoporosis. Even a minor fall or a forceful hug may cause fractured bone which heals very slowly or sometimes not at all or may cause long-term disability and accelerated death rate. It causes marked changes in posture as humped back, which is considered a stereotype of ageing, especially in our country. Deformed skeletal framework pushes or shifts various organs which

Women after Forty: Some Bony Issues

There is no magic pill for your day-to-day aches and pains due to osteoporosis. You have to change your diet and your lifestyle and follow that lifelong.

result into a spectrum of difficulties ranging from constipation to breathing problems. There may be chronic low backache, restlessness, arthritis and leg cramps, etc.

Cause of the problem

What you are suffering today is the culmination of a slow process that started decades back. We usually visualise bone as a solid, rigid and inactive mass, but in fact, it is an active living tissue, constantly being recycled. Inner part of the bone always breaks down and the outer surface is always in the process of reformation. The delicate balance of these two processes in response to the demand of the body, which is maintained in the



HEALTHY BONE



OSTEOPOROSIS

youth, gets disturbed during old age. More calcium is withdrawn from the bones than deposited. As a result, bones become porous and weak. Actual cause of this disbalance is still not known. It may be hormones, a genetic predisposition, nutrition, physical activity, lifestyle factors or probably a combination of all.

The female hormone, oestrogen, may be cited as a cause, because when its production stops due to ovarian atrophy, the process of bone degradation accelerates. Also, deficiencies of calcium and vitamin D, C and E, even in a healthy adult, have been blamed to be the cause for osteoporosis.

Who is at risk?

Anyone having the following factors may be at the risk of developing or accelerating the process of osteoporosis:

- Family members having bone disease;
- Those having short stature and thin built;
- Those who are fair skinned;
- If ovaries been removed before the age of 45;
- Those who are childless;
- Those who have been confined to bed for a long period;
- Those with diabetes, kidney or liver disease;
- Those with an underactive thyroid (Hypothyroidism);
- Those leading a sedentary life;
- Those who smoking; and
- Those on a diet or who fast frequently.

What to do?

Although it is almost unavoidable, you may sufficiently delay the onset of osteoporosis, reduce its intensity and cope with the problems arising due to it by following these tips:

Add extra calcium in your diet

Calcium is essential for bone health. The daily allowance of calcium for a woman prior to menopause is 1,000 milligrams per day and after menopause is around 1,500 milligrams per day. Take plenty of dairy products, turnips, fish (especially those which are eaten with bone), dates, etc. Ragi is a very good source of calcium.



We usually visualise bone as a solid, rigid and inactive mass, but in fact, it is an active living tissue, constantly being recycled. Inner part of the bone always breaks down and the outer surface is always in the process of reformation.

This can be taken as chapati or in some other form. Calcium supplements in the form of medicinal preparations may be a cheap and desirable alternative. Take about 1 to 1.5 grams of elemental calcium (the amount of calcium in a product) per day (according to your menopausal status) and at least 50,000 units of vitamin D per week. Vitamin D helps in depositing this calcium in the bones properly. A proper ratio of calcium to phosphates also affects the amount of calcium absorbed by the bones. So, reduce your intake of high phosphate foods. For adequate absorption and metabolism of calcium, you will also need vitamin C and magnesium. The whole business may look to you rather confusing, so it's better to consult your doctor for it.

Change your lifestyle

The speed at which your bones break down depends on the way you treat your body. These are few recommendations for changing your lifestyle:

- Remain active as inactivity increases bone breakdown. Even after fracture, start moving as early as permitted by your doctor.
- Cut down intake of meat as it has been seen that heavy meat eaters have twice more chances of developing osteoporosis than vegetarians. Eat more cereals, grains, beans, vegetables, nuts, etc.
- Avoid foods containing excess fats and saturated fats which are solid at room temperature, viz., ghee,

butter, lard and some vegetable oils such as coconut or palm oil. However, optimum amount of fat intake is necessary; beware of slimming courses which insist on non-fat milk.

- Minimise your intake of concentrated sugars which produce acidity in the blood and consequently more calcium comes out of your bones.
- Reduce intake of foods with high phosphate concentration such as processed or canned meat, processed cheese, instant soups, puddings, pastries and soft drinks to name a few.
- Stop smoking and consumption of alcohol as both of these reduce amount of oestrogen in blood that leads to increased bone dissolution.
- Limit intake of coffee and tea.

Make exercise a routine

Like muscles, bones grow stronger with use. Bone density in well-nourished women depends directly on how much the bone is stressed. Though exercise should be started at an early age, it is never too late. No matter how old you are, exercise can strengthen your bones. There is limited evidence indicating that exercise is helpful in promoting bone health in post-menopausal women. The best exercises for bone strengthening are those that put load or stress on your bones such as jogging, aerobics, skipping or brisk walking. Simple dancing or swimming is also good as exercise. To get the full benefit, exercise should be done for 20 to 30 minutes at a pace fast enough to accelerate your pulse rate moderately, for at least four days a week.

But remember, it should not be overdone, because if overdone the exercise may increase bone destruction at the place of its formation. So, before starting the exercise programme, consult your physician to know about any changes you should make due to some health problems and the amount and intensity of exercise you need to do.

Beware of self-medication

Intake of steroids (used erroneously for increasing muscle bulk and almost always present in so-called "rapid cure

preparations” offered by nonqualified quacks) results in severe bone loss. Drugs for acidity (antacids) which contain aluminium may contribute to osteoporosis, when taken regularly. Drugs for hypertension, which increase amount of urine, increase bone destruction by removal of calcium in urine. For such drugs calcium and vitamin D supplements should be taken after consulting doctor.

Can hormonal therapy be an answer?

Bone resorption hastens when the ovaries are non-functional and its hormones are unavailable. So, it is very likely to conclude that these hormones, especially oestrogen, might be a protector of the bone. But it is still debatable. It has been claimed that though oestrogen decreases bone dissolution, it does not increase bone formation, which usually decreases with advancing age. As therapy is withdrawn the bone loss resumes. Simultaneously it places a woman at the risk of cancer of the uterus, breast and liver, high blood pressure, gall bladder disease, diabetes, etc. So, hormone replacement therapy is not a desirable alternative for women with a family history of uterine or breast cancer, diabetes, liver diseases, gall bladder stones, migraine and uterine tumours.

It does not mean that no women should take oestrogen even if she is a high-risk candidate for osteoporosis. Current researches suggest that when oestrogen is taken in combination with another hormone called progesterone (this combination is found in almost all contraceptive pills), risk of cancer is reduced. But in any case, the therapy should be started and continued under strict medical supervision.

So, do not long for a magic pill for your day-to-day aches and pains due to osteoporosis which you can take at bedtime and find yourself cured the next morning. You have to change your diet and your lifestyle and follow that lifelong.

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EXERCISE TO BUILD STRONG BONES

SEQUENCE OF EXERCISE ►



The following exercises are good to strengthen bone and prevent bone loss, promote good posture and improve balance. These are recommended by the National Osteoporosis Foundation.



1

CORNER STRETCH

It improves posture and helps reduce rounded or “sloping” shoulders.

- Stand facing the corner of a room, with your hands and forearms against the walls at shoulder level.
- Step forward with one foot, bending the knee.
- Lean onto the front leg, bringing the head and chest toward the corner.
- Hold for 30 seconds; then stand up straight.
- Repeat with the other foot. Do at least for 10 times.



3

HIP ABDUCTOR LIFT

It strengthens the hip and improves balance.

- Stand up straight and place your left hand on a sturdy chair for support and right hand on the waist.
- Flex your right foot and keep your right leg straight as you lift it to the side no more than 15 cm off the ground; then lower the leg.
- Complete a set of reps, and then repeat with left leg. (A rep is the number of times you perform a specific exercise.)

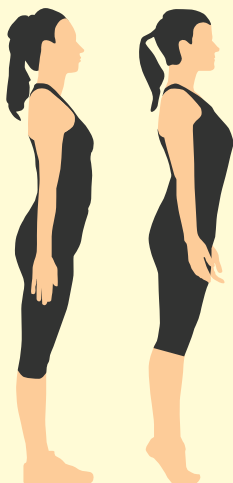


2

TOE AND HEEL RAISE

It strengthens lower leg and helps improve balance.

- Stand up straight and place your hands on the back of a sturdy chair for support.
- Lift the heels off the floor while keeping the toes on the floor and knees straight; then lower the heels.
- Lift the toes off the floor while keeping the heels on the floor and knees straight; then lower the toes.
- Repeat 10 times. To challenge your balance, hold on to the chair as little as possible.





Warm up by doing same type of movements slowly which you want to include in main exercise.

Exercise properly for 20 to 40 minutes. Start it with a few sets and with low intensity ones. Keep on increasing as your health and stamina permit.

Cool down by doing the same movements slowly which you have done in main exercise.



4

WALL SLIDE

It strengthens thighs, abdomen and back.

- Stand with your feet shoulder-width apart and heels one shoe-length away from the wall.
- Place your buttocks, palms of your hands and shoulders against the wall; tuck in your chin, and keep the back of your head as close to the wall as possible.
- Keeping muscles of your abdomen tight, slide down along the wall, bending your knees a quarter or halfway to sitting position; then slide back up. Keep your shoulders and back flat.
- Repeat 10 times



6

BICEPS CURL

It strengthens front of upper arm.

- Stand straight, with your feet about shoulder-width apart and knees slightly bent.
- Grasp a light-weight dumbbell or water bottle in one hand, with your palm facing in front of you.
- Keeping your elbow close to your side, slowly curl the weight up toward your shoulder by bending your elbow.
- Slowly lower the weight to the starting position. Don't swing your arm or elbow during the exercise.
- Repeat on opposite arm. Do 10 such sets.

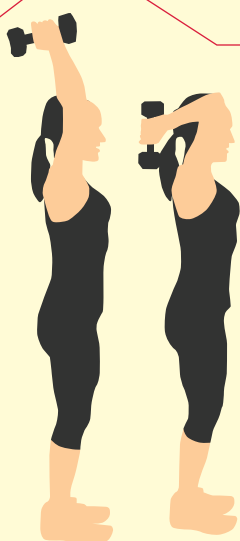


7

TRICEPS EXTENSION

It strengthens back of upper arm.

- Stand straight, with your feet about shoulder-width apart and knees slightly bent.
- Grasp a light-weight dumbbell or water bottle in one hand. Then raise your arm up and bend your elbow, so the weight is behind your head. Place your opposite hand on the tricep for support. Keep your abdominal muscles tight and don't arch the back.
- Slowly straighten your elbow and bring the weight overhead.
- Slowly lower your arm back down behind your head.
- Complete a set of 10 and then repeat with opposite arm.



5

LEG LIFT

It strengthens lower back and buttocks.

- Lie on the floor on your stomach with legs straight and hands on your sides.
- Place towels under your forehead, shoulders and stomach for comfort.
- Bend the right leg slightly and keeping your foot relaxed, lift your thigh off the floor; then lower it.
- Repeat 10 times on the right leg; then repeat with the left leg.

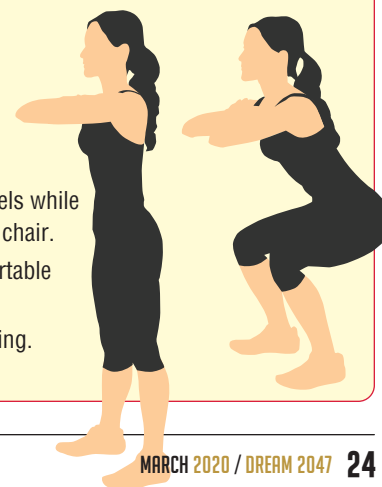


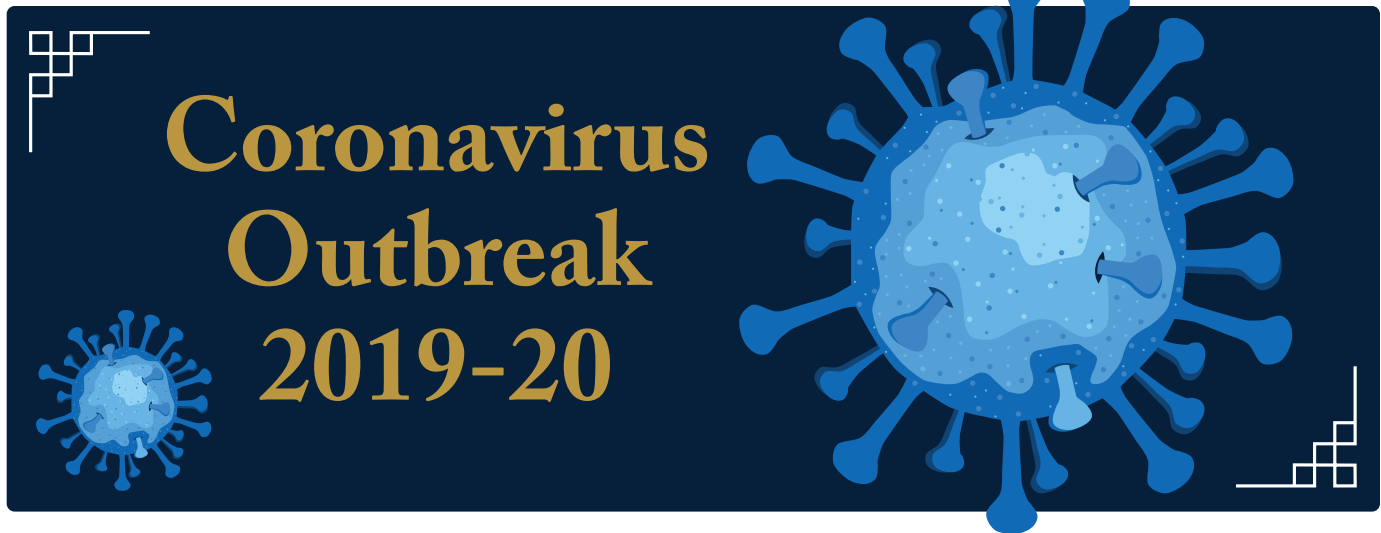
8

BODYWEIGHT SQUAT

It strengthens thighs and buttocks.

- Stand with your feet shoulder-distance apart or a little wider for better balance. If needed, hold on to something stable, like the back of sturdy chair or kitchen sink.
- Keep your chest lifted and shift your weight back into your heels while slowly pushing your hips back, as if you were sitting down on a chair.
- Keep your feet flat and lower yourself as far as you are comfortable (such as a quarter or halfway down to where a chair would be).
- Push through your heels and bring the body back up to standing.
- Complete a set of 10.





Coronaviruses (CoV) are a large family of viruses that cause a range of illnesses like common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV). A novel coronavirus (nCoV) is a new strain that has not been previously identified in humans. This new 2019-nCoV was first identified in Wuhan, the capital of China's Hubei province, when people developed pneumonia without a clear cause. Initial cases were linked to Huanan Seafood Wholesale Market, which sells fish, chickens, marmots, bats, venomous snakes and organs of rabbits and other wild animals.

Symptoms of the infection included coughing, fever and breathing difficulties and the disease turned out to be fatal in

several cases. Severe infection results in pneumonia, kidney failure and death. However, upper respiratory symptoms such as sneezing, runny nose or sore throat are less frequent. The virus has shown evidence of human-to-human transmission.

Coronaviruses are zoonotic, which means they can be transmitted between animals and people. Several cases from countries across Asia Pacific regions, Europe and North America have been reported. Though coronaviruses mainly circulate among animals, they have been known to evolve and infect humans as in the cases of SARS and MERS. The incubation period of the virus is between two and ten days. Existing vaccines or treatments are not effective for their treatment. Chinese scientists have isolated a strain of the new coronavirus

and shared its genetic sequence with laboratories across the world to develop PCR (polymerase chain reaction) for confirming infection in suspected patients. WHO has published protocols on diagnostic testing for 2019-nCoV. An updated preprint paper published on 23 January 2020 in bioRxiv suggests that the 2019-nCoV has possible bat origins.

As of 19 February 2020, a total of 75,216 coronavirus cases were reported, of which 12,057 were in critical condition; 2011 have died and 14,634 have recovered. Cases of novel coronavirus infection worldwide have been confirmed, including in every province of China. The new coronavirus has already spread to 28 countries. The virus has shown evidence of human-to-human transmission. Epidemiological studies suggest that a larger number of



people may have been infected but have not been detected.

Cities including Wuhan with a combined population over 57 million were placed on partial or full lockdown. Urban public transport and outward transport by long-distance buses, train and air have been terminated.

Chinese officials have assembled a 1,000-bed hospital in just 10 days in response to the novel coronavirus outbreak. Almost half of the facility is made up of isolation wards with 30 intensive care units. A second specialty hospital has also been planned having a capacity of 1,600 beds

Many countries have issued travel advisories warning against travel to Wuhan and Hubei province in China. Travellers who have visited Mainland China have also been asked to carefully monitor their health for at least two weeks. Many countries including India have resorted to evacuation of its citizens from Wuhan. Anyone who suspects to be carrying the virus is advised to wear a protective mask and seek medical advice by calling a doctor instead of directly visiting a clinic.

India has reported three positive cases of novel coronavirus in Kerala. One patient was a student studying in Wuhan University and two have travel history from China. These patients as well as others in cities including New Delhi and Kolkata have been placed in isolation. The three patients who tested positive were stable. Seventy-five patients have

been kept in isolation wards of various hospitals. Approximately 1,924 people were under home quarantine and have been asked not to go out in public until the end of the 28-day incubation period. WHO and local governments have started alerting people and set up measures to prevent new propagation of the virus.

Prevention and management

The virus spreads among human via droplets when breathing or coughing or via contact. It is primarily transmitted when a person is within a range of about 90 to 180 cm from the infected person.

Till date, no effective medicine or vaccine to treat 2019-nCoV infection is available, though efforts to develop some are going on. The Centers for Disease Control and Prevention of the United States has provided generic advice such as taking regular flu medications, drinking fluids and resting.

WHO Recommendations

- Wash your hands frequently with an alcohol-based hand rub or soap and water.
- Maintain social distancing – maintain at least 1 metre distance between yourself and other people, particularly those who are coughing, sneezing and have a fever.
- Avoid touching eyes, nose and mouth.
- If you have fever, cough and difficulty breathing, seek medical care early. Tell your healthcare provider if you

have travelled in an area in China where 2019-nCoV has been reported, or if you have been in close contact with someone with who has travelled from China and has respiratory symptoms.

- If you have mild respiratory symptoms and no travel history to or within China, carefully practise basic respiratory and hand hygiene and stay home until you are recovered, if possible.

Although wearing a medical mask limits the spread of some respiratory disease, using a mask alone is not guaranteed to stop the infections. It should be combined with other prevention measures. WHO has advised on rational use of medical masks to avoid unnecessary wastage of precious resources and misuse of masks.

It is still not known how long the 2019-nCoV virus survives on surfaces, but preliminary information suggests that the virus may survive a few hours. Simple disinfectants can kill the virus making it no longer possible to infect people.

Antibiotics do not work against viruses, as they only work on bacterial infections. Therefore, they should not be used as a means of prevention or treatment of 2019-nCoV.

Sources: WHO; Ministry of Health & Family Welfare (<https://mohfw.gov.in/sites/default/files/Guidelines%20on%20Clinical%20management%20of%20severe%20acute%20respiratory%20illness.pdf>)

Protect others from getting sick

When coughing and sneezing cover mouth and nose with flexed elbow or tissue



Throw tissue into closed bin immediately after use

Clean hands with alcohol-based hand rub or soap and water after coughing or sneezing and when caring for the sick



Protect others from getting sick



Avoid close contact when you are experiencing cough and fever

Avoid spitting in public



If you have fever, cough and difficulty breathing seek medical care early and share previous travel history with your health care provider



Practise food safety

Sick animals and animals that have died of diseases should not be eaten



GenomeIndia: Cataloguing the Genetic Variation in Indians

Genetic variations in individuals are often population specific and could predispose them to diseases and determine their response or adverse effects to certain drugs. Genetic variations also help track migration and evolutionary patterns of population groups.

Following Human Genome Project and the successful completion of the international sequencing projects (HapMap, 1000 Genomes Project) have led several countries to embark on their nation-specific large-scale population and disease sequencing endeavours in order to document their genetic variations and determine specific disease susceptibilities, thus achieving better and effective healthcare goals. Countries like, the USA, the UK, China, Japan, Australia, and Estonia among others have pledged to sequence more than 100,000 whole genomes for this purpose.

Indian population with more than a billion individuals is extremely diverse in terms of ethnic and linguistic groups. Still, after the initial Indian Genome Variation Project that documented certain single-nucleotide polymorphism (SNP) allele frequencies in the Indian population, no concerted effort has been made to use the current whole genome sequencing technologies to construct an exhaustive catalogue of genetic variations for our diverse population. India also lacks a comprehensive catalogue of genetic variations. This makes identification of the causal variations for monogenic disorders difficult and inaccurate. Currently, India also does not have a country-specific genome-wide chip that will make large-scale comprehensive genetic studies affordable. This calls for a

national-level effort in India to catalogue the genetic variations of its diverse population by whole genome sequencing of large numbers of individuals from diverse geographical regions and ethnicities spanning the country.

Such an effort is being undertaken in the GenomeIndia project. Successful completion of it will help in better understanding of the diseases in the Indian population based on an individual's genetic makeup. Further, this will help in devising novel tools for accurate and reliable molecular diagnosis, which will be instrumental in transforming the healthcare scenario of the country. The project was sanctioned by Department of Biotechnology, Government of India in January 2020 for a period of three years with a total approved cost of ₹237.74 Crore.

The outcome of this study would also be useful to other South Asian countries, as Indian genetics is relevant to the neighbouring South Asian countries. This will be an immense benefit for the world-wide human genetics research community as large-scale comprehensive genetic studies have conventionally centred around European populations, in general, and inroads for African and Hispanic populations have happened only recently. GenomeIndia will be the first of its kind in the country that brings together researchers from 20 institutions from varied disciplines

across the country to build a national genetic resource. The team includes geneticists, statisticians, computational scientists and clinicians.

Key question which will be addressed in this project is to know what are the overall genetic variations (common, low-frequency, rare, SNPs and structural) across our diverse Indian population and the project will also address the design of a genome-wide chip for India by creating the reference haplotypes for Indians. Cataloguing the genetic variations in Indians is a Pan India initiative focussed on wholegenome sequencing of representative populations across India. The goal is to start with and execute wholegenome sequencing and subsequent data analysis of 10,000 individuals representing the country's diverse population. This will help build an exhaustive catalogue of genetic variations in Indian population and aid in the designing of a genome-wide association chip for Indian population which will facilitate further large-scale genetic studies in a cost-effective manner. In the second phase, another 10,000 disease-based population will be sequenced. The results from this project would be a valuable national resource. It will also contribute in the national level capacity building in sequencing and computation for high-throughput human genomics. Several dovetailed efforts of additional wholegenome sequencing would happen that will facilitate understanding of diseases in the Indian population and open up avenues for precision medicine in the country. This would be a great example of convergence of technologies to generate results paving the way for precision medicine and promote better health and wellness in India.

AIM AND OBJECTIVES

1

Create an exhaustive catalogue of genetic variations (common, low-frequency, rare, SNPs and structural) in Indians.

2

Create a reference genome and haplotype structure for Indians

3

Design genome-wide arrays for research and diagnostics at an affordable cost

4

Establish a biobank for DNA and plasma collected for future use in research.

Email: mediacell@dbt.nic.in

ACTIVITY CORNER IN MAGH MELA (Allahabad)

Magh Mela is organised at the bank of Ganga every year in Allahabad (Prayagraj) during January-March. This year, during January 14-February 13, Vigyan Prasar organised a Science Exhibition-cum Activity corner at the Mela "Aao Dekhe, Kare, Aur Samjhe," (let's observe, experiment and understand). It was supported by local S&T organisations. It had Activity corners; Interactive exhibits to understand the basic natural phenomena and fundamental laws of science; and poster gallery on Ganga (Ganga Aur Hum) to understand its social and economic role and ecological/environmental services to humankind. Every day, on an average, five to seven thousand people visited the exhibition and participated in the activities.



GWALIOR MELA (Gwalior)

The Gwalior Mela is the annual activity of the State Government of Madhya Pradesh. Vigyan Prasar had put up an Activity Corner-cum-Exhibition at the Mela that was open for public from 7 January to 7 February. Two poster exhibitions on the themes of "India in Space" and "Indian Scientists"; interaction with the scientists; puppet shows; film shows; mathematic games/mathematics in nature; competitions etc. were organised daily. Students from 8-10 schools visited the activity corners/exhibitions and participated in different competitions. The stall was visited by more than five to seven thousand people every day.



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INBOX

Firstly, I would like to congratulate you on bringing some changes in the design of Dream 2047. I especially liked the article titled How Habitable is Mars which reminded me of a story "All Summer in a Day" by American writer Ray Bradbury. In the story, a class of students was in Venus and waiting for the Sun to come out, where the Sun shone for only one hour every seven years. After going through observations that "we will get to witness fantastic domed cities built on Mars where people will work and live as they look at the Earth on the horizon", I would like to know how long it may take this to happen in reality—10 years or even more?

And also, how ethical it would be to set habitats in Mars?

Manisha, Class XI, Bhubaneswar

The February 2020 issue of DREAM 2047 (Vol. 22, No. 5) is remarkably different from the earlier ones! I have always appreciated the quality of articles DREAM has carried over the years. As a person who gives more importance to the content—more than the design itself— I have never bothered myself with the latter so much. But the latest issue has compelled me to have a re-think on my prejudiced view. A good design can indeed go a long way in enhancing the overall 'look and feel' of the

magazine. The excellent story-telling ability of the authors and care taken to present them have made it a smooth read. Kudos to all! Wish you all the very best!

Vamshika E Menon, Chennai

In the LED article, health hazards of the LED bulbs were discussed. I would however like to add that these bulbs are much better than CFLs as they do not contain hazardous chemicals and therefore safe to dispose off with other wastes. Also, since some of the components in the LED bulbs can be recycled, the manufacturers may be contacted for returning them.

Hritwik, Vellore, Tamil Nadu

REQUEST TO THE AUTHOR

Science writers, and scientists, science communicators, doctors, journalists, teachers and researchers interested in popular science writing, are requested to send their articles for publication in Dream 2047 in 1500 to 2000 words in English or Hindi language. Also send high resolution images along with the article. Your articles can be based on the latest research in the field of science and technology, history of science, health and medicine, agriculture, energy, water, interviews with eminent scientists and working of science laboratories. Suggestions, feedback and letters from authors and readers are welcome. Please don't forget to attach your photograph along with your articles or letters/feedback. You can contact us by email: dream@vigyanprasar.gov.in

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