



DREAM 2047

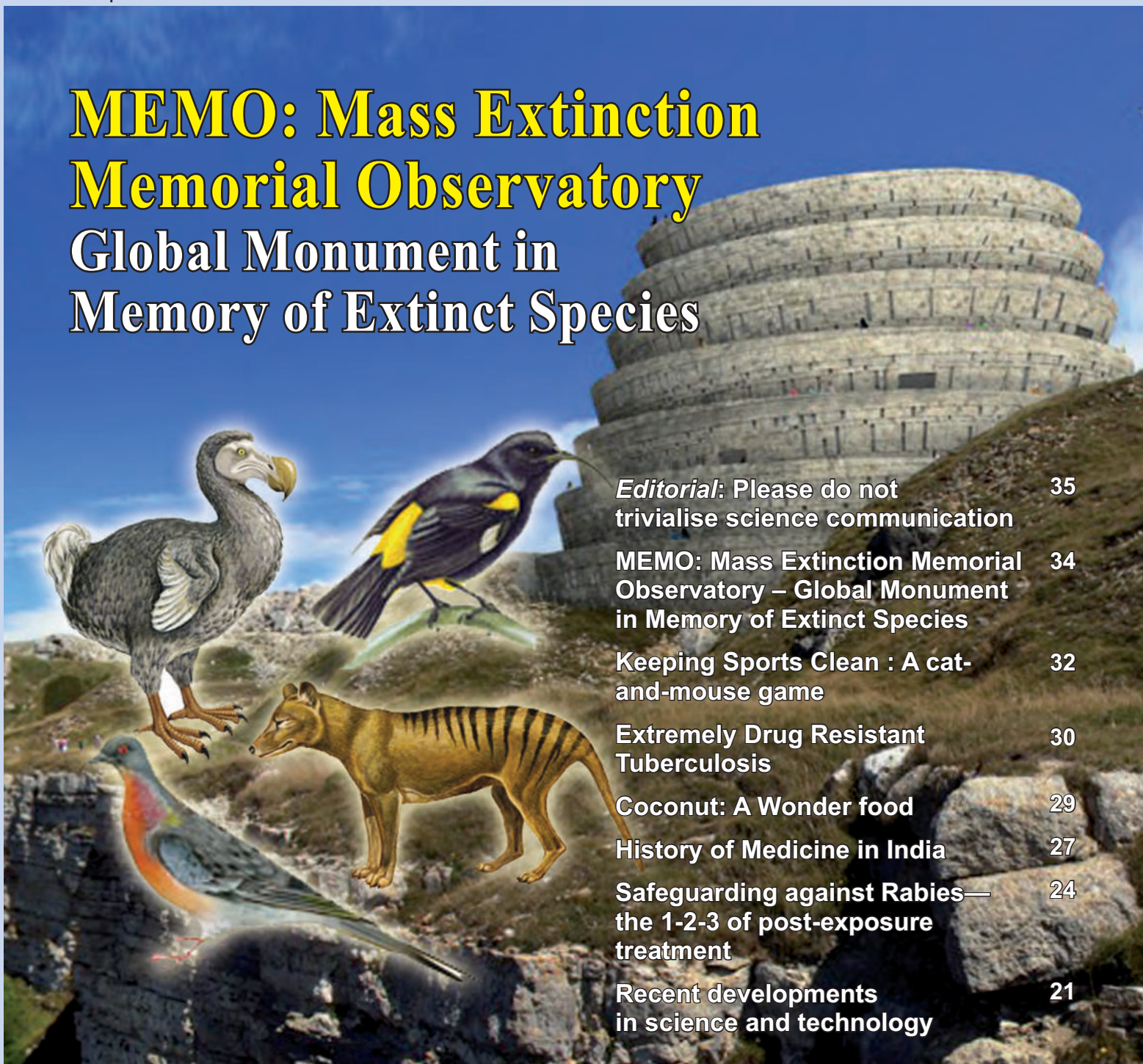
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MEMO: Mass Extinction Memorial Observatory Global Monument in Memory of Extinct Species



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... think scientifically, act scientifically... think scientifically, act scientifically... think scientifically, act...

Please do not trivialise science communication



Dr. R. Gopichandran

Let me argue for the cause of science communication. Science communicators are embedded in the cause. Any good for the cause will mean good for people engaged in it; almost Samaritans in this case. How often do we come across proofs/empirically evidenced cause-effect relationships pertaining to science communication? When will we get to see a steep rise in the spread and depth of case examples that demonstrate the holistic value of communication? Is it not important to position communication at the centre of missions, without trivialising the process or communicators? Do we really acknowledge the importance of a bottom-up feedback on the sustainability of interest on all that is communicated or larger impacts expected of communication?

Robustness of tools that may help reach out to large numbers is a stand-alone element of communication. Messages and truly messaging survive only account of the credibility of the former. Messages may not be accepted on face value. Impacts and their sustainability are too far away along this continuum. On the other hand, it is likely; expectations may sky rocket because of continuous messaging and therefore demand swift follows ups; consistent with claims/hype as the case may be. What is the importance we confer on enabling circumstances that can help transform learnings to action? Are the contents and communicators seen as credible or condescending? Importantly, is the focus on the agenda of science for development or for self-aggrandisement?

Do communicators recognise or highlight the limits and limitations of their own knowledge/stand/tools? I am sure you agree, these are directly relevant for success of science communication; especially when we see science and technology as public policy tools to improve quality of life. Add equity and justice to the equation; only to make absolutely sure that we mean the business of inclusiveness. Missions on environmental quality and eco-system services, alternative energy; sustainable production and consumption aligned with market advantages, water, health and sanitation and innovations provide some of the best windows of opportunity for this purpose.

Some of the most important tasks that have to be carried out in India on a priority basis are the following to address the questions raised: (i) Document experiences/insights on communication with special reference to local relevance for action; (ii) Assess skills and

opportunities to enhance them to help deliver appropriate information in a timely manner: and (III) Create interest to perceive and interpret credibility of messages delivered. This bottom-up stakeholder engagement can be expected to create critical groundswell to tackle challenges due to multiple anachronisms that tend to plague the message – intent – impact link.

Scale of operations is equally important. Reality checks should firewall this approach against illogical speculations/scepticism. In this process, however, communicators (including leaders, mediators and grass root actors) for credibility's sake, should not mistake their own (imagined) eloquence or eminence for the impact they may want to create. Communicators should be seen as credible and genuinely so. The logical framework about enhanced awareness should clearly differentiate impacts/outcomes of such awareness; especially as a function of the robustness of enabling circumstances.

I am confident about the large quantum of communication activities that have taken place through leading communication institutions at the national and grassroots level. No arguments also about the zeal and purpose they stood for. Only an overly myopic and self-perpetuating mind will pick illogical holes on such initiatives. The way ahead however has to seamlessly integrate the stated elements. This will also help the former get their due visibility. Rightly so, they set the context for enhanced value we wish to collectively infuse.

Those of us interested in the dynamics of internet tools will do well to read up the Facca & Alvarez's¹ roadmap on 'future internet'. Useful leads on scenarios and pathways. An equally important read is Top Ten Trends Driving Science published by the ACS².

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MEMO: Mass Extinction Memorial Observatory

Global Monument in Memory of Extinct Species



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MEMO as its name suggests is a global monument being built in memory of extinct the species of our planet. MEMO is to be a beautiful iconic monument combining natural history, architecture and arts aiming at creating awareness about our degrading biodiversity and species loss. Stone carvings of 860 species that have become extinct will find place on the walls of the building.



Artist impression of MEMO (© Adjaye Associates)

On geological scale – we are living amidst the sixth mass extinction of plants and animals – the sixth wave of extinctions in the past 500 million years.



Map: Location of Isle of Portland in UK (©Sajid Idrisi, Source: Google Map)

Mass extinctions in the past were caused due to natural events such as volcanic eruptions, asteroid strikes, and various other natural calamities, but the current one is purely anthropogenic in nature being caused by human-led habitat loss/fragmentation, invasive species introductions, rapid climate events, etc. As per IUCN (International Union for Conservation of Nature), out of our planet's 76,199 assessed species, 22,413 are in danger of extinction.

Species extinction is a natural process which occurs at the rate of one to five species per year, but the rate at which we are losing species currently is alarming. Experts estimate the current extinction rate to be between 1,000 and 10,000 higher than the natural extinction rate. With this alarming fact in mind, the Mass Extinction Memorial Observatory has been conceptualised and designed to be a global species-extinction awareness centre.

MEMO is being constructed on the Isle of Portland on the south coast of Britain. The site is a part of Jurassic Coast – a Geological World Heritage Site popular for its fossil-rich cliffs, which are apparently 180 million years old. Stones from the same cliffs will be used to carve out images of extinct species. The very idea that species could go extinct was discovered here by Robert Hooke, the surveyor of the city of London, who found giant ammonite fossils in the Portland stone quarried for the rebuilding of London's public buildings after the Great Fire of 1666.

Architectural Icon

Designed by British architect David Adjaye, the design is inspired from the ancient

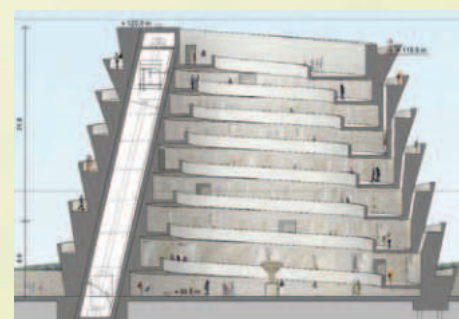
fossils of extinct gastropod “Portland Screw” (*Aptyxiella portlandica*) that were once abundant on the island. The building materials will include popular Portland limestone from the same site which has actually been the source of fine limestone for great architectural works ever since Roman times.



Internal cast of a Portland screwstone from the Jurassic Portland Stone which inspired the design of MEMO Building (©The Trustees of the Natural History Museum, London)

Most of the buildings in Central London as well as United Nations' building in New York are built of Portland stone.

According to David, MEMO would be a journey in which the floor is reached by a 'cut' into the ground with a continuous spiral walkway lined with the sculptures wrapped around a great central chamber – the venue for performances and events – ascending to, and ultimately right through an 'oculus' of sky above. At the top is the colossal sea view looking out over Lyme Bay and Chesil Beach stretching away into the distance. A second spiral winds around the exterior of the education centre, which is built into the ground looking out to sea. Accessed from both spirals are interpretation



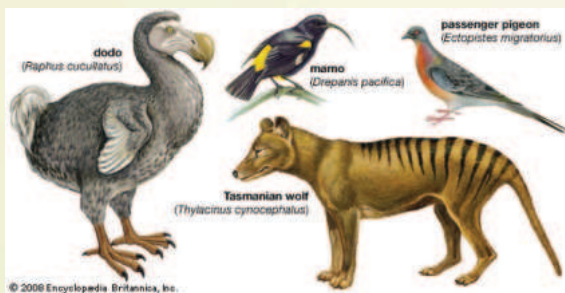
Cross section view of MEMO building (©Adjaye Associates)

spaces within the very walls. Surrounding MEMO will be a new 4-hectare park of species-rich limestone grassland permanently restored from the quarry. The total cost of the project is estimated at £ 30 million (Rs. 300 Crore approx.) Rising almost 30 metres into the air, the building will include an exhibition space, an information centre, and an observatory.

“Its creation will provide a global icon to our need to respect and protect the natural world and will ask in its testament whether we are worthy of the name we gave ourselves: *Homo sapiens* — the wise hominid,” says Tim Smit, Principal advisor to MEMO project.

Global Education Hub

The basic objective of the project is to create awareness about extinct species and those which are under threat. The structure will apparently become a focus for educational programmes, conservation initiatives,



Some extinct species (Source: Encyclopaedia Britannica, Inc., 2008)

exhibitions and conferences and is expected to attract 300,000 visitors a year. The space enclosed will become a living arena for projection and performance, exhibition and installation, conference and festival with the mission to inform, educate, and inspire. Schools and various conservation initiatives will be involved from all over the world. The ‘epic of evolution’ will be told and the solutions to halting biodiversity loss will be show-cased.

Extinct species and the reason behind their loss will be communicated. For example, the Dodo (*Raphus cucullatus*), an extinct flightless bird that was endemic to the island of Mauritius in the Indian Ocean became extinct due to over-exploitation as a source of meat by sailors. Other species such as the Passenger pigeon (*Ectopistes migratorius*) lost to overhunting, the golden frog (*Atelopus zeteki*) to climate change, and many others.

The site will constitute the vast geological picture, with the narrative of

scientific discoveries of the early Royal Society and the story of the rebuilding of London. The architecture itself will provide many creative teaching opportunities – from the lichens that will grow on it to the role of limestone deposition in the global carbon cycle. Like all limestones, Portland, both stone and island, is largely comprised of the bodily remains of ancient creatures.

The on-site education programmes will mobilise stone carving and all the arts to interpret the science for all ages. School groups will be invited to involve in innovative activities such as carving patterns based on the forms of micro-organisms and the geometry of organic growth, while all visitors will be invited to mark their visit – by carving their initials.

“I was deeply moved on learning of this brilliant, profound and ultimately humanitarian enterprise. I believe it can be the seed and soul of a renaissance in public engagement with biodiversity,” says E.O. Wilson, Professor Emeritus at Harvard

University and MEMO Patron.

The Extinction Bell

One remarkable feature of MEMO building will be a ‘geological’ or ‘extinction’ bell in order to make all future extinctions audible. It will be tolled whenever another species goes extinct. The bell will be more than 3 metres in diameter and weigh 9 tonnes and will be cast the Bronze Age way – from ‘roach’, the



Scale Model for the Memo Bell
(© Norman Lomax)



Hawaiian Haha tree
by Harry Brockway
Portland, 2008 (Source:
MEMO Project)

youngest of the Portland strata which is riddled with the fossil hollows of Jurassic shellfish. The bell will be cast by Taylor’s Bell Foundry in Loughborough, UK. The biggest bell in the UK of St. Paul’s Cathedral was also cast by the same foundry. It will also bear the name of Robert Hooke, who first alerted the world to the possibility of extinction.

The project, which is slated to be completed by 2019-2020, is being supported by several organisations and people in different capacities. HRH The Duke of Edinburgh is the Royal Patron. Other Patrons include many leading scientists and communicators of science including Professor E.O. Wilson and Sir David Attenborough. The principal international authorities – the IUCN Species Survival Commission, which



Harry Brockway carving the endangered Pink Seafan at The Lyme Regis Fossil festival, UK 2010 (Source: MEMO Project)

produces the ‘Red List’; and the Secretariat of the UN Convention on Biological Diversity – are committed supporters of MEMO Project.

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Keeping Sports Clean A cat-and-mouse game



Subha Sankar Ghosh

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"I've just proven to the World that you can do it clean, with hard work and determination. I've made the sport exciting, made people want to watch the sport".

—Usain Bolt (Jamaica), winner of 2008 gold medals in Olympics

"I feel sorry for Ben Johnson. All sportsmen - not all, but maybe 90%, including our own - use drugs."

— *Anonymous Soviet coach*, The New York Times, October 1988

The above two statements highlights the magnitude of doping in the world of sports.

Introduction

The abuse of doping has been one of the most serious threats to sports. Stimulants have been used by sportsmen from ancient times. Galen was a famous Greek physician who was instrumental in passing on the knowledge about magic potions from the ancient games to the Romans, praising the effects of eating herbs, mushrooms



Hans-Gunnar Liljenwall

and testicles. In the beginning the source of stimulants ranged from herbs, mushrooms, wine potions, hallucinogens, animal parts like testicles, etc. But the scenario started changing from last half of 19th century when modern medicines, steroids, hormones and drugs came to the used rampantly by athletes. Initially these synthetic molecules were believed to cause no adverse effects on athletes when taken under expert supervision, but slowly the ugly effects of the same came to the fore. In spite of knowing the same, the popularity for these substances continue to rise because of the effects it could produce.

Doping and Olympics

The Olympics is the stage where sports ought to be played with a spirit of fairness. It is the biggest sporting event for any athlete where winning a medal is a dream come true. A lot of factors play in the mind of the participants that ranges from corporate sponsorships, expectations of sports governing bodies,

worldwide recognition, financial security, etc., which put immense pressure on the participants. As a result many of them often cannot resist the lure of using these miraculous potions while knowing very well of the consequences, if caught. The offenders are willing to test their fate as the dope test is done randomly by the International Olympic Committee and as such there is always a probability of going scot-free.

The Olympics have been tainted time and again by athletes who were caught on charges of doping. Hans-Gunnar Liljenwall, a Swedish was the first Olympic athlete who tested positive for taking performance enhancing drugs at the 1968 Summer Olympics. As a result he lost his bronze medal.

Till the 2012 Summer Olympics, more than 50 athletes have been stripped of their medals on doping charges. The top three offending nations were Russia, USA and Bulgaria whereas the top three controversial sporting events have been weightlifting, women's cross country skiing and men's cycling.

In the recent past, the world was stunned to hear about high-profile sportsmen like Ben Johnson, Marion Jones and Tim Montgomery who were banned for doping. Lee Chong Wei, Badminton World No.1 for

199 consecutive weeks, was tested positive for the banned steroid dexamethasone and was subsequently banned for eight months. Seven-time Tour de France champion Lance Armstrong, who was suspected of using performance-enhancing drugs finally admitted that he took blood booster to win all the championships. Similarly Alberto Contador, winner of the 2010 Tour de France, tested positive for the banned anabolic agent Clenbuterol. Five-time Grand Slam tennis champion Maria Sharapova was tested positive for Meldonium, a performance-enhancing drug. World double-sprint champion Tyson Gay was suspended for a year after testing positive in 2013 for a banned anabolic steroid. Narsingh Yadav, the Indian wrestler who was selected for

Rio Olympics, has been banned from competing for the next four years.

Rumours of State sponsored doping came to the fore with the discovery that East Germany has undertaken a dedicated drug regimen to train their athletes. In Rio Olympics, there was a call by World Anti-doping Agency to ban the entire contingent of Russia on charges of prolonged doping programme

for their athletes.



What is doping?

Doping refers to the use of banned performance-enhancing drugs by athletics. The use of drugs has been banned by almost all International sporting organisations

as these drugs have adverse health effects on the athletes. In addition it violates the inherent spirit of sports, namely providing equality of opportunity to all the competitors. In order to keep the sports clean, the World Anti-doping Authority (WADA) was set up in 1999.

With the progress of



sports science, a myriad of drugs are being used by athletes. These drugs are so chosen that they may help in their respective discipline and may be administered in such a manner that they pass undetected during doping test. On the other hand, continuous research is going on by scientists of anti-doping agencies to catch the defaulters. As such a continuous cat-and-mouse game is being played every day.

Broadly the substances have been categorised into different categories as listed below-

example can be given of the UK sprinter Dwain Chambers who was suspended in 2003 for doping. According to him he used to take six different types of banned drugs for improving his performance.

The actions and effects of different types of drugs vary widely.

As is clear from the above table, these dopes or supplements can do long-term damage to athletes. As such a series of tests have been formulated by scientists to ascertain the cases of doping. The dope tests comprise of collecting urine and/or blood

How is doping detected?

The primary objective of the dope test is to test for the presence of banned substances in the biological fluids of the body i.e; blood and urine. The athlete who has been selected for dope test is required to submit his/her urine and/or blood samples only to the authorised personnel under their supervision.

In order to avoid any form of contamination, the urine is collected in presence of Doping Control Officer (DCO). Similarly the blood sample is collected in presence of Blood Collection Officer (BCO). The samples so collected are immediately sealed in presence of the sportsman and sent to accredited lab for testing. The samples are primarily tested for the presence of stimulants, narcotics, beta-blockers and diuretics.

The samples are subjected to gas/Liquid chromatography followed by mass spectrometry. In chromatography, the resultant chromatogram is matched with the standardised values to detect the presence of banned substances in the sample. Gas chromatography/Mass Spectrometry is one of the most accurate tools for analysing samples.

While on one hand sophisticated technologies are being employed to identify offenders, continuous research is being taken up by pharmaceutical companies to produce drugs that can evade these tests. It has been found that the sportsmen involved in doping are employing a host of methods to evade detection which include the following.

a) Urine replacement – Specialised kits such as the Whizzinator kit were developed and sold commercially with the help of which an athlete can replace his urine sample with clean urine.

b) Epitestosterone administration – The International Olympic Committee checks the level of testosterone by checking its relative presence compared to epitestosterone. The standard that has been fixed for T/E is 4:1. Knowing this fact, the athletes pump their body with epitestosterone and keep the ratio within acceptable limits.

c) Diuretics – Different types of natural and synthetic diuretics like dandelion root, caffeine with fasting, Permacleanse, etc., are used to detoxify the body of any traces of substance abuse.

Drug Effect	Drug	Related Sports
For alertness	Amphetamine, Caffeine, Cocaine and other stimulants	Baseball, Basketball, Boxing, Cycling, Judo, Gymnastics
For relaxing blood vessels	Alcohol, Beta-blocker, Cannabinoids	Archery, Diving, Pentathlon, Shooting
Increased oxygen delivery to tissues	Protein hormones, Blood doping	Cycling, Marathon, Pentathlon, Skiing, Swimming
Strength and mass builders	Anabolic steroids, Human chorionic gonadotrophin, Luetinising hormone, Human growth hormone, Insulin	Sprint events, Throwing, Weightlifting, Football
Body Weight management	Diuretics	
For masking doped drugs	Epitestosterone, Plasma expanders, Secretion inhibitors	Endurance sports like cycling

Confessions from athletes show that they take a cocktail of drugs instead of one. As a result, the health impacts of such actions can be terrible in the long run. An

sample of the athlete under supervision. Usually the athletes are selected randomly for the test.

Drug	Effect on the Body
Anabolic agents including testosterone	Acne, Male pattern baldness, Liver damage, stunted growth and puberty in children, increased aggressiveness or “Roid Rage”, gynaecological problems, depression, etc.
Peptide hormones and different types of growth factors	Hypertension, Heart attack, Pulmonary embolism or blockage, thyroid disorder, leukaemia, blood cancer, diabetes, arthritis
Beta-blocker	Muscle cramps, nervousness, nagging headaches, nausea, muscle cramps
Diuretics	Dehydration, muscle cramp, dizziness, drop in blood pressure, loss of body coordination
Narcotics	False sense of invincibility, nausea, vomiting, failure to recognise injury, decreased heart rate, addiction
Glucocorticosteroids	Loss of muscle mass, weakening of injured area, decrease in body growth of young people
Blood doping including the use of recombinant human erythropoietin	Blood clotting, stroke, increased risk of hepatitis and AIDS

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Extremely Drug Resistant Tuberculosis



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Tuberculosis (TB) is treatable and curable with a course of first-line anti-TB drugs. But if these drugs are mismanaged or misused, drug-resistant-TB (DR-TB) can develop. However, persons with TB can die if they do not get proper treatment. The vaccine for TB commonly known as Bacille Calmette-Guérin or BCG is used in some countries to prevent severe forms of TB in children.

Extremely drug-resistant tuberculosis (XDR-TB) is a very rare form of TB caused by TB bacteria that are resistant to some of most effective anti-TB drugs. It is defined as TB that has developed resistance to Isoniazid and Rifampicin (resistance to these first line anti-TB drugs defines multi-drug-resistant tuberculosis, or MDR-TB), and also to any member of the quinolone family and at least one of three second-line anti-TB injectable drugs such as Kanamycin, Amikacin or Capreomycin.

The symptoms of XDR-TB are same as ordinary or drug-susceptible TB, namely coughing with thick and cloudy mucous (or sputum) for more than two weeks, sometimes coughing up blood, chest pain, fever, chills, and night sweats, weight loss, fatigue and muscle weakness, and in some cases shortness of breath. A person with such symptoms does not necessarily have XDR-TB, but they must see a physician for diagnosis and a treatment plan.

Causes and transmission XDR-TB

Resistance to anti-TB drugs can occur when the anti-TB drugs are misused and mismanaged. Examples include when patients do not take their TB medicine regularly; do not complete their full course of treatment; do not take all of their doses as prescribed by doctor, or develop the disease again, after having taken TB medicine in the past. It can also arise if supply of anti-TB drugs is not available; or the drugs are of poor quality, or health-care providers prescribe the wrong treatment, the wrong dose, or length of time for taking the drugs.

XDR-TB is spread through the air as the drug-susceptible TB or MDR-TB. TB bacteria are released into the air when the person with TB coughs, sneezes, spits, speaks, or sings. The TB bacteria float for several hours in the air and a person inhaling a small number of these TB bacteria while breathing can become infected. XDR-TB is not spread by kissing, touching bed linens or toilet seats, shaking someone's hand, or sharing food or drink.

Diagnosis

The diagnosis of XDR-TB bacteria may take from 6-16 weeks. There is an urgent need of new tools for rapid TB diagnosis. The



drug susceptibility test (DST) is the original method used to determine how well the four primary anti-TB drugs, namely Isoniazid, Rifampin, Ethambutol and Pyrazinamide inhibit the growth of TB bacteria. In the drug susceptibility test the TB bacteria are spread plated on an agar medium and the discs containing one of the four primary drugs are added to the culture plate. After a few weeks of incubation the plate is examined for any inhibition zone of clearance around the disks. If there is a clear zone of inhibition, the drug has inhibited the bacteria and most likely the bacteria is not resistant to that

drug. The primary DST was not suitable for testing bacteria strains that were extensively drug resistant. The secondary test is known as 'Bactec MGIT 960 System' was accurate but still slow at determining the level of resistance. A recent study found that a research technique known as direct nitrate reductase assay (D-NRA) showed efficient accuracy for the rapid and simultaneous detection of resistance to Isoniazid (INH), Rifampicin (RIF), Kanamycin (KAN) and Ofloxacin (OFL). D-NRA results were obtained in about 17 days, comparably less than other drug susceptibility testing. In recent years DR-TB testing has shown a lot of progress. The Reverse Line Blot Hybridization Assay (RLBH) is accurate and takes only three days to determine how resistant the particular strain of bacteria is.

Prevention

A person can prevent the XDR-TB by taking all the medication exactly as prescribed by the doctor or nurse. The treatment should be completed at exact time and not to be stopped early and doses should not be missed. Health care providers can help prevent XDR-TB by quickly diagnosing cases, following recommended treatments, monitoring patients' responses, and ensuring completion of therapy. On the other hand, to prevent getting XDR-TB is to avoid exposure to known XDR-TB patients in closed or crowded places. Additionally, personal respiratory protective devices such as covering the mouth and nose are a necessity. An effective disease-control infrastructure is necessary as well for the prevention of XDR-TB. Increased funding for research, and strengthened laboratory facilities are much required. Immediate detection through drug susceptibility testing is vital, when trying to stop the spread of XDR tuberculosis.

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Coconut: A Wonder food



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The coconut (*Cocos nucifera*) is known as a “wonder-food”. Its Indian name is *narial*. It is a near-perfect diet, as it contains almost all

possibly Panama before 1492, Thereafter, it gradually spread to all tropical areas of the world. It is now widely cultivated in India, Sri Lanka, Indonesia, Philippines, East Indies, the west Indies and islands of the Indian and pacific oceans. Total 61 million tonnes of coconut is grown in nine countries of the world. The Philippines has the maximum coconut production. Coconut tree grows abundantly along the entire coast of the sea and also thrives well in loose sandy soil. It can live up to 200 years.



High food value

The coconut is a highly nourishing, strengthening and fattening food item.

the essential nutrients needed by the human body.

Experts describe the coconut as not just a fruit, but a nut and a seed as well – a drupe. It has three layers. The outermost part of the fruit is green and shining when tender. It becomes rough after its maturity. It is almost entirely water-proof and very hard. Beneath this is a thick layer of stout fibres, the layer being at times over 25-mm thick. Then follows a hard stone-like layer, about 6-mm thick. The inside of this stony layer is lined with fairly thick coating of soft, milky-white flesh. The cavity inside the flesh is filled with a watery fluid. It grows on a tall stately, unbranched tree, with a terminal crown of leaves growing to a height of 20 to 30 metres.

It has high oil content (lauric acid) which is easily digestible. It is more easily utilised by the body than all other fats. The protein content of coconut is of high quality, containing all the essential amino acids. It is also rich in potassium, sodium, magnesium, and sulphur. The energy value of dried coconut is very high, being 662 calories per 100 grams.

Coconut water

The water of tender green coconut is used as a beverage and refreshing drink. A one-month-old fully grown tender coconut



Origin and distribution

Coconut is believed to have originated in the Indo-Malaya region and to the south west of New Guinea. It was taken to the mainland of Asia in prehistoric times. There is evidence that the coconut was grown in India about 3000 years ago. The Vedas describe coconut tree as *Kalpa-Vriksha* or the ‘tree of heaven’,

Coconut reached East Africa, and

contains about 400 to 465 ml of water. It has special properties.

1. It is pure and hundred percent natural and safe.
2. Tender coconut water is a sterile natural drink with high nutritional value.
3. It contains less fat compared to milk. It is free from cholesterol. It helps to increase good cholesterol (HDL) in the body.
4. It is an excellent tonic for health. The water of a single coconut contains sufficient vitamin C to meet daily requirement of the body.
5. It also contains several vitamins of the B group. These are niacin, pantothenic acid, biotin, riboflavin, folic acid and thiamine, as well as pyridoxine in traces.
6. Coconut water also contains sodium, potassium, calcium, magnesium, iron, copper, phosphorus, and sulphur.
7. It contains less sodium compared to beverages available in the market.
8. Since tender coconut has high contents of potassium, it aids in dehydration by restoring electrolyte balance.
9. Tender coconut water is good first-aid home remedy in place of saline transfusion.
10. It contains natural sugar and is tasty.
11. Coconut milk is a rich source of proteins and is easily digestible. In the dilute form, it is good liquid food for the aged and weak.
12. Massaging the face with coconut milk regularly relieves pimples and prevents premature wrinkles.
13. The tender coconut kernel, which is a rich source of enzymes, is beneficial to diabetics, as it does not have starch.

Tender coconut water is very useful in cholera, to prevent dehydration and electrolyte imbalance. When taken with fresh lime juice it restores the electrolyte balance and neutralises the acidosis of the

Coconut: Nutritional facts*

Moisture	36.3%	Potassium	24.7%
Protein	4.2%	Calcium	40%
Fat	41.6%	Magnesium	15%
Minerals	1.10%	Phosphorus	6.3%
Fibre	3.6%	Iron	79%
Carbohydrates	13%	Vitamin B	2.2%
		Vitamin C	3.7%
Fresh coconut's calorific value – 444			
Dried coconut's calorific value – 662			
*Values per 100 grams edible portion. Source, USDA Nutrient Database.			



secretion of the stomach and gives much relief to the patient. Coconut oil is a tried and tested remedy not only for hair fall, but is also helpful in maintaining good texture of the hair. There are other benefits too. Application of a paste of coconut oil and turmeric powder relieves pain in cracked heels and wounds.

blood. Coconut water is a known source of potassium-rich fluid and beneficial for cholera patients.

Mature dried coconut is valuable in the treatment of acidity. Its oil reduces the acid

Digestive system disorders

Tender kernel of coconut is highly beneficial in the treatment of digestive system disorders. It is valuable in conditions like indigestion, colitis, gastric ulcers, diarrhoea, dysentery

and piles. The tender coconut water is also an excellent remedy for flatulence, vomiting and dyspepsia.

Ascites is a disease which causes swelling in the stomach due to fluid accumulation. Coconut water is valuable in ascites. The patient should be given two or three glassful of coconut water to drink. This quantity may be increased or decreased according to condition and the needs of the patient.

The oil extracted from the flesh of ripe coconut is an effective dressing for burns and scalds. It is of great value in the preparation of ointments as it penetrates the skin readily. The tar-like fluid obtained from the red, hot shell of a ripe coconut is a rubefacient which causes reddening and warming of the skin. It is household remedy for ringworm, itch and other skin diseases.

The coconut is widely used in the preparation of many products. The oil is the most important of these products. It is used in cooking and also as a hair-restorer and is used as hair oil. Dried coconut is used in cooking and in various preparations of sweets and curries.

Dr. V.H. Mulimani is retired Professor of Biochemistry, Gulbarga University Gulbarga, Karnataka state. His area of research includes enzymology and nutrition.

Extremely Drug Resistant Tuberculosis (continued from page 30)**Treatment**

The treatment of XDR-TB requires extensive chemotherapy for up to two years. For XDR-TB there is a reduced number treatment options and therefore it is associated with



higher mortality rate compared to MDR-TB. Recent studies have shown that XDR-TB can be treated through the use of aggressive regimens. Successful outcome depends on a number of factors such as the extent of drug resistance, the severity of the disease and whether the patient's immune system is compromised. It also depends on access to laboratories that can provide early and accurate diagnosis so that effective treatment is provided as soon as possible.

Risk factors

Studies on the effect of age and XDR-TB have found that individuals who are 65 and up are less prone to getting XDR-TB. A study in Japan has found that the younger are at higher risk of getting XDR-TB. Studies have

shown that men are more prone to getting XDR-TB than women. One study showed that the male to female ratio was more than threefold.

XDR-TB and HIV/AIDS

TB is one of the most common infections in HIV/AIDS patients. Where XDR-TB is most common, HIV patients are at greater risk of becoming infected with XDR-TB, compared with HIV negatives, because of their weakened immune system.

Ashwini Kumar Dubey, ICMR-SRF working on antimicrobial peptides from lactics at Department of Biochemistry and Molecular Biology, Pondicherry University, Puducherry.

History of Medicine in India



Dipayan Pal

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During the Stone Age, tools that were used as weapons began to be used for performing surgical operations. In this regard, there are extensive archaeological evidences like the discovery by V.S. Wakankar of Mesolithic rock paintings in Bhimbekta Rock Caves in Madhya Pradesh that portray surgery being performed on a subject's head. Psychotherapy occupied a significant place in primitive medical care system. People believed that diseases were caused by external agents like demons and evil spirits, and intrinsically the physicians were priests and magicians. During the 3rd Millennium BC, developments took place around the course of the Indus River that ultimately led to the establishment of magnificent Indus Valley Civilisation. No doubt that some kind of medical system existed, but the scripts of this matured civilisations remain undeciphered. So, we know little about the medical practices of the Indus Valley Civilisation. However, the Indus Valley Civilisation declined during the 2nd millennium BC, and the entire populace migrated to far away villages.

During the late 2nd millennium BC, Indo-Europeans (Aryans) began to migrate to South Asia. Their sacred scripture written in Sanskrit is called 'Veda' (meaning knowledge). From the paens that were recited by the hereditary priests (*Brahmanas*), we can infer that some medical system was prevalent in those days. In unified sense, there's nothing called 'Vedic medicine'. The scene emerges that there were two kinds of approach to the causes of disease and medicine: religious approach and magical approach. Several deities were imputed specific healing powers. People believed that diseases were caused by evil spirits or by external accidents and rituals and

prayers were to be offered to placate these superhuman beings who brought diseases upon mankind. Plants were acknowledged to have healing capacity. It was believed that diseases like *jwar* (fever) and *yakma* (consumption) had some magical causes whereas wounds and other external maladies were believed to be due to physical causes. There is evidence that proves that poison was widely used. Elementary ideas of the physiological process, a superficial knowledge of anatomy and simple forms of surgery are revealed in the Vedic Literature.



Indian method of the restoration of the nose by plastic surgery, from article by B.L. to Mr Urban, concerning Cowasjee, a man who had his nose reconstructed with the aid of plastic surgery. (Courtesy: Wellcome Library, London)

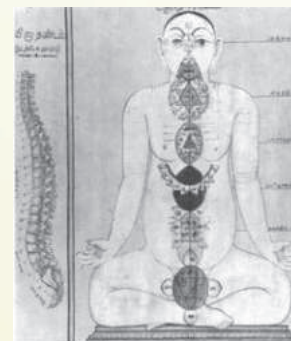
Auyurveda

In the post-Vedic period, Indian medicine reached its zenith. During this period, medicine developed on a rational platform eliminating mystical and magical faith. In Sanskrit, the classical system of Indian medicine is called *Ayurveda* (science of long life). *Ayurveda* is a medical system which has both preventive and prescriptive aspects. The basic concepts of Ayurvedic medicine are essentially true for all times.

In theory, *Ayurveda* stipulates three bodily *Dosha* or humours (bile, airy element and phlegm) and seven bodily components (blood, flesh, chyle, fat, marrow, bone and

semen). *Ayurvedic* medicines are mainly herbal and are used in a broad range of therapies. The origin of *Ayurveda* can traced to the *Atharvaveda* where several diseases are mentioned along with their treatments. *Atharvaveda* even classifies drugs into two kinds: *bhai saj yāni* (those which cure diseases) and *ūyu syāni* (drugs which prolong life). However, systematic development of *Ayurveda* began during the 6th century BC and continued till 7th Century AD. This period is known as 'Samhita period' when several classical works on *Ayurveda* were produced.

There are numerous texts on *Ayurveda*



Hortus Indicus Malabaricus

which were mainly written in Sanskrit language. The earliest of these texts are *Sushruta Samhita* (compendium of Sushruta) and *Caraka Samhita* (compendium of Caraka). These two texts form the cornerstone of *Ayurveda* that have survived from ancient India. The *Caraka*

Samhita is believed to have been composed in northwestern India whereas *Sushruta Samhita* was composed in Benares (now Varanasi). There are several other important texts that were written later which include *Bhela Samhita*, *Astangahrdaya Samhita* of Vagbhata, *Bhava-prakasa* of Bhavamisra, and *Sarngadhara Samhita* of Madhavakara. These texts ignited new concepts like rearrangement of medical agenda according to pathological categories, use of metallic compounds and an idea of respiration.

Both the *Caraka Samhita* and *Sushruta Samhita* discuss general ancient theories on epidemics, sensorial prognosis, pathology, diagnosis, the use of enemas, anatomy, therapeutics, pharmaceuticals, proper use of alcohol, etc. They differ in one major aspect: *Sushruta Samhita* contains extensive details on surgical



Sushruta, 'The Father of Surgery'



An oculist treating a patient, with specialist instruments laid out before him. (Courtesy: The British Library, London)

techniques, cataract surgery, plastic surgery and removal of foreign bodies whereas *Caraka Samhita* is primarily a foundation of general medicine and has long reflective and philosophical passages. The medicine in both the texts contains a broad assortment of vegetable, animal and mineral substances. Caraka stipulates an 'Oath of Initiation' that can be analogised with the 'Hippocratic Oath'. 'Oath of Initiation' is taken by a practitioner of Ayurveda at the beginning of his tutelage. The Ayurvedic physicians are called *Vaidya*. A good *vaidya* is supposed to have a thorough knowledge of the Sanskrit texts and memorise large medical verses on three humours, kinds of diseases and their healing procedures.

Sushruta Samhita is well-known for its extensive chapter on surgical techniques. It demystifies the ways a surgeon should be trained and the process of performing an operation. There are also descriptions of removal of arrows, suturing, ophthalmic couching, and analysis of dead human bodies for the study of anatomy. Sushruta even professes that *Salyatantra* (surgery) is the most ancient and coherent of the eight branches of medical science. But, there is no strong historical evidence that surgery was performed by the *vaidyas*.

With the proliferation of the caste system, *vaidyas* resisted surgeries and treated by other techniques like massage therapies. However, there is a famous historical event that is mostly cited to prove the fact that Sushruta's surgery was widely known. In the year 1793, a Maratha named Cowasjee, who had been a bullock-driver with the English Army in the Third Anglo-Mysore

war (1789-92), was captured by the forces of Tipu Sultan. As a punishment, his nose and one hand was cut off. One year later, he turned to a man of Brickmakers' caste to have his face repaired. Two British surgeons in the Bombay Presidency named Thomas Cruso and James Trindlay witnessed the operation and prepared a description of what they had witnessed, together with a portrait of the patient and illustrations of the plastic surgery that was performed by an anonymous brickmaker. The skin graft and nose reconstruction procedure used by the anonymous brickmaker was superior to the operations ever performed by an English surgeon. This surgery changed the very course of plastic surgery in Europe. The paradox is that rhinoplasty (plastic surgery of nose) operation is not delineated in *Sushruta Samhita*. Whatever contentious evidences may surround this case, this incident clearly manifests that surgery was a major medical practice in the late 18th century in India.

Before the early 20th century, inoculation was widely practised in India as it was an effective protection against smallpox (*masurika*). Europeans started practising inoculation after Lady Mary Wortley Montague (writer and wife of a British Ambassador to the Ottoman Empire) returned to England to preach the new technique after seeing a woman practising inoculation in Constantinople. This became



Anatomical painting with Sanskrit medical annotation (Courtesy: Wellcome Library, London)



A earpicker, specialist in removing wax, with his instruments laid out before him. (Courtesy: The British Library, London)

a major practice in Europe till Edward Jenner discovered vaccination in 1796. There are also historical evidences that prove the fact that the practice of inoculation was brought to Turkey from China. In the year 1767, an English surgeon described in a treatise that inoculation was widely practised in Bengal. There is also some evidence to push the practice of inoculation back further to the year 1718. Again a historical paradox, as inoculation is nowhere mentioned in the Sanskrit texts but smallpox is certainly acknowledged.

Instances like inoculation and rhinoplasty clearly depict the fact that we need to delve deeper into the issues to understand the history of Indian medicine. Historians argue that developments have hardly taken place in the field of Ayurveda as the two foundation texts (*Caraka Samhita* and *Sushruta Samhita*) appear as a timeless source of knowledge having no scope for further development. Developments have taken place in the domain of diagnostics and new prognostic methods have also come into practice. Ayurveda, which once received royal patronage, has become a highly popular modern medical system. Apart from Ayurveda, however, there are other medical systems like Unani system of the Muslims, Siddha system of Tamils, and Shamanism and other folk medicines.

There is one kind of ancient medicine known as astrological medicine. Astrologers are supposed to pacify planets and cure diseases which are influenced by the so-called celestial demons (*grahas*). They are supposed to be able to interpret and solve a person's problems and also predict an

individual's future. *Grahas* are clearly defined as celestial bodies in *Sushruta Samhita* and the literature of Indian astrology is known as *Jyotish sashtra*. There was a popular belief that *grahas* mainly attack children and afflict them with diseases. In the year 1383, Virasimha composed *Virasimhavaloka* which describes the close connection between astrology and medicine as a remedial system. Till today, Indian astrologers continue to charm and pray to supposedly ward off evil influences from one's life (although there is no scientific basis for such a belief). There is another ancient spiritual practice known Shamanism where the practitioner is supposed to communicate with the spirits to gain information on healing. A person who believes in evil spirits and devils visit such practitioners. Shamans even recommend the patients to modern medical clinics if they find that curing the disease is out of their reach. Sudhir Kakar (a psychoanalyst) has given us engaging details on the shamanism and other folk healers of India.

Siddha and Unani

In South India, a traditional medical system emanated from Dravidian culture where the entire literature is in Tamil language. Known as Siddha medicine, it is similar to the Ayurvedic system but has a preponderance of use of metals (especially mercury) and minerals. Pulse reading and urine testing were substantially developed by the practitioners of the Siddha system. Alchemy is said to have its origin in the Siddha system, which aims to transform man both physically and spiritually. Among the practitioners of Siddha, Ramadevar in his work on Alchemy titled *Cunnakandam* mentions that he travelled to Mecca, assumed the name of Yakub and taught the Arabians the art of alchemy. With the introduction of modern medicines, Siddha medicine has lost its popularity, but there are a large number of people who still prefer Siddha medicine for curing a few diseases like jaundice and chikunguniya.

With the inception of Delhi Sultanate, a medical practice named 'Unani tibb' (where tibb means medicine) was brought to India. Unani is a traditional medical system which is based on the teachings of the Greek physician Galen and is considerably interpreted by Ibn Sina (a Persian polymath who is regarded as one of the most prominent thinkers of the Islamic Golden Age) in his *Magnus opus*



Medical and Surgical Instruments of 19th Century Indian origin. According to Sushruta there were 101 instruments classified as either 'blunt' or 'sharp', but he recognised the main implement as the hand. (Courtesy: Science Museum, London)

The Canon of Medicine. Unani medicine played a very significant role during the Afghan invasion of Gujarat in the early 11th Century and developed in leaps and bounds during the Mughal era. Unani medicine is still very much existent in India and it is quite intriguing to think that a rudimentary Galenic medicine is still an extant practice.

Unani and Ayurveda have greatly influenced each other as a result of royal patronage. It is surmised that Sultan Alaudin Khilji had several notable *hakims* (Muslim physicians) in his court. So, it is quite evident that the development of Unani medicine in India as well as Unani literature was possible with the help of Ayurvedic physicians. There are Sanskrit texts on Unani even though the prime languages of Unani are Arabic and Persian. For example, during 18th Century, the devout Hindu scholar Mahadevadeva wrote *Hikmatprakasa*, dealing with Unani medicine in Sanskrit. Ayurveda stipulates three humours whereas Unani stipulates four. The main difference is that Unani physicians medicate Muslim patients whereas Ayurvedic physicians medicate Hindus.

First medical book printed in India

With the establishment of the Portuguese East India Company in Goa (1628–1633), Garcia d'Orta penned *Colóquios dos simples e drogas he cousas medicinais da Índia*

(first medical book printed in India) after gathering valuable materials from the local physicians. For the rest of the 17th Century, there was free exchange of ideas between the Indians and the Portuguese on medical treatment. The Dutch East India Company was also very much interested in the traditional medicines of India and showed a great deal of regard for the local flora and fauna of the Malabar Coast. Heinrich Van Rheed, administrator of the Dutch East India Company, went a step ahead and wrote a comprehensive treatise titled *Hortus Malabaricus*, which deals with the properties of Indian medicinal plants in Kerala. The treatise is spread over 12 volumes and was first published in Amsterdam.

Then, the British arrived in India to pursue trade which was followed by the establishment of the British East India Company, informally known as John Company. Subsequently, East India Company was dissolved in the year 1858 and the administration was taken over by the British crown. Like the Dutch and the Portuguese, the British rulers also faced the same difficulty, i.e., affected by new set of diseases in India. Naturally, they resorted to learning the art of oriental medical treatment from the native practitioners. In turn, native practitioners were highly interested in learning the surgical methods from the British as they were not accustomed to such methods even though there is a plethora of information on surgery in *Sushruta Samhita*. Later, we find that the attitude of the British towards the traditional medicine changed. With the introduction of Lord Bentinck's educational reforms in 1835, support for Ayurvedic training and teaching of oriental medicine in state-funded colleges ceased though the oriental practitioners continued to practise. As early as the 1860s, people of Bengal had forced the Medical Department of the Bengal Presidency to introduce a new policy, to prescribe traditional Indian medicine where it is possible.

During the Indian independence movement (especially during the Swadeshi and Boycott Movement), traditional medicines received inviolable support from the Indian masses, especially from the nationalists. Since India got independence in 1947, the government has shown interest in the development of both cosmopolitan

Continued on page 19

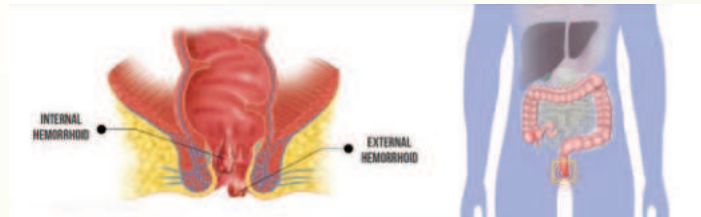
Knowing about Piles— Symptoms, Causes and Diagnosis



Dr. Yatish Agarwal

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Known in common parlance as piles, haemorrhoids are enlarged and swollen veins in or around the anus and rectum. Located in the lowest part of the back passage, the haemorrhoidal veins swell so that the vein walls become stretched, thin, and irritated by passing bowel movements. They may make going to the toilet uncomfortable and also cause rectal pain and bleeding.



Haemorrhoids are very common. Approximately 50 per cent of people experience them at some time in their life. Anyone at any age can be affected by them; but they are more commonly found in elderly people and in women during pregnancy.

Recognising the symptoms

In many cases, haemorrhoids don't cause symptoms and some people don't even realise they have them. However, when symptoms do occur, they may include:

- bleeding after passing a stool – the blood is usually bright red
- a lump hanging down outside of the anus, which may need to be pushed back in after passing a stool
- a mucus discharge after passing a stool
- itchy bottom
- soreness, redness and swelling around the anus
- discharge of mucus subsequent to passing a stool
- feeling as though your bowels are still full and need emptying



Haemorrhoids aren't usually painful, unless they get trapped in the anal sphincter and their blood supply slows down or is interrupted.

Haemorrhoids are the main cause of anal bleeding. Faced with anal bleeding and/or rectal pain, it is best never to neglect these symptoms. Even though haemorrhoids are rarely dangerous, a definite diagnosis from a doctor is essential. Very rarely, haemorrhoids can hide a life-threatening condition, such as colorectal cancer.

Seeking medical advice

If you are faced with persistent or severe symptoms suggestive of haemorrhoids or suffer from rectal bleeding, always consult a doctor without any delay. You could see your family physician, a general surgeon or colorectal surgeon. This is essential because these symptoms may sometimes hide a potentially more serious condition.

Many times, the symptoms of haemorrhoids clear up on their own. Often they respond to simple treatments that can be bought from a pharmacy without a prescription. However, if your symptoms don't get better or you experience pain or bleeding, never neglect to speak to a doctor.

Some people with haemorrhoids feel hesitant to consult a doctor because of the peculiar part of the anatomy they occur in. However, that should not be the case. The embarrassment is completely misplaced. Most importantly, you must tell the doctor about all of your symptoms – for example, tell the doctor if you've recently lost a lot of weight, if your bowel movements have changed, or if your stools have become dark or sticky.

How the doctors diagnose piles

A doctor can often diagnose haemorrhoids by just doing a simple internal examination of the rectum.

Rectal examination

The doctor may examine the outside of the anus to see if a person has visible haemorrhoids. Next, he is likely to carry out an internal examination. The simplest being a digital rectal examination.

Some people are sensitive about having a rectal examination for religious or cultural reasons. Equally, some may prefer a rectal examination be carried out by a doctor of the same sex, or a patient may want to have a friend or relative present during the examination. Let the doctor know in advance if you have any particular preferences.

The procedure

Before having a rectal examination, the doctor will explain the procedure to you. You'll be asked to remove your lower clothing and lie on a couch, on your left side, and to bring your knees up towards your chest.



The doctor will begin by making a careful visual examination of the anus. They'll look for any abnormalities, such as swollen blood vessels around the anus or rectum.

Once he's through with the inspection, he will put a glove on one hand and use a gel to lubricate one of his fingers. He will gently push the finger into your bottom and then up into your rectum. You may feel a little discomfort or pain at this stage of the examination.

During the rectal examination, you may be asked to squeeze your rectum around the doctor's finger so that he can assess how well the muscles in your rectum and bowels are working.

A rectal examination will usually take one to five minutes to complete, depending on whether your doctor finds anything unusual. Once the rectal examination is done, the doctor will gently remove his finger from your anus. There may be a small amount

of bleeding from your rectum, particularly if you have haemorrhoids. Do not fret over it.

Proctoscopy

In some cases, further internal examination using a proctoscope may be needed. A proctoscope is a thin, hollow tube with a light on the end that's inserted into the anus. This allows the doctor to see the entire anal canal and identify the haemorrhoids and their severity.



Types of haemorrhoids

Once your doctor has carried out a rectal examination or proctoscopy, he will be able to determine the type of haemorrhoids you suffer with.

Haemorrhoids can develop internally or externally. Internal haemorrhoids develop in the upper two-thirds of the anal canal, while external haemorrhoids develop in the lower third, closest to the anus. The nerves in the lower part can transmit pain messages, while the nerves in the upper part can't.

Internal haemorrhoids

Internal haemorrhoids lie far enough inside the rectum that you can't see or feel them. They don't usually hurt because there are few pain-sensing nerves in the rectum. Bleeding may be the only sign that they exist.

Sometimes internal haemorrhoids prolapse, or enlarge and protrude outside the anal sphincter. If so, you may be able to see or feel them as moist, pink pads of skin. Prolapsed haemorrhoids may hurt because they become irritated by rubbing from clothing and sitting. They usually recede into the rectum on their own; if they don't, they can be gently pushed back into place.

External haemorrhoids

External haemorrhoids lie within the anus and are often uncomfortable. If an external haemorrhoid prolapses to the outside, you can see and feel it as a lump hanging down outside of the anus. This usually happens in the course of passing a stool.

Blood clots sometimes form within prolapsed external haemorrhoids, causing an extremely painful condition called a thrombosis. If an external haemorrhoid becomes thrombosed, it can look rather frightening, turning purple or blue, and could possibly bleed. Despite their appearance, thrombosed haemorrhoids are usually not serious and will resolve themselves in about a week. If the pain is unbearable, the thrombosed haemorrhoid can be removed with surgery, which stops the pain.

A measure of severity

Depending on their size and severity, surgeons further classify haemorrhoids into the following categories:

First degree haemorrhoids

First degree haemorrhoids are small swellings that develop on the inside lining of the anus and aren't visible from outside the anus.

Second degree haemorrhoids

Second degree haemorrhoids are larger swellings that may come out of the anus when a person goes to the toilet, before disappearing inside again.

Third degree haemorrhoids

Third degree haemorrhoids are one or more small soft lumps that hang down from the anus and can be pushed back inside; the so-called prolapsing and reducible piles.

Fourth degree haemorrhoids

Fourth degree haemorrhoids are larger lumps that hang down from the anus and can't be pushed back inside; they are thus irreducible. It's useful for doctors to know what type and size of haemorrhoid you have, as they can then decide on the best treatment.

What causes haemorrhoids?

The exact cause of haemorrhoids is unclear, but they're associated with increased pressure in the blood vessels in and around the anus. This pressure can cause the blood vessels in the back passage to become swollen and inflamed.

The following factors have been found to increase a person's risk of developing haemorrhoids:

Family history of haemorrhoids

Though it is still not known how exactly this happens, but having a family history of haemorrhoids, increases your risk of being affected with the disease.

Constipation

Many cases of haemorrhoids are thought to be caused by too much straining on the toilet as a result of prolonged constipation. This is often caused by a lack of fibre in a person's diet.

Obesity

Being overweight or obese increases the pressure on your pelvic blood vessels, causing them to enlarge and become haemorrhoidal.

Pregnancy

When you're pregnant, the growing baby can place increased pressure on your pelvic blood vessels, causing them to enlarge. The pregnancy hormones also make your veins relax causing them to enlarge and swell. These piles due to pregnancy usually go away within weeks after you have given birth.

Age

As you get older, your body's supporting tissues get weaker, and this may increase your risk of haemorrhoids.

Conditions that increase abdominal pressure

Those individuals, who sit down for long periods of time, suffer with a persistent cough or repeated vomiting, or regularly lift heavy objects, and experience an increase in abdominal pressure are at an increased risk of developing haemorrhoids.

Chronic diarrhoea

Chronic long-term diarrhoea can also make a person more vulnerable to getting haemorrhoids.

Self-care measures

Some basic lifestyle changes can help reduce the strain on the rectal and anal blood vessels and help ease the symptoms.

Dietary changes

If constipation is thought to be the cause of your haemorrhoids, you need to keep your stools soft and regular so you don't strain when going to the toilet. You can do this by gradually increasing the amount of fibre in your diet. Good sources of fibre include wholegrain rice, wholegrain bread, pulses and beans, seeds, nuts and oats, and fruit and vegetables. You must also drink plenty of fluid – particularly water. You must avoid the use of medications that cause constipation – such as painkillers that contain codeine.

Losing weight if you're overweight

Eat frugally and exercising regularly can help you lose weight.

This can help prevent constipation, and reduce your chances of developing haemorrhoids.

Toilet training

When going to the toilet, you should avoid straining to pass stools, as it may make your haemorrhoids worse. You must also **not delay going to the toilet** – ignoring the urge to empty your bowels can make your stools harder and drier, which can lead to straining when you do go to the toilet. These measures can also reduce the risk of haemorrhoid recurrence.

(Next month: Cures for haemorrhoids: Home treatments and surgeries)

Prof Yatish Agarwal is a physician and teacher at New Delhi's Safdarjung Hospital. He has authored 47 popular health-books. ■

Keeping Sports Clean – A cat-and-mouse game (continued from page 31)

d) Blood transfusion—Athletes blood dope by either using blood transfusions or specific drugs to increase their red blood cell count (haemoglobin). When they transfuse blood into their bodies, they can re-infuse their own blood (autologous) or use blood from another person who serves as a donor (homologous).

Emergence of ABP Program

With the advent of designer drugs, recombinant proteins, peptides, biosimilars (drugs designed to have active properties similar to one that have previously been licensed), etc., that are strikingly similar to natural substances that are produced in the body, it becomes exceedingly to detect the same using the conventional analytical methods. As a result, a new form of dope test has come to the fore - it is famously known as Athlete Biological Passport program which has been developed by World Anti-doping Agency, WADA.

Human body maintains a relatively stable level for different parameters like haematological values (haemoglobin, haematocrit, red blood cell count, mean corpuscular haemoglobin concentration, etc.). ABP is based on the principle that if any booster substance is taken by an athlete, it will result in some kind of a physiological change. The same will be reflected if vital parameters called biomarkers are identified and tested. Even though it may be possible for the athlete to flush out the drug from

the body, it is virtually impossible to bring the biomarkers to their normal levels. As such, ABP is considered to be the latest tool against doping.

The ABP program involves monitoring of selected biological parameters of an athlete over time that may indirectly reveal doping over time. The longitudinal profile of the athlete is generated and monitored. Any sudden abnormality in the same indicates a possible case of doping. At present three different modules can be tested, namely Haematological module for testing blood doping; Steroidal module to detect anabolic agents; and Endocrinological module for detecting growth hormone and insulin growth factor-1 (IGF-1). Of the three, the Haematological Profiling method has been accepted on a broader scale.

Even though sceptics raise some questions regarding the universal acceptance of this technology, the ABP program is a real big step to combat the menace of intelligent doping. It is a good complement of the traditional methods where the aim is to detect the drug. As such a combination of both these methodologies may go a long way to establish the spirit of Sports.

Anti-doping agencies

The World Anti-doping Agency (WADA) was established after the first World Conference on Doping in Sports. The conference was held at Lausanne, Switzerland. The National Anti-doping agency (NADA) was established

by Government of India on 24 November 2005. These bodies are responsible for devising anti-doping rules, revising the same from time to time. In addition, extensive awareness programme is being conducted by them to make athletes aware of the different aspects of doping and the need to keep the sports clean.

Conclusion

True sports aims to recognise true talents. For doing the same a series of effective steps are required to be taken. While on the one hand extensive awareness program may be carried out for sportsmen and related officials, strict vigilance is also required out to catch the defaulters and exemplary punishments need to be awarded to the defaulters. In short, a sense of fear must be instilled among the athletes. Even though there has been a steady effort to evade the dope test by employing unscrupulous ways, it is the challenge for the sports researchers to tackle the same. So the need of the hour is to go for continuous upgradation in the testing methods which may guarantee cleaner sports for everyone to enjoy.

Subha Sankar Ghosh is M.Phil in Life Sciences and working as a project coordinator, Digha Science Centre under National Council of Science Museums. He is a science communicator and popular science writer. ■

Recent Developments in Science and Technology

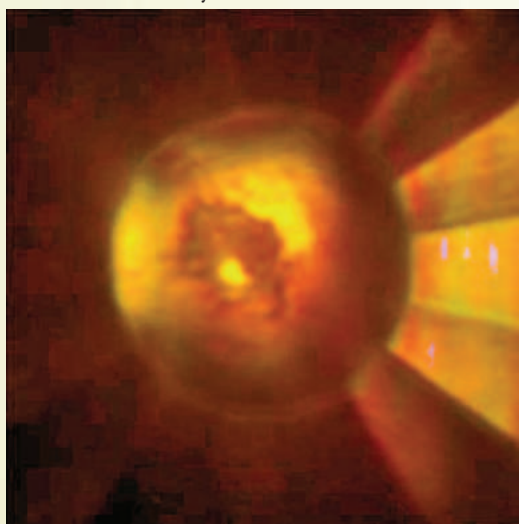


Biman Basu

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Stable helium compound formed

Helium has been known to be the noblest among the noble gases – a six-member group of elements in the periodic table that do not react easily with other elements.



Microphotograph of the diamond anvil cell high-pressure cavity used to create Na_2He light at 140 GPa after laser heating to more than 1,500 kelvins. The sample consists of mixture of Na and Na_2He . (Credit: Xiao Dong et al., doi: 10.1038/nchem.2716)

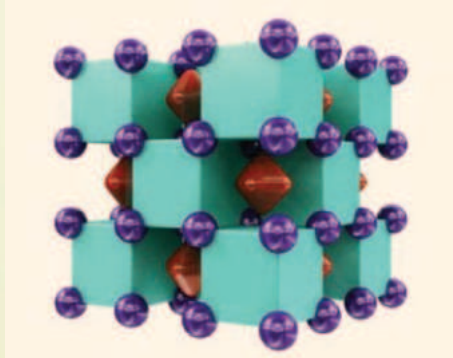
Helium is the least reactive element on the periodic table thanks to its full outer shell. Conventional wisdom states that noble gases cannot interact with other atoms to create stable compounds. However, till recently, except helium all the other noble gases – neon, argon, krypton, xenon and radon – were known to combine with other elements to form compounds. Now helium appears to have joined the same category. Scientists have reported creating what appears to be a stable helium-sodium compound, challenging some of the most basic assumptions of modern chemistry.

Helium is the second most abundant element in the universe, after hydrogen, and makes up a large proportion of stars and gas giants. The element has an extremely stable closed-shell electronic configuration, zero electron affinity and an extremely high ionisation potential. It has been known since the 1960s that the heavier noble gases will,

under sufficient pressure, form metastable compounds, but helium has always remained stubborn. Helium can form van der Waals molecules – very weakly bound clusters of atoms or molecules, at extremely low temperatures – but they cannot be sustained for long and are not considered true stable compounds.

The recent breakthrough was predicted by a team led by Artem Oganov of Stony Brook University, New York, USA. They used a ‘crystal structure-predicting’ computer model that suggested at least two helium compounds are possible – Na_2He and Na_2HeO . Subsequently, researchers from China, Russia, and the United States came together to see if they could make the first of these, using a diamond anvil to apply high pressure. A team led by Xiao Dong, working in the laboratory of Artem Oganov, succeeded in synthesising a sodium-helium compound using a diamond anvil cell to apply the requisite high pressures – about 113 GPa (gigapascals), which is more than a million times the normal atmospheric pressure (*Nature Chemistry* 6 February 2017 | DOI: 10.1038/nchem.2716).

Diamond anvil cells have been used to study many chemicals under extreme



Crystal structure of Na_2He : Purple spheres represent sodium atoms, which are inside the green cubes that represent helium atoms; the reddish-brown regions inside voids of the structure show areas where localised electron pairs reside. (Credit: Xiao Dong et al., doi: 10.1038/nchem.2716)

pressure, most recently hydrogen wherein scientists claim to have made its metallic form. The new sodium-helium compound has been shown to be a highly insulating solid – an electride. Electrides are something of a chemical curiosity. They are ionic materials within which electrons act as anions and they find roles in catalysis and as reducing agents in organic synthesis. They have been shown both theoretically and experimentally to exist in several materials at high pressures.

The new helium compound has been hailed as a breakthrough that may change many of our old chemistry assumptions. The team now plans to synthesise a compound of sodium, helium and oxygen, which has been predicted to be possible. According to Oganov, the next step is to make Na_2HeO . This compound, he says, is stable at a very moderate pressure of 15 GPa, and if the researchers find a way to lower the pressure to 3-5 GPa or so, this compound could be used for storing helium.

Lost continent discovered under Indian Ocean

Many of us have heard about the legendary lost continent of Atlantis although no real Atlantis has ever been found. But now scientists have discovered remains of a real ‘lost continent’ which they say lay submerged under the Indian Ocean. It has been officially named Mauritia, which the scientists believe was a microcontinent that was once sandwiched between India and Madagascar as the supercontinent of Gondwanaland broke up, some 184 million years ago. It is believed that around 85 million years ago Mauritia (roughly a quarter the size of modern Madagascar) existed after the break-up of Gondwanaland. As other landmasses, namely India, Madagascar and Africa continued to drift apart, Mauritia was pulled into pieces – breaking up and sinking beneath the waves, which have now been discovered. According to the new results, the break-up of Gondwanaland did not involve a simple splitting of the ancient supercontinent, but rather, a complex splintering took place with “fragments of continental crust of variable



Mauritia is the name given to the proposed 'lost continent,' whose remains may exist today beneath the Indian Ocean.

Scientists picture it as a microcontinent that broke away as what is now India and Madagascar separated some 60 million years ago. (Credit: Nature Communications)

sizes left adrift within the evolving Indian Ocean basin”.

The first clue to the possibility of the existence of a lost continent came from samples of zircon almost 3 billion old years found in lava-coated pieces of the ancient landmass recovered off the coast of Mauritius by a research team led by Lewis Ashwal of the University of the Witwatersrand, Johannesburg, South Africa. Zircons are minerals found in rocks spewed up by lava during volcanic eruptions and occur mainly in granites from the continents. They contain trace amounts of uranium, thorium and lead, and since they survive geological process very well, they contain a rich record of geological processes and can be dated extremely accurately. According to Ashwal, the sample of zircon found were far too old to have originated on the relatively young island of Mauritius, which is believed to be no more than 9 million years old. According to the researchers, the discovery of zircons of this age proves that there are much older crustal materials under Mauritius that could only have originated from a continent (*Nature Communications*, 31 January 2017 | DOI: 10.1038/ncomms14086).

The story goes back to more than 184 million years ago when the supercontinent called Gondwanaland started breaking up. The supercontinent existed more than 200 million years ago and contained rocks as old as 3.6 billion years old, before it split up into what are now the continents of Africa, South America, Antarctica,

India and Australia. The breakup was caused by the geological process known as plate tectonics – a process that keeps the ocean basins in continuous motion and moving between 2 cm and 11 cm per year. Continents ride on the plates that make up the ocean floor, which causes the movement of the continents.

According to Ashwal, “Discovering new pieces of continent will help geoscientists to understand the details of how continents break apart, and how the pieces can be better reconstructed to their pre-breakup configurations. This could, for example, be used as an important exploration tool for mineral deposits”.

Dangerous bacteria turned into cancer fighter

Cancer is any malignant growth or tumour caused by abnormal and uncontrolled cell division. The immune system of our body can fight infections because it identifies pathogens as ‘foreign’ and destroys them. But our immune system cannot destroy cancer cells. This is because, with some major exceptions, cancer cells generally have all of the same antigens as the rest of our cells, so any immune cells that would have been activated by their antigens are not around to react. Several research groups have been looking into the possibility of training our immune system into attacking cancer cells, or cancer immunotherapy.

Salmonella is a rod-shaped anaerobic microbe notorious for causing most cases

of food poisoning. Usually, most people get better without treatment. But, Salmonella can cause more serious illness in older adults, infants, and persons with chronic diseases. Recently an international team of researchers led by Jin Hai Zheng, from Chonnam National University Hwasun Hospital in Jeonnam, South Korea have managed to turn this dangerous bacterium into a life-saver by making it infiltrate tumours and marking the cancer cells up to the body’s immune defences, making them a target for attack. Of course, the scientists used genetically modified Salmonella, which is a million times less potent than the version of the bacterium that causes food poisoning. In other words, it a very safe strain and does not seem to cause any systemic inflammation or toxicity in internal organs. In trials with mice transplanted with human colon cancer cells, more than half the animals were completely cured without any side effects (*Science Translational Medicine* 8 Feb 2017 | DOI: 10.1126/scitranslmed.aak9537).

The team discovered the possibility of using Salmonella for cancer immunotherapy accidentally while working on unrelated research in which they noticed that the bacteria that attacked shellfish produced a protein called ‘FlaB’ that caused a strong immune response. This led them to genetically modify the common Salmonella bacteria so that it, too, would produce the same protein – and stimulate the immune system into action.

It has been known for some time that certain types of bacteria, including strains of Salmonella, are able to grow in cancerous tumours but not in normal tissues. But until now, attempts to use bacteria as anti-cancer therapies have had only limited success, both in the laboratory and in the clinic. The current work by Zheng and colleagues therefore represents a fascinating new approach to using bacteria to fight cancer.

It must, however, be mentioned here that the modified bacteria do not kill cancer cells directly; they only trigger the immune system to mount an attack on the tumour. There have been previous studies that have looked at using bacteria to carry anti-cancer drugs into tumours. But this is the first time scientists have used bacteria to trigger the body’s own immune response to combat cancer.



Genetically modified Salmonella is a million times less potent than the version of the bacterium that causes food poisoning, but can make cancer cells prone to attack by the body’s immune system.

Encouraged by the success of animal trials the team is now seeking funding for clinical trials on humans.

Harappans built the earliest tsunami-protection wall

The Harappans who lived around 5,000 years before present may have been aware of the devastation caused by tsunami. This has been revealed in a recent study by a group of marine archaeologists of CSIR-National Institute of Oceanography (NIO), Goa at the ancient port town of Dholavira in Kutch, Gujarat. Dholavira was the largest port-town of the Harappans, and is the second largest Harappan site located within the present borders of India. According to archaeologists, it was perhaps the best planned Harappan city with several divisions and many new features



Location of Dholavira in Great Rann of Kutch, Gujarat.

hitherto unknown. This well-planned urban settlement flourished for about 1,500 years from about 5000 to 3450 BCE.

Archaeological excavations show a unique feature of Dholavira – the presence of a 14-18-metre thick wall, apparently built as a protective measure. The most intriguing feature of the wall is its unusually

large thickness. According to the researchers, walls of such thickness are not found even in historic times when the conflicts have been more common and the weapons have become increasingly more destructive. The wall thickness at Dholavira exceeds the functional (protection from Harappan weapons, namely sling shots/bow arrow) and investment (in terms of material and labour involved at the times of limited resources) limits of military protection. Moreover, discovery of gunpowder and its introduction in India was much later than the timing of the Dholavira settlement. There must have been other reasons.

The real purpose of the Dholavira wall has been a topic of considerable debate. After examining the wall closely and surveying a hitherto unexcavated area using Ground Penetrating Radar (GPS) and systematically collecting soil samples, the CSIR-NIO team has come to the conclusion that the thick wall was built to protect the town from extreme oceanic events such as storm surges and tsunamis. Dholavira, being close to the sea could have been vulnerable to oceanic calamities. There is a traditional history of tsunami waves and strong storms hitting the Gujarat coast. The coastal geomorphology of Kutch region indicates that inland portions of the coastline have features which amplify the effect of tsunami waves when they get coupled with high tide, thus becoming fatal. According



The remains of the magnificent Northern wall of Dholavira that is believed to have been built as a protection against storm surges and tsunamis.

to the scientists, Dholavira site has the first evidence of tsunami-protection wall in the world (*Current Science*, 25 December 2016 | doi: 10.18520/cs/v111/i12/2040-2043).

According to Rajiv Nigam of NIO who led the team, study of oceanography showed that Makran coast that was close to Bhuj was a highly tsunami-prone area and their research study indicated that the earliest recorded tsunami in the region was about 8,000 years old. The structure of the Dholavira wall is similar to that of 400-kilometre 'sea-wall' that Japan is said to have started last year, although given the use of concrete material these days the width of the sea-wall would be 12 metres, but the idea is the same. It means our Harappan ancestors were aware of tsunami and succeeded in creating a defence to it.

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History of Medicine in India (continued from page 25)

and traditional medicines. The Chopra report of 1948 declared that "Science is Universal" and stressed the need of bringing all the healing traditions together. In the post-independence period, our leaders emphasised on science and unity which were of paramount importance. As a result, the government recognises Ayurveda in its health policy. Cosmopolitan medicines have not been very successful to overhaul the

traditional medicines in the rural areas due to the social problem of poverty. Today, there are several government-funded institutions providing professional courses in Ayurveda. After graduating from such institutions, students can run clinics or be employed at Primary Health Care Centres.

In conclusion, it can be said that medical science in India has developed in leaps and bounds during the late 20th

Century and is still advancing at an exponential rate. Today, there is a plethora of medical facilities available and a patient can take any of the many available paths to cure his/her illness.

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