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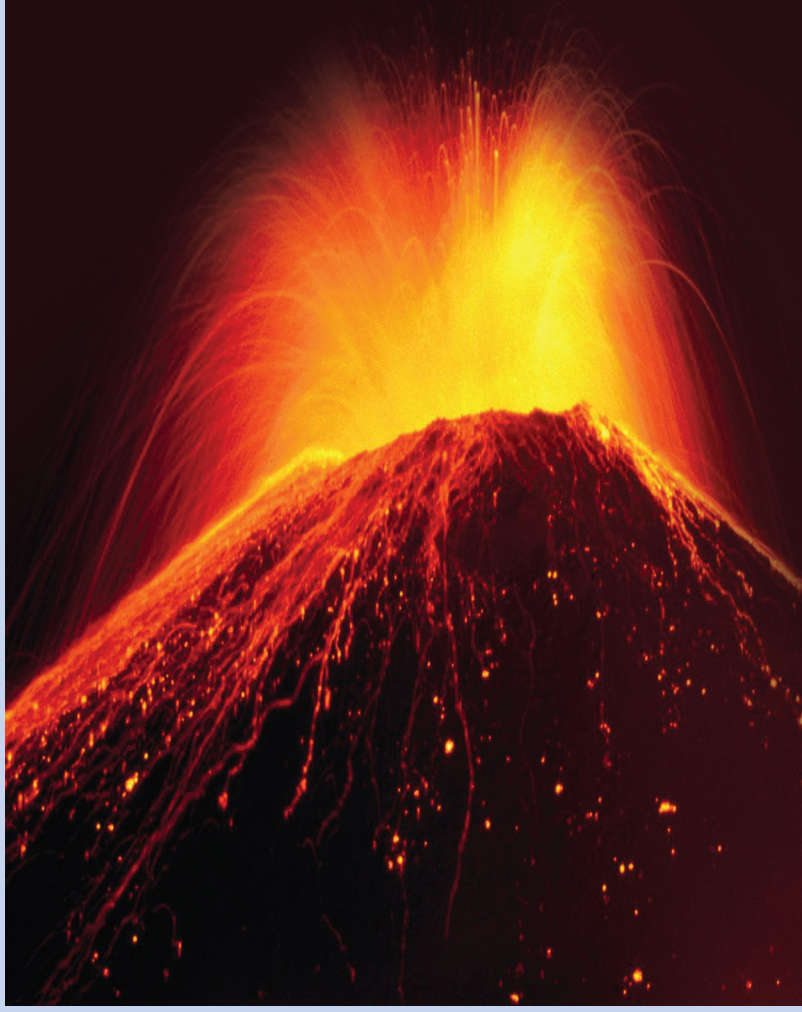
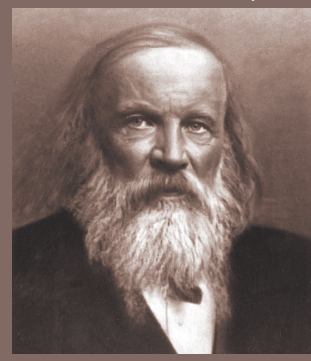
A View on Volcano



Mendeleev
(Creator of the Periodic Table of Elements)



(1834-1907)

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

Every Contact Builds Public Relations

E-mail: sanuj@vigyanprasar.gov.in

Every organisation strives for better human relations. It needs to discourage misinformation and improve its image by encouraging positive influence that can persuade opinion and perception of its different publics.

The public has expectations from any organisation. Through appropriate questionnaires, polls, and feedback, the managers should try and assess these periodically. Methods and tools are being refined continuously and these need to be customised and deployed for effective understanding and influencing appropriate lobbies. No effective campaign can be built on hunches, incomplete data or superficial analysis.

Scientists at Vigyan Prasar over the past two decades have strived to raise awareness on important issues of science in different population segments. The successes notched by such dedicated efforts have resulted in higher expectations of the public from this institution. Information flows in many directions and this development is to be expected.

In the corporate world where the objective of public relations can be quantified and the effectiveness measured against accepted criteria compromises may be winked at in the overall pursuit of the goals. A government research and extension laboratory, on the other hand, has to be effective while adhering to very high ethics and professionalism. This offers many challenges and provides satisfaction when positive opinion is generated.

The public relations campaign has to aim at some of the following objectives:

- Creating a distinctive identity for the organisation;
- Developing an image of a responsive organisation;
- Reaching solutions to communicators and resource persons;
- Motivating internal scientists and employees; and
- Influencing sponsors and controlling bodies.

Most efforts will impact on different objectives differently and will need to be formulated to influence the main goal and optimise effect on other goals. Each of the above will also be impacted by other factors both internal and external.

As the contours of an effective campaign take shape it has to include publications, events, advertising, website and more. Internal talent or services of a consultant has to be debated and decision has to be taken to work through press, radio, television and Internet. Strong bonds with influential representatives will be useful and need to be nurtured. Costs will have to be balanced against benefits, as with any investment.

There are many opportunities to develop good relations with every contact that we make. Reponse to each phone call received, each letter replied, each visitor to our website or premises, each person who interacts with any of the scientists must bring out the fact that there is potentially a goodwill ambassador at the receiving end. A sincere effort to address the concern of the other person through our daily interaction can be more valuable than repeated advertisements in the mass media.

Many of us have been deliberately or unconsciously responsible for recommending a restaurant, denigrating an airline, buying a skin fairness cream, or condemning a radio serial. A dispassionate analysis will often reveal that the basis for forming an opinion is very often through a limited exposure to such a product or service. We can conclude that the best efforts at image building can be washed out by a single negative experience and the word of mouth campaign from one communicator to another.

Our institution needs well-designed brochures, interesting films and attractive reports. Facilities and protocols for handling visitors are necessary for developing positive and enduring relations with opinion makers including media representatives. There is scope for working in each sector with different publics. A coordinated effort will force communication up the ladder of effectiveness.

A proper analysis of our strengths and opportunities is necessary before finalising the initiative. The external public is heterogeneous and the public relation needs have to be classified and segregated. The values, lifestyles and interests need to be studied. This can provide important inputs into developing a campaign for public relations.

Developing strong relationships with correspondents, encouraging exchange of news and views, frequent and regular press releases and many other tactics are available for developing strong network with the media. Essentially 'Public Relation' is a management function.

In the final analysis it is vital to foster understanding about the institution. Truthfulness and professionalism must be the hallmark of all efforts. We have to select our strategy intelligently and develop programmes that will not only further our cause but also prepare us for bad press that will occur once in a while. This column will discuss the issue and analyse the impact of the action taken shortly.

☐ Anuj Sinha

Editor : **Er Anuj Sinha**
Address for correspondence : Vigyan Prasar, C-24, Qutab Institutional Area, New Delhi-110 016
Tel : 011-26967532; Fax : 0120-2404437
e-mail : info@vigyanprasar.gov.in
website : http://www.vigyanprasar.gov.in

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Dmitri Ivanovich Mendeleev

Creator of the Periodic Table of Elements

Subodh Mahanti
E-mail: smahanti@vigyanprasar.gov.in

"Today, Mendeleev's name is most closely identified with his formulation of the periodic system of chemical elements, an ordering of the sixty-three then-known elements in order of increasing atomic weights. Although seven other chemists formulated similar periodic classifications before Mendeleev in the 1860s, his generally recognized priority stems from his novel prediction of three elements to fill empty spaces in the periodic table…The periodic system, originally conceived as a convenient pedagogical classification, is today almost universally employed as a teaching tool throughout the world."

Michael D. Gordin in *The Oxford Companion to the Modern History of Science,* J. L. Heilbron (Ed.), Oxford University Press, 2003.

"He (Mendeleev) was a flamboyant individual of principle and courage, unafraid of skeptics, naysayers, political pressures or airborne craft. A native of Siberia, he was the magician who…had brought order to the chaotic mess of elements chemists had by that time discovered. He was the first scientist from the Russian empire whose work made a timely impact in Europe and in 1955, nearly 50 years after his death, his extraordinary contributions to chemistry and physics received the perfect tribute: a newly discovered element, mendelevium, named in his honour."

The History of Science in the Nineteenth Century by Ray Spangenberg and Diane K. Moser, Universities Press (India) Limited, 1999.

Dmitri Ivanovich Mendeleev (also Mendeleyev or Mendeleef) is mostly known for his discovery of the Periodic Table and the periodic law, which states that certain properties of elements repeat periodically when arranged by atomic number. In fact the Periodic Table which arranges elements into vertical columns (Groups) and horizontal rows (Periods) is a visual representation of the period law. The formulation of the Periodic Table was a great scientific achievement. The chemical properties of an element could be predicted based on the position of the element within the Periodic Table or the group to which it belongs.

While commenting on the importance of the Periodic Table, the *Cambridge Dictionary of Scientists* wrote: "The whole scheme (i.e., the Periodic Table) brought order into chemistry by allowing a great range of known facts to be arranged and classified. It stands like Newton's work in physics or Darwin's in biology as one of the great intellectual advances in science. It was devised on an entirely empirical basis and it was half a century later that Mosley's work, and that of Bohr, provided an explanation for it in terms of atomic structure."

Dmitri Ivanovich Mendeleev

Mendeleev made many other notable contributions to chemistry and chemical industry. L.A. Tachugayeb, Russian chemist and a historian of science described Mendeleev in the following words: "a chemist of genius, first-class physicist, a fruitful researcher in the field of hydrodynamics, meteorology, geology, certain branches of chemical technology (explosive, petroleum and fuels for example) and other disciplines adjacent to chemistry and physics, a thorough expert of chemical industry and industry in general and an original thinker in the field of economy.

While investigating the expansion of liquids with heat, Mendeleev devised a formula similar to Gay Lussac's law of the uniformity of the expansion of gases. He also anticipated Thomas Andres's idea of the critical temperature of gases as early as 1861.

Mendeleev was one of the founders of the Russian Chemical Society, which was established in 1869.

In 1982, Mendeleev invented pyrocollodion, a smokeless gunpowder which was derived from nitrocellulose. The invention was commissioned by the Russian Navy. Mendeleev proposed that it would replace gunpowder in the Russian Navy. However, it could not be adopted because of its cost and efficiency.

Mendeleev designed a new kind of barometer, which could accurately measure the height above sea level. He had a fascination for the study of the upper atmosphere. He thought of designing a hermetically sealed gondola capable of carrying a human observer or automatic recording equipment. He got an opportunity for observing a solar eclipse, which took place on 7 August 1887, from above on a government sponsored balloon. It has been reported that when Mendeleev found that the balloon lacked the power to lift both him and his experienced balloonist, he physically removed the balloonist and undertook a solo flight.

Mendeleev viewed science as an important means for modernising his country. However, he did not believe that science was panacea for all of society's problems. He was of the opinion that science must be complemented with other sources of knowledge.

Mendeleev was a staunch supporter of human rights. In fact his application for extraordinary membership of the St. Petersburg Academy made in 1880 was

Johann Wolfgang Döbereiner

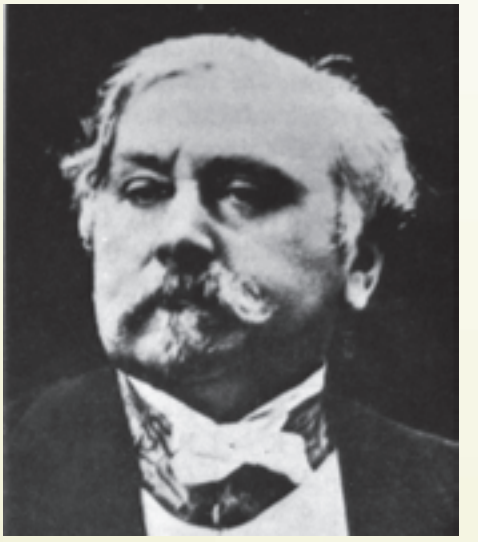
rejected because it was thought that his humanitarian and democratic tendencies were quite "threatening". In 1890 he lent support to the students of the St. Petersburg University protesting unjust conditions by personally delivering their petition to the Ministry of Education. He was forced to region his professorship at the university.

Mendeleev was born on 7 February, 1834 in Tobolsk, Siberia. He was the youngest of 14 children (the exact number differs among sources) of his parents—Maria Dmitrievna Korniliev and Ivan Pavolovitch Medeleev. Mendellev's father was the director of a local gymnasium.

He was greatly influenced by his mother. The other two persons who inspired Mendeleev was his sister Olga's husband Bessargin and Timofei, the glass blower in his mother's glass factory. Bessargin had been banished to Siberia because he was a Decembrist. Decembrists were a group of literary men who headed a revolution in 1825. His mother taught him that "everything in the world is love", Bessargin believed that "everything in the world is science", and according to Timofei "everything in the world is art". These three principles guided his development.

His father died when Mendeleev was quite young and the whole burden of raising a large family fell on his mother. The family pension she received for her husband's service was too meager for running the family. She took the work of managing a glass factory in Aremziansk, which belonged to her family. She was given a modest wage for this work. She was determined to educate Mendeleev and started saving money for this purpose. Mendeleev started attending the local Gymnasium. However, the glass factory run by his mother was burned to the ground. This was a great blow to the family.

But Mendeleev's mother did not give up her determination of educating her favourite son. She realised that this would be possible only if Mendeleev got a scholarship. So she pushed Mendeleev hard for improving the grades in his final years at the Gymnasium and for preparing for the entrance examination. In 1849, Mendeleev's mother brought him to Moscow for getting him admitted in Moscow University. However, in those days Moscow was passing through political unrest and the university was not admitting any student from outside Moscow and Mendeleev was not given



Alexandre-Emile Beguyer de Chancourtois

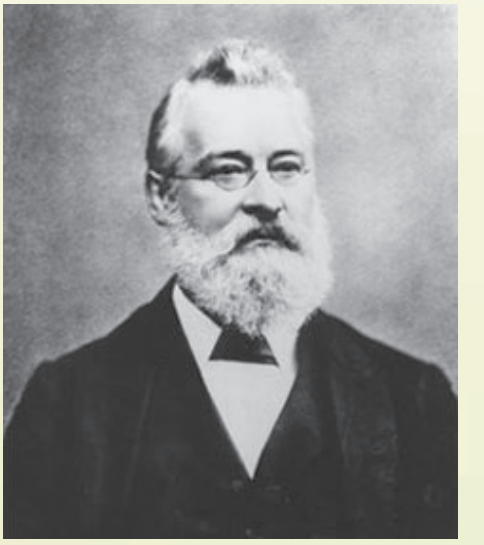
admission. His mother was determined that his son pursue higher education. So she moved to St. Petersburg. There also was political unrest. However, with the support of one of his father's friends, Mendeleev was able to take the entrance examination of the Main Pedagogical Institute for the science teacher training programme. The Institute was his father's alma mater. Mendeleev qualified the entrance examination with a scholarship and graduated in 1855. He had demonstrated his interest in research. He studied the effect of chemical composition on the crystal structures of certain substances.

Mendeleev contracted tuberculosis just after he completed his graduate studies. To restore his health he moved to the Crimean Peninsula on the northern coast of the Black Sea in 1855. He did not sit idle, he started working as science master in the Simferopol gymnasium there. He also continued his research activities. In 1857, when his health was fully restored, he returned to St. Petersburg and joined the University of St. Petersburg. During 1859-60, Mendeleev worked with Robert Bunsen at the University of Heidelberg. In 1863, Mendeleev became professor of chemistry at St. Petersburg Technological Institute and St. Petersburg State University.

It was Mendeleev who took the idea of order among the elements to its most logical conclusion. However, there were other scientists who made serious attempts to classify the elements. Johann Wolfgang Döbereiner was one of those early scientists who made attempts in classifying the elements. As early as 1817 he observed that some elements formed groups of three with related properties and he termed such groups as 'triads'. It also found that in such triads the atomic weight of the second element was almost equal to the mean of the atomic weights of the other two elements in the triad. Examples of some triads identified by Döbereiner are given below:

1. Chlorine, bromine and iodine
2. Calcium, strontium, and barium
3. Sulphur, selenium, and tellurium
4. Lithium, sodium, and potassium

It appears that the periodicity of the elements was first noticed by the French geologist Alexandre-Emile Beguyer de Chancourtois. He observed that when elements are arranged by their atomic weights, similar elements tend to appear at



John Alexander Reina Newlands

Julius Lothar Meyer

regular intervals. He arranged the elements in a spiral on a cylinder by order of increasing atomic weights. It was an early version of periodic table. De Chancourtois called it 'telluric helix', in which elements with similar properties with similar properties lined up vertically. He published his observations in a paper in 1862.

In 1865, English industrial chemist John Alexander Reina Newlands (1837-1898), an English chemist, classified 56 elements into 11 groups. Newlands' classification was based on similar physical properties. He observed that "the eighth element, starting from a given one, is a kind of repetition of the first, like the eighth note in an octave of music." Newlands called his discovery the "law of octaves." His ideas were ridiculed by his contemporary chemists. In fact George Carey Foster even suggested Newlands to order the elements in alphabetical order to see some pattern. Though there were some flaws in Newlands' table of elements, it could not be denied that Newlands recognised a useful pattern. His work was finally recognised by the Royal Society of London by awarding him the Davy Medal for his discovery.

It is not known how exactly Mendeleev came upon the idea of the periodic table. It has even been reported that the concept of the Periodic Table was revealed to him in a dream. It may be noted here that Kekule himself admitted that he had realised the structure of benzene in a dream. However, Mendeleev apparently has not made any such claim. It is generally believed that he got the idea while he was working for preparing a new textbook of chemistry in the 1860s.The book was titled *Principles of Chemistry*. It was a two-volume work and published during 1868–1870. It proved to be a highly successful textbook. While planning for the textbook he had prepared a series of cards, each listing the main properties of one chemical element. When he arranged these cards in rows of suitably varying length, with the elements in order of increasing atomic weights, Mendeleev noticed a pattern. He liked playing a type of solitaire game called patience. The game was a means of relaxation. He found that the elements with similar chemical characteristics lie in the vertical groups. The pattern absorbed led him to the formulation of the Periodic Table.

Mendeleev presented a paper on his findings of the Periodic Table to the Russian Chemical Society on 6 March 1869. It was titled "relation of the Properties to the Atomic weights of the Elements". Some of the important points in the paper were:

1. When elements are arranged according to their atomic weights, they exhibit an apparent periodicity of properties.
2. Elements displaying similar chemical properties have atomic weights which are either of nearly same value (for example Pt, Ir, Os) or which increase regularly (for example K. Rb, Cs).
3. There are many elements which are yet to be discovered; for example, two elements analogous to aluminium and silicon whose atomic weights would be between 65 and 75.
4. Certain characteristic properties of elements can be predicted from their atomic weights.

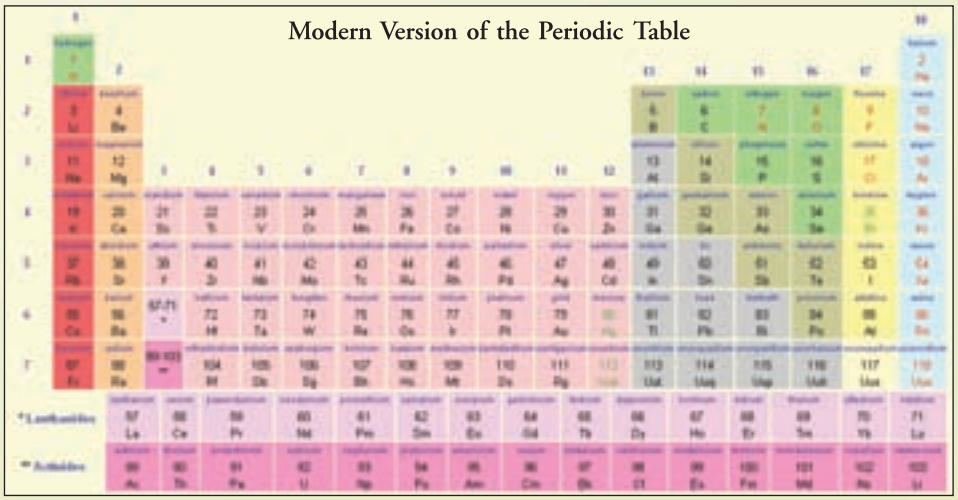
Mendeleev predicted 10 elements which he thought were yet to be discovered and he named eight of them. They were: *eka*-aluminium (gallium), *eka*-boron (scandium), *eka*-silicon (germanium), *eka*-manganese (technetium), *tri*-manganese (rhenium), *dvi*-tellurium (polonium), *dvi*-caesium (francium), and *eka*-tantalum (protoactinium).

Mendeleev used Sanskrit prefixes of *eka*, *dvi* and *tri* (meaning one, two and three respectively) in their naming. It is believed by giving Sanskrit names to his missing elements, Mendeleev wanted to show his appreciation of the Sanskrit grammarian of ancient India, particularly Panini who had developed sophisticated theories of language.

While noting the striking similarities between the Period Table and the introductory *Siva Sutras* in Panini's grammar, Paul Kiparsky of the Stanford University wrote: "The analogies between the two systems are striking. Just as Panini found that the phonological patterning of sounds in the language is a function of their articulatory properties. So Mendeleev found that the chemical properties of elements are a function of their atomic weights. Like Panini, Mendeleev arrived at his discovery through a search for the 'grammar' of the elements." According to Kiparsky, Mendeleev was a friend of Sanskritist Bohtlingk, who was preparing the second edition of his Panini's biography. But then it has also been argued that Mendeleev did not have sufficient knowledge of Sanskrit to appreciate the subtle points related to the organisation of *Siva Sutras*.

Julius Lothar Meyer (1830-1895) published his classic paper on the arrangement of chemical elements in 1870.

Modern Version of the Periodic Table



Sculpture in honour of Mendeleev and the Periodic Table at Bratislava, Slovakia

He presented the periodicity of atomic volume plotted against atomic weight. There was a dispute between Meyer and Mendeleev over the priority over the discovery of the Periodic Table. As mentioned earlier, Mendeleev is given the credit for discovering the Modern Periodic Table. His great success was in predicting the properties of elements which were not yet discovered. It may be noted that when the elements gallium and germanium were discovered their properties were found to be very similar to the predictions made by Mendeleev. After Mendeleev the Periodic Table was further modified. However, all modern versions of the Periodic Table are based on the one formulated by Mendeleev.

In 1890, Mendeleev resigned from the University of St. Petersburg and started working for the Ministry of War. In 1892, he became the treasurer of the Chamber of Standard Weights and Measures and he became its chief in 1893. He is credited for the introduction of the metric system to the Russian Empire. He was given the task of formulating new standards for the production of vodka. Following Mendeleev's recommendation Russian law adopted new standards for vodka. All vodka should have 40 % alcohol by volume.

In 1905, Mendeleev was elected a member of the Royal Swedish Academy of Sciences. He received the Davy Medal (1882) and the Copley Medal (1905) from the Royal Society of London. Many universities in the world including Oxford and Cambridge universities conferred doctorate degree on him. Mendeleev was not given the Nobel Prize. His name was recommended by the Nobel Committee for Chemistry for the 1906 Nobel Prize in chemistry. Though the Chemistry Section of the Swedish Academy supported the proposal, his name was rejected by the full meeting of Swedish Academy. This was largely due to strong opposition from Peter Klason, the dissenting member of the Nobel Committee and Svante Arrhenius, who was not a member of the Nobel Committee but exerted strong influences in the affairs of the Academy. It was argued that the discovery of the Periodic Table was too old for consideration in 1906. It has been said that Arrhenius was opposed to Mendeleev's name for the Prize because of Mendeleev's criticism of Arrhenius' dissociation theory. The 1906 Nobel Prize in Chemistry went to Henry Moissan.

Mendeleev died on 2 February 1907 in St. Petersburg from influenza. He was 72. Hundreds of his students carrying with them a periodic table took part in his funeral processing.

Sculpture in honour of Mendeleev at St. Petersburg.

Mendeleev medal

The chemical element number 101 has been named after him. Its symbol is Md. A Moon crater has also been named after him.

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(The article is a popular presentation of the important points on the life and work of Dmitri Ivanovich Mendeleev available in the existing literature. The idea is to persuade the younger generation to know more about Mendeleev. The author has given sources consulted for writing this article. However, the sources on the Internet are numerous and so they have not been individually listed. The author is grateful to all those authors whose works have contributed to writing this article.) ■

India is a very promising country with an emerging economy: Mr. Koji Omi

Mr. Koji Omi is a key figure in the field of science and technology in Japan. He has served in various capacities in the ministry of International Trade and Industry and has been a member of the House of Representatives for eight terms and a Cabinet Minister with different portfolios. He promoted the founding of the Okinawa Institute of Science and Technology, an international and interdisciplinary graduate university. He also founded the Science and Technology in Society Forum with the aim of building a worldwide network among scientists, policymakers and business people.

Mr. Koji Omi visited India during March 2010 and met political and economic leaders, and academicians and left with high hopes of cooperation between the two countries. Er. Anuj Sinha, Consultant, Department of Science & Technology, Govt. of India and Director, Vigyan Prasar interacted with Mr. Koji Omi, during his visit to India. Here are excerpts of the interaction for our readers.

Dream 2047: Welcome to India. Sir, I am very happy that you have given this opportunity to talk to you. We have seen that in the past many years you have lead various developmental efforts in Japan and also you are a very good friend of India. Can you tell us how we can benefit from your ideas and perspective? India is a large country with a large percentage of young people. What are your expectations from the Indian society?

KO: We look upon India as a very promising country with an emerging economy. As a result of the open market policies that commenced in 1990s, this country has a very promising future. India has been developing very dramatically in many fields. Simultaneously the people of this country are democratically supporting the government and that is very important from our point of view. Another point is that we realise that Indian people have very high level of technical attainments. We can foresee a very promising future for this country. In Asia, I feel India is the most promising and influential country.

Dream 2047: We have some local problems of environment, industrialization, and also some global issues like climate change. There is a debate between those who are talking of development and those who are in favour of conservation. How do you view these issues?

KO: Global warming is the most important and serious problem for humankind. In Science & Technology Society Forum, of which I am the founder Chairman, we are of the opinion that humankind should decide to make a frame-work of constitutional protocols, to which all countries including United States, China, and India will participate. The Kyoto protocol covers only 30 percent of the CO_2 emissions (Japan and the European countries). Even if this is achieved, I don't think humankind can solve the problem of global warming, unless the majority (70 percent) of the world's population agrees to take concrete measures. In the 21st century the globe has become finite and all people on Earth have to realise that. Humankind has to change the way of living and the economy has to adjust to such limitations. This is a fundamental shift in thinking. China, India, Japan and other European countries have their own limited agendas, but we are all living on one ship. We must remember that the global population is likely to increase from 6.5 billion in 20th century to 9 billion by the end of the 21st century. Humankind will have to resolve economic development on one side and consider sustainability of our lifestyles on the other. For reducing the CO_2 level in the atmosphere, we have to consider increasing the areas under rainforests. Reduction in CO_2 emission is the other side of the solution. It is tough but we must attempt it.

Mr. Koji Omi, (right), Chairperson, Science and Technology Society Forum with Er. Anuj Sinha, Hony. Director, Vigyan Prasar

Dream 2047: The argument in several international fora is that the per capita CO_2 emission of a country like US vis-à-vis a country like India is widely different and therefore more reduction should be done by the developed than by the developing countries. And this argument can go on for several years.

KO: We understand that the amounts of emission of CO_2 are different in developed and developing countries. I cannot suggest how to solve this matter concretely; however, one thing is very clear that science and technology only can solve this matter in some way. We have to make a new frame-work to reach all countries with equity. That is my comment about this matter.

Dream 2047: Over past few years, we have been inviting several leading universities from the US, UK and other countries to set up campuses in India. Are some leading Japanese universities also interested? How can we promote academic interactions between the Japanese universities and Indian scholars?

KO: Yes! I really am very much impressed by the Indian Government, which is very forward looking in education. Situations are changing dramatically in this country with strong emphasis on education for young people. This is the right way for a bright future. The development of society will go up as a result of economic

development. So in my view Japan should cooperate more eagerly in this academic opportunity. The dream of Japan is to cooperate not only in business activities, but on academic level also. Science and technology has a very important role in this. Potential of the people is very strong and powerful. There is a very bright future if India continues this policy of the educating people. Studying and teaching at the IITs is of very high standards.

Dream 2047: Is there any possibility of leading Japanese universities setting up research centres in India? Is there anything in the pipeline?

KO: I think it is desirable and necessary for Japanese institutions and Government of Japan to see the opportunity. The young people of this country have very high potential, so it is not only a one way but a relation of mutual benefit. I visited IIT at Delhi and Mumbai and scientific institutions in Bangalore. The facilities, faculty and quality of teaching and research are of very high standard for the development of not only India but also Asia in general.

Dream 2047: You have set up the Science & Technology Society Forum in Japan with a vision. What have been its achievements over the past few years?

KO: When I was the Minister in charge of Science & Technology Policy in 2001, I conceived of this forum and I am here to explain our activities to the people of India and ask the leaders from the business community, academic circle, and government officials to attend the next meeting. We have organised six annual meetings in Kyoto, Japan, which have been attended by the Prime Minister of Japan. At the last meeting in October 2009 about 800 people from 85 countries including Noble laureates, ministers in charge of Science & Technology and academicians from leading universities participated to discuss current issues. I would like to have more participation from this country. This year our meeting will commence on October 25. We are inviting Indian leaders in our Science & Technology Society Forum's meetings this time also. We are expecting a delegation of 30 experts to attend the meeting to discuss the future of humankind.

I have met Mr. Prithvi Raj Chavan, Union Minister of State for Science & Technology and Earth Sciences and Mr. Kapil Sibal, Union Minister of Human Resources Development and both have accepted our invitation. We really appreciate this very positive attitude of the leaders. I have bought an invitation letter for honorable Prime Minister Dr. Manmohan Singh to attend, since he is very eager for development through science and technology and also in the education of the young people. I have met many leaders of CII, FICCI, industrial leaders from Mahindra, Tata, Infosys, Wipro,

Science and Technology in Society forum: Lights and Shadows Fundamental Concept

6th Annual Meeting of the STS forum (Kyoto, Oct. 4-6, 2009)

The explosive progress of science and technology up to the 20th century brought prosperity and enriched the quality of life for much of mankind.

However, the advance of science and technology raises important ethical, safety and environmental issue: possibly negative applications are threatening mankind's own future. Since progress in science and technology is expected to accelerate and will be necessary for sustainable human development in the 21st century, wisdom must be exercise to keep it under proper control.

In that sense, the most pressing problems we face today include harmonizing economic development with global warming preventing terrorist; controlling infectious diseases; and assessing the potential health benefits and ethical factors relating to cloning technology. International efforts to address these problems are needed now more then ever. This is really what symbolizes the "lights and shadows of science and technology." Opportunities need to be taken, but risks must also be minimized. Health, meeting energy needs, and many other aspects of human welfare are depends on continued progress in science and technology.

At the same time, the benefits of science and technology are not reaching a major part of the world's people. The barriers to seizing the opportunities for using science and technology to solve the problems of humankind need to be discussed.

Because the problems we face today are becoming increasingly complex against the backdrop of globalization and international competition, they are beyond the control of any single country.

These issues are also beyond the control of the scientific community alone, because many of the problems will find solutions through changes in social systems, international collaboration, global networks, and the building of common rules.

The time has come for not only scholars and researchers but also policy makers, business leaders and media leaders from all over the world to meet and discuss science and technology issues in the 21st century.

The Science and Technology in Society forum aims to provide a new mechanism for open discussions on an informal basis, and to build a human network that would, in time, resolve the new types of problems stemming from the application of science and technology. The forum community will also explore the opportunities arising from science and technology, and address how to remove the barriers to using science and technology to solve the problems facing humankind.

Forum members are expected to participate, not as representatives of their country or organization, but as individuals expressing a platform for specialists to unilaterally convey their knowledge. This is an opportunity for real dialogue among peers. Participants should also undertake cross borders activities towards the establishment of shared values and commitment for the future.

etc., and discussed issues of mutual interest. India will be a major leader of the development in the next 5 to 10 years and we need to discuss about the CO_2 emissions and global warming problems, population problem and other developmental issues. This country has an open society and an open economy and that is the reason for our two countries to build cooperation in field of the economic development.

Dream 2047: I am very happy that you have lot of confidence that Indian society will meet the challenges and expectations in future. How can we encourage Japanese industries to invest more in India?

KO: It is estimated that the number of Japanese people working in India is about 4,000. On the other hand there are 1,20,000 Japanese in China and about 40,000 in Thailand. The number of Japanese companies in India is of the order of 700, compared to 6,000 in China, 1,300 in Thailand. Both the number of the people and number of companies have been dramatically increasing in the recent decade. The leaders of Japan perceive the important role this country will be playing in the future. I am optimistic that our relations with India will register dramatic increase in a few years from now and industry presence will also increase.

Dream 2047: Engineers and scientists from Japan are known for their precision and manufacturing processes with zero defects. Japanese products are known for their quality. Do you have any kind of assessment of how Indian technicians, engineers and managers can develop eye for details, insistence on quality, and standards that make sophisticated products good for export?

KO: Thank you for the positive observation on our engineering and technology. Only by working together can we achieve a culture of pervasions as in the Japanese industry. More collaboration will help.

Dream 2047: Young people who are good in studies, opt for careers in management but not in science or research. This is of concern because from where are we to get teachers and researchers in future? Are there some lessons from Japan that we can learn from?

KO: There are many avenues for young people. Some of them like to be sportsmen and some of them aspire to be actors. They are free to choose their careers themselves, but it is important that they must know in which direction they are going. It is necessary to give them the right education and motivate them to join universities for learning science and pursue research. There are a lot of people who would like to learn science in IISc Bangalore, IIT Delhi, etc. Some ambitious scholarship schemes have been started recently. This should help.

Mr. Koji Omi (left) explaining his vision

Dream 2047: We are also working in science outreach and science communication. Our major challenge is disparity in society. There is a section of highly developed population which is very receptive to new ideas and there is a section that is illiterate. Rituals, superstitions, and myths come from culture. It may also be true for Japan but not like India because the level of literacy is much higher in Japan. The role of the media, print, TV and radio has not been positive in our country because they are in private sector and looking for entertainment and quick profits but not development. Would you like to suggest some solutions that may perhaps work?

KO: I understand that it is a very serious problem in this country. I don't think there is any easy way to solve this. Continuing effort on the education of young people is necessary for the situation to gradually improve. Indian leaders in different fields should give the right direction. The success of Japan in the development of modern society, in my opinion, is because we work very hard on these issues.

Dream 2047: Sir, you started your career in commerce, moved to government, then the House of Representatives and were minister of several important departments. Now you have established the Science & Technology Society Forum. You have had major shifts of careers. Readers would like to know about the decisive stages in your profession and personal life. What were the major accomplishments?

KO: When I was a government official, I was responsible for working for the economic development of Japan. And when I came to the stage of policy making (I stayed in this for 26 years) I continued making sincere efforts. I had a major role in defining the Science & Technology Policy in 1995. I perused matters of S&T as member of the parliament which was a rare case. Now we are developing 5-year plans. This is the third such plan. It is based upon this S&T Policy we defined in 1995. I am a member of the parliament even now but I concentrate my energy on this Science & Technology Society Forum that is concerned with the future of the humankind. This is very important.

Dream 2047: Diverse people of Brazil, China, India, and Japan have different concerns, value systems, etc. Can we actually still work together and do something for our grandchildren?

KO: We have to find solutions for the future of the humankind because natural resources are finite. Through this forum, we need to enroll everybody and persuade them to think about the future of the humankind not only for us but for the next generation.

Dream 2047: We would like to continue to learn from you. Thank you, very much.

KO: Thank you; I also enjoyed this discussion with you.

A View on Volcano

Rintu Nath
E-mail: rnath@vigyanprasar.gov.in

A volcano in Iceland with a tongue-twisting name 'Eyjafjallajokull' began erupting in March this year. Busy cities across the Europe however did not contemplate much on this volcanic activity until 14 April when the eruption entered in a new explosive phase. The volcanic eruption halted the activities across the European airspace and caused widespread disruption and chaos in most of the European airports between 14 and 21 April.

The reason of this disruption was the volcanic ash which is a potential risk to aircraft. The fine, abrasive particles erode metal, clog fuel and cooling systems and melt to form glassy deposits which eventually may cause engine failure while the aircraft is flying. Flight instruments, windows, lights, wings and cabin air supply can also be affected. Hence the volcanic ash clouds pose a great danger to an aircraft and can lead to disastrous consequence.

More than 1930 years ago, on 24 August, 79 AD. People of Pompeii, a city near today's Naples in Italy, were busy in their usual daily activities. They were completely oblivious to the fact that Mount Vesuvius, the volcano near its territory, started erupting. What happened next was obscured in the history for long time. Pompeii along with its sister city Herculaneum were destroyed and completely buried during the long catastrophic eruption of Mount Vesuvius spanning two days. The eruption buried Pompeii under 22 meters of ash and pumice, and it was lost for nearly 1,600 years before its accidental rediscovery in 1592.

A volcano is an opening, or rupture, in a planet's surface or crust, which allows hot magma, ash and gases to escape from below the surface. The word 'volcano' is thought to be derived from 'Vulcano', a volcanic island in the Aeolian Islands of Italy whose name in turn originates from 'Vulcan', the name of a god of fire in Roman mythology. The study of volcanoes is called 'volcanology' and scientists who study volcanology are called 'volcanologists'.

17 April 2010. Molten lava vents from a rupture near the Eyjafjallajokull glacier in Iceland, as a volcano erupted. The Eyjafjallajokull volcano began erupting after 200 years of silence.

The making of a volcano: Movement of tectonic plates

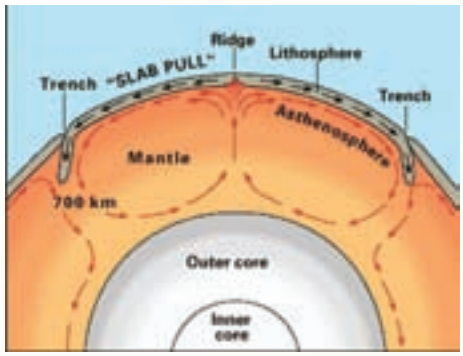
The Earth is composed of many layers, roughly divided into three mega-layers: the core, the mantle, and the outer crust. The lithosphere is the rigid outer portion of the Earth. The lithosphere is broken up into several tectonic plates. There are currently seven to eight major and many minor plates that make the surface of the Earth. With a thickness of about 100 km, the lithosphere is composed of an upper layer of crust (~7 km thick under the oceans, and ~35 km thick under the continents), and a lower, denser layer of the Earth's upper mantle. The lithospheric plates ride on a soft layer called asthenosphere, which is a hot, mobile layer of partially molten rock lying within the Earth's upper mantle.

The theory 'plate tectonics' describes the large scale motions of Earth's lithosphere. The activity at the boundary between some of these plates is the primary catalyst for formation of volcanic and earthquake activities.

Where different plates meet, they typically interact in one of three ways: (i) collide with each other and one plate goes under the other (subduction), (ii) collide with each other but no subduction takes place, and (iii) move past each other without collision. A fourth process is the moving apart of two plates due to formation of new crust at the mid-oceanic ridges.

March 21, 2010. Eyjafjallajokull volcano

In the first scenario, when two plates collide and one plate is pushed under the other plate, so that it sinks into the mantle. This process is called 'subduction'. This typically forms a trench, a very deep ditch, usually on the ocean floor. As the rigid lithosphere pushes down into the hot, high-pressure mantle, it heats up. According to many scientists, the sinking lithosphere layer cannot melt at this depth, but the heat and pressure forces the water (the surface



Different layers of earth (Photo credit: U.S. Geological Survey)

water and water from hydrated minerals) out of the plate and into the mantle layer above. The increased water content lowers the melting point of the mantle rock in this wedge, causing it to melt into magma. This type of magma production is called 'subduction zone volcanism'.

In the second scenario, if the plates collide and neither plate can subduct under the other, the crust material will just 'crumple', pushing up mountains. This process does not produce volcanoes. That is how there is no volcanoes in the Himalayas. However, some of the most tectonically active areas in the world are located throughout Himalayas, increasing the risk of earthquakes.

In the third case, when two plates move against each other without pushing or pulling, the transform plate boundaries so formed rarely produce volcanic activity.

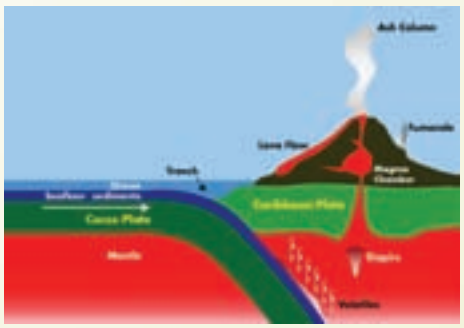
In the fourth case, as molten mantle rock from the asthenosphere layer below flows up to the surface under the ocean, the two plates separate and move towards opposite sides. As the magma flows out, it cools and hardens to form new crust. This fills in the gap created by the diverging plates. This sort of magma production is called 'spreading centre volcanism'.

Volcano formation

When hot mantle material, which is formed in the lower mantle, pushes up into the upper mantle, inter-plate volcanic activity ensues. The mantle material creates a 'hot spot' under a particular point on the Earth. Because of the unusual heat of this mantle material, it melts and forms magma just under the Earth's crust. The hot spot itself is stationary; but as a continental plate moves over the spot, the magma creates a string of volcanoes, which die out once they move past the hot spot. When the solid rock changes to a more liquid rock material, it becomes less dense than the surrounding solid rock. Because of this difference in density, the magma pushes upward with great force. As it pushes up, its intense heat melts some more rock, adding to the magma mixture. The magma keeps moving through the crust due to its upward pressure. At this point, the magma collects in 'magma chambers' below the surface of the Earth.

Magma eruption

The material that forms magma contains a lot of dissolved gases. The dissolved gases have lower density and they push the magma out causing spewing eruption. If the magma pressure rises to a high enough level, or a crack opens up in the crust, the molten rock spews out at the Earth's surface and the flowing magma (now called lava) forms a volcano. The intensity of a volcanic eruption depends primarily on the gas content and viscosity of the magma materials.



Subduction zone

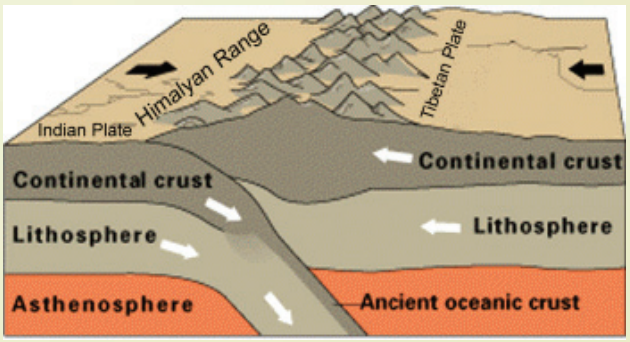
There are different types of volcanic eruptions and associated activity: phreatic eruptions (steam-generated eruptions), explosive eruption of high-silica lava, effusive eruption of low-silica lava (e.g., basalt), pyroclastic flows, lahars (debris flow), and carbon dioxide emission. All of these activities can pose a hazard to humans. Earthquakes, hot springs, fumaroles, mud pots, and geysers often accompany volcanic activity.

The concentrations of different volcanic gases can vary considerably from one volcano to the next. Water vapour is typically the most abundant volcanic gas, followed by carbon dioxide and sulphur dioxide. Other principal volcanic gases include hydrogen sulphide, hydrogen chloride, and hydrogen fluoride. A large number of minor and trace gases are also found in volcanic emissions. They include hydrogen, carbon monoxide, halocarbons, organic compounds, and volatile metal chlorides.

Classification of volcanoes

A popular classification of magmatic volcanoes is according to their frequency of eruption, with those that erupt regularly called 'active', those that have erupted in historical times but are now quiet called 'dormant', and those that have not erupted in historical times called 'extinct'. However, these popular classifications ('extinct' in particular) are practically not advocated by scientists. They use classifications which refer to a particular volcano's formative and eruptive processes and resulting shapes.

Scientists usually consider a volcano to be erupting or likely to erupt if it is currently erupting, or showing signs of unrest such as unusual earthquake activity or significant new gas emissions. Most scientists consider a volcano active if it has erupted in the Holocene epoch (the time period from 10,000 years ago to the present). Potentially active volcanoes are geologically young. These volcanoes have young-looking geomorphology (thin soil cover/sparse vegetation; low degree of erosion and dissection) with suspected seismic activity, documented local ground deformation, geochemical indicators of magmatic involvement, geophysical proof of magma bodies, and strong connection with subduction zones and external tectonic settings. Inactive volcanoes have no record of eruption and their form shows change by the agents of weathering and erosion via formation of deep and long gullies.



Collision of Indian plate with Tibetan plate and formation of Himalaya

Ring of Fire

Presently there are about 1500 active volcanoes in the world – the majority lying along the Pacific 'Ring of Fire', and around 50 of these erupt each year.

The Ring of Fire has 75% of the Earth's active and dormant volcanoes. The "Ring of Fire" is an arc stretching from New Zealand, along the eastern edge of Asia, north across the Aleutian Islands of Alaska, and south along the coast of North and South America. The whole Ring of Fire stretches for 40,000 km in length. Around the Ring of Fire, the Pacific Plate is colliding with and sliding underneath other plates (subduction) and the volcanically and seismically active area. There is a tremendous amount of energy created by these plates and they easily melt rock into magma, which rises to the surface as lava and forms volcanoes.

Extinct volcanoes are those that scientists consider unlikely to erupt again, because the volcano no longer has a lava supply. Examples of extinct volcanoes are the volcanoes on the Hawaiian Islands in the Pacific Ocean. It is difficult to distinguish an extinct volcano from a dormant one. An example is the Yellowstone Caldera which is located in Yellowstone National Park in the United States (sometimes referred to as the Yellowstone Supervolcano). This volcano is at least 2 million years old and has not erupted violently for almost 640,000 years, although there has been some minor activity relatively recently, with hydrothermal eruptions less than 10,000 years ago and lava flows about 70,000 years ago. For this reason, scientists do not consider the Yellowstone Caldera extinct. Volcanoes are often considered to be extinct if there are no written records of its activity. Nevertheless volcanoes may remain dormant for a long period of time, and it is not uncommon for a so-called 'extinct' volcano to erupt again. Recent example is Fourpeaked Mountain in Alaska, which, prior to its eruption in September 2006, had not erupted since before 8000 BC and was long thought to be extinct.

Volcanoes in India

Barren Island (located in the Andaman Sea) is the only confirmed active volcano in South Asia. The first recorded eruption of the volcano dates back to 1787. Since then, the volcano has erupted more than seven times, most recently on 19 April 2010.

Baratang Island in the Andaman Islands is the only known examples of mud volcanoes in India. These mud volcanoes have erupted sporadically, with recent eruptions in 2005 believed to have been associated with the 2004 Indian Ocean earthquake that caused devastating tsunami waves. The previous major eruption recorded was on 18 February 2003. The locals call this mud volcano as 'Jalki'.

Narcondam in the Andaman Islands is classified as a dormant volcano by the Geological Survey of India. The island is formed from a volcano, which is known to be inactive in recent times. However, on 8 June 2005, there were reports of 'mud and smoke' being ejected from the volcano. The 2004 Indian Ocean earthquake is thought to have caused magma to move underground and caused the associated activity.

Volcanoes on other planetary bodies

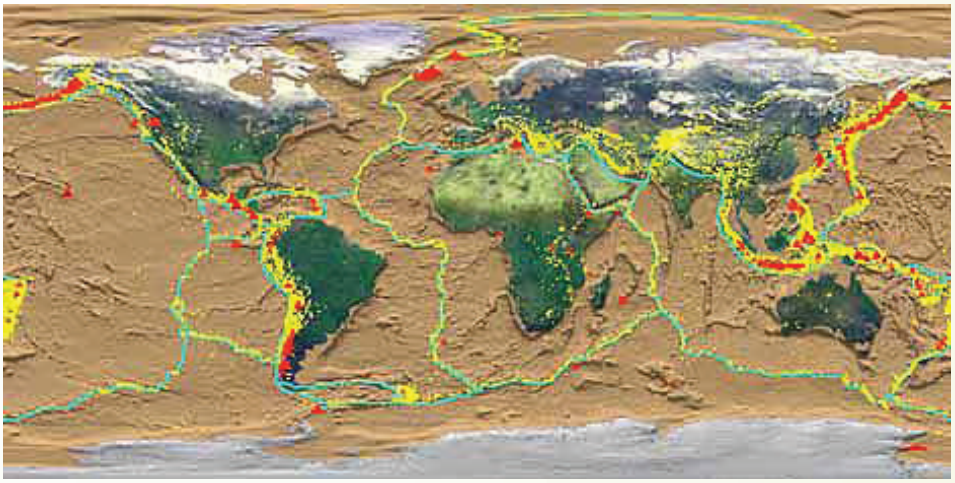
The Earth's Moon has no large volcano and there is no evidence of current volcanic activity, although it is suggested that it may still possess a partially molten core.

The planet Venus has a surface that is 90% basalt, indicating that volcanic activity played a major role in shaping its surface.

There are several extinct volcanoes on Mars, four of which are vast shield volcanoes which are far bigger than any volcanoes on the Earth. Olympus Mons is the largest extinct volcano in the solar system. It stands 21 kilometres high above the mean surface level of Mars, which is about three times the height of Mount Everest. Other Martian volcanoes include Arsia Mons, Ascraeus Mons, Hecates Tholus, , and Pavonis Mons. These volcanoes have been extinct for many millions of years.

Jupiter's moon Io is the most volcanically active object in the solar system because of tidal interaction with Jupiter. It is covered with volcanoes that erupt sulphur, sulphur dioxide and silicate rock, and as a result, Io is constantly being resurfaced. Its lavas are the hottest known anywhere in the solar system, with temperatures exceeding 1,800 K (1,500°C). In February 2001, the largest recorded volcanic eruptions in the solar system occurred on Io. Europa, the smallest of Jupiter's Galilean moons, also appears to have an active volcanic system, except that its volcanic activity is entirely in the form of water, which freezes into ice on the frigid surface. This process is known as cryovolcanism, and is apparently most common on the moons of the outer planets of the solar system.

In 1989, the *Voyager 2* spacecraft observed cryovolcanoes (ice volcanoes) on Triton, a moon of Neptune, and in 2005 the *Cassini-Huygens* probe photographed fountains of frozen particles erupting from Enceladus, a moon of Saturn.



World map showing plate boundaries (blue lines), the distribution of recent earthquakes (yellow dots) and active volcanoes (red triangles). (Photo credit: NASA)

Forecasting volcanic eruption

Prediction or forecasting of volcanic eruption requires an interdisciplinary scientific and engineering approach to natural catastrophic event forecasting. Volcanic activity prediction has not been perfected, but significant progress has been made in recent decades. The most widely used methods include studying the geographical area of the volcano, analysing data on seismic activity, gas emission, ground deformation, and evaluating the data generated from the remote-sensing satellites.

Seismic activity

Seismic activity (earthquakes and tremors) always occurs as volcanoes awaken and prepare to erupt and are a very important link to eruptions. Some volcanoes normally have continuing low-level seismic activity, but an increase may signal a greater likelihood of an eruption. Patterns of seismicity are complex and often difficult to interpret; however, increasing seismic activity is a good indicator of increasing eruption risk, especially if long-period events become dominant and episodes of harmonic tremor appear.

Gas emission

As magma nears the surface and its pressure decreases, gases escape. Sulphur dioxide is one of the main components of volcanic gases, and increasing amounts of it herald the arrival of increasing amounts of magma near the surface. For example, on 13 May 1991, an increasing amount of sulphur dioxide was released from Mount Pinatubo in the Philippines. On 28 May just two weeks later, sulphur dioxide emissions had increased to 5,000 tonnes, ten times the earlier amount. Mount Pinatubo later erupted on 12 June 1991.

Ground deformation

Swelling of a volcano often signals that magma has accumulated near the surface. Scientists monitoring an active volcano will often measure the tilt of the slope and track changes in the rate of swelling. An increased rate of swelling, especially if accompanied by an increase in sulphur dioxide emissions and harmonic tremors portends a high probability of an impending event. The deformation of Mount St. Helens prior to the 18 May 1980 eruption was a classic example of deformation. The north side of the volcano was seen bulging upwards as magma was building up underneath. But most cases of ground deformation are usually detectable only by sophisticated equipment used by scientists.

Thermal and Hydrological monitoring

Both magma movement and changes in gas release and hydrothermal activity can lead to thermal emissivity changes at the volcano's surface. These can be measured using several techniques. Similarly, hydrological evidences can be used to predict a volcanic eruption.

Remote Sensing

Remote sensing is the detection by a satellite's sensors of the electromagnetic energy absorbed, reflected, radiated or scattered from the surface of a volcano or from its erupted material in an eruption cloud. Scientists can forecast the likelihood of a volcanic eruption using data from cloud sensing, gas sensing, thermal sensing and deformation sensing.

Mass movements and mass failures

Monitoring mass movements and failures uses techniques lending from seismology (geophones), deformation, and meteorology. Landslides, rock falls, pyroclastic flows, and mud flows (lahars) are example of mass failures of volcanic material before, during, and after eruptions.

Final word

Scientists are using all available technologies and information to forecast the incidences of volcanic eruptions as well as model the spread of volcanic ashes integrating information on weather data. The recent incidence on air travel disruption in Europe due to spread of volcanic ash points to the need for exploring all technological advances and identifying extensive strategies to prevent similar unprecedented circumstance in the future. Otherwise, the nature will still have the last word in the modern world.

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Letter to the Editor

Interesting article on progeria

The article Progeria: Life in Fast-forward Mode (*Dream 2047*, May 2010) was very interesting. I had never heard about it before reading the article. Is there any relationship of the disease with growth retardation? I have a relative living near Churachandpur in Manipur. Both he and his wife are very short. Two of their children are more than 12 years old. But they look like children of three or four years of age. Could they be called dwarfs? Has any study been done such people?

Dr. Dal Lian Haokip,
Principal cum Proprietor,
Blue Star Academy,
Simveng, Churachandpur, Manipur.
Phone nos. 9436024013, 9615945150.

The Growing Epidemic of
Depression

Dr. Yatish Agarwal
e-mail: dryatish@yahoo.com

Geez, if I could get through to you, kiddo, that depression is not sobbing and crying and giving vent, it is plain and simple reduction of feeling. Reduction, see? Of all feeling.

–Judith Guest in *Ordinary People*

Melancholy is a mood — a way of feeling — which all of us experience from time to time, usually as a result of some unsettling event. However, it becomes pathological if the dejected state continues for a prolonged period of time.

Too many people seem to go under the term depression these days. You are talking to a friend, who has all the things his own way, and still the man laments, "Oh, I am so depressed!" The expression of momentary unhappiness, sadness, despair, lack of energy, or hopelessness is not qualified enough to be awarded clinical verdict of depression. On the contrary, the passing feeling of gloom may simply be a sign of our times, where the individual is too lonely, lost in a mad, mad, mechanised world. If these emotions catch you once in a while, and pass quickly, you do not have much to worry. Just look for the simple recipes to bail your mind out, and you would shake off the blues.

Difficulties arise, when the melancholia persists over a long period. It could turn out to be a major illness. You may find little, if any, joy in life and feel compelled to take continually a negative view of the world. You may feel anxious and sapped of energy, feel unworthy or guilty for no reason, and find it hard to think clearly, concentrate, remember, or take pleasure in anything. You may have trouble eating and sleeping or may, conversely, want to eat and sleep excessively. You might feel irritable for no rhyme or reason, experience a recurring sense of hopelessness and may even consider suicide. A person with depression may have some, most, or all of these symptoms. The hallmark is it is not a passing mood. A persistent and severe mood disorder, it has no truck with normal mood changes and interferes significantly with an individual's ability to function. It can be devastating to all areas of a person's everyday life, including family relationships, friendships, and the ability to work.

If someone is told that s/he is suffering from a depressive disorder it means the symptoms with which the person is suffering are pathological and severe enough to require treatment. It is certainly not a sign of personal weakness or weak character. Rather it is a real illness, much like any other bodily or psychological disorder, over which a person has no control. The clinical depression can be of several types, which differ in important ways. Among these are major depression, dysthymia, bipolar disorder, and seasonal affective disorder (SAD).

Disease of all times

The critical pathology in these disorders is one of 'mood', the inner emotional state of a person. The disorder is not of 'affect', the external, momentary expression of emotional content. These symptoms have been recorded since antiquity, and descriptions of what are now called mood disorders can be found in many ancient documents. The ancient Hindu medicine texts of Ayurveda record mania (*unmad*) and melancholia, and advocate among other recipes the use of *Rauwolfia serpentina* to treat depression. Both mania and depression also find a description in the works of ancient Greek physicians Hippocrates (400 BC), Arataeus (AD 120-180), Galen (AD 129-199), and others.

Even though it is tempting to think of these disorders on a continuum with normal mood variations, the concept cuts no ice with a clinician's experience. Just as the psychiatrist Berger says to Conrad Jarrett in Judith Guest's *Ordinary People*, patients with mood disorders suffer 'a plain and simple reduction of feeling'. But before we go into the finer details of depression, let us take a quick look at some of the more common forms of these disorders.

Manic-depressive illness (Bipolar disorder)

In bipolar disorder, sometimes called manic-depressive illness, a person's mood swings back and forth between depression and mania. The condition involves a series of emotional peaks and valleys that over time often become higher, lower, and closer together. Some sufferers experience deep depressions and moderate manic episodes, while others have moderate, short-lived depressions but become terribly manic. In the manic phase, a person displays euphoria, ideas which 'fly' or crowd his or her brain, decreased sleep, heightened self-importance, fantasies, grandiose thoughts, and feels full of energy. But when the person becomes depressed, the mood shifts to extreme sadness, negative thinking, and apathy. There is an abject loss of energy and interest, and thoughts of death or suicide.

A number of studies profess that the disease occurs at unusually high rates in creative people, and some psychologists have also compiled a list of the artists, writers, and musicians of this unhappy club. The formidable roll includes, in fact, practically every famously tormented artist: novelists Virginia Woolf, Ernest Hemingway, Emile Zola, Mary Shelley, Leo Tolstoy, Maxim Gorky, and Robert Louis Stevenson; playwright Eugene O'Neill; poets Lord Byron, William Blake, John Keats, P B Shelley, Edgar Allan Poe, Emily Dickinson, and Anne Sexton; painters Michelangelo, Amedeo Modigliani, Edvard Munch, Paul Gaugin, Vincent van Gogh, and Mark Rothko; and composers Peter Ilyich Tchaikovsky and Sergey Rachmaninoff. It probably needs a more detailed enquiry, but the self-destruction of the creative genius of Hindi cinema, Guru Dutt, despite his outstanding success may also have been a case of bipolar disorder.

Seasonal affective disorder

Some people also suffer from a seasonal depression. Their mood takes a dip only during autumn and winter, and lifts in the spring. This seasonal affective disorder (SAD) appears related to the fewer hours of daylight, and mostly affects people living in low-light conditions. People living at higher latitudes, where winter days are dark and short, have higher rates of the disorder than those living at lower latitudes. Like all depressed persons, individuals with SAD feel profoundly indifferent to people, work, and activities that once brought them pleasure. They think slowly, have poor concentration, and may view everything negatively. They may experience an increased appetite, weight gain, and a craving for foods high in carbohydrates, including chocolate or other sweets. They may sleep many more hours than normal and become sluggish and socially withdrawn. But come spring, and their mood soars, the disorder a thing of darkness in the past.

Dysthymia and cyclothymia

Dysthymia and cyclothymia are milder forms of depression and bipolar disorder. Literally, the term dysthymia means 'ill-humoured', and people with this disorder are often introverted, morose, and extremely low on self-esteem. It is a common disorder affecting three per cent of all adults. The major symptom is a feeling of down in the dumps, or the blues, but the person is often so sarcastic, brooding, demanding and complaining, that even the physician may get annoyed with the patient. People with cyclothymia experience repeated cycles of good times and bad times, much like the manic and depressive phase of bipolar illness, except for that the duration is not quite as prolonged as in the bipolar illness.

The Growing Epidemic

Depression is a major health problem all around the world. It affects people of all nationalities, heedless of sex, age, race, ethnicity, or socio-economic standing. Yet, the illness shows a gender predisposition. Women are two to three times more likely to suffer than men. The neurobiologists attribute this increased rates of depression among women to the genetics of the illness and, tentatively, also to the female sex hormones and menstrual cycle. But the social scientists believe that it is the lesser social status of women, the stress generated by the expectations of society, and the oppression in the form of physical or sexual abuse, harassment and discrimination, that drives women towards the disorder. Behavioural scientists have still another theory: namely, while women internalise their stress through their 'acting in' behaviour and suffer from depressive illness, men externalise and get rid of stress with their 'acting out' or aggressive behaviour.

Though the incidence rates of depressive illness are different among different cultures, between eight and twenty per cent adults suffer from depression at some point in their life. The illness can occur at any age from childhood to senescence, but the highest rates are found among people in their early twenties to mid-fifties. Single persons are more commonly affected than those who are married and have family. The prevailing figures are lower for bipolar disorder at one per cent in all adults, common to both sexes, and occurring at an age younger by a decade than in unipolar disorder.

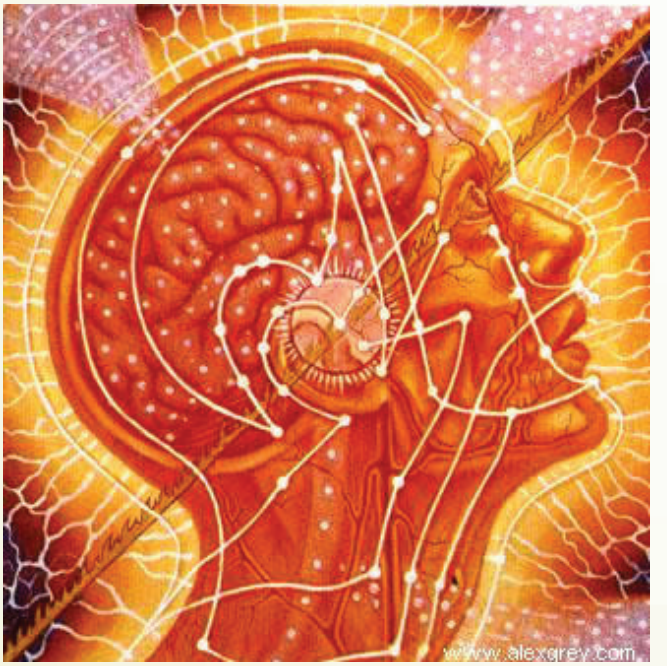
The incidence rates of depression have also been registering a worldwide increase over the past several decades. Several large-scale studies bear out this truth. The illness has become increasingly more common in successive generations. No one knows for sure what exactly is causing this so-called cohort effect, but the radical changes in family structure, the dismantling of joint families, increased urbanisation, reduced influence of cultural and religious communitarian values, and spread of violence have played a significant role.

The cost of this growing epidemic to the human society is enormous. More than half of the people with unipolar disorder suffer from more than one episode of illness, and each spell generally lasts between six and thirteen months unless medical attention is sought. Among those who receive appropriate treatment, it usually takes about three months before all is well again. Over the subsequent months and years, the illness may recur more than once in 50 to 85 per cent people. Men are likely to experience a chronic spell more than women.

The situation is generally much more difficult in the case of bipolar disorder. Even though an untreated spell is shorter and typically lasts about three months, the gravity of the illness and the frequent attacks lead to severe psychological pain and disability. It can

lead to a loss of job, financial worries, and generally, a load of misery for the family.

Both depression and manic illness are also potential killers. Up to 15 per cent of those who suffer from these mood disorders commit suicide, while many more try to put an end to their lives but survive.



Symptoms

Depression can appear at anytime in anybody. The illness may begin slowly and it may deepen gradually over months or years, or may spark off all of a sudden over a few days or weeks.

Often at first the sufferer is so taken up with negative thoughts, and the feelings of sadness, hopelessness and helplessness are so overwhelming that the family feels the person has had a nervous breakdown. He or she may cry for hours together, think that life is not worth living, and may not feel pleasure in meeting with people, or engaging in work and activities that used to bring him or her happiness at one time. Thoughts of death and suicide may dominate over him or her and he or she may constantly demand company and support.

A depressed person's body language also tells the story. A stooped posture, lack of spontaneous movements, and a downcast, averted gaze is the classic description.

The symptoms of depression may vary with age. In younger children, a depressive disorder may present with vague physical complaints, such as stomachache and headaches, as well as changes in eating habits, irritability, social withdrawal, and isolation. Such children show a lack of enthusiasm. They do not feel happy about taking part in any activity or in attending school.

In adolescents, common symptoms include sad mood, sleep disturbances, and lack of energy. They may also experience sudden mood swings. Adults may suffer similar symptoms, including changes in appetite, sleep, and energy level, sadness, loss of self-esteem, and the lack of volition. Many people suffer from physical problems. This is also the case with elderly people. They may unconsciously believe that physical complaints are more likely to win attention and treatment, but often the attending physicians fail to diagnose the emotional problem. Often, the signs of depression are thought of as eccentricity and dismissed summarily as a part of ageing, and the family members may fail to recognize the symptoms.

The classic symptoms of depression include:

Poor self-esteem

People with depression often suffer from a persistent feeling of worthlessness, helplessness, guilt, and self-blame. They may interpret a minor failing on their part as a sign of incompetence, or interpret minor criticism as condemnation. Even a competent and decent person may feel deficient, useless, stupid, or guilty of having deceived others.

Negative thoughts

Added to the negative perception of self, depressed people also tend to take a persistent negative view of the world. This may turn them into a social recluse. They may draw away from all activity and typically become slow and monosyllabic in their response.

Lasting sadness

A feeling of overwhelming sadness may swallow up the person's routine. He may weep silently and suffer from black despair. Nothing seems to please him and he does not enjoy the activities that used to give him profound pleasure.

Inability to take decisions

Depressed people often suffer from irritability and mood swings. They have difficulty in thinking clearly, suffer from slowness of thought, lack concentration, and find it difficult to take any decisions.

Persistent lack of energy

Depression also leads to a drop in one's energy level. Depressed people generally experience great fatigue, lack of energy, and a feeling of being worn out or overburdened.

Bodily symptoms

A number of depressed people complain of bodily symptoms such as headaches, stomachache, weakness, and fatigue. Generally, these people end up going through a number of clinical tests without any useful result and continue to suffer because the physician cannot figure out their root problem.

Loss of appetite or overeating

Depression usually alters a person's appetite. While some depressed people take to overeating, more often they just stop to eat or eat barely to survive. This leads to a loss of weight. Depressed people may also suffer from indigestion, constipation, or diarrhoea.

Changes in sleep habits

People with depression may oversleep. But, more commonly, they have difficulty in falling asleep and also staying asleep. A depressed person thus might go to sleep at midnight, sleep restlessly, and then wake up after two or three hours of sleep feeling tired and gloomy. This recurrent early morning awakening at 3AM or 4AM is a typical sign of depression.

Loss of interest in sex

The negative emotions also play havoc with the love life of the depressed people. They may lose all interest in sex and this may also adversely affect their relationship with their spouse and cause severe difficulties in their marriage.

Risk of suicide

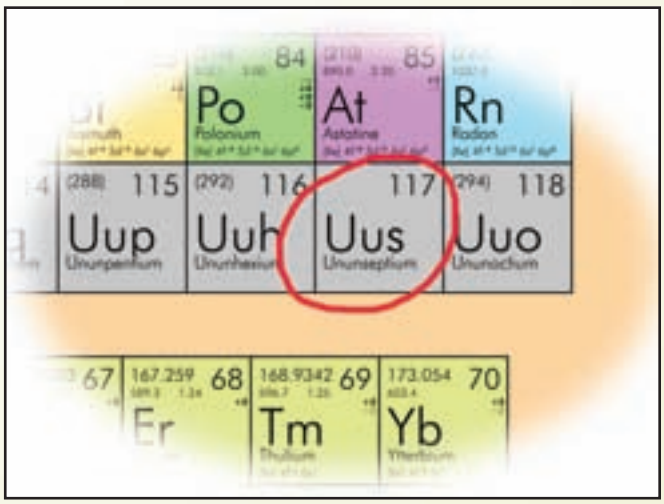
A major depression can lead to such extreme emotional distress that people may contemplate or attempt suicide. Some 15 per cent of the seriously depressed people do commit suicide, and many times more attempt it without being able to do so. ■

Recent Developments in Science and Technology

☐ Biman Basu
e-mail: bimanbasu@gmail.com

Element 117 created

With the announcement of the creation of element number 117 the current Periodic Table appears to be complete now. Element 117 was the only missing element in row seven of the Periodic Table. Before 1930 the periodic table was filled entirely with naturally occurring elements, the heaviest of which was uranium with 92 protons. Since then nuclear physics experiments yielded a further 27 elements. In the in early 1990s scientists at the GSI laboratory in Darmstadt, Germany, synthesised elements 107 up to 112, and over the last decade experiments at the Joint Institute for Nuclear Research in Dubna, Russia, have added elements 113 to 116 and 118. With the creation of element number 117 the gap in the Periodic Table has now been filled. The credit for creating all the five superheavy elements goes to the Joint Institute for Nuclear Research in Dubna, Russia.



Position of element 117 (ununseptium) in the Periodic Table

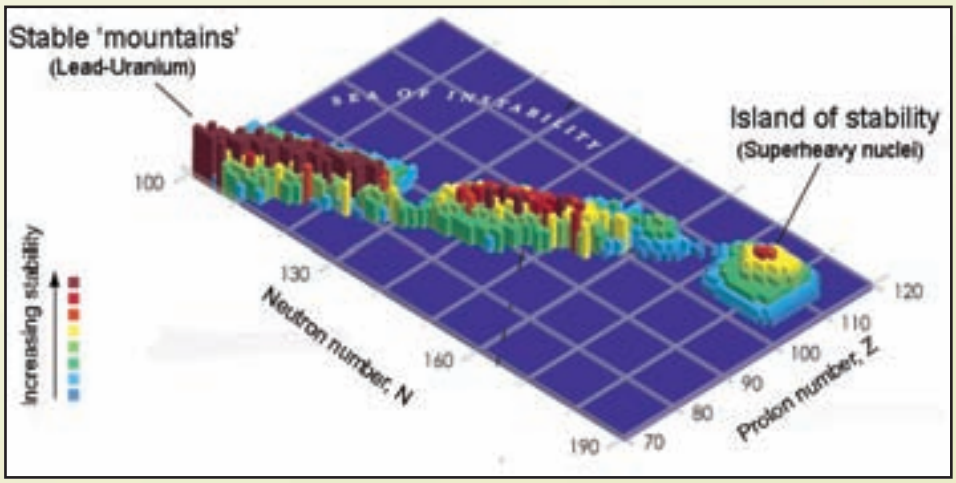
The newest element was created by an international team of scientists by repeatedly smashing high-speed calcium-48 (^{48}Ca) – an isotope with 20 protons and 28 neutrons – and berkelium-249 (^{249}Bk), which has 97 protons and 152 neutrons. In course of the bombardments, in rare instances, the two elements fused to produce two isotopes of the new superheavy element, ^{293}117 and ^{294}117. The scientists identified element 117 from its characteristic decay chains. Like its cousin elements 116 and 118 – which have already been created – element 117 has isotopes with half-lives that are in keeping with theories of elements near the presumed island of stability, which has elements with 184 neutrons. The team was led by Yuri Oganessian, director of the Flerov Laboratory of Nuclear Reactions at the Joint Institute for Nuclear Research, in Dubna, Russia, and included scientists from Lawrence Livermore National Laboratory, Oak Ridge National Laboratory, Vanderbilt University, and the University of Nevada, Las Vegas, USA (*Physical Review Letters*, 9 April 2010| DOI: 10.1103/PhysRevLett.104.142502).

The two-year experimental campaign began at the High Flux Isotope Reactor in Oak Ridge National Laboratory, with a 250-day irradiation to produce 22 mg of berkelium-249. This was followed by 90 days of processing to separate and purify the berkelium, target preparation at Dimitrovgrad in Russia, and 150 days of bombardment at one of the world's most powerful heavy ion accelerators at Dubna. The data analysis was done at Livermore in USA and Dubna in Russia.

A total of six atoms of element 117 were produced in the experiment. For each atom, the team observed the alpha decay from element 117 to 115 to 113 and so on until the nucleus underwent fission and split into two lighter elements. In total, 11 new "neutron-rich" isotopes were produced, bringing researchers closer to the presumed "island of stability" of superheavy elements.

The island of stability is a term from nuclear physics that describes the possibility of elements with particularly stable "magic numbers" of protons and neutrons. This would allow certain transuranium elements to exist beyond the current Periodic Table which would have special numbers of neutrons and protons and would exhibit increased stability. Such an island would extend the current Periodic Table to even heavier elements and support longer isotopic lifetimes to enable chemistry experiments.

According to the researchers, the new isotopes, together with superheavy nuclides previously synthesised in reactions with ^{48}Ca, present a consistent picture of nuclear properties in the area of heaviest nuclei. They



Graphic representation of 'Island of stability'

demonstrate the critical role of nuclear shells and represent an experimental verification for the existence of the predicted island of stability for superheavy elements.

The new element has been tentatively named 'ununseptium' as per IUPAC nomenclature. After its existence is confirmed by independent teams, it will receive a permanent name, suggested by the discoverers, from the International Union of Pure and Applied Chemistry – a process that may take some time.

Artificial pancreas offer hope for diabetics

Diabetes is a condition in which a person has a high blood glucose level. The reason can be either the body does not produce enough insulin, or because body cells are not able to properly utilise the insulin that is produced. Insulin is a hormone produced in the pancreas which enables body cells to absorb glucose, to turn into energy. If the body cells do not utilise the glucose, the glucose accumulates in the blood causing hyperglycemia (high glucose level in blood), which can lead to various complications.

There are many types of diabetes, but the most common types are: Type 1 and Type 2 diabetes. Type 1 diabetes is caused by the body's failure to produce insulin, and presently requires the person to inject insulin. Type 2 diabetes on the other hand is caused by insulin resistance, a condition in which cells fail to use insulin properly.

The treatment of Type 1 diabetes is complicated by the need for regular injection of insulin and occasional wide fluctuations in the blood glucose level, which sometimes dropped too low, sending the patient into a coma. For this reason automated control of blood glucose level has been a long-sought goal for type 1 diabetes therapy. Now a team from Boston University, Massachusetts, USA, have developed a closed-loop control system that uses frequent measurements of blood glucose concentration along with subcutaneous delivery of insulin and another hormone glucagon, which raises the glucose level in blood. The system consists of a blood glucose monitor and insulin pump hooked up to a laptop that runs a programme to control the levels of insulin and glucagon. By running an algorithm that monitors blood sugar levels and is capable of administering both blood-glucose raising and lowering hormones – glucagon and insulin respectively this system helps maintain a reasonably constant blood glucose level without the danger of the blood glucose level dropping too low.

According to Edward Damiano of the Boston University department of biomedical engineering, who co-led the research team, both hormones are important because large doses of glucagon are used as a rescue drug for people with severely low blood sugar. The new system is designed to counteract moderate drops in blood sugar with minute doses of glucagon spread out throughout the day, just as the body does in people without diabetes.

The artificial pancreas was first tested in pigs in 2007, and has now being used in 11 Type 1 diabetes patients for 24 hours, all given high carbohydrate meals. In six of the eleven the system controlled blood sugar successfully, while five of the patients needed a shot of orange juice to bring their blood sugar levels back to normal. This mismatch in the first trial was adjusted by minor changes in the algorithms used in the software that control the release of the hormones and the second run was a success in all patients (*Science Translational Medicine*, 14 April 2010 |DOI: 10.1126/scitranslmed.3000619). According to the researchers, the device could one day be run on a small, wearable computer chip, making persons with Type 1 diabetes lead a more carefree life.

The mystery of cobra's hood solved

The image of a hooded cobra with its neck flared is one of the most iconic from the animal kingdom. The cobra's hood is formed by an active lateral expansion of their neck skin and underlying musculature and ribs. But for more than 200 years herpetologists did not have any idea of how the cobra did it. Now scientists have uncovered the mechanism behind the menacing "hood flare", which cobras use as a defensive display. A team of researchers led by Kenneth Kardong from Washington State University, USA, have identified the precise group of muscles used by cobras to raise their hoods. They have found that the menacing 'hood flare' is done with the help of just eight muscles. According to the researchers, in the cobra, both the rib bones and the muscles that work them are deployed to erect this visual display. The team did some very tricky surgery to implant electrodes into the snake's neck muscles and took measurements of electrical activity from all of the muscles in the cobra's neck (*Journal of Experimental Biology*, 16 April 2010 |doi: 10.1242/jeb.034447).

The cobra uses its hood as a defensive display. (Inset) The cobra's skeleton reveals how its ribs have been "co-opted" for display of the hood

As early as1804 it was suggested by some scientists that muscles were entirely responsible for the hood's erection. Since then a majority of scientists had suggested that the snake uses its ribs and some had suggested that the reptile's skin might be involved in pulling the ribs into place, but no one had tried to find the mechanism. Taking up the challenge, Kardong and Bruce Young from the University

of Massachusetts decided to measure the electrical activity of all of the muscles in the neck region as the snakes erected their hoods, to find out exactly which ones were involved. After months of patient studies the duo concluded that eight muscles were involved in erecting the hood, with two groups playing major roles. While one group of muscles raised the first few ribs nearest to the head, another group held the ribs together while the hood is erect, and muscles connecting the ribs to the skin held the skin taut. The maintenance of the erect hood requires continued muscle activity. According to the researchers, in the cobra, both the rib bones and the muscles that work them are deployed to erect this visual display. They describe this mechanism as an example of "evolutionary remodelling."

Moringa oleifera sticks.

Drumstick seeds as water purifier

Moringa oleifera, commonly known as the drumstick, is a vegetable tree which is grown in Africa, Central and South America, the Indian subcontinent, and South East Asia. *Moringa* seeds contain 30-50% oil, which is good as cooking oil and also for making biodiesel with low NOx emissions and fuel stability.

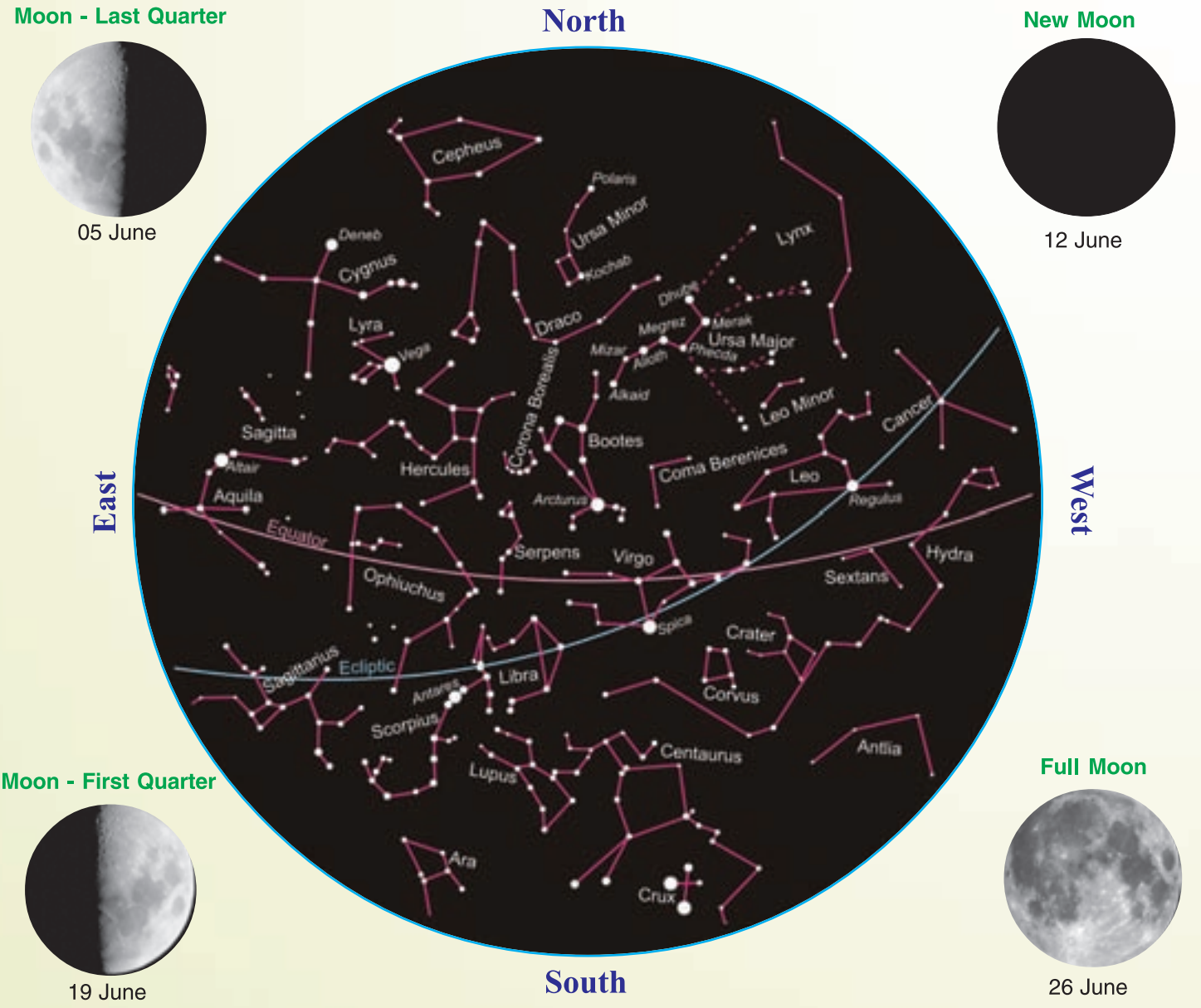
Not only is the tree drought resistant, it also yields cooking and lighting oil, soil fertiliser, as well as highly nutritious food in the form of its pods, leaves, seeds and flowers. Perhaps most importantly, its seeds can be used to purify drinking water at virtually no cost, according to a low-cost water purification technique published in *Current Protocols in Microbiology* (February 2010 | DOI: 10.1002/9780471729259.mc01g02s16). The technique if used widely could help drastically reduce the incidence of water-borne disease in the developing world. A billion people across Asia, Africa, and Latin America are estimated to rely on untreated surface water sources for their daily water needs. Of these, some two million are thought to die from diseases caught from contaminated water every year, with the majority of these deaths occurring

The seeds, when crushed into powder, can be used as a water-soluble extract in suspension and can produce a 90.00% to 99.99% bacterial reduction in previously untreated water. As well as improving drinkability, this technique reduces water turbidity by up 90%, as the powder joins with the solids in the water and sinks to the bottom. The clarified water is aesthetically as well as microbiologically more acceptable for human consumption. Michael Lea, a *Current Protocols* author and a researcher at Clearinghouse, a Canadian organisation dedicated to investigating and implementing low-cost water purification technologies, believes the *Moringa oleifera* tree could go a long way in reducing deaths due to contaminated water. By using *Moringa* seeds people will no longer be depending on expensive chemicals such as aluminium sulphate (alum), which are dangerous to people and the environment. Water from different sources will, of course, need different amounts of *Moringa* seeds powder because of the impurities present will not be the same.

Drumstick seeds

According to Lea, despite its live-saving potential, the technique is still not widely known, even in areas where the *Moringa* is routinely cultivated. He hopes that the publication of this technique in a freely available protocol format will make it easier to disseminate the procedure to the communities that need it. "Given that the cultivation and use of the *Moringa* tree can bring benefits in the shape of nutrition and income as well as of far purer water, there is the possibility that thousands of 21st century families could find themselves liberated from what should now be universally seen as19th century causes of death and disease," he says. [The full protocol can be downloaded at: http://mrw.interscience.wiley.com/emrw/9780471729259/cp/cpmc/article/mc01g02/current/pdf.]

Sky Map for June 2010



The sky map is prepared for viewers in Nagpur (21.090 N, 79.090 E). It includes constellations and bright stars. For viewers south of Nagpur, constellations of the southern sky will appear higher up in the sky , and those of the northern sky will appear nearer the northen horizon. Similarly, for viewer north of Nagpur, constellations of northern sky will appear higher up in the sky, and those of the southern sky will appear nearer the southern horizon. The map can be used at 10 PM on 1 June, at 9 PM on 15 June and at 8 PM on 30 June.

Tips to use sky map:

(1) Choose a place away from city lights/street lights.

(2) Hold the sky-map overhead with North in the direction of Polaris.

(3) Use a pencil torch for reading the sky map.

(4) Try to identify constellation as shown in the map one by one.

Visibility of Planets[1] (IST)

	Rising	Setting	In the Zodiac
Mercury	04:41	17:43	Aries-Taurus-Gemini
Venus	08:25	21:29	Gemini-Cancer
Mars	10:53	23:26	Leo
Jupiter	00:48	12:49	Pisces
Saturn	12:36	00:50	Virgo
Uranus*	00:45	12:46	Pisces
Neptune*	22:57	10:37	Aquarius

[1]Time shown is subject to vary (± 1 hr) from place to place.
*Not naked eye object

Sky Event

Date	IST	Event
01		Venus: 34° E
01		Jupiter near Uranus
03	22:20	Moon Apogee
15	12:38	Moon-Venus
15	20:24	Moon Perigee
21	15:58	Northern Summer Solstice
26	15:46	partial eclipse
26	17:00	Full Moon

☐ Arvind C. Ranade
E-mail : rac@vigyanprasar.gov.in

YOUR OPINION

Dream 2047 has been inviting your opinion on a specific topic every month. The reader sending the best comments will receive a popular science book published by VP. Selected comments received will also be published in *Dream 2047*. The comments should be limited to 400 words.

This month's topic:

If rainwater is harvested on a large scale will it affect the flow of the rivers?

Response should contain full name; postal address with pincode and email ID, if any; and should be accompanied by a recent passport size photograph. Response may be sent by email (**opinion@vigyanprasar.gov.in**) or by post to the address given below. If sent by post, "**Response: *Dream 2047* May 2010**" should be clearly written on the envolope.

Vigyan Prasar
A-50, Institutional Area, Sector-62, NOIDA 201 307 (U.P.)
Phone: 91-120-240 4430/35 Fax: 91-120-240 4437
Email: info@vigyanprasar.gov.in Website: www.vigyanprasar.gov.in

Winners of "Your Opinion" contest for March 2010

Topic: "Are genetically modified crops/vegetables essential for ensuring India's food security?"

Aditya,
M.Sc. Scholar,
Department of Extension Education,
Institute of Agricultural Sciences,
Banaras Hindu University,
Varanasi-221 005, Uttar Pradesh
Email- adityainc@yahoo.co.in

The rapid increase in population, unemployment, and more than 40 per cent people living below poverty line has made food security an issue which requires urgent attention of the government. Although there is no harm in using GM food crops, its use should be limited, keeping in mind the needs and requirements of the country. However, genetically modified food crops cannot be the sole answer to India's food security problems. There is also need to increase the production of conventional food crops. Today, GM crops are not feeding the world. They remain confined to only about 2.6 per cent of agricultural land worldwide, and 99 per cent of GM crops are grown for animal feed and fuels rather than for human consumption.

*****

Dr.Vishwanath G Makne.
Ex. Professor of Genetics and Plant Breeding,
Marathwada Agril.University, Latur.
Engineering Colony, New Ausa Road,
Latur – 413512.(MS).
E-mail - dr.vgmakne@gmail.com.

In the real sense food security is attainable under Indian condition only through the use of GM crops and vegetables. Transgenic crops, commonly referred to as genetically modified organisms, are produced through genetic engineering. It is now possible to develop different biotech crops in a short span. These hybrid plants, which grow bigger, better and faster and simultaneously have resistance against diseases and harmful insects, dramatically increase production and reduce the use of chemicals and pesticides. Biotech plants can also be used to develop edible vaccines. Today in India, the available arable land is dwindling and the population is exploding. In this situation we have no alternative but to turn to GM crops for food security.

*****

R.P. Agrawal,
Purani Gudri Road,
Rajeshwari Bhawan,
P.O. Ramna,
Muzafarpur – 842 002, Bihar.

When it comes to food, the enhanced yield, pest/weed control, etc., of GM crops are forcefully publicised, suppressing the negative aspects such as impact on human/animal health and environment. Experience with GM cotton is sufficient to say 'NO' to GM vegetables and food items. We need not to be allured by short-lived achievements claimed by proponents of GM crops and get into economic dependence on mighty corporations whose only concern is money leading to insecurity in the long run. Environmental pollution caused by GM crops is altering the natural pollinator regime with dangerous aftermath. Our natural agricultural practices are the right way to for food security.

The winners will receive a copy of VP Publication

Workshops on Nature Study, Innovative Experiments in Physics and Telescope assembling at Sikkim

Workshop in progress

Three state level workshops were organised jointly by Vigyan Prasar and Sikkim State Council of Science and Technolohy at Sikkim Science Centre, Gangtok, during 19-25 May 2010.

The objective of the Nature Study workshop was to understand the dynamics of nature and to promote the habit of learning by doing, using the immediate surrounding as an open laboratory. Forty teachers participated in the workshop. The resource persons were Shri Jayanta Sharma, Science communicator, Assam; Javed Alam, Nature Club of India, Patna and Shri B. K. Tyagi, Scientist, Vigyan Prasar. During the workshop practical demonstrations were held through nature walk where activities like identification and classification of plants, animals and birds were done. The observation and studies of nocturnal animals were also taken up. Biodiversity activity kit, developed by Vigyan Prasar was distributed to the participants.

The objective of the Physics workshop was to train teachers in doing innovative activities/ experiments for the students during the classroom teaching. These activities are aimed at conceptual understanding of physical phenomena through interesting hands-on activities. Most of the activities/ experiments were developed jointly by Vigyan Prasar and Department of Physics, IIT Kanpur. Forty teachers and twenty students participated in the workshop. Shri Rintu Nath, Scientist, Vigyan Prasar and Shri Manmohan Singh Marwaha from Chandigarh were the resource persons for the workshop. During the workshop, about 100 experiments/activities were performed and discussed. A kit on Modern Physics developed by Vigyan Prasar was distributed. Participants performed 27 hands-on activities using the kit. A number of experiments based on a computer were demonstrated. An interactive CD 'Innovative Experiments in Physics' was distributed to the participants.

In the telescope assembling workshop 60 Galilean telescopes were assembled and participants were allowed to take the telescope they have assembled to start sky observation activity in their schools.

The workshops are expected to help in promoting activity based science learning for inculcating scientific and technical temperament among students in Sikkim. A number of Science Clubs are expected to be formed by the participants. Vigyan Prasar would initiate new activities through these clubs. Newly formed clubs will also be part of national level campaigns like Year of Biodiversity 2010 and Year of Chemistry 2011.

One of the participants of the workshop sharing his experience during valedictory function

Demonstration of innovative activities in Physics