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The Time is Ripe

Humphry Davy

(Founder of Electrochemistry)



(1778-1829)

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Technology Solutions to Energy Issues – Dissemination strategies



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The system of water, energy, environment and agriculture comprise the four major components of the Earth system concerned with life support. Technology (and science) cuts across the four systems. An integrated multi-level system is needed to address the problem of global change with its demographic, environmental, climatic, biological, technological, economical, social, and health components. Natural and human-engineered resource systems, such as environmental security, energy security, and security of food and freshwater supply have already become critical. There is a growing concern about the unprecedented damage being done to the planet Earth. At the same time, there are many examples at different levels of society of actions for positive change.

No country can be termed a developed country without adequate power, efficient transmission and equitable distribution throughout the country. India has progressed from a meagre 1,362 MW in 1947 to about 128,000 MW in 2006 but this is not enough to keep pace with the rising load demand. Even today, there is a peak power deficit of at least 11 per cent and energy shortage of about 6 per cent. There are issues of quality of power supply (fluctuations and stability) that are often critical.

Emphasis is being placed on alternative and renewable energy sources such as wind energy, biomass, and solar and hydro energy in order to bridge the demand-supply gap. This has received a major thrust under the Prime Minister's National Action Plan for Climate Change. Energy conservation and efficiency are crucial in the power sector. Every unit saved is a unit generated.

Suitable opportunities already exist for adopting environment-friendly technologies in the area of energy, transportation, water conservation and use, agriculture and industry. Many of the eco-friendly technologies can be adopted in a decentralised manner. Bio-fuels potentially supply some 30 per cent of global demand in an environment-friendly manner without significantly affecting food production. While oil will not disappear in the near future and even after the recent surge in its prices, farm-grown bio-fuels such as ethanol and biodiesel will account for no more than a small fraction of fossil fuel use. Some micro-algae are efficient miniature biochemical factories and also good CO₂ fixers. Municipal and industrial organic waste treatment for composting has received inadequate attention. Recycling, reuse and reduced energy consumption deserve to be widely encouraged as also the use of solar heating and cooling and electric technologies, energy-efficient design, ventilation and improved insulation of buildings to reduce the consumption of energy in buildings. The use of safe industrial and agricultural waste products and other types of low-energy and recycled building materials in construction also should be encouraged.

Possibilities and challenges of the coming decade and the roles of the state, civil society and research institutions need refining for a more just and equitable world. Sensitising the policy makers and developing their capacity for better decision making is crucial.

The development and dissemination of new and environmentally sound technologies, including the reduction of metal compounds as part of transportation

fuels and good practices in the use of energy, deserve to be popularised, promoted and encouraged. How can you lead campaigns that help society make better choices?

Existing mass media including television, radio and print offer many opportunities. Personal interaction through lecture demonstrations, dialogue and debates need to be harnessed. Efforts will have the objectives of bringing into focus, among other issues, the following:

1. Identification of social and environmental benefits of alternative energy among college students;
2. Options to upgrade biomass fuels so they can be used for a broader range of markets and applications (e.g., wood pellet fuels) to decision makers;
3. Improving efficiency of utilising energy and its conservation to opinion makers; and
4. Biomethanation for the disposal of organic residues and waste products of agricultural products and in animal husbandry to research scientists.

The next few weeks will witness every college and university organising its cultural festival with opportunities for expressing and developing the creative potential of the participants. There are competitions and exhibitions that demonstrate the rich variety of forms available. Can the above concerns not be integrated in these creative expressions?

□ Anuj Sinha

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Humphry Davy

Founder of Electrochemistry



Subodh Mahanti

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wide coverage in newspapers and magazines. Through his public lectures he popularised his experimental discoveries in chemistry, electrochemistry, agriculture, geology, and catalysis. Davy's popular lectures helped the Royal Institution become a social and financial success.

Davy was an enthusiastic poet and he wrote a number of poems. He had friendly terms with eminent poets like William Wordsworth (1770-1850), Samuel Taylor Coleridge (1772-1834), and Robert Southey (1774-1843). Coleridge said that if Davy "had not been the first chemist, he would have been the first poet of his age." Southey declared that "he (Davy) had all the elements of a poet; he only wanted the art." John Ayrton Paris said that Davy's verses "bear the stamp of lofty genius." It can be said that Davy could have become a noted poet if had pursued his interest in poetry seriously. However, many point out that his sporadic writings did not show any true poetic imagination.

Humphry Davy was born on 17 December 1778 at Penzance in Cornwall, UK. His father Robert Davy was a wood-carver. He was representative of a very old family—his ancestors could be traced as far back as 1635. Robert Davy took his profession as more of a hobby rather than a means of earning money. Humphry's mother Grace Davy (nee Millet) had been adopted by John Tonkin, an eminent surgeon of Penzance after the untimely death of her parents. It was Tonkin who first placed Davy in a preparatory school. Tonkin was very much impressed by the progress made by the boy and so he persuaded Davy's father to send him to a better school. And so, at an early age Davy was sent to Penzance Grammar School, where he studied under Rev. J. C. Coryton. Young Davy displayed an unusual inquisitiveness to acquire knowledge at an early age. He possessed a remarkable memory and was fond of reading books, especially history books. One of his favourite

"I have learned more from my mistakes than from my successes."

Humphry Davy

"Language is not only the vehicle of thought; it is a great and efficient instrument in thinking."

Humphry Davy

Humphry Davy made important contributions to the development of chemistry. To realise the importance of his contribution we should understand the state of chemistry in his time. To do this we quote here from *The History of Science in the Nineteenth Century* by Ray Spangenburg and Diane K Moser: "The year was 1829 (referring to the year in which Davy died), and for chemistry, the century had only just begun, bolstered by the atomic theory of John Dalton, the new tool invented by Volta and the extraordinary discoveries of new elements, to continue to search out more new elements and to make sense of the vast jungle of molecules that form with the element carbon. Progress in all these fields was soon to come." We should also remember that in England when Davy was trying to pursue a career in science only the Royal Astronomer could be described as a professional scientist.

Davy is mostly known today for his discovery of metals namely sodium, potassium, calcium, magnesium, barium through electrolysis of their compounds. He also discovered boron. He established the elemental nature of chlorine and iodine. It was Davy who put an end to Lavoisier's theory that oxygen is an essential component of acids. In 1806, he delivered the Bakerian Lecture. The lecture, which was titled "On Some Chemical Agencies of Electricity", was hailed by Jons Jacob Berzelius as "one of the best memoirs which has ever enriched the theory of chemistry." The Bakerian Lecture is a prize lecture of the Royal Society which was established by Henry Baker in 1775 when he left 100 pounds for a spoken lecture by a Fellow on such part of natural history or experimental philosophy as the Society shall determine.

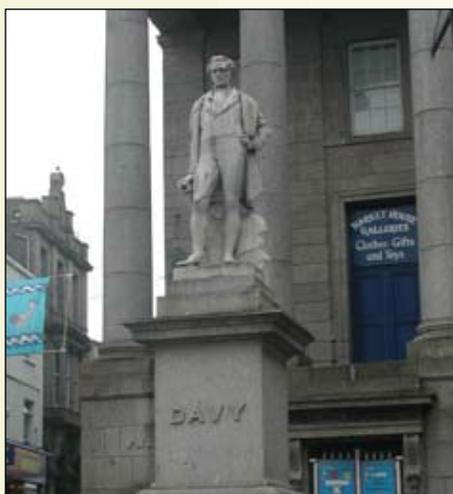
Davy invented the Davy lamp (1815), which allowed miners to work safely in presence of inflammable gases. Davy had found in 1801 that nitrous oxide had the ability to entirely take away the sensation of pain and thus it was a hint that it could be used as anaesthetic in surgery. However, his suggestion was not taken up for another half a century.

Davy was a great science populariser. He joined the newly established Royal Institution as a chemist in 1801 where he gave public lectures accompanied by experimental demonstrations. He conducted



Humphry Davy

experiments in different areas of science and had wonderful ability of storytelling. By his dramatic presentation he could easily captivate his audience. His lectures used to be attended by a large number of people. His public scientific lectures used to be important social events and they were given



Statue of Davy in his hometown of Penzance

books was *Pilgrim's Progress*, written by John Bunyan (1628-1688), a Christian writer and preacher. When he was eight years old, Davy used to give lecture standing on a cart in the market place on the subject of his latest reading. His audience consisted of fellow students and he used to be thrilled by the applause by his companions.

While at the Penzance Grammar School Davy developed an interest in conducting scientific experiments mainly encouraged by Robert Dunkin, who was a member of Society of Friends (a Christian denomination founded in England about 1650 by George Fox). Dunkin was an accomplished experimentalist and he himself had constructed an electrical machine, voltaic piles, Leyden jars and models for illustrating mathematical principles. In 1793, he moved to Truro to complete his school education under Rev. Dr. Cardew. Davy learned a lot of chemistry from reading books.

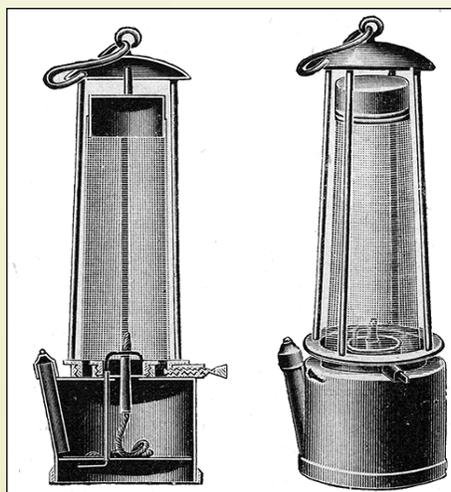
In his childhood Davy largely taught himself. He once said: "I consider it fortunate I was left much to myself as a child, and put upon no particular plan of study...What I am, I made myself."

After the death of his father, Davy was apprenticed to John Bingham Borlase, a well-known physician of Penzance. This happened because of the initiative taken by John Tonkin. In the dispensary of the physician Davy served the role of a chemist. He also started conducting experiments in the attic in Tonkin's house. His friends used to be alarmed by his rather dangerous experiments and would often say: "This boy Humphry is incorrigible. He will blow us all." His eldest sister would also often complain because her dresses used to get damaged by the corrosive

chemicals used by Davy.

In 1798, Davy joined the Pneumatic Institution at Bristol founded by Dr. Thomas Beddoes. The main objective of the institute was to investigate the medical powers of different gases (or airs). Davy's role was to conduct different experiments on the gases. While conducting these gas experiments Davy had to subject himself to considerable risks. Inhaling nitric oxide had the danger that it could have combined with common air in the mouth and form nitric acid capable of severely injuring mucous membrane. Describing his experiment with carbon monoxide he described that after inhaling the gas he "seemed sinking into annihilation." It took hours before the painful symptoms ceased. He produced a large quantity of nitrous oxide or laughing gas. He often demonstrated the effect of the gas publicly. Describing his own experience after inhaling the gas he wrote: "My first definite sensation was dizziness, such as to induce a fear of falling. This was momentary. When I took the mouthpiece furnishing the gas from my mouth, I immediately laughed. The laugh was involuntary, but highly pleasurable, accompanied by a thrill all through me. And a tingling in my toes and fingers, a sensation perfectly new and delightful." In the Pneumatic Institute Davy also conducted experiments with voltaic batteries.

Davy joined the Royal Institution in 1801. The Royal Institution was established in 1799 by the eminent British scientists including Henry Cavendish. Its first President was George Finch, the 9th Earl of Winchilsea. The Institution established for "diffusing the knowledge, and facilitating



The Davy Lamp



Davy's gravesite in Geneva

the general introduction of useful mechanics invention and improvements; and for teaching by courses of philosophical lectures and experiments, the application of science to the common purposes of life". The 'Society for Bettering the Condition and Improving the Comforts of the Poor', under the guidance of philanthropist Sir Thomas Bernard and American-born British scientist Benjamin Thompson (Count Rumford) supported the Royal Institution in its initial years.

Davy had been interviewed for the post by Joseph Banks, Benjamin Thompson (Count Rumford) and Henry Cavendish. The resolution of the Royal Institution appointing Davy said: "...that Humphry Davy be engaged in the service of the Royal Institution in the capacity of assistant lecturer in chemistry, director of the chemical laboratory, and assistant editor of the journals of the institution, and that he be allowed to occupy a room in the house, and be furnished with coal and candles, and that he paid a salary of 1001 (pounds) per annum."

Davy was a pioneer in the field of electrolysis. He successfully used the voltaic pile to prepare many new elements by splitting common compounds using the voltaic pile. He discovered potassium in 1807 by electrolyzing caustic potash (KOH). Potassium happens to be the first element to be isolated by electrolysis. The name "potassium" was also coined by Davy. In 1807 he also isolated sodium by passing an electric current through molten sodium hydroxide. The name "sodium" was also given by Davy. In 1808, he isolated calcium, which was also independently isolated by Berzelius and Pontin. Throughout his life Davy worked with electrolysis. He went on



Michael Faraday

to discover magnesium, boron and barium.

It was Davy who established the elemental nature of chlorine in 1810. It may be noted that chlorine was discovered in 1774 by the Swedish chemist Carl Wilhelm Scheele, who produced the gas by reacting manganese dioxide (MnO_2) with hydrogen chloride (HCl) solution also called oxymuriatic acid. Scheele termed the gas “dephlogisticated marine acid” and he mistakenly thought that it contained oxygen. The name “chlorine” was given by Davy. He also demonstrated that oxygen could not be obtained from oxymuriatic acid. Davy’s observation was important because it disproved Lavoisier’s definition of acids as compounds of oxygen.

Davy damaged his eyesight while experimenting with nitrogen trichloride. It may be noted that Pierre Louis Dulong, who first prepared nitrogen trichloride in 1812, also lost two fingers and an eye in two separate accidents resulting from handling the compound. Davy’s accident proved to be a major incident in the history of science as it induced him to engage Michael Faraday as his assistant.

In 1813, Davy resigned his Professorship at the Royal Institution and went on a two-year tour of the European continent. He was accompanied by his wife, Michael Faraday, and two boxes of apparatus. Irrespective of the fact that England was at war with France, Napoleon welcomed Davy’s visit. It is said that Davy had remarked: “There is never a war among the men of science.” In France he characterised iodine as a true element. In Italy he undertook some of the earliest analyses of the pigments used in ancient paintings and there he also burnt diamond

to prove that it was identical to carbon.

In 1815, Davy invented a lamp for use in deep mines by miners. The lamp later became known as the Davy lamp. The invention was made in response to a letter received from Newcastle miners informing that they faced danger from methane and other inflammable gases which often filled the mines and could easily be sparked off resulting in fires and explosions causing many deaths. The flame in the Davy lamp is enclosed inside a mesh of wire, which acts as flame arrestor. Air can easily pass through the mesh to support combustion or any flammable gas to burn inside but the holes of the mesh are so fine that they do not allow the flames to go out and ignite any flammable gas present. The Davy lamp could also crudely detect the presence of any flammable gas because in the presence of such gas the flame of the Davy lamp would burn higher with blue tinge. In case the mine air was oxygen-poor, the lamp flame would be extinguished. George Stephenson had invented a similar lamp in 1816. There was dispute on the question who invented the lamp first. However, the Davy lamp was simpler and cheaper and it was popular with mine owners. His other practical inventions were carbon arc light and cathodic protection of the copper hulls of warships.

Davy made a great contribution to science by giving an opportunity to Michael Faraday to work in the Royal Institution. As we know, Faraday went on to become one of the greatest scientists of the world. Towards the end Davy was not very appreciative of Faraday. Many think that Davy was zealous of Faraday’s unprecedented success. Davy opposed Faraday’s nomination to the



Carl Scheele



Joseph Banks

Fellowship of the Royal Society three times. Faraday could become Fellow of the Royal Society only after Davy resigned from the Presidentship of the Royal Society.

Davy was elected a Fellow of the Royal Society of London in 1804 and he also served as its President (1810-1827). He was elected a foreign member of the Royal Swedish Academy of Sciences. Davy was a founding Fellow of the Zoological Society of London. A lunar crater is named after Davy. To honour Davy a plaque was included on the wall of the Royal Panopticon of Science and Art in 1854, the institution which was one of the grand social institutions and architectural splendours of the Victorian London, was later closed. His hometown Penzance has a secondary school named Humphry Davy School.

A pub in his hometown is named after Davy, it is called “Sir Humphry Davy”. Interestingly there are also pubs named after James Prescott Joule and Isaac Newton. Davy is the subject of a humorous song by Richard Gendall, each verse of which recalls one of Davy’s major discoveries. The song was recorded by Cornish folksinger Brenda Wootton in 1980. A comedy script about the life of Davy was produced by the Truro-based production company O-region. The comedy script was written by Nicke Darke, a Cornish playwright in 2005. Darke died before he could complete the work and it was completed Carl Grose, a Cornish actor and playwright.

Davy died on 29 May 1829. He was given a state funeral. He is buried in the Plainpalais Cemetery in Geneva.

continued on page 23

Hetal and Ankur

Student innovators par excellence

By using agricultural waste and the natural binder derived from spoiled garlic two students of Rajkot, Gujarat - Hetal Kanjibhai Vaishnav, Shree S.G. Dholakiya Memorial High School, and Ankur Kanjibhai Vaishnav, of Shree P.V. Modi School, have developed an eco-friendly particle board that has been recognised at the international level. The two students have won an award at the I-SWEEEP, the International Sustainable World (Energy, Engineering, and Environment) Project Olympiad, for their project.

Er Anuj Sinha, Director, Vigyan Prasar and Consultant, Department of Science and Technology interacted both the students on their project and story of success; for the motivation of students towards science.

VP: Tell us about your project and explain why it is innovative.

H & A: After harvesting the crops the agricultural waste is usually burnt by the farmers. Such agricultural waste includes wheat husk, cotton straw, groundnut husk, etc. This spreads air pollution. There is no other use of this type of agricultural waste. Secondly, crops grown from Bt seeds have

harmful effect on earthworms. If Bt crop waste remains in the ground for a long time, it affects the fertility of the soil. Hence the farmers cannot use Bt crop waste as organic manure. And they are left with no other option except burning the crop waste.

The life of garlic is about 6 to 8 months. Right from the process of harvesting till it reaches the customer nearly about 25%

no use to anyone. On the other hand, the binders used in making particle boards are harmful with respect to the environment and human health. Such binders include phenol formaldehyde, melamine formaldehyde etc.

By using agricultural waste and natural binder derived from spoiled garlic we have been able to make particle boards which can be used in furniture applications.

The ecofriendly particle boards were made by employing both agricultural waste and spoiled garlic waste. By doing so, the cutting of trees for furniture applications can be reduced. Also, the air pollution caused by burning such waste can be reduced.

Indirectly, it would help the farmers, who can sell the agriculture and garlic waste as another source of income. It would also help reduce unemployment in the rural areas by developing a new technology, if available commercially. Hence, this project is beneficial to society.

VP: How did you get the idea and who gave you support at the early stage?

H & A: We are farmers, so we often visit our farm and help our family members in farming. We realised that the amount of agricultural waste generated is much more



Hetal and Ankur talking with Anuj Sinha at the IRIS National Fair 2009 held Ahmadabad

of garlic gets spoiled. This is due to the transportation and long period of storage in marketing yards. All of this garlic waste which is generated is simply thrown away and is of

IRIS National Fair

Every year Department of Science & Technology, Govt. of India, Intel and CII jointly organise a National Science fair namely, IRIS National Fair. Students across the country send synopses (abstracts) of their project. The SRC (Scientific Review Committee) short lists the best among them. Then students are called for presenting their project in the IRIS National Fair. 8 best projects among them are declared as the national winners. The national winners are selected only from senior (class IX to XII) category. About 100 projects were entered in the IRIS national Fair 2009.

Hetal and Ankur receiving an award as they became national winner at IRIS national fair held at Ahmedabad.



than the actual crop. This waste is burnt off. So, we wanted to utilise such agricultural waste into useful application in day to day life.

We also saw the garlic which was grown in the farm, some of which would spoil due to improper climatic conditions and also during the transport and storage. Our grand mother had told us that in olden days they used garlic to join the broken glass of the lantern. They used to rub the garlic on the edges of the glass and then used to light up the lantern, which would seal the crack on glass due to heat from lantern.

We wanted to see if the garlic waste has enough adhesion property and whether it can be used in binding the agriculture waste for making particle boards and found that It indeed does!

VP: Where did you look for more information? Was it difficult to find the current research?

H & A: We looked in books and surfed the Internet, for more information we also met many professors, etc. But it was very difficult for us to find references regarding spoiled garlic, as not much research appears to have been done on it.

VP: Who was your main support during the process of making the project?

H & A: During the process of making the project, the main support for us was our father Mr. Kanjibhai Vaishnav and our guide Mr. Vaibhav Ramani.

VP: Would you like to do more work on this project?

H & A: Yes. We would like to commercialise this product, if there is any financial aid available.

VP: Have you participated in other science competitions and won prizes?

Hetal: I have become national winner at IRIS 2008 and have participated in ISEF 2009 held at Reno, Nevada in USA. There I won four Awards. I had participated in IRIS in the year 2006 and 2007 also.

Ankur: I have participated in the science fair held at my school. There I was first in all the three divisions of my school. The name of the fair was Discovery Science Fair.

Then in the year 2009 we have become the national winner in IRIS national science fair. And we were selected for ISWEEEP 2010. At ISWEEEP, we won an honorable mention award for our project on ecofriendly particle boards

I-SWEEEP



Hetal and Ankur receiving their award at ISWEEEP-2010

I-SWEEEP, the International Sustainable World (Energy, Engineering, and Environment) Project Olympiad, is a groundbreaking science fair open to high school students. It is the largest science fair event of its kind world-wide. I-SWEEEP is organised by the Cosmos Foundation, with a mission to establish college preparatory K-12 schools focussing on math, science, engineering, and computer technologies. I-SWEEEP works with local, national, and international science fair organisations to bring together the top-ranking participants and qualifying projects from these competitions.

I-SWEEEP 2010 brought together over 1,000 brightest science like-minded students and their supervisors in Houston, USA. Young scientists from 70 countries and 43 U.S. states displayed 470 science projects about pressing issues of energy, engineering, and environment.

VP: Has this competition had any negative or positive impact on your studies?

H & A: If a student plans his/her every day's work then he/she will not face any negative impact. He/she should keep the track with both the things, i.e., studies and the project work, with proper planning.

VP: What has been the reaction of your teachers and parents when you were selected for representing India at the ISWEEEP?

H & A: When our parents and teachers came to know about our selection to represent India at International level, they were very happy and were very proud of us.

VP: What have you learnt from the international exposure?

H & A: Going to an international science fair was a great opportunity for us. Meeting the world class scientists and having a viva with them was also a great opportunity for us. Our mind started thinking in a scientific manner. By going over there and by seeing other projects, we came to know about many different problems faced by the people and Earth's environment.

VP: What is your message for other students who may participate in such events in future?

H & A: We would like to tell every student of India that they must participate in such a great event. But they should not only think of winning the awards. Rather they should participate to step out from the bookish knowledge and get to know the Creative world. They should not stop once success is achieved but keep participating in such events.

VP: Can you recall the question from judges (in Ahmadabad or US) that you found most searching and what was your reply?

H & A: During the judging session, some questions asked by judges were beyond our level, as they asked us about the chemistry of the spoiled garlic and the constituents of our binder. But this is a PhD level work as till now no one has done research on spoiled garlic, and it is a very complex compound.

And about the constituents of our binder, it was also beyond our level. Because, finding the constituents of our binder is like doing a PhD on the binder within 4 months! And for this we have approached many labs like NCL-Pune, Sicart-Baroda, and Saurashtra University (Polymer Department)-Rajkot, S.K. Research and Remedies-Mumbai, Shri Ram

ISEF

The International Science and Engineering Fair (ISEF) began in 1950 as a platform to encourage pre-college students to conduct scientific research. Intel ISEF brings together more than 1,200 students from over 40 nations to compete for over 900 prizes. There is US\$ 4 million to be won, including scholarships, tuition grants, internships, scientific field trips and the grand prize: a trip to attend the Nobel Prize Ceremony in Stockholm, Sweden.



Hetal and Ankur explaining their project to a judge judging session at ISWEEP-2010

Institute-Delhi, and Junagadh Agricultural University-Junagadh. But we were not able to analyse our binder up to the extent where we can find its constituents, in the short span of time. It is a very complicated and lengthy process.

In the reply to the above question, we gave the judges the reason why we were not able to find the constituents of our binder and the chemistry of spoiled garlic. We told them that our binder is very sticky and very complex material, so if it is run through HPLC or GCMS column then it can spoil the column.

VP: What was in your opinion the one most important aspect of your project that got it the award?

H & A: The binder that we used for making particle boards is derived from spoiled garlic. Hence, it is eco-friendly and can be used in place of hazardous binders like phenol formaldehyde, melamine formaldehyde, etc.

Agriculture waste is used in place of wood to make the particle boards, thereby reducing de-forestation and making it eco-

friendly. Utilisation of agricultural waste for making particle boards, also helped reduce air pollution by preventing their burning.

VP: Do you propose to continue to improve this or leave it for others? What type of support will be required now?

H & A: We want to continue with this project. We have applied for a patent. To start making this product commercially, we need to make the design of the machine; we need to construct a pilot plant also. For this we require the technical and financial support.

VP: How has your academic performance been affected because of this competition, travelling, etc?

H & A: There is no significant effect on our academic performance.

VP: What subjects do you wish to pursue in college and why? (Ankur and Hetal can have different answers)

Hetal: I want to do first BSc, then MSc and then PhD. I want to do my MSc and PhD in chemistry.

Ankur: I also want to do the same, but I'd like to do MSc and PhD in physics.

Letters to the Editor

Coach or Player

I liked the way you drew parallels between a soccer game and development of resource materials for science communication (Editorial, Dream2047, August). You have put it very succinctly and lucidly. Thanks for the thought-provoking piece.

T V Jayan
Science Editor, The Telegraph
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Andhra coffee

Thank you for the nice article about coffee, our favourite brew, which is very informative and enlightening. While the author discussed about Arabica and Robusta, no mention was made of Peaberry which is considered as a premium variety.

The author has mentioned that it is a favourite only in Tamil Nadu and South Karnataka. It is a great favourite of Andhriles also. Further, coffee is grown in Andhra Pradesh also, though quantitatively it is only a very small percentage. It has nonetheless won the Flavour of India - the Fine Cup Award in the years 2003, 2005, 2007, 2008, and 2009. The author has totally ignored Andhra.

Suryanarayana, Ch V
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Secunderabad (AP)

Corrigendum

In the interview with Lalita Balakrishnan (Dream 2047, August 2010), the caption of the photo at bottom on page 35 should read, ".....with solar lanterns developed by different manufacturers and propagated by AIWC." Instead of "....with solar lantern and solar panel, developed by AIWC".

In column 3 para 3, on page 35, please read "I had joined, already existing AIWC Branches in Delhi, Hyderabad, Bhopal, Haridwar, and at all these places I also started BHEL Ladies Welfare Association and did active work" instead of "We lived in Delhi, Hyderabad, Bhopal, Haridwar and in all these cities I established AIWC offices".

The Time is Ripe

The question often asked is: “Are you green and growing or ripe and rotting?” Now, thanks to the clues found by Indian scientists, “ripe” and “rotting” may not necessarily always be clubbed together. Not for 45 days at least—if it is the tomato we are talking about.

According to scientists at the National Institute of Plant Genome Research, New Delhi, there are two tomato genes that, when silenced or “knocked down”, allow tomatoes to remain ripe (without rotting) for three times as long as other tomatoes. This is indeed great news for cultivators and chefs alike.

Ripe challenge

Farmers know that fruit and vegetables perish quickly. If care is not taken during transport, they soon spoil and become unfit for consumption. In India the post-harvest losses of fruits and vegetables is enormous. About 35-40 per cent of the total produce is lost because it becomes excessively soft. This means that India incurs a loss, not only in terms of revenue, but also in terms of health because the fruits/vegetables are wasted.

Although ripe fruits taste best, the paradox is that even in the market, most buyers would rather buy a semi-ripe fruit because they know they will not be eating the fruit right away. They judge that if they buy a semi-ripe one, it would be ripe for a feast by the time they get around to consuming it. So the prudent shopper, knowing fully well that ripeness is the stage before a fruit begins to rot, would rather buy a semi-ripe fruit instead of an overtly ripe one.

The challenge therefore is to correctly judge the exact degree of “ripeness” when fruit should be harvested so that it can tempt potential buyers with its ripeness when it finally reaches the market. It is obvious therefore that ripening is a crucial parameter when it comes to both buying or selling fresh fruits and vegetables. Any method that can regulate ripeness is a boon to farmers and consumers alike.

Ripe for harvest

Normally fruits and vegetables are ready for harvest when these have reached ideal condition for consumption. This stage is called ‘harvest maturity’. However, Harvest maturity is not quite the same as physiological maturity, which is the term for the stage when the plant has completed its active vegetative growth and reached the stage of seed production. Harvest maturity includes the time required to reach the market. Thus it takes into account a degree of time lag. Usually, fruits and vegetables are harvested before these reach the maturity considered ideal for immediate consumption.



Green and growing

Ripening is often triggered by a signal...usually ethylene. Tomato too shows a rapid increase in the synthesis of ethylene at the beginning of the ripening process. In commercial fruit production, artificial ripening is used to control the rate of ripening, thus enabling transport and marketing to be carefully planned. Ethylene is used commercially for the artificial ripening of certain fruits. Another commonly used agent for artificial ripening is calcium carbide. However, the type of fruit under consideration also influences the strategy for that fruit.

Different fruits ripen at different rates and to varying degrees. Fruits such as mango, papaya and banana undergo drastic and extensive softening from “stone hard” stage to a “soft pulpy” stage. Fruits



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such as apple and orange do not exhibit such extensive softening. Obviously, the strategy to transport these two types has to be different.

Then again, fruits are classified as being either of the ‘climacteric’ or the ‘non-climacteric’ type when it comes to ripening.

- Climacteric fruits can be ripened off the parent plant. The respiration rate and associated rise of ethylene production (signal for ripening) gradually reaches a climacteric peak at the onset of ripening; after which it declines. Tomato is a climacteric fruit.

- Non-climacteric fruits are not capable of continuing their ripening process once they are detached from the parent plant. Also, these fruits produce tiny quantities of ethylene, and do not respond to external ethylene treatment. Non-climacteric fruits show a gradual decline in their respiration pattern and ethylene production, throughout the ripening process.

Molecular ripening research has focussed primarily on ethylene, but little is known of control before ethylene induction, or of common regulatory mechanisms shared by climacteric and non-climacteric species

Really ripe?

Almost nobody has trouble identifying a ripe fruit from an unripe one.

Unripe fruits are:

- Green with little/none of the tantalizing smells associated with the riper version.
- Smaller
- More sour/astringent
- Hard

Ripe fruits are:

- Visually striking: mostly red, dark (almost black) or yellow.
- Tempting when smelled



Hint of ripeness

- Luscious to look at
- Sweet and juicy.
- Soft to touch

Ripe fruits become soft because the tissue softens thanks to the increase in cell-wall degrading enzymes that act upon proteins and carbohydrates. Other structural alterations involve changes in cell wall thickness, permeability of plasma membrane, increased water content of cell wall, decrease in the structural integrity, and increase in intracellular spaces.

During ripening, colour, flavour, aroma and texture all change in a coordinated manner. The change in colour when the fruit is ripe happens because previously present pigments come to light when chlorophyll is degraded. There is also synthesis and/or accumulation of coloured anthocyanins and carotenoids such as β -carotene, xanthophyll esters, xanthophylls, and lycopene. The increase in flavour and aroma during fruit ripening happens because of the production of a complex mixture of volatile compounds and the degradation of bitter flavanoids, tannins, etc. Sweetness increases because of increased production of glucose, hydrolysis of polysaccharides (especially starch), decreased acidity, and accumulation of sugars and organic acids. Thus, increased respiration, chlorophyll degradation, biosynthesis of carotenoids, anthocyanins, essential oils, and increased concentrations of compounds influencing flavour and aroma mark the process of ripening.

A host of enzymes also come into play during ripening and these bring on many of the changes we associate with ripening. Enzymes such as α -hexosaminidase, α -mannosidase and α -galactosidase are thought to play a major role in the softening of the fruit during ripening. In ripening tomatoes, to give a specific example, the activities of the enzymes α -hexosaminidase and α -

galactosidase, which are low initially during fruit development, significantly increase.

Ripening thus is coordinated manifestation of changes in colour, texture, flavour, aroma, and nutritional characteristics that render fruit attractive to those that eat it and thus assist in seed dispersal. Ripeness is followed by ageing or senescence. Then comes breakdown of the fruit...what we call rotting!

Regulating ripeness

The softening of ripe fruits increases risk of damage during shipping and handling. However, it is the softness of the fruit that directly impacts on palatability and influences consumer acceptability and also, shelf-life. Thus this is the one criterion that most scientists have sought to regulate. One



Ripe and Red



Rotting on the vine



Will you buy these

of the strategies to regulate ripening is to identify and characterise proteins expressed during the process and whose biochemical activities can be related to the observed changes. Initially efforts that were targeted at controlling fruit ripening sought to suppress genes that coded cell-wall degrading proteins. This is because these proteins play a key role in the softening associated with ripening and it is because the fruits are soft that they are squashed easily during transport.

Carbohydrates play a major role in the ripening process. The major classes of cell wall polysaccharides that undergo modifications during ripening are starch, pectins, cellulose, and hemicelluloses. Pectins are responsible for the texture and quality of fruits and it is pectin degradation during ripening that causes softening of the fruits. Pectin-degrading enzymes are active in fruit-tissue softening. Very early on, studies in fruit-ripening focussed on these enzymes, which were manipulated in order to suppress cell-wall degrading enzymes. However, this met with limited success and scientists turned to other strategies such as genetically modified tomatoes.

Genetically modified tomato

The first genetically modified (transgenic) tomato that was engineered to stay firm and fresh for longer was the Flavr Savr tomato in 1994. This was a genetically altered tomato developed by Calgene using anti-sense RNA technology to inhibit the expression of a gene that normally causes fruit to soften. Broadly speaking, anti-sense technology produces a molecule that blocks the target gene's ability to produce its protein. Unfortunately the Flavr Savr tomato was not a commercial success and was withdrawn from the market in 1997. However, the search for the perfect tomato that will remain firm, fresh and bruise-free went on.

Indian contributions

More than a decade ago, Dr. T N Prabha and her colleagues at the Central Food Technology Research Institute (a CSIR laboratory), Mysore, had identified two genes that were active in the process of fruit ripening. However, despite at least four acclaimed research papers (posthumous) that were published with Dr. K Srinivasan and her PhD student B Jagadeesh, which elaborated how these two genes affected fruit ripening, Dr. Prabha did not live to see her ideas come to fruition. She died aged just 55 in June 2002.

However, the recent research paper on tomato ripening that was published by Prof. Asis Datta and his colleagues of the National Institute of Plant Genome Research (NIPGR), Delhi, in the 9 February 2010 issue of the Proceedings of the National Academy of Sciences proves that the torch of Science is always carried forward, much like a baton relay race. It is fitting tribute indeed to the pioneering work that she

had done that Dr. Prabha has been named as a co-author. Incidentally, Dr. Prabha was a former student of Prof. Datta.

In the experiment that built on the studies of Dr. Prabha, the scientists at NIPGR successfully delayed ripening in tomatoes by 30-45 days. They achieved this by suppressing two enzymes responsible for ripening in tomato — the N-glycoprotein modifying enzymes, α -mannosidase (α -

Man) and α -D-N-acetylhexosaminidase (α -Hex). It has been known for some time that N-glycoproteins are common in cell walls and free N-glycans are present in the pericarp of tomatoes at all stages of growth, but mostly during the ripening process. Interestingly, blocking of N-glycosylation delayed ripening. This suggested that N-glycan processing is an important event in the ripening process. Thus, as the scientists have said, it was tempting to explore the possibility that, “genetic manipulation of N-glycan processing can be of strategic importance to enhance fruit shelf life,



Asis Datta

without any negative effect on either appearance or yield.”

The scientists targeted the N-glycan processing enzymes α -Man and α -Hex. They found that over-expression of α -Man or α -Hex resulted in excessive fruit softening and the signs of deterioration set in early. On the other hand, the suppression of α -Man and α -Hex enhanced fruit shelf-life, owing to the reduced rate of

softening.

In the experiment, expression of α -Man and α -Hex was silenced by using RNA interference (RNAi) technology. This is a method of blocking gene function by inserting short sequences of ribonucleic acid (RNA) that match part of the target gene's sequence; thus no proteins are produced. The RNAi technique offers specificity and efficacy in silencing gene(s) allowing its

actions to be studied.

The RNAi tomato plants grew normally and bore typical amounts of fruit. The tomatoes showed normal climacteric ripening and colour development while attached to the plant. However, these tomatoes held on to their texture and showed longer life. The RNAi tomatoes harvested at the pink stage, retained their texture for 25-30 days, whereas the control tomatoes started shrinking and losing their texture after 15 days. Also, the tomatoes with ‘silenced genes’ (that is those with suppressed expression of the two enzymes) were firmer than other tomatoes. Overall, the scientists reported, “a substantial improvement in the shelf-life” of tomatoes where N-glycan processing enzymes are targeted. They also say that α -Man and α -Hex activities are high in papaya, banana and mango, which raises the hope that this strategy may yield positive results for these fruits also. The team plans to conduct larger-scale open field trials, followed by multi-location trials before seeking clearance from Regulatory Authorities for commercial cultivation. The entire process is expected to take two years.

Tomato genome studies

With the explosive development of genome studies, the tomato genome with its 24 chromosomes is under scrutiny too. The tomato genome is being sequenced part of the International Solanaceae Genome Initiative. The project aims to develop the Family Solanaceae (to which both tomatoes and potatoes belong) as a model for Systems Biology. Tomato has been selected since it has the smallest diploid genome in the Family. It encodes approximately 35,000 genes. India too is part of this Initiative. The sequencing of tomato chromosome 5 is being jointly carried out at the University of Delhi, South Campus; National Research Centre on Plant Biotechnology; Indian Agriculture Research Institute and the National Centre for Plant Genome Research -- all at Delhi. The aim of tomato genome sequencing is to identify agronomically useful genes.

More than 80 genes related to ripening of tomato fruits have been cloned. Scientists know that tomato plants harbouring the ripening-inhibitor (rin) mutation yield fruits that fail to ripen. Thus, the rin mutation can be widely used in tomato hybrid cultivars to yield fruit with a long shelf-life and acceptable quality. ■



National Institute of Plant Genome Research

Personality disorders

Why Some People Think, Feel, and Act the Way They Do

My idea of an agreeable person is a person who agrees with me.

Benjamin Disraeli, Lothair

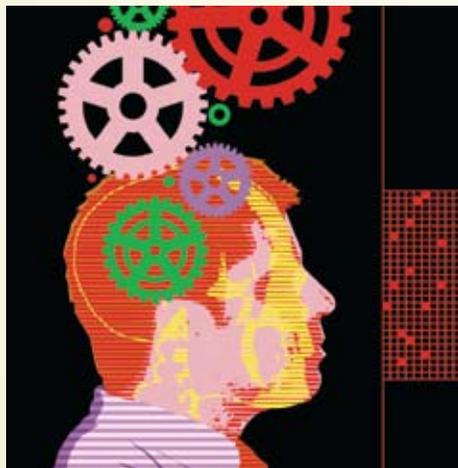
Warps in personality are common and nobody may quite make the perfect grade, yet some people due to a genetic lineage or harsh environment may develop a character that is at serious odds with the norms of their culture. These traits might take different forms and shapes and be recognised by a name, but there is also a school of thought that posits these personality disorders as a continuum between the normal functioning of the mind and a formal mental illness. Extremely hard to change, the salvation for a person with this disorder might lie in trying to mend the most dysfunctional aspects of their feelings and behaviour. While psychotherapy and behaviour therapy is useful in some situations, medications can be used to rectify the biological functioning of the mind if the disorder is serious and holds risk to self or others.

Mainly a hypothetical construct, the term 'personality' stands for a pattern of thought, feeling, and behaviour that identify a person. It is a sum of definite traits that are deeply ingrained, enduring, and unique about a person and distinguish him from the other people. An upshot of personal drives and influences from the outside world, it reflects predictability about how a person will act or react under certain circumstances. Usually, the more satisfactory a person's early development and experiences, the stronger and more balanced is his personality. People who fail to experience and integrate satisfactory early experiences tend to have personality structures that are faulty and manifest more primitive responses. The flaw may also lie in the genetic background or biological functioning of the brain.

Nobody fits the perfect bill. Most people, if not all, experience at least some difficulties and problems that result from their personality. The specific point at which those problems justify the diagnosis of a personality disorder is difficult to tell, but if it significantly impairs social or work functioning, is repetitive and inflexible, is stable over time, and is annoying to others, there clearly is a problem.

Broadly, the farther a person digresses from the code of one's culture the more severe

is the disorder. Yet, people who deviate from cultural norms are not necessarily dysfunctional, nor are people who conform to cultural norms necessarily healthy. The truth is, many personality disorders represent extreme variants of behaviour patterns that people usually value and encourage. For instance, most people value friendliness but not submissiveness, self-belief but not arrogance, and conscientiousness but not perfectionism. The dividing line may at times be rather hazy. In fact, a behaviour that seems deviant to one person may seem normal to another depending on one's gender, ethnicity, and cultural background.



Based on the predominant symptoms and their severity, personality disorders have been categorised into several subtypes. The current edition of the Diagnostic and Statistical Manual of Mental Disorders portrays ten personality disorders, while others describe twelve. Each of them reflects a developmental maladaptation from an early age, and yet, each is distinctly different from the other.

If you were to evaluate yourself on the altar of their characteristics, you might find yourself fitting into many of the subtypes! However, do not feel distraught unless you find these traits are pervasive enough to bring you into conflict with others and handicap your daily functioning. Just remember, you cannot be agreeable to everybody even if you



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tried. The idea, equally, is to try and develop an understanding of the behaviour of people you intermingle with.

Let us now look into the common deviants of personality.

Paranoid personality disorder

People with a paranoid personality are constantly defensive, secretive, suspicious and distrustful toward other people. They believe that others are against them and constantly look for evidence to support their suspicions. They doubt the trustworthiness and loyalty of acquaintances and friends, persistently bear grudges against others, and are reluctant to confide in others because of the fear that the information will be used against them. They are hostile toward others and react angrily to perceived insults reading hidden meanings into gentle remarks or events, perceive attacks on their reputation where none is intended, and are suspicious about the fidelity of their sex partner.

They may be objective, rational, and unemotional, but they are often rigid and cannot accept criticism. Their aggressive suspicious nature usually spurs a hostile reaction from other people and makes them extremely unlikable. They find it difficult to collaborate with others and have few close relationships. Due to these handicaps, they need to be self-sufficient and autonomous to be able to maintain themselves.

The disorder may surface during the teens with solitariness, poor peer relationships, social anxiety, hypersensitivity and underachievement in school. Some 0.5 to 2.5 per cent of people are affected by a paranoid personality disorder. It is more common in males.

Schizoid personality disorder

People with schizoid personality are shy, introverted, detached and distant from other people. Socially withdrawn, they have few close personal relationships, and do not care much to be a part of the family. They are emotionally cold. Being loners, they prefer solitary pursuits and remain preoccupied with

mechanical or abstract activities. Bookish, reserved, out of touch with others, they are relatively blind to social cues and their personal lives are usually barren. However, this remote exterior may belie the strong emotion which they may hide in their bosom. To find a vehicle for their private feelings, they may keep a diary or indulge in daydreaming.

They seem indifferent to appreciation or criticism by other people and may not react actively even if circumstances so demand. Since they lack social skills and have no desire for sex, they also may not marry.

More common in men, a schizoid personality usually finds it difficult to operate well at work, particularly if a job requires working with other people. But they may do well in vocations that can be done singly or without intimate social interaction.

Schizotypal personality disorder

People with schizotypal personality engage in bizarre thinking, speech, and behaviour. They are superstitious, believe in clairvoyance, telepathy or sixth sense, and may feel that they have special powers to sense events before they happen and can read the thoughts of others. They tend to use words and phrases in unusual ways, and may think they have magical control over other people. They suffer unusual bodily illusions and may feel that there is another person present, or they may hear a voice murmur their name. Due to their odd thinking, they may behave in a strange manner. For instance, they may walk past a specific object several times to avoid an imagined harmful outcome.

People with schizotypal personality disorder are often also overly suspicious. This makes them uncomfortable in relating to other people. They have few or no close friends and feel anxious in social situations. The disorder affects three per cent of all people. Most look for help due to symptoms of anxiety, depression, or restlessness. The disorder usually has a relatively stable course.

Antisocial personality disorder

A person with antisocial personality acts in a way that disregards the feelings and rights of other people. Lacking in conscience, he comes into conflict with the code and customs of the community, and still does not realise his mistakes. He is chronically in trouble and may not hesitate to use or exploit other people for his own gain. He may lie repeatedly, act impulsively, and get into physical fights. Loveless, indifferent

and destructive, he cannot form satisfactory relationships, and may suffer failures in his personal, work-related and social life.

Many people with antisocial personality are superficially likeable and charming, and initially mislead well-meaning people whom they subsequently disappoint and mortify. They may mistreat their spouses, neglect or abuse their children, and exploit their employees. They often engage in impulsive behaviour and may dismay others by their uncontrolled, destructive outbursts.

Individuals with antisocial personality usually fail to understand that their behaviour is wrong because they simply do not have a conscience. The fact is, even if guilt, remorse, shame, and anxiety make for unpleasant



feelings, these emotions are crucial to healthy social functioning and even physical survival. Antisocial personalities may take chances that other people would shun. They may engage in kleptomania, gambling or physical assaults repeatedly.

The disorder affects about three per cent of males and one per cent of females. People with this disorder are at high risk for poor personal life, loss of employment, bankruptcy, injury, alcoholism, drug dependence, imprisonment, and premature and violent death.

The disorder runs a chronic course but may become a little milder as the individual gets older. Those affected by this disorder were in the past called sociopaths or psychopaths, and gave a lot of stuff to writers to weave a novel or a film around them.

Borderline personality disorder

People with borderline personality suffer from a chronic feeling of emptiness, and make frantic efforts to avoid real or imagined abandonment by others. They experience inappropriate anger even when there are unavoidable changes in plans. For example, they may panic or burst into intense fury if somebody important to them is even a few minutes late. Even on such minor disappointments, they may develop severe frustration, anger, and dismay and they may indulge in suicidal behaviour, self-mutilation, and other self-destructive acts.

Individuals with this disorder have a pattern of unstable but intense relationships. At first they may impress people as stimulating and exciting, and may share the most intimate details about themselves early in a relationship. But they can turn bitter or angry at the slightest of reasons, and their relationships tend to be unstable and explosive.

People with borderline personalities also tend to have an unstable self-image or sense of self. This reflects sudden changes in their career plans, change in values, and change in type of friends. They may also at times sense such major void in their life that they begin to feel as if they do not exist at all.

The disorder may also lead to impulsivity. In addition to self-mutilating acts, they may gamble, spend money irresponsibly, abuse substances, binge eat, drive recklessly, and engage in unsafe sex.

About two per cent of all people have borderline personality disorder. Out of every four with this disorder, three are women. Borderline personalities run a high risk of depression, bulimia (an emotional disorder characterised by an obsessive desire to lose weight, in which bouts of extreme overeating are followed by fasting or self-induced vomiting or purging), stress disorders, dissociative disorders, and drug dependence. About 10 per cent of people with this disorder commit suicide by the age of 30.

Histrionic personality disorder

People with histrionic personality constantly strive to be the centre of attention. Often lively and dramatic, they may initially charm new acquaintances by their enthusiasm, apparent openness, and overly flirtatious behaviour. They believe in being the life of the party, being charmers, and do not hesitate in making up stories or even creating a scene to draw attention. Their appearance, including the apparel and looks, and behaviour is

seductive. This may easily mislead the people they come in contact with, but it does not necessarily reflect their romantic interests. They usually talk in a dramatic or theatrical fashion and display exaggerated emotional reactions. They may embarrass friends and acquaintances by excessive emotional display, such as embracing casual acquaintances with excessive passion, sobbing for no real good reason, or having tantrums. They also suffer from a high degree of suggestibility and are easily influenced by others.

Without being aware of it, people with this disorder may seek to control their partner through emotional manipulation on one level, whereas displaying a marked dependency on them at another level. Their clamour for constant attention may ruin their personal relationship with friends. They look for novelty and excitement and are easily frustrated if their actions are not met with immediate gratification.

The disorder is found in about two or three per cent of people. Women outnumber men, but only because they are more likely to be noticed. In the male-dominated milieu, a man with this disorder may just be tolerated as a macho, while a woman would stand out if she is provocatively dressed or acts in a seductive fashion.

Narcissistic personality disorder

People with narcissistic personality have a grandiose sense of self-importance. They seek excessive admiration from others, routinely overestimate their abilities, and boast unabashedly about their deeds. They fantasise about unlimited success, power, brilliance, and beauty and compare themselves favourably with the famous and beautiful. They believe they are special, unique, and superior to others and may think they are only meant to associate with the very best and top of the range people, places and activities. They may fish for compliments and are furious when this does not happen. They tend to develop relationships only if the other person seems likely to advance their self-esteem and do not hesitate to exploit a relationship.

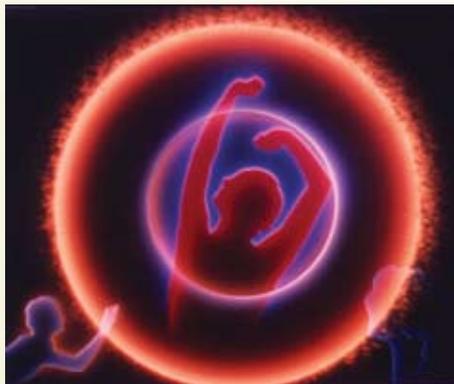
They mostly lack concern for others and have difficulty in recognising the desires and feelings of others. They do not have an ear for listening to the concerns and problems of others and may appear extremely insensitive to their hurts and emotions. They may be envious of others or think that others are envious of them. They may exhibit snobbish, arrogant and haughty behaviour.

Narcissistic personalities, however, have a very fragile self-esteem. They may not show it outwardly, but they are easily stung by criticism which leaves them emotionally bruised. In such a situation, they may react with scorn, rage or counterattack.

Due to an overwhelming need for admiration at all times and the insensitivity to the sentiments of others, they have few lasting relationships. They are also vulnerable to depression, hypomania (a mild form of mania), and might not achieve much in their work because of their poor attitude. The disorder is found in less than one per cent of people.

Avoidant personality disorder

People with avoidant personality suffer from social shyness, feelings of inadequacy and hypersensitivity to negative evaluation. They are intensely reserved, quiet, inhibited, and withdrawn. They try to be invisible and feel



afraid that no matter what they say, others will reject it, and so they say nothing at all. They are loath to work with other people because of an inner fear of being criticised, disapproved, or rejected. So deep is their fear that they might even reject a promotion and prefer to remain on a lower rung of the official hierarchy. Although capable of developing a close relationship if assured of uncritical acceptance, they usually hold back from intimate associations for fear of being shamed or ridiculed.

Avoidant personalities have low self-esteem and feel inadequate about themselves. They view themselves as socially inept and inferior to others. They are usually reluctant to engage in any new activities because they fear it may prove embarrassing. These self-doubts may make them the butt of ridicule by others. These individuals may become socially isolated and may have little or no social support group to bail them out in a moment of crisis.

The disorder affects 0.5–1.0 per cent of people. It is equally distributed among males

and females. The disorder begins at a young age, runs a chronic course, and becomes milder with age.

Dependent personality disorder

People with dependent personality have a severe and disabling emotional dependency on others. They are submissive and prefer to cling to others for support and advice at all times. They may experience difficulty in taking even simple everyday decisions as to the colour of dress to wear to work, or the briefcase they should carry. They need a great deal of guidance and reassurance, and usually depend on a parent or spouse to choose the kind of job for them, who to befriend, and how to lead their life. Since they are overly dependant, they do not express disagreement with other people and might even agree with things that they feel are grossly wrong. Due to lack of self-confidence, they have difficulty in doing things by themselves despite the fact that they might be quite capable of functioning adequately. They might go to any length to please those whose support they yearn for. Even if a task is unpleasant, necessitates self-sacrifices, or implies verbal, physical or sexual abuse, they accept it to avoid losing the relationship. They feel uncomfortable by themselves. If a close relationship comes to an end, such as on the death of a caregiver or spouse, they eagerly seek out another relationship to fulfil their emotional need of care and support.

Due to their self-doubts, pessimism, and constant need for nurturance, they may avoid positions of responsibility and lag behind in their professional career. Their social relationships are also limited only to people on whom they are dependant. The disorder is fairly common and is found more commonly in women than men.

Obsessive-compulsive personality disorder

People with obsessive-compulsive personality disorder are preoccupied with details, orderliness, perfection, and control. Their attitude is mostly so inflexible that in going for details, the objective of the activity might be lost. Even though they devote excessive amounts of time to work and productivity, their perfectionism might delay the project and interfere enormously with its completion timeframe. They also loathe delegating tasks to others unless those people submit to exactly their way of doing things. They are generally rigid, formal, stubborn, serious,

and fail to take time for leisure activities and friendships. They also have a miserly spending style towards both self and others and might maintain a standard of living far below what they can afford, believing that spending must be checked for future catastrophes.

This personality trait is found in about one per cent of people and twice as much in men as women. It differs from a full-blown obsessive-compulsive disorder both in severity and extent.

Other personality disorders

Many psychiatrists use two additional diagnoses. One of them relates to people with depressive personality disorder. They are overwhelmed by a sense of chronic pessimism, gloominess, and cheerlessness. They brood and are given to worry; are critical and derogatory towards self; and appear negativistic, critical and judgemental towards others.

In contrast, people with passive-aggressive personality show a negative, sullen and argumentative attitude; are stubborn and procrastinating by nature; they passively resist completing tasks and chores, criticise and scorn authority figures, eye others with envy and resentment, and voice exaggerated complaints of misfortune.

What causes the personality warp?

Controversies

There is a growing consensus among researchers engaged in explorations of the mind that personality disorders are not just a product of life experiences, but also hinge on inherited genetic traits and biological malfunctioning of the brain. For example, the roots of dependent personality disorder may be in a genetic anxiety flaw. Overly protective, clinging or, contrarily, neglectful parenting and a fearful temperament during childhood may just be the stuff that germinates this flaw into a full-blown personality disorder. While this mix of factors seems to be most plausible, in the present molecular era the pendulum is swinging more and more in favour of the biological perspective. It makes small of the significance of life experience and emphasises genetic and other biological factors.

The biggest endorsement of the genetic basis of personality disorders has come from behavioural studies carried on identical twins raised in different homes and cultural settings. The same faults in personality were detected in a large number of identical twins even though they were reared in different homes.

Associations between specific biological factors, including hormones, neurotransmitters and electrophysiological aberrations on one hand, and a personality disorder on the other have also been identified. For example, people who have impulsive traits often have increased levels of testosterone, 17-oestradiol and oestrone.

Despite these biological associations, it will be naïve to negate the significance of life experience altogether in shaping the personality. Interplay of all factors may be behind most disorders. Let us take the two most serious personality disorders before resting the case. A genetic predisposition to mood disorder may open up a person to acquire a borderline personality disorder, if he or she experiences parental neglect, intense marital conflicts between parents, or repeated episodes of severe emotional or sexual abuse. Similarly, a genetic predisposition to alcoholism, impulsiveness and violence may lead a person to antisocial personality disorder if he or she has a troubled childhood marked by inconsistent parenting, and a harsh environment that develops emotional coldness and prizes aggressiveness and exploitation.

Treatment

Changing an innate human trait is extremely difficult, and the difficulty quotient spirals if the person is not ready for it. Yet, most people with warped and disorderly personalities often fail to recognise that it is their personality that has contributed to their social, occupational, and personal problems. They may think they have no real problems despite a history of failed relationships, erratic jobs, and failures in making good the promise they held. The beginning therefore must be made with an attempt to help the person understand the significance of his or her personality traits. Family members, friends, peer group, and therapists all can play a role. Once the realisation dawns, people can try and mend the most dysfunctional aspects of their feelings and behaviour.

Psychotherapy

The treatment of personality disorders relies on long-term psychotherapy. The basic thought is to try and recreate pathologic patterns of interaction with the world at large, examine faulty defence mechanisms at play and finally, if possible, iron them out through a controlled therapeutic relationship. A variety of approaches continue to be in use and the choice of treatment is guided by the nature of the disorder.

Therapists sometimes use cognitive and behavioural techniques, such as role-playing

and logical argument, to help alter a person's irrational perceptions and assumptions about himself. Aversive behaviour therapy may also be fruitful, particularly in some of the relatively less serious disorders if practised regularly. It calls for a simple punishment, such as disapproval, immediately after a specific behavioural response. When practised regularly, the behaviour pattern is eventually inhibited and extinguished. Sending a child who has done a wrong on time-out uses the same concept. Not responding at all to an inappropriate behaviour may work along similar lines, where a lack of response eventually causes a person to abandon that type of behaviour.

Individual-group therapy has also been found useful when specific interpersonal behaviour needs to be improved. This may work well in the case of schizoid, avoidant, and histrionic personalities.

Some therapists also prefer to use a technique called dialectical behaviour therapy in treating people with borderline personality disorder. Using logical arguments, they help a person arrive at the truth and develop skills to cope with anger and self-destructive impulses. Once the risk of suicidal tendencies stands curbed, the therapist focuses on developing personal strength in the individual to learn to accept the disappointments and interpersonal conflicts that are a natural part of life.

Most of these treatments can be taken by a person as an outpatient, but in more severe disorders, such as antisocial personality disorder, residential treatments have also been tried. The focus is on a strict supervision of the person's behaviour and imposing rigid, consistent rules and responsibilities. These programmes appear to help some people, even though it is unclear if the benefit is permanent.

Medications

As the role of biological factors has come to the fore, physicians have started to use medications to help control symptoms. Antidepressant medications, low-dose anti-psychotic medicines, and mood-stabilising agents have all been tried successfully to overcome feelings of anxiety, depression, or severe distortions of thought. In all cases, however, it is important for both physician and patient to have reasonable expectations as to the possible benefit of medication. While beneficial responses may be subtle and observable only over time, it has to be borne in mind that long-term medication also carries a risk of side effects.

Technology Solutions to Energy Issues – Dissemination strategies



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The system of water, energy, environment and agriculture comprise the four major components of the Earth system concerned with life support. Technology (and science) cuts across the four systems. An integrated multi-level system is needed to address the problem of global change with its demographic, environmental, climatic, biological, technological, economical, social, and health components. Natural and human-engineered resource systems, such as environmental security, energy security, and security of food and freshwater supply have already become critical. There is a growing concern about the unprecedented damage being done to the planet Earth. At the same time, there are many examples at different levels of society of actions for positive change.

No country can be termed a developed country without adequate power, efficient transmission and equitable distribution throughout the country. India has progressed from a meagre 1,362 MW in 1947 to about 128,000 MW in 2006 but this is not enough to keep pace with the rising load demand. Even today, there is a peak power deficit of at least 11 per cent and energy shortage of about 6 per cent. There are issues of quality of power supply (fluctuations and stability) that are often critical.

Emphasis is being placed on alternative and renewable energy sources such as wind energy, biomass, and solar and hydro energy in order to bridge the demand-supply gap. This has received a major thrust under the Prime Minister's National Action Plan for Climate Change. Energy conservation and efficiency are crucial in the power sector. Every unit saved is a unit generated.

Suitable opportunities already exist for adopting environment-friendly technologies in the area of energy, transportation, water conservation and use, agriculture and industry. Many of the eco-friendly technologies can be adopted in a decentralised manner. Bio-fuels potentially supply some 30 per cent of global demand in an environment-friendly manner without significantly affecting food production. While oil will not disappear in the near future and even after the recent surge in its prices, farm-grown bio-fuels such as ethanol and biodiesel will account for no more than a small fraction of fossil fuel use. Some micro-algae are efficient miniature biochemical factories and also good CO₂ fixers. Municipal and industrial organic waste treatment for composting has received inadequate attention. Recycling, reuse and reduced energy consumption deserve to be widely encouraged as also the use of solar heating and cooling and electric technologies, energy-efficient design, ventilation and improved insulation of buildings to reduce the consumption of energy in buildings. The use of safe industrial and agricultural waste products and other types of low-energy and recycled building materials in construction also should be encouraged.

Possibilities and challenges of the coming decade and the roles of the state, civil society and research institutions need refining for a more just and equitable world. Sensitising the policy makers and developing their capacity for better decision making is crucial.

The development and dissemination of new and environmentally sound technologies, including the reduction of metal compounds as part of transportation

fuels and good practices in the use of energy, deserve to be popularised, promoted and encouraged. How can you lead campaigns that help society make better choices?

Existing mass media including television, radio and print offer many opportunities. Personal interaction through lecture demonstrations, dialogue and debates need to be harnessed. Efforts will have the objectives of bringing into focus, among other issues, the following:

1. Identification of social and environmental benefits of alternative energy among college students;
2. Options to upgrade biomass fuels so they can be used for a broader range of markets and applications (e.g., wood pellet fuels) to decision makers;
3. Improving efficiency of utilising energy and its conservation to opinion makers; and
4. Biomethanation for the disposal of organic residues and waste products of agricultural products and in animal husbandry to research scientists.

The next few weeks will witness every college and university organising its cultural festival with opportunities for expressing and developing the creative potential of the participants. There are competitions and exhibitions that demonstrate the rich variety of forms available. Can the above concerns not be integrated in these creative expressions?

□ **Anuj Sinha**

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Technology Solutions to Energy Issues – Dissemination strategies



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Humphry Davy

Founder of Electrochemistry



Subodh Mahanti

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wide coverage in newspapers and magazines. Through his public lectures he popularised his experimental discoveries in chemistry, electrochemistry, agriculture, geology, and catalysis. Davy's popular lectures helped the Royal Institution become a social and financial success.

Davy was an enthusiastic poet and he wrote a number of poems. He had friendly terms with eminent poets like William Wordsworth (1770-1850), Samuel Taylor Coleridge (1772-1834), and Robert Southey (1774-1843). Coleridge said that if Davy "had not been the first chemist, he would have been the first poet of his age." Southey declared that "he (Davy) had all the elements of a poet; he only wanted the art." John Ayrton Paris said that Davy's verses "bear the stamp of lofty genius." It can be said that Davy could have become a noted poet if had pursued his interest in poetry seriously. However, many point out that his sporadic writings did not show any true poetic imagination.

Humphry Davy was born on 17 December 1778 at Penzance in Cornwall, UK. His father Robert Davy was a wood-carver. He was representative of a very old family—his ancestors could be traced as far back as 1635. Robert Davy took his profession as more of a hobby rather than a means of earning money. Humphry's mother Grace Davy (nee Millet) had been adopted by John Tonkin, an eminent surgeon of Penzance after the untimely death of her parents. It was Tonkin who first placed Davy in a preparatory school. Tonkin was very much impressed by the progress made by the boy and so he persuaded Davy's father to send him to a better school. And so, at an early age Davy was sent to Penzance Grammar School, where he studied under Rev. J. C. Coryton. Young Davy displayed an unusual inquisitiveness to acquire knowledge at an early age. He possessed a remarkable memory and was fond of reading books, especially history books. One of his favourite

"I have learned more from my mistakes than from my successes."

Humphry Davy

"Language is not only the vehicle of thought; it is a great and efficient instrument in thinking."

Humphry Davy

Humphry Davy made important contributions to the development of chemistry. To realise the importance of his contribution we should understand the state of chemistry in his time. To do this we quote here from *The History of Science in the Nineteenth Century* by Ray Spangenburg and Diane K Moser: "The year was 1829 (referring to the year in which Davy died), and for chemistry, the century had only just begun, bolstered by the atomic theory of John Dalton, the new tool invented by Volta and the extraordinary discoveries of new elements, to continue to search out more new elements and to make sense of the vast jungle of molecules that form with the element carbon. Progress in all these fields was soon to come." We should also remember that in England when Davy was trying to pursue a career in science only the Royal Astronomer could be described as a professional scientist.

Davy is mostly known today for his discovery of metals namely sodium, potassium, calcium, magnesium, barium through electrolysis of their compounds. He also discovered boron. He established the elemental nature of chlorine and iodine. It was Davy who put an end to Lavoisier's theory that oxygen is an essential component of acids. In 1806, he delivered the Bakerian Lecture. The lecture, which was titled "On Some Chemical Agencies of Electricity", was hailed by Jons Jacob Berzelius as "one of the best memoirs which has ever enriched the theory of chemistry." The Bakerian Lecture is a prize lecture of the Royal Society which was established by Henry Baker in 1775 when he left 100 pounds for a spoken lecture by a Fellow on such part of natural history or experimental philosophy as the Society shall determine.

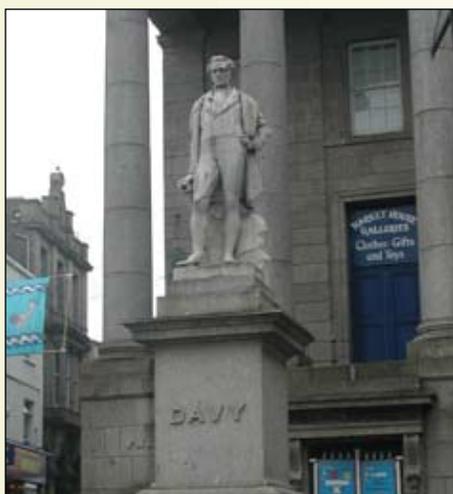
Davy invented the Davy lamp (1815), which allowed miners to work safely in presence of inflammable gases. Davy had found in 1801 that nitrous oxide had the ability to entirely take away the sensation of pain and thus it was a hint that it could be used as anaesthetic in surgery. However, his suggestion was not taken up for another half a century.

Davy was a great science populariser. He joined the newly established Royal Institution as a chemist in 1801 where he gave public lectures accompanied by experimental demonstrations. He conducted



Humphry Davy

experiments in different areas of science and had wonderful ability of storytelling. By his dramatic presentation he could easily captivate his audience. His lectures used to be attended by a large number of people. His public scientific lectures used to be important social events and they were given



Statue of Davy in his hometown of Penzance

books was *Pilgrim's Progress*, written by John Bunyan (1628-1688), a Christian writer and preacher. When he was eight years old, Davy used to give lecture standing on a cart in the market place on the subject of his latest reading. His audience consisted of fellow students and he used to be thrilled by the applause by his companions.

While at the Penzance Grammar School Davy developed an interest in conducting scientific experiments mainly encouraged by Robert Dunkin, who was a member of Society of Friends (a Christian denomination founded in England about 1650 by George Fox). Dunkin was an accomplished experimentalist and he himself had constructed an electrical machine, voltaic piles, Leyden jars and models for illustrating mathematical principles. In 1793, he moved to Truro to complete his school education under Rev. Dr. Cardew. Davy learned a lot of chemistry from reading books.

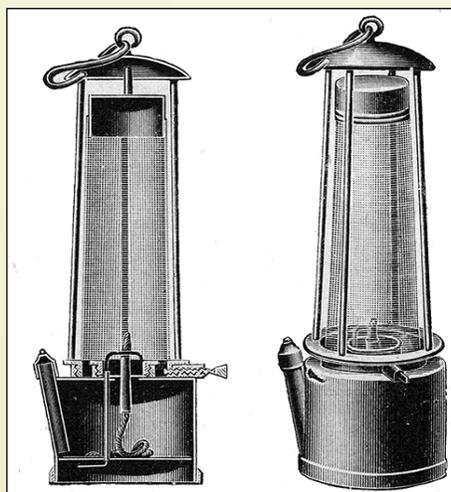
In his childhood Davy largely taught himself. He once said: "I consider it fortunate I was left much to myself as a child, and put upon no particular plan of study...What I am, I made myself."

After the death of his father, Davy was apprenticed to John Bingham Borlase, a well-known physician of Penzance. This happened because of the initiative taken by John Tonkin. In the dispensary of the physician Davy served the role of a chemist. He also started conducting experiments in the attic in Tonkin's house. His friends used to be alarmed by his rather dangerous experiments and would often say: "This boy Humphry is incorrigible. He will blow us all." His eldest sister would also often complain because her dresses used to get damaged by the corrosive

chemicals used by Davy.

In 1798, Davy joined the Pneumatic Institution at Bristol founded by Dr. Thomas Beddoes. The main objective of the institute was to investigate the medical powers of different gases (or airs). Davy's role was to conduct different experiments on the gases. While conducting these gas experiments Davy had to subject himself to considerable risks. Inhaling nitric oxide had the danger that it could have combined with common air in the mouth and form nitric acid capable of severely injuring mucous membrane. Describing his experiment with carbon monoxide he described that after inhaling the gas he "seemed sinking into annihilation." It took hours before the painful symptoms ceased. He produced a large quantity of nitrous oxide or laughing gas. He often demonstrated the effect of the gas publicly. Describing his own experience after inhaling the gas he wrote: "My first definite sensation was dizziness, such as to induce a fear of falling. This was momentary. When I took the mouthpiece furnishing the gas from my mouth, I immediately laughed. The laugh was involuntary, but highly pleasurable, accompanied by a thrill all through me. And a tingling in my toes and fingers, a sensation perfectly new and delightful." In the Pneumatic Institute Davy also conducted experiments with voltaic batteries.

Davy joined the Royal Institution in 1801. The Royal Institution was established in 1799 by the eminent British scientists including Henry Cavendish. Its first President was George Finch, the 9th Earl of Winchilsea. The Institution established for "diffusing the knowledge, and facilitating



The Davy Lamp



Davy's gravesite in Geneva

the general introduction of useful mechanics invention and improvements; and for teaching by courses of philosophical lectures and experiments, the application of science to the common purposes of life". The 'Society for Bettering the Condition and Improving the Comforts of the Poor', under the guidance of philanthropist Sir Thomas Bernard and American-born British scientist Benjamin Thompson (Count Rumford) supported the Royal Institution in its initial years.

Davy had been interviewed for the post by Joseph Banks, Benjamin Thompson (Count Rumford) and Henry Cavendish. The resolution of the Royal Institution appointing Davy said: "...that Humphry Davy be engaged in the service of the Royal Institution in the capacity of assistant lecturer in chemistry, director of the chemical laboratory, and assistant editor of the journals of the institution, and that he be allowed to occupy a room in the house, and be furnished with coal and candles, and that he paid a salary of 1001 (pounds) per annum."

Davy was a pioneer in the field of electrolysis. He successfully used the voltaic pile to prepare many new elements by splitting common compounds using the voltaic pile. He discovered potassium in 1807 by electrolyzing caustic potash (KOH). Potassium happens to be the first element to be isolated by electrolysis. The name "potassium" was also coined by Davy. In 1807 he also isolated sodium by passing an electric current through molten sodium hydroxide. The name "sodium" was also given by Davy. In 1808, he isolated calcium, which was also independently isolated by Berzelius and Pontin. Throughout his life Davy worked with electrolysis. He went on



Michael Faraday

to discover magnesium, boron and barium.

It was Davy who established the elemental nature of chlorine in 1810. It may be noted that chlorine was discovered in 1774 by the Swedish chemist Carl Wilhelm Scheele, who produced the gas by reacting manganese dioxide (MnO_2) with hydrogen chloride (HCl) solution also called oxymuriatic acid. Scheele termed the gas “dephlogisticated marine acid” and he mistakenly thought that it contained oxygen. The name “chlorine” was given by Davy. He also demonstrated that oxygen could not be obtained from oxymuriatic acid. Davy’s observation was important because it disproved Lavoisier’s definition of acids as compounds of oxygen.

Davy damaged his eyesight while experimenting with nitrogen trichloride. It may be noted that Pierre Louis Dulong, who first prepared nitrogen trichloride in 1812, also lost two fingers and an eye in two separate accidents resulting from handling the compound. Davy’s accident proved to be a major incident in the history of science as it induced him to engage Michael Faraday as his assistant.

In 1813, Davy resigned his Professorship at the Royal Institution and went on a two-year tour of the European continent. He was accompanied by his wife, Michael Faraday, and two boxes of apparatus. Irrespective of the fact that England was at war with France, Napoleon welcomed Davy’s visit. It is said that Davy had remarked: “There is never a war among the men of science.” In France he characterised iodine as a true element. In Italy he undertook some of the earliest analyses of the pigments used in ancient paintings and there he also burnt diamond

to prove that it was identical to carbon.

In 1815, Davy invented a lamp for use in deep mines by miners. The lamp later became known as the Davy lamp. The invention was made in response to a letter received from Newcastle miners informing that they faced danger from methane and other inflammable gases which often filled the mines and could easily be sparked off resulting in fires and explosions causing many deaths. The flame in the Davy lamp is enclosed inside a mesh of wire, which acts as flame arrestor. Air can easily pass through the mesh to support combustion or any flammable gas to burn inside but the holes of the mesh are so fine that they do not allow the flames to go out and ignite any flammable gas present. The Davy lamp could also crudely detect the presence of any flammable gas because in the presence of such gas the flame of the Davy lamp would burn higher with blue tinge. In case the mine air was oxygen-poor, the lamp flame would be extinguished. George Stephenson had invented a similar lamp in 1816. There was dispute on the question who invented the lamp first. However, the Davy lamp was simpler and cheaper and it was popular with mine owners. His other practical inventions were carbon arc light and cathodic protection of the copper hulls of warships.

Davy made a great contribution to science by giving an opportunity to Michael Faraday to work in the Royal Institution. As we know, Faraday went on to become one of the greatest scientists of the world. Towards the end Davy was not very appreciative of Faraday. Many think that Davy was zealous of Faraday’s unprecedented success. Davy opposed Faraday’s nomination to the



Carl Scheele



Joseph Banks

Fellowship of the Royal Society three times. Faraday could become Fellow of the Royal Society only after Davy resigned from the Presidentship of the Royal Society.

Davy was elected a Fellow of the Royal Society of London in 1804 and he also served as its President (1810-1827). He was elected a foreign member of the Royal Swedish Academy of Sciences. Davy was a founding Fellow of the Zoological Society of London. A lunar crater is named after Davy. To honour Davy a plaque was included on the wall of the Royal Panopticon of Science and Art in 1854, the institution which was one of the grand social institutions and architectural splendours of the Victorian London, was later closed. His hometown Penzance has a secondary school named Humphry Davy School.

A pub in his hometown is named after Davy, it is called “Sir Humphry Davy”. Interestingly there are also pubs named after James Prescott Joule and Isaac Newton. Davy is the subject of a humorous song by Richard Gendall, each verse of which recalls one of Davy’s major discoveries. The song was recorded by Cornish folksinger Brenda Wootton in 1980. A comedy script about the life of Davy was produced by the Truro-based production company O-region. The comedy script was written by Nicke Darke, a Cornish playwright in 2005. Darke died before he could complete the work and it was completed Carl Grose, a Cornish actor and playwright.

Davy died on 29 May 1829. He was given a state funeral. He is buried in the Plainpalais Cemetery in Geneva.

continued on page 23

Hetal and Ankur

Student innovators par excellence

By using agricultural waste and the natural binder derived from spoiled garlic two students of Rajkot, Gujarat - Hetal Kanjibhai Vaishnav, Shree S.G. Dholakiya Memorial High School, and Ankur Kanjibhai Vaishnav, of Shree P.V. Modi School, have developed an eco-friendly particle board that has been recognised at the international level. The two students have won an award at the I-SWEEP, the International Sustainable World (Energy, Engineering, and Environment) Project Olympiad, for their project.

Er Anuj Sinha, Director, Vigyan Prasar and Consultant, Department of Science and Technology interacted both the students on their project and story of success; for the motivation of students towards science.

VP: Tell us about your project and explain why it is innovative.

H & A: After harvesting the crops the agricultural waste is usually burnt by the farmers. Such agricultural waste includes wheat husk, cotton straw, groundnut husk, etc. This spreads air pollution. There is no other use of this type of agricultural waste. Secondly, crops grown from Bt seeds have

harmful effect on earthworms. If Bt crop waste remains in the ground for a long time, it affects the fertility of the soil. Hence the farmers cannot use Bt crop waste as organic manure. And they are left with no other option except burning the crop waste.

The life of garlic is about 6 to 8 months. Right from the process of harvesting till it reaches the customer nearly about 25%

no use to anyone. On the other hand, the binders used in making particle boards are harmful with respect to the environment and human health. Such binders include phenol formaldehyde, melamine formaldehyde etc.

By using agricultural waste and natural binder derived from spoiled garlic we have been able to make particle boards which can be used in furniture applications.

The ecofriendly particle boards were made by employing both agricultural waste and spoiled garlic waste. By doing so, the cutting of trees for furniture applications can be reduced. Also, the air pollution caused by burning such waste can be reduced.

Indirectly, it would help the farmers, who can sell the agriculture and garlic waste as another source of income. It would also help reduce unemployment in the rural areas by developing a new technology, if available commercially. Hence, this project is beneficial to society.

VP: How did you get the idea and who gave you support at the early stage?

H & A: We are farmers, so we often visit our farm and help our family members in farming. We realised that the amount of agricultural waste generated is much more



Hetal and Ankur talking with Anuj Sinha at the IRIS National Fair 2009 held Ahmadabad

of garlic gets spoiled. This is due to the transportation and long period of storage in marketing yards. All of this garlic waste which is generated is simply thrown away and is of

IRIS National Fair

Every year Department of Science & Technology, Govt. of India, Intel and CII jointly organise a National Science fair namely, IRIS National Fair. Students across the country send synopses (abstracts) of their project. The SRC (Scientific Review Committee) short lists the best among them. Then students are called for presenting their project in the IRIS National Fair. 8 best projects among them are declared as the national winners. The national winners are selected only from senior (class IX to XII) category. About 100 projects were entered in the IRIS national Fair 2009.

Hetal and Ankur receiving an award as they became national winner at IRIS national fair held at Ahmedabad.



than the actual crop. This waste is burnt off. So, we wanted to utilise such agricultural waste into useful application in day to day life.

We also saw the garlic which was grown in the farm, some of which would spoil due to improper climatic conditions and also during the transport and storage. Our grand mother had told us that in olden days they used garlic to join the broken glass of the lantern. They used to rub the garlic on the edges of the glass and then used to light up the lantern, which would seal the crack on glass due to heat from lantern.

We wanted to see if the garlic waste has enough adhesion property and whether it can be used in binding the agriculture waste for making particle boards and found that It indeed does!

VP: Where did you look for more information? Was it difficult to find the current research?

H & A: We looked in books and surfed the Internet, for more information we also met many professors, etc. But it was very difficult for us to find references regarding spoiled garlic, as not much research appears to have been done on it.

VP: Who was your main support during the process of making the project?

H & A: During the process of making the project, the main support for us was our father Mr. Kanjibhai Vaishnav and our guide Mr. Vaibhav Ramani.

VP: Would you like to do more work on this project?

H & A: Yes. We would like to commercialise this product, if there is any financial aid available.

VP: Have you participated in other science competitions and won prizes?

Hetal: I have become national winner at IRIS 2008 and have participated in ISEF 2009 held at Reno, Nevada in USA. There I won four Awards. I had participated in IRIS in the year 2006 and 2007 also.

Ankur: I have participated in the science fair held at my school. There I was first in all the three divisions of my school. The name of the fair was Discovery Science Fair.

Then in the year 2009 we have become the national winner in IRIS national science fair. And we were selected for ISWEEEP 2010. At ISWEEEP, we won an honorable mention award for our project on ecofriendly particle boards

I-SWEEEP



Hetal and Ankur receiving their award at ISWEEEP-2010

I-SWEEEP, the International Sustainable World (Energy, Engineering, and Environment) Project Olympiad, is a groundbreaking science fair open to high school students. It is the largest science fair event of its kind world-wide. I-SWEEEP is organised by the Cosmos Foundation, with a mission to establish college preparatory K-12 schools focussing on math, science, engineering, and computer technologies. I-SWEEEP works with local, national, and international science fair organisations to bring together the top-ranking participants and qualifying projects from these competitions.

I-SWEEEP 2010 brought together over 1,000 brightest science like-minded students and their supervisors in Houston, USA. Young scientists from 70 countries and 43 U.S. states displayed 470 science projects about pressing issues of energy, engineering, and environment.

VP: Has this competition had any negative or positive impact on your studies?

H & A: If a student plans his/her every day's work then he/she will not face any negative impact. He/she should keep the track with both the things, i.e., studies and the project work, with proper planning.

VP: What has been the reaction of your teachers and parents when you were selected for representing India at the ISWEEEP?

H & A: When our parents and teachers came to know about our selection to represent India at International level, they were very happy and were very proud of us.

VP: What have you learnt from the international exposure?

H & A: Going to an international science fair was a great opportunity for us. Meeting the world class scientists and having a viva with them was also a great opportunity for us. Our mind started thinking in a scientific manner. By going over there and by seeing other projects, we came to know about many different problems faced by the people and Earth's environment.

VP: What is your message for other students who may participate in such events in future?

H & A: We would like to tell every student of India that they must participate in such a great event. But they should not only think of winning the awards. Rather they should participate to step out from the bookish knowledge and get to know the Creative world. They should not stop once success is achieved but keep participating in such events.

VP: Can you recall the question from judges (in Ahmadabad or US) that you found most searching and what was your reply?

H & A: During the judging session, some questions asked by judges were beyond our level, as they asked us about the chemistry of the spoiled garlic and the constituents of our binder. But this is a PhD level work as till now no one has done research on spoiled garlic, and it is a very complex compound.

And about the constituents of our binder, it was also beyond our level. Because, finding the constituents of our binder is like doing a PhD on the binder within 4 months! And for this we have approached many labs like NCL-Pune, Sicart-Baroda, and Saurashtra University (Polymer Department)-Rajkot, S.K. Research and Remedies-Mumbai, Shri Ram

ISEF

The International Science and Engineering Fair (ISEF) began in 1950 as a platform to encourage pre-college students to conduct scientific research. Intel ISEF brings together more than 1,200 students from over 40 nations to compete for over 900 prizes. There is US\$ 4 million to be won, including scholarships, tuition grants, internships, scientific field trips and the grand prize: a trip to attend the Nobel Prize Ceremony in Stockholm, Sweden.



Hetal and Ankur explaining their project to a judge judging session at ISWEEP-2010

Institute-Delhi, and Junagadh Agricultural University-Junagadh. But we were not able to analyse our binder up to the extent where we can find its constituents, in the short span of time. It is a very complicated and lengthy process.

In the reply to the above question, we gave the judges the reason why we were not able to find the constituents of our binder and the chemistry of spoiled garlic. We told them that our binder is very sticky and very complex material, so if it is run through HPLC or GCMS column then it can spoil the column.

VP: What was in your opinion the one most important aspect of your project that got it the award?

H & A: The binder that we used for making particle boards is derived from spoiled garlic. Hence, it is eco-friendly and can be used in place of hazardous binders like phenol formaldehyde, melamine formaldehyde, etc.

Agriculture waste is used in place of wood to make the particle boards, thereby reducing de-forestation and making it eco-

friendly. Utilisation of agricultural waste for making particle boards, also helped reduce air pollution by preventing their burning.

VP: Do you propose to continue to improve this or leave it for others? What type of support will be required now?

H & A: We want to continue with this project. We have applied for a patent. To start making this product commercially, we need to make the design of the machine; we need to construct a pilot plant also. For this we require the technical and financial support.

VP: How has your academic performance been affected because of this competition, travelling, etc?

H & A: There is no significant effect on our academic performance.

VP: What subjects do you wish to pursue in college and why? (Ankur and Hetal can have different answers)

Hetal: I want to do first BSc, then MSc and then PhD. I want to do my MSc and PhD in chemistry.

Ankur: I also want to do the same, but I'd like to do MSc and PhD in physics.

Letters to the Editor

Coach or Player

I liked the way you drew parallels between a soccer game and development of resource materials for science communication (Editorial, Dream2047, August). You have put it very succinctly and lucidly. Thanks for the thought-provoking piece.

T V Jayan
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Andhra coffee

Thank you for the nice article about coffee, our favourite brew, which is very informative and enlightening. While the author discussed about Arabica and Robusta, no mention was made of Peaberry which is considered as a premium variety.

The author has mentioned that it is a favourite only in Tamil Nadu and South Karnataka. It is a great favourite of Andhriles also. Further, coffee is grown in Andhra Pradesh also, though quantitatively it is only a very small percentage. It has nonetheless won the Flavour of India - the Fine Cup Award in the years 2003, 2005, 2007, 2008, and 2009. The author has totally ignored Andhra.

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Corrigendum

In the interview with Lalita Balakrishnan (Dream 2047, August 2010), the caption of the photo at bottom on page 35 should read, ".....with solar lanterns developed by different manufacturers and propagated by AIWC." Instead of "....with solar lantern and solar panel, developed by AIWC".

In column 3 para 3, on page 35, please read "I had joined, already existing AIWC Branches in Delhi, Hyderabad, Bhopal, Haridwar, and at all these places I also started BHEL Ladies Welfare Association and did active work" instead of "We lived in Delhi, Hyderabad, Bhopal, Haridwar and in all these cities I established AIWC offices".

The Time is Ripe

The question often asked is: “Are you green and growing or ripe and rotting?” Now, thanks to the clues found by Indian scientists, “ripe” and “rotting” may not necessarily always be clubbed together. Not for 45 days at least—if it is the tomato we are talking about.

According to scientists at the National Institute of Plant Genome Research, New Delhi, there are two tomato genes that, when silenced or “knocked down”, allow tomatoes to remain ripe (without rotting) for three times as long as other tomatoes. This is indeed great news for cultivators and chefs alike.

Ripe challenge

Farmers know that fruit and vegetables perish quickly. If care is not taken during transport, they soon spoil and become unfit for consumption. In India the post-harvest losses of fruits and vegetables is enormous. About 35-40 per cent of the total produce is lost because it becomes excessively soft. This means that India incurs a loss, not only in terms of revenue, but also in terms of health because the fruits/vegetables are wasted.

Although ripe fruits taste best, the paradox is that even in the market, most buyers would rather buy a semi-ripe fruit because they know they will not be eating the fruit right away. They judge that if they buy a semi-ripe one, it would be ripe for a feast by the time they get around to consuming it. So the prudent shopper, knowing fully well that ripeness is the stage before a fruit begins to rot, would rather buy a semi-ripe fruit instead of an overtly ripe one.

The challenge therefore is to correctly judge the exact degree of “ripeness” when fruit should be harvested so that it can tempt potential buyers with its ripeness when it finally reaches the market. It is obvious therefore that ripening is a crucial parameter when it comes to both buying or selling fresh fruits and vegetables. Any method that can regulate ripeness is a boon to farmers and consumers alike.

Ripe for harvest

Normally fruits and vegetables are ready for harvest when these have reached ideal condition for consumption. This stage is called ‘harvest maturity’. However, Harvest maturity is not quite the same as physiological maturity, which is the term for the stage when the plant has completed its active vegetative growth and reached the stage of seed production. Harvest maturity includes the time required to reach the market. Thus it takes into account a degree of time lag. Usually, fruits and vegetables are harvested before these reach the maturity considered ideal for immediate consumption.



Green and growing

Ripening is often triggered by a signal...usually ethylene. Tomato too shows a rapid increase in the synthesis of ethylene at the beginning of the ripening process. In commercial fruit production, artificial ripening is used to control the rate of ripening, thus enabling transport and marketing to be carefully planned. Ethylene is used commercially for the artificial ripening of certain fruits. Another commonly used agent for artificial ripening is calcium carbide. However, the type of fruit under consideration also influences the strategy for that fruit.

Different fruits ripen at different rates and to varying degrees. Fruits such as mango, papaya and banana undergo drastic and extensive softening from “stone hard” stage to a “soft pulpy” stage. Fruits



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such as apple and orange do not exhibit such extensive softening. Obviously, the strategy to transport these two types has to be different.

Then again, fruits are classified as being either of the ‘climacteric’ or the ‘non-climacteric’ type when it comes to ripening.

- Climacteric fruits can be ripened off the parent plant. The respiration rate and associated rise of ethylene production (signal for ripening) gradually reaches a climacteric peak at the onset of ripening; after which it declines. Tomato is a climacteric fruit.

- Non-climacteric fruits are not capable of continuing their ripening process once they are detached from the parent plant. Also, these fruits produce tiny quantities of ethylene, and do not respond to external ethylene treatment. Non-climacteric fruits show a gradual decline in their respiration pattern and ethylene production, throughout the ripening process.

Molecular ripening research has focussed primarily on ethylene, but little is known of control before ethylene induction, or of common regulatory mechanisms shared by climacteric and non-climacteric species

Really ripe?

Almost nobody has trouble identifying a ripe fruit from an unripe one.

Unripe fruits are:

- Green with little/none of the tantalizing smells associated with the riper version.
- Smaller
- More sour/astringent
- Hard

Ripe fruits are:

- Visually striking: mostly red, dark (almost black) or yellow.
- Tempting when smelled



Hint of ripeness

- Luscious to look at
- Sweet and juicy.
- Soft to touch

Ripe fruits become soft because the tissue softens thanks to the increase in cell-wall degrading enzymes that act upon proteins and carbohydrates. Other structural alterations involve changes in cell wall thickness, permeability of plasma membrane, increased water content of cell wall, decrease in the structural integrity, and increase in intracellular spaces.

During ripening, colour, flavour, aroma and texture all change in a coordinated manner. The change in colour when the fruit is ripe happens because previously present pigments come to light when chlorophyll is degraded. There is also synthesis and/or accumulation of coloured anthocyanins and carotenoids such as β -carotene, xanthophyll esters, xanthophylls, and lycopene. The increase in flavour and aroma during fruit ripening happens because of the production of a complex mixture of volatile compounds and the degradation of bitter flavanoids, tannins, etc. Sweetness increases because of increased production of glucose, hydrolysis of polysaccharides (especially starch), decreased acidity, and accumulation of sugars and organic acids. Thus, increased respiration, chlorophyll degradation, biosynthesis of carotenoids, anthocyanins, essential oils, and increased concentrations of compounds influencing flavour and aroma mark the process of ripening.

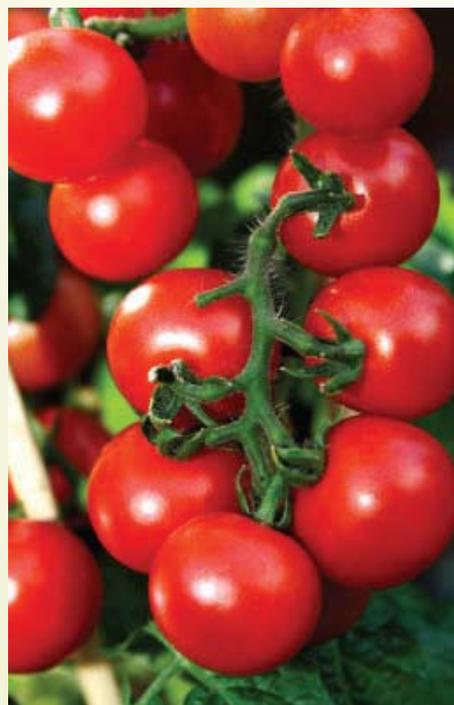
A host of enzymes also come into play during ripening and these bring on many of the changes we associate with ripening. Enzymes such as α -hexosaminidase, α -mannosidase and α -galactosidase are thought to play a major role in the softening of the fruit during ripening. In ripening tomatoes, to give a specific example, the activities of the enzymes α -hexosaminidase and α -

galactosidase, which are low initially during fruit development, significantly increase.

Ripening thus is coordinated manifestation of changes in colour, texture, flavour, aroma, and nutritional characteristics that render fruit attractive to those that eat it and thus assist in seed dispersal. Ripeness is followed by ageing or senescence. Then comes breakdown of the fruit...what we call rotting!

Regulating ripeness

The softening of ripe fruits increases risk of damage during shipping and handling. However, it is the softness of the fruit that directly impacts on palatability and influences consumer acceptability and also, shelf-life. Thus this is the one criterion that most scientists have sought to regulate. One



Ripe and Red



Rotting on the vine



Will you buy these

of the strategies to regulate ripening is to identify and characterise proteins expressed during the process and whose biochemical activities can be related to the observed changes. Initially efforts that were targeted at controlling fruit ripening sought to suppress genes that coded cell-wall degrading proteins. This is because these proteins play a key role in the softening associated with ripening and it is because the fruits are soft that they are squashed easily during transport.

Carbohydrates play a major role in the ripening process. The major classes of cell wall polysaccharides that undergo modifications during ripening are starch, pectins, cellulose, and hemicelluloses. Pectins are responsible for the texture and quality of fruits and it is pectin degradation during ripening that causes softening of the fruits. Pectin-degrading enzymes are active in fruit-tissue softening. Very early on, studies in fruit-ripening focussed on these enzymes, which were manipulated in order to suppress cell-wall degrading enzymes. However, this met with limited success and scientists turned to other strategies such as genetically modified tomatoes.

Genetically modified tomato

The first genetically modified (transgenic) tomato that was engineered to stay firm and fresh for longer was the Flavr Savr tomato in 1994. This was a genetically altered tomato developed by Calgene using anti-sense RNA technology to inhibit the expression of a gene that normally causes fruit to soften. Broadly speaking, anti-sense technology produces a molecule that blocks the target gene's ability to produce its protein. Unfortunately the Flavr Savr tomato was not a commercial success and was withdrawn from the market in 1997. However, the search for the perfect tomato that will remain firm, fresh and bruise-free went on.

Indian contributions

More than a decade ago, Dr. T N Prabha and her colleagues at the Central Food Technology Research Institute (a CSIR laboratory), Mysore, had identified two genes that were active in the process of fruit ripening. However, despite at least four acclaimed research papers (posthumous) that were published with Dr. K Srinivasan and her PhD student B Jagadeesh, which elaborated how these two genes affected fruit ripening, Dr. Prabha did not live to see her ideas come to fruition. She died aged just 55 in June 2002.

However, the recent research paper on tomato ripening that was published by Prof. Asis Datta and his colleagues of the National Institute of Plant Genome Research (NIPGR), Delhi, in the 9 February 2010 issue of the Proceedings of the National Academy of Sciences proves that the torch of Science is always carried forward, much like a baton relay race. It is fitting tribute indeed to the pioneering work that she

had done that Dr. Prabha has been named as a co-author. Incidentally, Dr. Prabha was a former student of Prof. Datta.

In the experiment that built on the studies of Dr. Prabha, the scientists at NIPGR successfully delayed ripening in tomatoes by 30-45 days. They achieved this by suppressing two enzymes responsible for ripening in tomato — the N-glycoprotein modifying enzymes, α -mannosidase (α -

Man) and α -D-N-acetylhexosaminidase (α -Hex). It has been known for some time that N-glycoproteins are common in cell walls and free N-glycans are present in the pericarp of tomatoes at all stages of growth, but mostly during the ripening process. Interestingly, blocking of N-glycosylation delayed ripening. This suggested that N-glycan processing is an important event in the ripening process. Thus, as the scientists have said, it was tempting to explore the possibility that, “genetic manipulation of N-glycan processing can be of strategic importance to enhance fruit shelf life,



Asis Datta

without any negative effect on either appearance or yield.”

The scientists targeted the N-glycan processing enzymes α -Man and α -Hex. They found that over-expression of α -Man or α -Hex resulted in excessive fruit softening and the signs of deterioration set in early. On the other hand, the suppression of α -Man and α -Hex enhanced fruit shelf-life, owing to the reduced rate of

softening.

In the experiment, expression of α -Man and α -Hex was silenced by using RNA interference (RNAi) technology. This is a method of blocking gene function by inserting short sequences of ribonucleic acid (RNA) that match part of the target gene's sequence; thus no proteins are produced. The RNAi technique offers specificity and efficacy in silencing gene(s) allowing its

actions to be studied.

The RNAi tomato plants grew normally and bore typical amounts of fruit. The tomatoes showed normal climacteric ripening and colour development while attached to the plant. However, these tomatoes held on to their texture and showed longer life. The RNAi tomatoes harvested at the pink stage, retained their texture for 25-30 days, whereas the control tomatoes started shrinking and losing their texture after 15 days. Also, the tomatoes with ‘silenced genes’ (that is those with suppressed expression of the two enzymes) were firmer than other tomatoes. Overall, the scientists reported, “a substantial improvement in the shelf-life” of tomatoes where N-glycan processing enzymes are targeted. They also say that α -Man and α -Hex activities are high in papaya, banana and mango, which raises the hope that this strategy may yield positive results for these fruits also. The team plans to conduct larger-scale open field trials, followed by multi-location trials before seeking clearance from Regulatory Authorities for commercial cultivation. The entire process is expected to take two years.

Tomato genome studies

With the explosive development of genome studies, the tomato genome with its 24 chromosomes is under scrutiny too. The tomato genome is being sequenced part of the International Solanaceae Genome Initiative. The project aims to develop the Family Solanaceae (to which both tomatoes and potatoes belong) as a model for Systems Biology. Tomato has been selected since it has the smallest diploid genome in the Family. It encodes approximately 35,000 genes. India too is part of this Initiative. The sequencing of tomato chromosome 5 is being jointly carried out at the University of Delhi, South Campus; National Research Centre on Plant Biotechnology; Indian Agriculture Research Institute and the National Centre for Plant Genome Research -- all at Delhi. The aim of tomato genome sequencing is to identify agronomically useful genes.

More than 80 genes related to ripening of tomato fruits have been cloned. Scientists know that tomato plants harbouring the ripening-inhibitor (rin) mutation yield fruits that fail to ripen. Thus, the rin mutation can be widely used in tomato hybrid cultivars to yield fruit with a long shelf-life and acceptable quality. ■



National Institute of Plant Genome Research

Personality disorders

Why Some People Think, Feel, and Act the Way They Do

My idea of an agreeable person is a person who agrees with me.

Benjamin Disraeli, Lothair

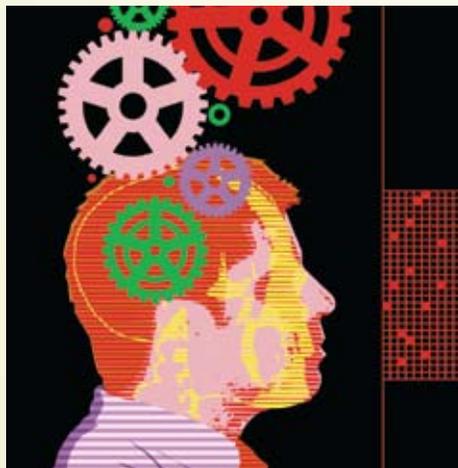
Warps in personality are common and nobody may quite make the perfect grade, yet some people due to a genetic lineage or harsh environment may develop a character that is at serious odds with the norms of their culture. These traits might take different forms and shapes and be recognised by a name, but there is also a school of thought that posits these personality disorders as a continuum between the normal functioning of the mind and a formal mental illness. Extremely hard to change, the salvation for a person with this disorder might lie in trying to mend the most dysfunctional aspects of their feelings and behaviour. While psychotherapy and behaviour therapy is useful in some situations, medications can be used to rectify the biological functioning of the mind if the disorder is serious and holds risk to self or others.

Mainly a hypothetical construct, the term 'personality' stands for a pattern of thought, feeling, and behaviour that identify a person. It is a sum of definite traits that are deeply ingrained, enduring, and unique about a person and distinguish him from the other people. An upshot of personal drives and influences from the outside world, it reflects predictability about how a person will act or react under certain circumstances. Usually, the more satisfactory a person's early development and experiences, the stronger and more balanced is his personality. People who fail to experience and integrate satisfactory early experiences tend to have personality structures that are faulty and manifest more primitive responses. The flaw may also lie in the genetic background or biological functioning of the brain.

Nobody fits the perfect bill. Most people, if not all, experience at least some difficulties and problems that result from their personality. The specific point at which those problems justify the diagnosis of a personality disorder is difficult to tell, but if it significantly impairs social or work functioning, is repetitive and inflexible, is stable over time, and is annoying to others, there clearly is a problem.

Broadly, the farther a person digresses from the code of one's culture the more severe

is the disorder. Yet, people who deviate from cultural norms are not necessarily dysfunctional, nor are people who conform to cultural norms necessarily healthy. The truth is, many personality disorders represent extreme variants of behaviour patterns that people usually value and encourage. For instance, most people value friendliness but not submissiveness, self-belief but not arrogance, and conscientiousness but not perfectionism. The dividing line may at times be rather hazy. In fact, a behaviour that seems deviant to one person may seem normal to another depending on one's gender, ethnicity, and cultural background.



Based on the predominant symptoms and their severity, personality disorders have been categorised into several subtypes. The current edition of the Diagnostic and Statistical Manual of Mental Disorders portrays ten personality disorders, while others describe twelve. Each of them reflects a developmental maladaptation from an early age, and yet, each is distinctly different from the other.

If you were to evaluate yourself on the altar of their characteristics, you might find yourself fitting into many of the subtypes! However, do not feel distraught unless you find these traits are pervasive enough to bring you into conflict with others and handicap your daily functioning. Just remember, you cannot be agreeable to everybody even if you



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tried. The idea, equally, is to try and develop an understanding of the behaviour of people you intermingle with.

Let us now look into the common deviants of personality.

Paranoid personality disorder

People with a paranoid personality are constantly defensive, secretive, suspicious and distrustful toward other people. They believe that others are against them and constantly look for evidence to support their suspicions. They doubt the trustworthiness and loyalty of acquaintances and friends, persistently bear grudges against others, and are reluctant to confide in others because of the fear that the information will be used against them. They are hostile toward others and react angrily to perceived insults reading hidden meanings into gentle remarks or events, perceive attacks on their reputation where none is intended, and are suspicious about the fidelity of their sex partner.

They may be objective, rational, and unemotional, but they are often rigid and cannot accept criticism. Their aggressive suspicious nature usually spurs a hostile reaction from other people and makes them extremely unlikely. They find it difficult to collaborate with others and have few close relationships. Due to these handicaps, they need to be self-sufficient and autonomous to be able to maintain themselves.

The disorder may surface during the teens with solitariness, poor peer relationships, social anxiety, hypersensitivity and underachievement in school. Some 0.5 to 2.5 per cent of people are affected by a paranoid personality disorder. It is more common in males.

Schizoid personality disorder

People with schizoid personality are shy, introverted, detached and distant from other people. Socially withdrawn, they have few close personal relationships, and do not care much to be a part of the family. They are emotionally cold. Being loners, they prefer solitary pursuits and remain preoccupied with

mechanical or abstract activities. Bookish, reserved, out of touch with others, they are relatively blind to social cues and their personal lives are usually barren. However, this remote exterior may belie the strong emotion which they may hide in their bosom. To find a vehicle for their private feelings, they may keep a diary or indulge in daydreaming.

They seem indifferent to appreciation or criticism by other people and may not react actively even if circumstances so demand. Since they lack social skills and have no desire for sex, they also may not marry.

More common in men, a schizoid personality usually finds it difficult to operate well at work, particularly if a job requires working with other people. But they may do well in vocations that can be done singly or without intimate social interaction.

Schizotypal personality disorder

People with schizotypal personality engage in bizarre thinking, speech, and behaviour. They are superstitious, believe in clairvoyance, telepathy or sixth sense, and may feel that they have special powers to sense events before they happen and can read the thoughts of others. They tend to use words and phrases in unusual ways, and may think they have magical control over other people. They suffer unusual bodily illusions and may feel that there is another person present, or they may hear a voice murmur their name. Due to their odd thinking, they may behave in a strange manner. For instance, they may walk past a specific object several times to avoid an imagined harmful outcome.

People with schizotypal personality disorder are often also overly suspicious. This makes them uncomfortable in relating to other people. They have few or no close friends and feel anxious in social situations. The disorder affects three per cent of all people. Most look for help due to symptoms of anxiety, depression, or restlessness. The disorder usually has a relatively stable course.

Antisocial personality disorder

A person with antisocial personality acts in a way that disregards the feelings and rights of other people. Lacking in conscience, he comes into conflict with the code and customs of the community, and still does not realise his mistakes. He is chronically in trouble and may not hesitate to use or exploit other people for his own gain. He may lie repeatedly, act impulsively, and get into physical fights. Loveless, indifferent

and destructive, he cannot form satisfactory relationships, and may suffer failures in his personal, work-related and social life.

Many people with antisocial personality are superficially likeable and charming, and initially mislead well-meaning people whom they subsequently disappoint and mortify. They may mistreat their spouses, neglect or abuse their children, and exploit their employees. They often engage in impulsive behaviour and may dismay others by their uncontrolled, destructive outbursts.

Individuals with antisocial personality usually fail to understand that their behaviour is wrong because they simply do not have a conscience. The fact is, even if guilt, remorse, shame, and anxiety make for unpleasant



feelings, these emotions are crucial to healthy social functioning and even physical survival. Antisocial personalities may take chances that other people would shun. They may engage in kleptomania, gambling or physical assaults repeatedly.

The disorder affects about three per cent of males and one per cent of females. People with this disorder are at high risk for poor personal life, loss of employment, bankruptcy, injury, alcoholism, drug dependence, imprisonment, and premature and violent death.

The disorder runs a chronic course but may become a little milder as the individual gets older. Those affected by this disorder were in the past called sociopaths or psychopaths, and gave a lot of stuff to writers to weave a novel or a film around them.

Borderline personality disorder

People with borderline personality suffer from a chronic feeling of emptiness, and make frantic efforts to avoid real or imagined abandonment by others. They experience inappropriate anger even when there are unavoidable changes in plans. For example, they may panic or burst into intense fury if somebody important to them is even a few minutes late. Even on such minor disappointments, they may develop severe frustration, anger, and dismay and they may indulge in suicidal behaviour, self-mutilation, and other self-destructive acts.

Individuals with this disorder have a pattern of unstable but intense relationships. At first they may impress people as stimulating and exciting, and may share the most intimate details about themselves early in a relationship. But they can turn bitter or angry at the slightest of reasons, and their relationships tend to be unstable and explosive.

People with borderline personalities also tend to have an unstable self-image or sense of self. This reflects sudden changes in their career plans, change in values, and change in type of friends. They may also at times sense such major void in their life that they begin to feel as if they do not exist at all.

The disorder may also lead to impulsivity. In addition to self-mutilating acts, they may gamble, spend money irresponsibly, abuse substances, binge eat, drive recklessly, and engage in unsafe sex.

About two per cent of all people have borderline personality disorder. Out of every four with this disorder, three are women. Borderline personalities run a high risk of depression, bulimia (an emotional disorder characterised by an obsessive desire to lose weight, in which bouts of extreme overeating are followed by fasting or self-induced vomiting or purging), stress disorders, dissociative disorders, and drug dependence. About 10 per cent of people with this disorder commit suicide by the age of 30.

Histrionic personality disorder

People with histrionic personality constantly strive to be the centre of attention. Often lively and dramatic, they may initially charm new acquaintances by their enthusiasm, apparent openness, and overly flirtatious behaviour. They believe in being the life of the party, being charmers, and do not hesitate in making up stories or even creating a scene to draw attention. Their appearance, including the apparel and looks, and behaviour is

seductive. This may easily mislead the people they come in contact with, but it does not necessarily reflect their romantic interests. They usually talk in a dramatic or theatrical fashion and display exaggerated emotional reactions. They may embarrass friends and acquaintances by excessive emotional display, such as embracing casual acquaintances with excessive passion, sobbing for no real good reason, or having tantrums. They also suffer from a high degree of suggestibility and are easily influenced by others.

Without being aware of it, people with this disorder may seek to control their partner through emotional manipulation on one level, whereas displaying a marked dependency on them at another level. Their clamour for constant attention may ruin their personal relationship with friends. They look for novelty and excitement and are easily frustrated if their actions are not met with immediate gratification.

The disorder is found in about two or three per cent of people. Women outnumber men, but only because they are more likely to be noticed. In the male-dominated milieu, a man with this disorder may just be tolerated as a macho, while a woman would stand out if she is provocatively dressed or acts in a seductive fashion.

Narcissistic personality disorder

People with narcissistic personality have a grandiose sense of self-importance. They seek excessive admiration from others, routinely overestimate their abilities, and boast unabashedly about their deeds. They fantasise about unlimited success, power, brilliance, and beauty and compare themselves favourably with the famous and beautiful. They believe they are special, unique, and superior to others and may think they are only meant to associate with the very best and top of the range people, places and activities. They may fish for compliments and are furious when this does not happen. They tend to develop relationships only if the other person seems likely to advance their self-esteem and do not hesitate to exploit a relationship.

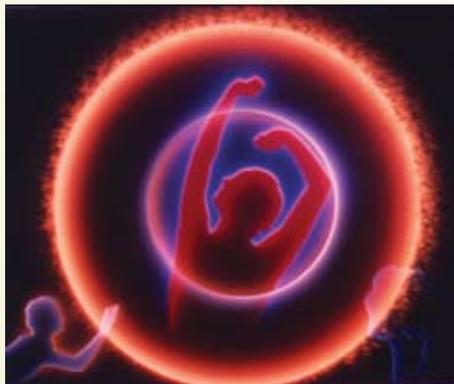
They mostly lack concern for others and have difficulty in recognising the desires and feelings of others. They do not have an ear for listening to the concerns and problems of others and may appear extremely insensitive to their hurts and emotions. They may be envious of others or think that others are envious of them. They may exhibit snobbish, arrogant and haughty behaviour.

Narcissistic personalities, however, have a very fragile self-esteem. They may not show it outwardly, but they are easily stung by criticism which leaves them emotionally bruised. In such a situation, they may react with scorn, rage or counterattack.

Due to an overwhelming need for admiration at all times and the insensitivity to the sentiments of others, they have few lasting relationships. They are also vulnerable to depression, hypomania (a mild form of mania), and might not achieve much in their work because of their poor attitude. The disorder is found in less than one per cent of people.

Avoidant personality disorder

People with avoidant personality suffer from social shyness, feelings of inadequacy and hypersensitivity to negative evaluation. They are intensely reserved, quiet, inhibited, and withdrawn. They try to be invisible and feel



afraid that no matter what they say, others will reject it, and so they say nothing at all. They are loath to work with other people because of an inner fear of being criticised, disapproved, or rejected. So deep is their fear that they might even reject a promotion and prefer to remain on a lower rung of the official hierarchy. Although capable of developing a close relationship if assured of uncritical acceptance, they usually hold back from intimate associations for fear of being shamed or ridiculed.

Avoidant personalities have low self-esteem and feel inadequate about themselves. They view themselves as socially inept and inferior to others. They are usually reluctant to engage in any new activities because they fear it may prove embarrassing. These self-doubts may make them the butt of ridicule by others. These individuals may become socially isolated and may have little or no social support group to bail them out in a moment of crisis.

The disorder affects 0.5–1.0 per cent of people. It is equally distributed among males

and females. The disorder begins at a young age, runs a chronic course, and becomes milder with age.

Dependent personality disorder

People with dependent personality have a severe and disabling emotional dependency on others. They are submissive and prefer to cling to others for support and advice at all times. They may experience difficulty in taking even simple everyday decisions as to the colour of dress to wear to work, or the briefcase they should carry. They need a great deal of guidance and reassurance, and usually depend on a parent or spouse to choose the kind of job for them, who to befriend, and how to lead their life. Since they are overly dependant, they do not express disagreement with other people and might even agree with things that they feel are grossly wrong. Due to lack of self-confidence, they have difficulty in doing things by themselves despite the fact that they might be quite capable of functioning adequately. They might go to any length to please those whose support they yearn for. Even if a task is unpleasant, necessitates self-sacrifices, or implies verbal, physical or sexual abuse, they accept it to avoid losing the relationship. They feel uncomfortable by themselves. If a close relationship comes to an end, such as on the death of a caregiver or spouse, they eagerly seek out another relationship to fulfil their emotional need of care and support.

Due to their self-doubts, pessimism, and constant need for nurturance, they may avoid positions of responsibility and lag behind in their professional career. Their social relationships are also limited only to people on whom they are dependant. The disorder is fairly common and is found more commonly in women than men.

Obsessive-compulsive personality disorder

People with obsessive-compulsive personality disorder are preoccupied with details, orderliness, perfection, and control. Their attitude is mostly so inflexible that in going for details, the objective of the activity might be lost. Even though they devote excessive amounts of time to work and productivity, their perfectionism might delay the project and interfere enormously with its completion timeframe. They also loathe delegating tasks to others unless those people submit to exactly their way of doing things. They are generally rigid, formal, stubborn, serious,

and fail to take time for leisure activities and friendships. They also have a miserly spending style towards both self and others and might maintain a standard of living far below what they can afford, believing that spending must be checked for future catastrophes.

This personality trait is found in about one per cent of people and twice as much in men as women. It differs from a full-blown obsessive-compulsive disorder both in severity and extent.

Other personality disorders

Many psychiatrists use two additional diagnoses. One of them relates to people with depressive personality disorder. They are overwhelmed by a sense of chronic pessimism, gloominess, and cheerlessness. They brood and are given to worry; are critical and derogatory towards self; and appear negativistic, critical and judgemental towards others.

In contrast, people with passive-aggressive personality show a negative, sullen and argumentative attitude; are stubborn and procrastinating by nature; they passively resist completing tasks and chores, criticise and scorn authority figures, eye others with envy and resentment, and voice exaggerated complaints of misfortune.

What causes the personality warp?

Controversies

There is a growing consensus among researchers engaged in explorations of the mind that personality disorders are not just a product of life experiences, but also hinge on inherited genetic traits and biological malfunctioning of the brain. For example, the roots of dependent personality disorder may be in a genetic anxiety flaw. Overly protective, clinging or, contrarily, neglectful parenting and a fearful temperament during childhood may just be the stuff that germinates this flaw into a full-blown personality disorder. While this mix of factors seems to be most plausible, in the present molecular era the pendulum is swinging more and more in favour of the biological perspective. It makes small of the significance of life experience and emphasises genetic and other biological factors.

The biggest endorsement of the genetic basis of personality disorders has come from behavioural studies carried on identical twins raised in different homes and cultural settings. The same faults in personality were detected in a large number of identical twins even though they were reared in different homes.

Associations between specific biological factors, including hormones, neurotransmitters and electrophysiological aberrations on one hand, and a personality disorder on the other have also been identified. For example, people who have impulsive traits often have increased levels of testosterone, 17-oestradiol and oestrone.

Despite these biological associations, it will be naïve to negate the significance of life experience altogether in shaping the personality. Interplay of all factors may be behind most disorders. Let us take the two most serious personality disorders before resting the case. A genetic predisposition to mood disorder may open up a person to acquire a borderline personality disorder, if he or she experiences parental neglect, intense marital conflicts between parents, or repeated episodes of severe emotional or sexual abuse. Similarly, a genetic predisposition to alcoholism, impulsiveness and violence may lead a person to antisocial personality disorder if he or she has a troubled childhood marked by inconsistent parenting, and a harsh environment that develops emotional coldness and prizes aggressiveness and exploitation.

Treatment

Changing an innate human trait is extremely difficult, and the difficulty quotient spirals if the person is not ready for it. Yet, most people with warped and disorderly personalities often fail to recognise that it is their personality that has contributed to their social, occupational, and personal problems. They may think they have no real problems despite a history of failed relationships, erratic jobs, and failures in making good the promise they held. The beginning therefore must be made with an attempt to help the person understand the significance of his or her personality traits. Family members, friends, peer group, and therapists all can play a role. Once the realisation dawns, people can try and mend the most dysfunctional aspects of their feelings and behaviour.

Psychotherapy

The treatment of personality disorders relies on long-term psychotherapy. The basic thought is to try and recreate pathologic patterns of interaction with the world at large, examine faulty defence mechanisms at play and finally, if possible, iron them out through a controlled therapeutic relationship. A variety of approaches continue to be in use and the choice of treatment is guided by the nature of the disorder.

Therapists sometimes use cognitive and behavioural techniques, such as role-playing

and logical argument, to help alter a person's irrational perceptions and assumptions about himself. Aversive behaviour therapy may also be fruitful, particularly in some of the relatively less serious disorders if practised regularly. It calls for a simple punishment, such as disapproval, immediately after a specific behavioural response. When practised regularly, the behaviour pattern is eventually inhibited and extinguished. Sending a child who has done a wrong on time-out uses the same concept. Not responding at all to an inappropriate behaviour may work along similar lines, where a lack of response eventually causes a person to abandon that type of behaviour.

Individual-group therapy has also been found useful when specific interpersonal behaviour needs to be improved. This may work well in the case of schizoid, avoidant, and histrionic personalities.

Some therapists also prefer to use a technique called dialectical behaviour therapy in treating people with borderline personality disorder. Using logical arguments, they help a person arrive at the truth and develop skills to cope with anger and self-destructive impulses. Once the risk of suicidal tendencies stands curbed, the therapist focuses on developing personal strength in the individual to learn to accept the disappointments and interpersonal conflicts that are a natural part of life.

Most of these treatments can be taken by a person as an outpatient, but in more severe disorders, such as antisocial personality disorder, residential treatments have also been tried. The focus is on a strict supervision of the person's behaviour and imposing rigid, consistent rules and responsibilities. These programmes appear to help some people, even though it is unclear if the benefit is permanent.

Medications

As the role of biological factors has come to the fore, physicians have started to use medications to help control symptoms. Antidepressant medications, low-dose anti-psychotic medicines, and mood-stabilising agents have all been tried successfully to overcome feelings of anxiety, depression, or severe distortions of thought. In all cases, however, it is important for both physician and patient to have reasonable expectations as to the possible benefit of medication. While beneficial responses may be subtle and observable only over time, it has to be borne in mind that long-term medication also carries a risk of side effects.

Technology Solutions to Energy Issues – Dissemination strategies



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The system of water, energy, environment and agriculture comprise the four major components of the Earth system concerned with life support. Technology (and science) cuts across the four systems. An integrated multi-level system is needed to address the problem of global change with its demographic, environmental, climatic, biological, technological, economical, social, and health components. Natural and human-engineered resource systems, such as environmental security, energy security, and security of food and freshwater supply have already become critical. There is a growing concern about the unprecedented damage being done to the planet Earth. At the same time, there are many examples at different levels of society of actions for positive change.

No country can be termed a developed country without adequate power, efficient transmission and equitable distribution throughout the country. India has progressed from a meagre 1,362 MW in 1947 to about 128,000 MW in 2006 but this is not enough to keep pace with the rising load demand. Even today, there is a peak power deficit of at least 11 per cent and energy shortage of about 6 per cent. There are issues of quality of power supply (fluctuations and stability) that are often critical.

Emphasis is being placed on alternative and renewable energy sources such as wind energy, biomass, and solar and hydro energy in order to bridge the demand-supply gap. This has received a major thrust under the Prime Minister's National Action Plan for Climate Change. Energy conservation and efficiency are crucial in the power sector. Every unit saved is a unit generated.

Suitable opportunities already exist for adopting environment-friendly technologies in the area of energy, transportation, water conservation and use, agriculture and industry. Many of the eco-friendly technologies can be adopted in a decentralised manner. Bio-fuels potentially supply some 30 per cent of global demand in an environment-friendly manner without significantly affecting food production. While oil will not disappear in the near future and even after the recent surge in its prices, farm-grown bio-fuels such as ethanol and biodiesel will account for no more than a small fraction of fossil fuel use. Some micro-algae are efficient miniature biochemical factories and also good CO₂ fixers. Municipal and industrial organic waste treatment for composting has received inadequate attention. Recycling, reuse and reduced energy consumption deserve to be widely encouraged as also the use of solar heating and cooling and electric technologies, energy-efficient design, ventilation and improved insulation of buildings to reduce the consumption of energy in buildings. The use of safe industrial and agricultural waste products and other types of low-energy and recycled building materials in construction also should be encouraged.

Possibilities and challenges of the coming decade and the roles of the state, civil society and research institutions need refining for a more just and equitable world. Sensitising the policy makers and developing their capacity for better decision making is crucial.

The development and dissemination of new and environmentally sound technologies, including the reduction of metal compounds as part of transportation

fuels and good practices in the use of energy, deserve to be popularised, promoted and encouraged. How can you lead campaigns that help society make better choices?

Existing mass media including television, radio and print offer many opportunities. Personal interaction through lecture demonstrations, dialogue and debates need to be harnessed. Efforts will have the objectives of bringing into focus, among other issues, the following:

1. Identification of social and environmental benefits of alternative energy among college students;
2. Options to upgrade biomass fuels so they can be used for a broader range of markets and applications (e.g., wood pellet fuels) to decision makers;
3. Improving efficiency of utilising energy and its conservation to opinion makers; and
4. Biomethanation for the disposal of organic residues and waste products of agricultural products and in animal husbandry to research scientists.

The next few weeks will witness every college and university organising its cultural festival with opportunities for expressing and developing the creative potential of the participants. There are competitions and exhibitions that demonstrate the rich variety of forms available. Can the above concerns not be integrated in these creative expressions?

□ **Anuj Sinha**

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Humphry Davy

Founder of Electrochemistry



Subodh Mahanti

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wide coverage in newspapers and magazines. Through his public lectures he popularised his experimental discoveries in chemistry, electrochemistry, agriculture, geology, and catalysis. Davy's popular lectures helped the Royal Institution become a social and financial success.

Davy was an enthusiastic poet and he wrote a number of poems. He had friendly terms with eminent poets like William Wordsworth (1770-1850), Samuel Taylor Coleridge (1772-1834), and Robert Southey (1774-1843). Coleridge said that if Davy "had not been the first chemist, he would have been the first poet of his age." Southey declared that "he (Davy) had all the elements of a poet; he only wanted the art." John Ayrton Paris said that Davy's verses "bear the stamp of lofty genius." It can be said that Davy could have become a noted poet if had pursued his interest in poetry seriously. However, many point out that his sporadic writings did not show any true poetic imagination.

Humphry Davy was born on 17 December 1778 at Penzance in Cornwall, UK. His father Robert Davy was a wood-carver. He was representative of a very old family—his ancestors could be traced as far back as 1635. Robert Davy took his profession as more of a hobby rather than a means of earning money. Humphry's mother Grace Davy (nee Millet) had been adopted by John Tonkin, an eminent surgeon of Penzance after the untimely death of her parents. It was Tonkin who first placed Davy in a preparatory school. Tonkin was very much impressed by the progress made by the boy and so he persuaded Davy's father to send him to a better school. And so, at an early age Davy was sent to Penzance Grammar School, where he studied under Rev. J. C. Coryton. Young Davy displayed an unusual inquisitiveness to acquire knowledge at an early age. He possessed a remarkable memory and was fond of reading books, especially history books. One of his favourite

"I have learned more from my mistakes than from my successes."

Humphry Davy

"Language is not only the vehicle of thought; it is a great and efficient instrument in thinking."

Humphry Davy

Humphry Davy made important contributions to the development of chemistry. To realise the importance of his contribution we should understand the state of chemistry in his time. To do this we quote here from *The History of Science in the Nineteenth Century* by Ray Spangenburg and Diane K Moser: "The year was 1829 (referring to the year in which Davy died), and for chemistry, the century had only just begun, bolstered by the atomic theory of John Dalton, the new tool invented by Volta and the extraordinary discoveries of new elements, to continue to search out more new elements and to make sense of the vast jungle of molecules that form with the element carbon. Progress in all these fields was soon to come." We should also remember that in England when Davy was trying to pursue a career in science only the Royal Astronomer could be described as a professional scientist.

Davy is mostly known today for his discovery of metals namely sodium, potassium, calcium, magnesium, barium through electrolysis of their compounds. He also discovered boron. He established the elemental nature of chlorine and iodine. It was Davy who put an end to Lavoisier's theory that oxygen is an essential component of acids. In 1806, he delivered the Bakerian Lecture. The lecture, which was titled "On Some Chemical Agencies of Electricity", was hailed by Jons Jacob Berzelius as "one of the best memoirs which has ever enriched the theory of chemistry." The Bakerian Lecture is a prize lecture of the Royal Society which was established by Henry Baker in 1775 when he left 100 pounds for a spoken lecture by a Fellow on such part of natural history or experimental philosophy as the Society shall determine.

Davy invented the Davy lamp (1815), which allowed miners to work safely in presence of inflammable gases. Davy had found in 1801 that nitrous oxide had the ability to entirely take away the sensation of pain and thus it was a hint that it could be used as anaesthetic in surgery. However, his suggestion was not taken up for another half a century.

Davy was a great science populariser. He joined the newly established Royal Institution as a chemist in 1801 where he gave public lectures accompanied by experimental demonstrations. He conducted



Humphry Davy

experiments in different areas of science and had wonderful ability of storytelling. By his dramatic presentation he could easily captivate his audience. His lectures used to be attended by a large number of people. His public scientific lectures used to be important social events and they were given

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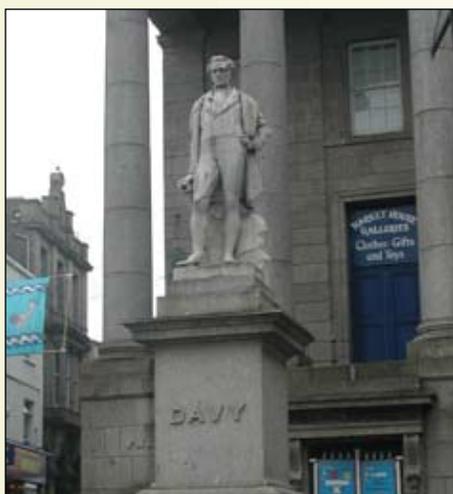
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Statue of Davy in his hometown of Penzance

books was *Pilgrim's Progress*, written by John Bunyan (1628-1688), a Christian writer and preacher. When he was eight years old, Davy used to give lecture standing on a cart in the market place on the subject of his latest reading. His audience consisted of fellow students and he used to be thrilled by the applause by his companions.

While at the Penzance Grammar School Davy developed an interest in conducting scientific experiments mainly encouraged by Robert Dunkin, who was a member of Society of Friends (a Christian denomination founded in England about 1650 by George Fox). Dunkin was an accomplished experimentalist and he himself had constructed an electrical machine, voltaic piles, Leyden jars and models for illustrating mathematical principles. In 1793, he moved to Truro to complete his school education under Rev. Dr. Cardew. Davy learned a lot of chemistry from reading books.

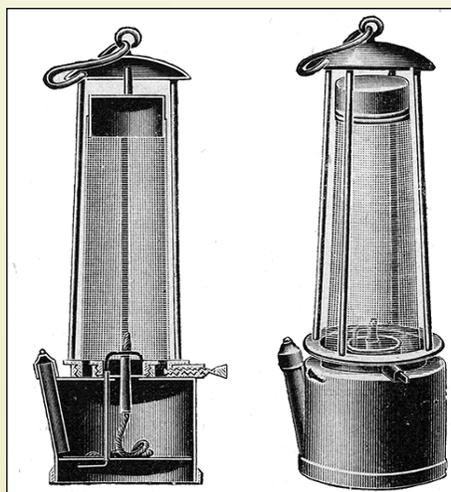
In his childhood Davy largely taught himself. He once said: "I consider it fortunate I was left much to myself as a child, and put upon no particular plan of study...What I am, I made myself."

After the death of his father, Davy was apprenticed to John Bingham Borlase, a well-known physician of Penzance. This happened because of the initiative taken by John Tonkin. In the dispensary of the physician Davy served the role of a chemist. He also started conducting experiments in the attic in Tonkin's house. His friends used to be alarmed by his rather dangerous experiments and would often say: "This boy Humphry is incorrigible. He will blow us all." His eldest sister would also often complain because her dresses used to get damaged by the corrosive

chemicals used by Davy.

In 1798, Davy joined the Pneumatic Institution at Bristol founded by Dr. Thomas Beddoes. The main objective of the institute was to investigate the medical powers of different gases (or airs). Davy's role was to conduct different experiments on the gases. While conducting these gas experiments Davy had to subject himself to considerable risks. Inhaling nitric oxide had the danger that it could have combined with common air in the mouth and form nitric acid capable of severely injuring mucous membrane. Describing his experiment with carbon monoxide he described that after inhaling the gas he "seemed sinking into annihilation." It took hours before the painful symptoms ceased. He produced a large quantity of nitrous oxide or laughing gas. He often demonstrated the effect of the gas publicly. Describing his own experience after inhaling the gas he wrote: "My first definite sensation was dizziness, such as to induce a fear of falling. This was momentary. When I took the mouthpiece furnishing the gas from my mouth, I immediately laughed. The laugh was involuntary, but highly pleasurable, accompanied by a thrill all through me. And a tingling in my toes and fingers, a sensation perfectly new and delightful." In the Pneumatic Institute Davy also conducted experiments with voltaic batteries.

Davy joined the Royal Institution in 1801. The Royal Institution was established in 1799 by the eminent British scientists including Henry Cavendish. Its first President was George Finch, the 9th Earl of Winchilsea. The Institution established for "diffusing the knowledge, and facilitating



The Davy Lamp



Davy's gravesite in Geneva

the general introduction of useful mechanics invention and improvements; and for teaching by courses of philosophical lectures and experiments, the application of science to the common purposes of life". The 'Society for Bettering the Condition and Improving the Comforts of the Poor', under the guidance of philanthropist Sir Thomas Bernard and American-born British scientist Benjamin Thompson (Count Rumford) supported the Royal Institution in its initial years.

Davy had been interviewed for the post by Joseph Banks, Benjamin Thompson (Count Rumford) and Henry Cavendish. The resolution of the Royal Institution appointing Davy said: "...that Humphry Davy be engaged in the service of the Royal Institution in the capacity of assistant lecturer in chemistry, director of the chemical laboratory, and assistant editor of the journals of the institution, and that he be allowed to occupy a room in the house, and be furnished with coal and candles, and that he paid a salary of 1001 (pounds) per annum."

Davy was a pioneer in the field of electrolysis. He successfully used the voltaic pile to prepare many new elements by splitting common compounds using the voltaic pile. He discovered potassium in 1807 by electrolyzing caustic potash (KOH). Potassium happens to be the first element to be isolated by electrolysis. The name "potassium" was also coined by Davy. In 1807 he also isolated sodium by passing an electric current through molten sodium hydroxide. The name "sodium" was also given by Davy. In 1808, he isolated calcium, which was also independently isolated by Berzelius and Pontin. Throughout his life Davy worked with electrolysis. He went on



Michael Faraday

to discover magnesium, boron and barium.

It was Davy who established the elemental nature of chlorine in 1810. It may be noted that chlorine was discovered in 1774 by the Swedish chemist Carl Wilhelm Scheele, who produced the gas by reacting manganese dioxide (MnO_2) with hydrogen chloride (HCl) solution also called oxymuriatic acid. Scheele termed the gas “dephlogisticated marine acid” and he mistakenly thought that it contained oxygen. The name “chlorine” was given by Davy. He also demonstrated that oxygen could not be obtained from oxymuriatic acid. Davy’s observation was important because it disproved Lavoisier’s definition of acids as compounds of oxygen.

Davy damaged his eyesight while experimenting with nitrogen trichloride. It may be noted that Pierre Louis Dulong, who first prepared nitrogen trichloride in 1812, also lost two fingers and an eye in two separate accidents resulting from handling the compound. Davy’s accident proved to be a major incident in the history of science as it induced him to engage Michael Faraday as his assistant.

In 1813, Davy resigned his Professorship at the Royal Institution and went on a two-year tour of the European continent. He was accompanied by his wife, Michael Faraday, and two boxes of apparatus. Irrespective of the fact that England was at war with France, Napoleon welcomed Davy’s visit. It is said that Davy had remarked: “There is never a war among the men of science.” In France he characterised iodine as a true element. In Italy he undertook some of the earliest analyses of the pigments used in ancient paintings and there he also burnt diamond

to prove that it was identical to carbon.

In 1815, Davy invented a lamp for use in deep mines by miners. The lamp later became known as the Davy lamp. The invention was made in response to a letter received from Newcastle miners informing that they faced danger from methane and other inflammable gases which often filled the mines and could easily be sparked off resulting in fires and explosions causing many deaths. The flame in the Davy lamp is enclosed inside a mesh of wire, which acts as flame arrestor. Air can easily pass through the mesh to support combustion or any flammable gas to burn inside but the holes of the mesh are so fine that they do not allow the flames to go out and ignite any flammable gas present. The Davy lamp could also crudely detect the presence of any flammable gas because in the presence of such gas the flame of the Davy lamp would burn higher with blue tinge. In case the mine air was oxygen-poor, the lamp flame would be extinguished. George Stephenson had invented a similar lamp in 1816. There was dispute on the question who invented the lamp first. However, the Davy lamp was simpler and cheaper and it was popular with mine owners. His other practical inventions were carbon arc light and cathodic protection of the copper hulls of warships.

Davy made a great contribution to science by giving an opportunity to Michael Faraday to work in the Royal Institution. As we know, Faraday went on to become one of the greatest scientists of the world. Towards the end Davy was not very appreciative of Faraday. Many think that Davy was zealous of Faraday’s unprecedented success. Davy opposed Faraday’s nomination to the



Carl Scheele



Joseph Banks

Fellowship of the Royal Society three times. Faraday could become Fellow of the Royal Society only after Davy resigned from the Presidentship of the Royal Society.

Davy was elected a Fellow of the Royal Society of London in 1804 and he also served as its President (1810-1827). He was elected a foreign member of the Royal Swedish Academy of Sciences. Davy was a founding Fellow of the Zoological Society of London. A lunar crater is named after Davy. To honour Davy a plaque was included on the wall of the Royal Panopticon of Science and Art in 1854, the institution which was one of the grand social institutions and architectural splendours of the Victorian London, was later closed. His hometown Penzance has a secondary school named Humphry Davy School.

A pub in his hometown is named after Davy, it is called “Sir Humphry Davy”. Interestingly there are also pubs named after James Prescott Joule and Isaac Newton. Davy is the subject of a humorous song by Richard Gendall, each verse of which recalls one of Davy’s major discoveries. The song was recorded by Cornish folksinger Brenda Wootton in 1980. A comedy script about the life of Davy was produced by the Truro-based production company O-region. The comedy script was written by Nicke Darke, a Cornish playwright in 2005. Darke died before he could complete the work and it was completed Carl Grose, a Cornish actor and playwright.

Davy died on 29 May 1829. He was given a state funeral. He is buried in the Plainpalais Cemetery in Geneva.

continued on page 23

Hetal and Ankur

Student innovators par excellence

By using agricultural waste and the natural binder derived from spoiled garlic two students of Rajkot, Gujarat - Hetal Kanjibhai Vaishnav, Shree S.G. Dholakiya Memorial High School, and Ankur Kanjibhai Vaishnav, of Shree P.V. Modi School, have developed an eco-friendly particle board that has been recognised at the international level. The two students have won an award at the I-SWEEP, the International Sustainable World (Energy, Engineering, and Environment) Project Olympiad, for their project.

Er Anuj Sinha, Director, Vigyan Prasar and Consultant, Department of Science and Technology interacted both the students on their project and story of success; for the motivation of students towards science.

VP: Tell us about your project and explain why it is innovative.

H & A: After harvesting the crops the agricultural waste is usually burnt by the farmers. Such agricultural waste includes wheat husk, cotton straw, groundnut husk, etc. This spreads air pollution. There is no other use of this type of agricultural waste. Secondly, crops grown from Bt seeds have

harmful effect on earthworms. If Bt crop waste remains in the ground for a long time, it affects the fertility of the soil. Hence the farmers cannot use Bt crop waste as organic manure. And they are left with no other option except burning the crop waste.

The life of garlic is about 6 to 8 months. Right from the process of harvesting till it reaches the customer nearly about 25%

no use to anyone. On the other hand, the binders used in making particle boards are harmful with respect to the environment and human health. Such binders include phenol formaldehyde, melamine formaldehyde etc.

By using agricultural waste and natural binder derived from spoiled garlic we have been able to make particle boards which can be used in furniture applications.

The ecofriendly particle boards were made by employing both agricultural waste and spoiled garlic waste. By doing so, the cutting of trees for furniture applications can be reduced. Also, the air pollution caused by burning such waste can be reduced.

Indirectly, it would help the farmers, who can sell the agriculture and garlic waste as another source of income. It would also help reduce unemployment in the rural areas by developing a new technology, if available commercially. Hence, this project is beneficial to society.

VP: How did you get the idea and who gave you support at the early stage?

H & A: We are farmers, so we often visit our farm and help our family members in farming. We realised that the amount of agricultural waste generated is much more



Hetal and Ankur talking with Anuj Sinha at the IRIS National Fair 2009 held Ahmadabad

of garlic gets spoiled. This is due to the transportation and long period of storage in marketing yards. All of this garlic waste which is generated is simply thrown away and is of

IRIS National Fair

Every year Department of Science & Technology, Govt. of India, Intel and CII jointly organise a National Science fair namely, IRIS National Fair. Students across the country send synopses (abstracts) of their project. The SRC (Scientific Review Committee) short lists the best among them. Then students are called for presenting their project in the IRIS National Fair. 8 best projects among them are declared as the national winners. The national winners are selected only from senior (class IX to XII) category. About 100 projects were entered in the IRIS national Fair 2009.

Hetal and Ankur receiving an award as they became national winner at IRIS national fair held at Ahmedabad.



than the actual crop. This waste is burnt off. So, we wanted to utilise such agricultural waste into useful application in day to day life.

We also saw the garlic which was grown in the farm, some of which would spoil due to improper climatic conditions and also during the transport and storage. Our grand mother had told us that in olden days they used garlic to join the broken glass of the lantern. They used to rub the garlic on the edges of the glass and then used to light up the lantern, which would seal the crack on glass due to heat from lantern.

We wanted to see if the garlic waste has enough adhesion property and whether it can be used in binding the agriculture waste for making particle boards and found that It indeed does!

VP: Where did you look for more information? Was it difficult to find the current research?

H & A: We looked in books and surfed the Internet, for more information we also met many professors, etc. But it was very difficult for us to find references regarding spoiled garlic, as not much research appears to have been done on it.

VP: Who was your main support during the process of making the project?

H & A: During the process of making the project, the main support for us was our father Mr. Kanjibhai Vaishnav and our guide Mr. Vaibhav Ramani.

VP: Would you like to do more work on this project?

H & A: Yes. We would like to commercialise this product, if there is any financial aid available.

VP: Have you participated in other science competitions and won prizes?

Hetal: I have become national winner at IRIS 2008 and have participated in ISEF 2009 held at Reno, Nevada in USA. There I won four Awards. I had participated in IRIS in the year 2006 and 2007 also.

Ankur: I have participated in the science fair held at my school. There I was first in all the three divisions of my school. The name of the fair was Discovery Science Fair.

Then in the year 2009 we have become the national winner in IRIS national science fair. And we were selected for ISWEEEP 2010. At ISWEEEP, we won an honorable mention award for our project on ecofriendly particle boards

I-SWEEEP



Hetal and Ankur receiving their award at ISWEEEP-2010

I-SWEEEP, the International Sustainable World (Energy, Engineering, and Environment) Project Olympiad, is a groundbreaking science fair open to high school students. It is the largest science fair event of its kind world-wide. I-SWEEEP is organised by the Cosmos Foundation, with a mission to establish college preparatory K-12 schools focussing on math, science, engineering, and computer technologies. I-SWEEEP works with local, national, and international science fair organisations to bring together the top-ranking participants and qualifying projects from these competitions.

I-SWEEEP 2010 brought together over 1,000 brightest science like-minded students and their supervisors in Houston, USA. Young scientists from 70 countries and 43 U.S. states displayed 470 science projects about pressing issues of energy, engineering, and environment.

VP: Has this competition had any negative or positive impact on your studies?

H & A: If a student plans his/her every day's work then he/she will not face any negative impact. He/she should keep the track with both the things, i.e., studies and the project work, with proper planning.

VP: What has been the reaction of your teachers and parents when you were selected for representing India at the ISWEEEP?

H & A: When our parents and teachers came to know about our selection to represent India at International level, they were very happy and were very proud of us.

VP: What have you learnt from the international exposure?

H & A: Going to an international science fair was a great opportunity for us. Meeting the world class scientists and having a viva with them was also a great opportunity for us. Our mind started thinking in a scientific manner. By going over there and by seeing other projects, we came to know about many different problems faced by the people and Earth's environment.

VP: What is your message for other students who may participate in such events in future?

H & A: We would like to tell every student of India that they must participate in such a great event. But they should not only think of winning the awards. Rather they should participate to step out from the bookish knowledge and get to know the Creative world. They should not stop once success is achieved but keep participating in such events.

VP: Can you recall the question from judges (in Ahmadabad or US) that you found most searching and what was your reply?

H & A: During the judging session, some questions asked by judges were beyond our level, as they asked us about the chemistry of the spoiled garlic and the constituents of our binder. But this is a PhD level work as till now no one has done research on spoiled garlic, and it is a very complex compound.

And about the constituents of our binder, it was also beyond our level. Because, finding the constituents of our binder is like doing a PhD on the binder within 4 months! And for this we have approached many labs like NCL-Pune, Sicart-Baroda, and Saurashtra University (Polymer Department)-Rajkot, S.K. Research and Remedies-Mumbai, Shri Ram

ISEF

The International Science and Engineering Fair (ISEF) began in 1950 as a platform to encourage pre-college students to conduct scientific research. Intel ISEF brings together more than 1,200 students from over 40 nations to compete for over 900 prizes. There is US\$ 4 million to be won, including scholarships, tuition grants, internships, scientific field trips and the grand prize: a trip to attend the Nobel Prize Ceremony in Stockholm, Sweden.



Hetal and Ankur explaining their project to a judge judging session at ISWEEP-2010

Institute-Delhi, and Junagadh Agricultural University-Junagadh. But we were not able to analyse our binder up to the extent where we can find its constituents, in the short span of time. It is a very complicated and lengthy process.

In the reply to the above question, we gave the judges the reason why we were not able to find the constituents of our binder and the chemistry of spoiled garlic. We told them that our binder is very sticky and very complex material, so if it is run through HPLC or GCMS column then it can spoil the column.

VP: What was in your opinion the one most important aspect of your project that got it the award?

H & A: The binder that we used for making particle boards is derived from spoiled garlic. Hence, it is eco-friendly and can be used in place of hazardous binders like phenol formaldehyde, melamine formaldehyde, etc.

Agriculture waste is used in place of wood to make the particle boards, thereby reducing de-forestation and making it eco-

friendly. Utilisation of agricultural waste for making particle boards, also helped reduce air pollution by preventing their burning.

VP: Do you propose to continue to improve this or leave it for others? What type of support will be required now?

H & A: We want to continue with this project. We have applied for a patent. To start making this product commercially, we need to make the design of the machine; we need to construct a pilot plant also. For this we require the technical and financial support.

VP: How has your academic performance been affected because of this competition, travelling, etc?

H & A: There is no significant effect on our academic performance.

VP: What subjects do you wish to pursue in college and why? (Ankur and Hetal can have different answers)

Hetal: I want to do first BSc, then MSc and then PhD. I want to do my MSc and PhD in chemistry.

Ankur: I also want to do the same, but I'd like to do MSc and PhD in physics.

Letters to the Editor

Coach or Player

I liked the way you drew parallels between a soccer game and development of resource materials for science communication (Editorial, Dream2047, August). You have put it very succinctly and lucidly. Thanks for the thought-provoking piece.

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Andhra coffee

Thank you for the nice article about coffee, our favourite brew, which is very informative and enlightening. While the author discussed about Arabica and Robusta, no mention was made of Peaberry which is considered as a premium variety.

The author has mentioned that it is a favourite only in Tamil Nadu and South Karnataka. It is a great favourite of Andhriles also. Further, coffee is grown in Andhra Pradesh also, though quantitatively it is only a very small percentage. It has nonetheless won the Flavour of India - the Fine Cup Award in the years 2003, 2005, 2007, 2008, and 2009. The author has totally ignored Andhra.

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Corrigendum

In the interview with Lalita Balakrishnan (Dream 2047, August 2010), the caption of the photo at bottom on page 35 should read, ".....with solar lanterns developed by different manufacturers and propagated by AIWC." Instead of "....with solar lantern and solar panel, developed by AIWC".

In column 3 para 3, on page 35, please read "I had joined, already existing AIWC Branches in Delhi, Hyderabad, Bhopal, Haridwar, and at all these places I also started BHEL Ladies Welfare Association and did active work" instead of "We lived in Delhi, Hyderabad, Bhopal, Haridwar and in all these cities I established AIWC offices".

The Time is Ripe

The question often asked is: “Are you green and growing or ripe and rotting?” Now, thanks to the clues found by Indian scientists, “ripe” and “rotting” may not necessarily always be clubbed together. Not for 45 days at least—if it is the tomato we are talking about.

According to scientists at the National Institute of Plant Genome Research, New Delhi, there are two tomato genes that, when silenced or “knocked down”, allow tomatoes to remain ripe (without rotting) for three times as long as other tomatoes. This is indeed great news for cultivators and chefs alike.

Ripe challenge

Farmers know that fruit and vegetables perish quickly. If care is not taken during transport, they soon spoil and become unfit for consumption. In India the post-harvest losses of fruits and vegetables is enormous. About 35-40 per cent of the total produce is lost because it becomes excessively soft. This means that India incurs a loss, not only in terms of revenue, but also in terms of health because the fruits/vegetables are wasted.

Although ripe fruits taste best, the paradox is that even in the market, most buyers would rather buy a semi-ripe fruit because they know they will not be eating the fruit right away. They judge that if they buy a semi-ripe one, it would be ripe for a feast by the time they get around to consuming it. So the prudent shopper, knowing fully well that ripeness is the stage before a fruit begins to rot, would rather buy a semi-ripe fruit instead of an overtly ripe one.

The challenge therefore is to correctly judge the exact degree of “ripeness” when fruit should be harvested so that it can tempt potential buyers with its ripeness when it finally reaches the market. It is obvious therefore that ripening is a crucial parameter when it comes to both buying or selling fresh fruits and vegetables. Any method that can regulate ripeness is a boon to farmers and consumers alike.

Ripe for harvest

Normally fruits and vegetables are ready for harvest when these have reached ideal condition for consumption. This stage is called ‘harvest maturity’. However, Harvest maturity is not quite the same as physiological maturity, which is the term for the stage when the plant has completed its active vegetative growth and reached the stage of seed production. Harvest maturity includes the time required to reach the market. Thus it takes into account a degree of time lag. Usually, fruits and vegetables are harvested before these reach the maturity considered ideal for immediate consumption.



Green and growing

Ripening is often triggered by a signal...usually ethylene. Tomato too shows a rapid increase in the synthesis of ethylene at the beginning of the ripening process. In commercial fruit production, artificial ripening is used to control the rate of ripening, thus enabling transport and marketing to be carefully planned. Ethylene is used commercially for the artificial ripening of certain fruits. Another commonly used agent for artificial ripening is calcium carbide. However, the type of fruit under consideration also influences the strategy for that fruit.

Different fruits ripen at different rates and to varying degrees. Fruits such as mango, papaya and banana undergo drastic and extensive softening from “stone hard” stage to a “soft pulpy” stage. Fruits



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such as apple and orange do not exhibit such extensive softening. Obviously, the strategy to transport these two types has to be different.

Then again, fruits are classified as being either of the ‘climacteric’ or the ‘non-climacteric’ type when it comes to ripening.

- Climacteric fruits can be ripened off the parent plant. The respiration rate and associated rise of ethylene production (signal for ripening) gradually reaches a climacteric peak at the onset of ripening; after which it declines. Tomato is a climacteric fruit.

- Non-climacteric fruits are not capable of continuing their ripening process once they are detached from the parent plant. Also, these fruits produce tiny quantities of ethylene, and do not respond to external ethylene treatment. Non-climacteric fruits show a gradual decline in their respiration pattern and ethylene production, throughout the ripening process.

Molecular ripening research has focussed primarily on ethylene, but little is known of control before ethylene induction, or of common regulatory mechanisms shared by climacteric and non-climacteric species

Really ripe?

Almost nobody has trouble identifying a ripe fruit from an unripe one.

Unripe fruits are:

- Green with little/none of the tantalizing smells associated with the riper version.
- Smaller
- More sour/astringent
- Hard

Ripe fruits are:

- Visually striking: mostly red, dark (almost black) or yellow.
- Tempting when smelled



Hint of ripeness

- Luscious to look at
- Sweet and juicy.
- Soft to touch

Ripe fruits become soft because the tissue softens thanks to the increase in cell-wall degrading enzymes that act upon proteins and carbohydrates. Other structural alterations involve changes in cell wall thickness, permeability of plasma membrane, increased water content of cell wall, decrease in the structural integrity, and increase in intracellular spaces.

During ripening, colour, flavour, aroma and texture all change in a coordinated manner. The change in colour when the fruit is ripe happens because previously present pigments come to light when chlorophyll is degraded. There is also synthesis and/or accumulation of coloured anthocyanins and carotenoids such as β -carotene, xanthophyll esters, xanthophylls, and lycopene. The increase in flavour and aroma during fruit ripening happens because of the production of a complex mixture of volatile compounds and the degradation of bitter flavanoids, tannins, etc. Sweetness increases because of increased production of glucose, hydrolysis of polysaccharides (especially starch), decreased acidity, and accumulation of sugars and organic acids. Thus, increased respiration, chlorophyll degradation, biosynthesis of carotenoids, anthocyanins, essential oils, and increased concentrations of compounds influencing flavour and aroma mark the process of ripening.

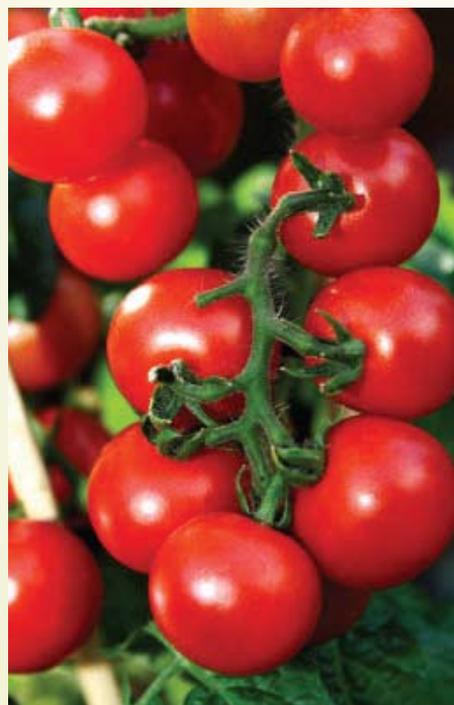
A host of enzymes also come into play during ripening and these bring on many of the changes we associate with ripening. Enzymes such as α -hexosaminidase, α -mannosidase and α -galactosidase are thought to play a major role in the softening of the fruit during ripening. In ripening tomatoes, to give a specific example, the activities of the enzymes α -hexosaminidase and α -

galactosidase, which are low initially during fruit development, significantly increase.

Ripening thus is coordinated manifestation of changes in colour, texture, flavour, aroma, and nutritional characteristics that render fruit attractive to those that eat it and thus assist in seed dispersal. Ripeness is followed by ageing or senescence. Then comes breakdown of the fruit...what we call rotting!

Regulating ripeness

The softening of ripe fruits increases risk of damage during shipping and handling. However, it is the softness of the fruit that directly impacts on palatability and influences consumer acceptability and also, shelf-life. Thus this is the one criterion that most scientists have sought to regulate. One



Ripe and Red



Rotting on the vine



Will you buy these

of the strategies to regulate ripening is to identify and characterise proteins expressed during the process and whose biochemical activities can be related to the observed changes. Initially efforts that were targeted at controlling fruit ripening sought to suppress genes that coded cell-wall degrading proteins. This is because these proteins play a key role in the softening associated with ripening and it is because the fruits are soft that they are squashed easily during transport.

Carbohydrates play a major role in the ripening process. The major classes of cell wall polysaccharides that undergo modifications during ripening are starch, pectins, cellulose, and hemicelluloses. Pectins are responsible for the texture and quality of fruits and it is pectin degradation during ripening that causes softening of the fruits. Pectin-degrading enzymes are active in fruit-tissue softening. Very early on, studies in fruit-ripening focussed on these enzymes, which were manipulated in order to suppress cell-wall degrading enzymes. However, this met with limited success and scientists turned to other strategies such as genetically modified tomatoes.

Genetically modified tomato

The first genetically modified (transgenic) tomato that was engineered to stay firm and fresh for longer was the Flavr Savr tomato in 1994. This was a genetically altered tomato developed by Calgene using anti-sense RNA technology to inhibit the expression of a gene that normally causes fruit to soften. Broadly speaking, anti-sense technology produces a molecule that blocks the target gene's ability to produce its protein. Unfortunately the Flavr Savr tomato was not a commercial success and was withdrawn from the market in 1997. However, the search for the perfect tomato that will remain firm, fresh and bruise-free went on.

Indian contributions

More than a decade ago, Dr. T N Prabha and her colleagues at the Central Food Technology Research Institute (a CSIR laboratory), Mysore, had identified two genes that were active in the process of fruit ripening. However, despite at least four acclaimed research papers (posthumous) that were published with Dr. K Srinivasan and her PhD student B Jagadeesh, which elaborated how these two genes affected fruit ripening, Dr. Prabha did not live to see her ideas come to fruition. She died aged just 55 in June 2002.

However, the recent research paper on tomato ripening that was published by Prof. Asis Datta and his colleagues of the National Institute of Plant Genome Research (NIPGR), Delhi, in the 9 February 2010 issue of the Proceedings of the National Academy of Sciences proves that the torch of Science is always carried forward, much like a baton relay race. It is fitting tribute indeed to the pioneering work that she

had done that Dr. Prabha has been named as a co-author. Incidentally, Dr. Prabha was a former student of Prof. Datta.

In the experiment that built on the studies of Dr. Prabha, the scientists at NIPGR successfully delayed ripening in tomatoes by 30-45 days. They achieved this by suppressing two enzymes responsible for ripening in tomato — the N-glycoprotein modifying enzymes, α -mannosidase (α -

Man) and α -D-N-acetylhexosaminidase (α -Hex). It has been known for some time that N-glycoproteins are common in cell walls and free N-glycans are present in the pericarp of tomatoes at all stages of growth, but mostly during the ripening process. Interestingly, blocking of N-glycosylation delayed ripening. This suggested that N-glycan processing is an important event in the ripening process. Thus, as the scientists have said, it was tempting to explore the possibility that, “genetic manipulation of N-glycan processing can be of strategic importance to enhance fruit shelf life,

without any negative effect on either appearance or yield.”

The scientists targeted the N-glycan processing enzymes α -Man and α -Hex. They found that over-expression of α -Man or α -Hex resulted in excessive fruit softening and the signs of deterioration set in early. On the other hand, the suppression of α -Man and α -Hex enhanced fruit shelf-life, owing to the reduced rate of

softening.

In the experiment, expression of α -Man and α -Hex was silenced by using RNA interference (RNAi) technology. This is a method of blocking gene function by inserting short sequences of ribonucleic acid (RNA) that match part of the target gene's sequence; thus no proteins are produced. The RNAi technique offers specificity and efficacy in silencing gene(s) allowing its

actions to be studied.

The RNAi tomato plants grew normally and bore typical amounts of fruit. The tomatoes showed normal climacteric ripening and colour development while attached to the plant. However, these tomatoes held on to their texture and showed longer life. The RNAi tomatoes harvested at the pink stage, retained their texture for 25-30 days, whereas the control tomatoes started shrinking and losing their texture after 15 days. Also, the tomatoes with ‘silenced genes’ (that is those with suppressed expression of the two enzymes) were firmer than other tomatoes. Overall, the scientists reported, “a substantial improvement in the shelf-life” of tomatoes where N-glycan processing enzymes are targeted. They also say that α -Man and α -Hex activities are high in papaya, banana and mango, which raises the hope that this strategy may yield positive results for these fruits also. The team plans to conduct larger-scale open field trials, followed by multi-location trials before seeking clearance from Regulatory Authorities for commercial cultivation. The entire process is expected to take two years.

Tomato genome studies

With the explosive development of genome studies, the tomato genome with its 24 chromosomes is under scrutiny too. The tomato genome is being sequenced part of the International Solanaceae Genome Initiative. The project aims to develop the Family Solanaceae (to which both tomatoes and potatoes belong) as a model for Systems Biology. Tomato has been selected since it has the smallest diploid genome in the Family. It encodes approximately 35,000 genes. India too is part of this Initiative. The sequencing of tomato chromosome 5 is being jointly carried out at the University of Delhi, South Campus; National Research Centre on Plant Biotechnology; Indian Agriculture Research Institute and the National Centre for Plant Genome Research -- all at Delhi. The aim of tomato genome sequencing is to identify agronomically useful genes.

More than 80 genes related to ripening of tomato fruits have been cloned. Scientists know that tomato plants harbouring the ripening-inhibitor (rin) mutation yield fruits that fail to ripen. Thus, the rin mutation can be widely used in tomato hybrid cultivars to yield fruit with a long shelf-life and acceptable quality. ■



Asis Datta



National Institute of Plant Genome Research

Personality disorders

Why Some People Think, Feel, and Act the Way They Do

My idea of an agreeable person is a person who agrees with me.

Benjamin Disraeli, Lothair

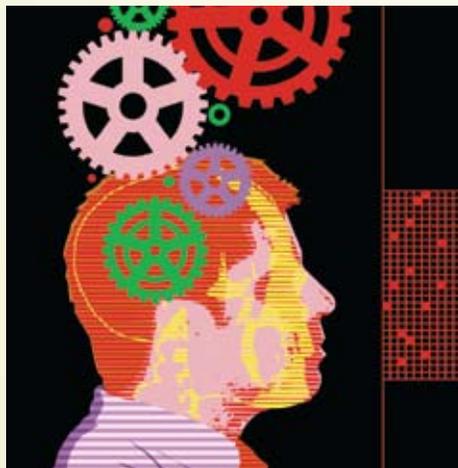
Warps in personality are common and nobody may quite make the perfect grade, yet some people due to a genetic lineage or harsh environment may develop a character that is at serious odds with the norms of their culture. These traits might take different forms and shapes and be recognised by a name, but there is also a school of thought that posits these personality disorders as a continuum between the normal functioning of the mind and a formal mental illness. Extremely hard to change, the salvation for a person with this disorder might lie in trying to mend the most dysfunctional aspects of their feelings and behaviour. While psychotherapy and behaviour therapy is useful in some situations, medications can be used to rectify the biological functioning of the mind if the disorder is serious and holds risk to self or others.

Mainly a hypothetical construct, the term 'personality' stands for a pattern of thought, feeling, and behaviour that identify a person. It is a sum of definite traits that are deeply ingrained, enduring, and unique about a person and distinguish him from the other people. An upshot of personal drives and influences from the outside world, it reflects predictability about how a person will act or react under certain circumstances. Usually, the more satisfactory a person's early development and experiences, the stronger and more balanced is his personality. People who fail to experience and integrate satisfactory early experiences tend to have personality structures that are faulty and manifest more primitive responses. The flaw may also lie in the genetic background or biological functioning of the brain.

Nobody fits the perfect bill. Most people, if not all, experience at least some difficulties and problems that result from their personality. The specific point at which those problems justify the diagnosis of a personality disorder is difficult to tell, but if it significantly impairs social or work functioning, is repetitive and inflexible, is stable over time, and is annoying to others, there clearly is a problem.

Broadly, the farther a person digresses from the code of one's culture the more severe

is the disorder. Yet, people who deviate from cultural norms are not necessarily dysfunctional, nor are people who conform to cultural norms necessarily healthy. The truth is, many personality disorders represent extreme variants of behaviour patterns that people usually value and encourage. For instance, most people value friendliness but not submissiveness, self-belief but not arrogance, and conscientiousness but not perfectionism. The dividing line may at times be rather hazy. In fact, a behaviour that seems deviant to one person may seem normal to another depending on one's gender, ethnicity, and cultural background.



Based on the predominant symptoms and their severity, personality disorders have been categorised into several subtypes. The current edition of the Diagnostic and Statistical Manual of Mental Disorders portrays ten personality disorders, while others describe twelve. Each of them reflects a developmental maladaptation from an early age, and yet, each is distinctly different from the other.

If you were to evaluate yourself on the altar of their characteristics, you might find yourself fitting into many of the subtypes! However, do not feel distraught unless you find these traits are pervasive enough to bring you into conflict with others and handicap your daily functioning. Just remember, you cannot be agreeable to everybody even if you



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tried. The idea, equally, is to try and develop an understanding of the behaviour of people you intermingle with.

Let us now look into the common deviants of personality.

Paranoid personality disorder

People with a paranoid personality are constantly defensive, secretive, suspicious and distrustful toward other people. They believe that others are against them and constantly look for evidence to support their suspicions. They doubt the trustworthiness and loyalty of acquaintances and friends, persistently bear grudges against others, and are reluctant to confide in others because of the fear that the information will be used against them. They are hostile toward others and react angrily to perceived insults reading hidden meanings into gentle remarks or events, perceive attacks on their reputation where none is intended, and are suspicious about the fidelity of their sex partner.

They may be objective, rational, and unemotional, but they are often rigid and cannot accept criticism. Their aggressive suspicious nature usually spurs a hostile reaction from other people and makes them extremely unlikable. They find it difficult to collaborate with others and have few close relationships. Due to these handicaps, they need to be self-sufficient and autonomous to be able to maintain themselves.

The disorder may surface during the teens with solitariness, poor peer relationships, social anxiety, hypersensitivity and underachievement in school. Some 0.5 to 2.5 per cent of people are affected by a paranoid personality disorder. It is more common in males.

Schizoid personality disorder

People with schizoid personality are shy, introverted, detached and distant from other people. Socially withdrawn, they have few close personal relationships, and do not care much to be a part of the family. They are emotionally cold. Being loners, they prefer solitary pursuits and remain preoccupied with

mechanical or abstract activities. Bookish, reserved, out of touch with others, they are relatively blind to social cues and their personal lives are usually barren. However, this remote exterior may belie the strong emotion which they may hide in their bosom. To find a vehicle for their private feelings, they may keep a diary or indulge in daydreaming.

They seem indifferent to appreciation or criticism by other people and may not react actively even if circumstances so demand. Since they lack social skills and have no desire for sex, they also may not marry.

More common in men, a schizoid personality usually finds it difficult to operate well at work, particularly if a job requires working with other people. But they may do well in vocations that can be done singly or without intimate social interaction.

Schizotypal personality disorder

People with schizotypal personality engage in bizarre thinking, speech, and behaviour. They are superstitious, believe in clairvoyance, telepathy or sixth sense, and may feel that they have special powers to sense events before they happen and can read the thoughts of others. They tend to use words and phrases in unusual ways, and may think they have magical control over other people. They suffer unusual bodily illusions and may feel that there is another person present, or they may hear a voice murmur their name. Due to their odd thinking, they may behave in a strange manner. For instance, they may walk past a specific object several times to avoid an imagined harmful outcome.

People with schizotypal personality disorder are often also overly suspicious. This makes them uncomfortable in relating to other people. They have few or no close friends and feel anxious in social situations. The disorder affects three per cent of all people. Most look for help due to symptoms of anxiety, depression, or restlessness. The disorder usually has a relatively stable course.

Antisocial personality disorder

A person with antisocial personality acts in a way that disregards the feelings and rights of other people. Lacking in conscience, he comes into conflict with the code and customs of the community, and still does not realise his mistakes. He is chronically in trouble and may not hesitate to use or exploit other people for his own gain. He may lie repeatedly, act impulsively, and get into physical fights. Loveless, indifferent

and destructive, he cannot form satisfactory relationships, and may suffer failures in his personal, work-related and social life.

Many people with antisocial personality are superficially likeable and charming, and initially mislead well-meaning people whom they subsequently disappoint and mortify. They may mistreat their spouses, neglect or abuse their children, and exploit their employees. They often engage in impulsive behaviour and may dismay others by their uncontrolled, destructive outbursts.

Individuals with antisocial personality usually fail to understand that their behaviour is wrong because they simply do not have a conscience. The fact is, even if guilt, remorse, shame, and anxiety make for unpleasant



feelings, these emotions are crucial to healthy social functioning and even physical survival. Antisocial personalities may take chances that other people would shun. They may engage in kleptomania, gambling or physical assaults repeatedly.

The disorder affects about three per cent of males and one per cent of females. People with this disorder are at high risk for poor personal life, loss of employment, bankruptcy, injury, alcoholism, drug dependence, imprisonment, and premature and violent death.

The disorder runs a chronic course but may become a little milder as the individual gets older. Those affected by this disorder were in the past called sociopaths or psychopaths, and gave a lot of stuff to writers to weave a novel or a film around them.

Borderline personality disorder

People with borderline personality suffer from a chronic feeling of emptiness, and make frantic efforts to avoid real or imagined abandonment by others. They experience inappropriate anger even when there are unavoidable changes in plans. For example, they may panic or burst into intense fury if somebody important to them is even a few minutes late. Even on such minor disappointments, they may develop severe frustration, anger, and dismay and they may indulge in suicidal behaviour, self-mutilation, and other self-destructive acts.

Individuals with this disorder have a pattern of unstable but intense relationships. At first they may impress people as stimulating and exciting, and may share the most intimate details about themselves early in a relationship. But they can turn bitter or angry at the slightest of reasons, and their relationships tend to be unstable and explosive.

People with borderline personalities also tend to have an unstable self-image or sense of self. This reflects sudden changes in their career plans, change in values, and change in type of friends. They may also at times sense such major void in their life that they begin to feel as if they do not exist at all.

The disorder may also lead to impulsivity. In addition to self-mutilating acts, they may gamble, spend money irresponsibly, abuse substances, binge eat, drive recklessly, and engage in unsafe sex.

About two per cent of all people have borderline personality disorder. Out of every four with this disorder, three are women. Borderline personalities run a high risk of depression, bulimia (an emotional disorder characterised by an obsessive desire to lose weight, in which bouts of extreme overeating are followed by fasting or self-induced vomiting or purging), stress disorders, dissociative disorders, and drug dependence. About 10 per cent of people with this disorder commit suicide by the age of 30.

Histrionic personality disorder

People with histrionic personality constantly strive to be the centre of attention. Often lively and dramatic, they may initially charm new acquaintances by their enthusiasm, apparent openness, and overly flirtatious behaviour. They believe in being the life of the party, being charmers, and do not hesitate in making up stories or even creating a scene to draw attention. Their appearance, including the apparel and looks, and behaviour is

seductive. This may easily mislead the people they come in contact with, but it does not necessarily reflect their romantic interests. They usually talk in a dramatic or theatrical fashion and display exaggerated emotional reactions. They may embarrass friends and acquaintances by excessive emotional display, such as embracing casual acquaintances with excessive passion, sobbing for no real good reason, or having tantrums. They also suffer from a high degree of suggestibility and are easily influenced by others.

Without being aware of it, people with this disorder may seek to control their partner through emotional manipulation on one level, whereas displaying a marked dependency on them at another level. Their clamour for constant attention may ruin their personal relationship with friends. They look for novelty and excitement and are easily frustrated if their actions are not met with immediate gratification.

The disorder is found in about two or three per cent of people. Women outnumber men, but only because they are more likely to be noticed. In the male-dominated milieu, a man with this disorder may just be tolerated as a macho, while a woman would stand out if she is provocatively dressed or acts in a seductive fashion.

Narcissistic personality disorder

People with narcissistic personality have a grandiose sense of self-importance. They seek excessive admiration from others, routinely overestimate their abilities, and boast unabashedly about their deeds. They fantasise about unlimited success, power, brilliance, and beauty and compare themselves favourably with the famous and beautiful. They believe they are special, unique, and superior to others and may think they are only meant to associate with the very best and top of the range people, places and activities. They may fish for compliments and are furious when this does not happen. They tend to develop relationships only if the other person seems likely to advance their self-esteem and do not hesitate to exploit a relationship.

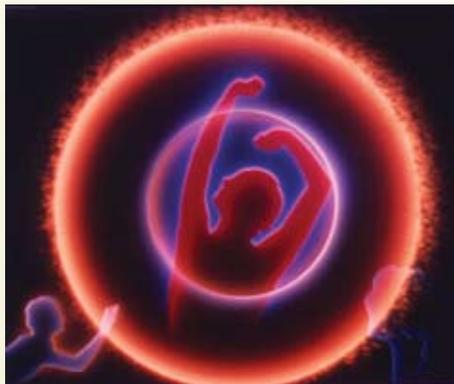
They mostly lack concern for others and have difficulty in recognising the desires and feelings of others. They do not have an ear for listening to the concerns and problems of others and may appear extremely insensitive to their hurts and emotions. They may be envious of others or think that others are envious of them. They may exhibit snobbish, arrogant and haughty behaviour.

Narcissistic personalities, however, have a very fragile self-esteem. They may not show it outwardly, but they are easily stung by criticism which leaves them emotionally bruised. In such a situation, they may react with scorn, rage or counterattack.

Due to an overwhelming need for admiration at all times and the insensitivity to the sentiments of others, they have few lasting relationships. They are also vulnerable to depression, hypomania (a mild form of mania), and might not achieve much in their work because of their poor attitude. The disorder is found in less than one per cent of people.

Avoidant personality disorder

People with avoidant personality suffer from social shyness, feelings of inadequacy and hypersensitivity to negative evaluation. They are intensely reserved, quiet, inhibited, and withdrawn. They try to be invisible and feel



afraid that no matter what they say, others will reject it, and so they say nothing at all. They are loath to work with other people because of an inner fear of being criticised, disapproved, or rejected. So deep is their fear that they might even reject a promotion and prefer to remain on a lower rung of the official hierarchy. Although capable of developing a close relationship if assured of uncritical acceptance, they usually hold back from intimate associations for fear of being shamed or ridiculed.

Avoidant personalities have low self-esteem and feel inadequate about themselves. They view themselves as socially inept and inferior to others. They are usually reluctant to engage in any new activities because they fear it may prove embarrassing. These self-doubts may make them the butt of ridicule by others. These individuals may become socially isolated and may have little or no social support group to bail them out in a moment of crisis.

The disorder affects 0.5–1.0 per cent of people. It is equally distributed among males

and females. The disorder begins at a young age, runs a chronic course, and becomes milder with age.

Dependent personality disorder

People with dependent personality have a severe and disabling emotional dependency on others. They are submissive and prefer to cling to others for support and advice at all times. They may experience difficulty in taking even simple everyday decisions as to the colour of dress to wear to work, or the briefcase they should carry. They need a great deal of guidance and reassurance, and usually depend on a parent or spouse to choose the kind of job for them, who to befriend, and how to lead their life. Since they are overly dependant, they do not express disagreement with other people and might even agree with things that they feel are grossly wrong. Due to lack of self-confidence, they have difficulty in doing things by themselves despite the fact that they might be quite capable of functioning adequately. They might go to any length to please those whose support they yearn for. Even if a task is unpleasant, necessitates self-sacrifices, or implies verbal, physical or sexual abuse, they accept it to avoid losing the relationship. They feel uncomfortable by themselves. If a close relationship comes to an end, such as on the death of a caregiver or spouse, they eagerly seek out another relationship to fulfil their emotional need of care and support.

Due to their self-doubts, pessimism, and constant need for nurturance, they may avoid positions of responsibility and lag behind in their professional career. Their social relationships are also limited only to people on whom they are dependant. The disorder is fairly common and is found more commonly in women than men.

Obsessive-compulsive personality disorder

People with obsessive-compulsive personality disorder are preoccupied with details, orderliness, perfection, and control. Their attitude is mostly so inflexible that in going for details, the objective of the activity might be lost. Even though they devote excessive amounts of time to work and productivity, their perfectionism might delay the project and interfere enormously with its completion timeframe. They also loathe delegating tasks to others unless those people submit to exactly their way of doing things. They are generally rigid, formal, stubborn, serious,

and fail to take time for leisure activities and friendships. They also have a miserly spending style towards both self and others and might maintain a standard of living far below what they can afford, believing that spending must be checked for future catastrophes.

This personality trait is found in about one per cent of people and twice as much in men as women. It differs from a full-blown obsessive-compulsive disorder both in severity and extent.

Other personality disorders

Many psychiatrists use two additional diagnoses. One of them relates to people with depressive personality disorder. They are overwhelmed by a sense of chronic pessimism, gloominess, and cheerlessness. They brood and are given to worry; are critical and derogatory towards self; and appear negativistic, critical and judgemental towards others.

In contrast, people with passive-aggressive personality show a negative, sullen and argumentative attitude; are stubborn and procrastinating by nature; they passively resist completing tasks and chores, criticise and scorn authority figures, eye others with envy and resentment, and voice exaggerated complaints of misfortune.

What causes the personality warp?

Controversies

There is a growing consensus among researchers engaged in explorations of the mind that personality disorders are not just a product of life experiences, but also hinge on inherited genetic traits and biological malfunctioning of the brain. For example, the roots of dependent personality disorder may be in a genetic anxiety flaw. Overly protective, clinging or, contrarily, neglectful parenting and a fearful temperament during childhood may just be the stuff that germinates this flaw into a full-blown personality disorder. While this mix of factors seems to be most plausible, in the present molecular era the pendulum is swinging more and more in favour of the biological perspective. It makes small of the significance of life experience and emphasises genetic and other biological factors.

The biggest endorsement of the genetic basis of personality disorders has come from behavioural studies carried on identical twins raised in different homes and cultural settings. The same faults in personality were detected in a large number of identical twins even though they were reared in different homes.

Associations between specific biological factors, including hormones, neurotransmitters and electrophysiological aberrations on one hand, and a personality disorder on the other have also been identified. For example, people who have impulsive traits often have increased levels of testosterone, 17-oestradiol and oestrone.

Despite these biological associations, it will be naïve to negate the significance of life experience altogether in shaping the personality. Interplay of all factors may be behind most disorders. Let us take the two most serious personality disorders before resting the case. A genetic predisposition to mood disorder may open up a person to acquire a borderline personality disorder, if he or she experiences parental neglect, intense marital conflicts between parents, or repeated episodes of severe emotional or sexual abuse. Similarly, a genetic predisposition to alcoholism, impulsiveness and violence may lead a person to antisocial personality disorder if he or she has a troubled childhood marked by inconsistent parenting, and a harsh environment that develops emotional coldness and prizes aggressiveness and exploitation.

Treatment

Changing an innate human trait is extremely difficult, and the difficulty quotient spirals if the person is not ready for it. Yet, most people with warped and disorderly personalities often fail to recognise that it is their personality that has contributed to their social, occupational, and personal problems. They may think they have no real problems despite a history of failed relationships, erratic jobs, and failures in making good the promise they held. The beginning therefore must be made with an attempt to help the person understand the significance of his or her personality traits. Family members, friends, peer group, and therapists all can play a role. Once the realisation dawns, people can try and mend the most dysfunctional aspects of their feelings and behaviour.

Psychotherapy

The treatment of personality disorders relies on long-term psychotherapy. The basic thought is to try and recreate pathologic patterns of interaction with the world at large, examine faulty defence mechanisms at play and finally, if possible, iron them out through a controlled therapeutic relationship. A variety of approaches continue to be in use and the choice of treatment is guided by the nature of the disorder.

Therapists sometimes use cognitive and behavioural techniques, such as role-playing

and logical argument, to help alter a person's irrational perceptions and assumptions about himself. Aversive behaviour therapy may also be fruitful, particularly in some of the relatively less serious disorders if practised regularly. It calls for a simple punishment, such as disapproval, immediately after a specific behavioural response. When practised regularly, the behaviour pattern is eventually inhibited and extinguished. Sending a child who has done a wrong on time-out uses the same concept. Not responding at all to an inappropriate behaviour may work along similar lines, where a lack of response eventually causes a person to abandon that type of behaviour.

Individual-group therapy has also been found useful when specific interpersonal behaviour needs to be improved. This may work well in the case of schizoid, avoidant, and histrionic personalities.

Some therapists also prefer to use a technique called dialectical behaviour therapy in treating people with borderline personality disorder. Using logical arguments, they help a person arrive at the truth and develop skills to cope with anger and self-destructive impulses. Once the risk of suicidal tendencies stands curbed, the therapist focuses on developing personal strength in the individual to learn to accept the disappointments and interpersonal conflicts that are a natural part of life.

Most of these treatments can be taken by a person as an outpatient, but in more severe disorders, such as antisocial personality disorder, residential treatments have also been tried. The focus is on a strict supervision of the person's behaviour and imposing rigid, consistent rules and responsibilities. These programmes appear to help some people, even though it is unclear if the benefit is permanent.

Medications

As the role of biological factors has come to the fore, physicians have started to use medications to help control symptoms. Antidepressant medications, low-dose anti-psychotic medicines, and mood-stabilising agents have all been tried successfully to overcome feelings of anxiety, depression, or severe distortions of thought. In all cases, however, it is important for both physician and patient to have reasonable expectations as to the possible benefit of medication. While beneficial responses may be subtle and observable only over time, it has to be borne in mind that long-term medication also carries a risk of side effects.

Recent Developments in Science and Technology

Pulsar discovered through grid computing

The combined effort of more than 250,000 ordinary citizens from around the world has recently led to the discovery of a new pulsar through grid computing. Grid computing is applying the resources of many computers in a network to a single problem at the same time – usually to a scientific or technical problem that requires a great number of computer processing cycles or access to large amounts of data. Grid computing requires the use of software that can divide and distribute pieces of a program to as many as several thousand computers. A well-known example of grid computing in the public domain is the ongoing SETI (Search for Extraterrestrial Intelligence)@Home project in which thousands of people are sharing the unused processor cycles of their PCs in the vast search for signs of “rational” signals from outer space. Einstein@Home is another such project which has recently led to the discovery of a new pulsar by the combined efforts of more than 250,000 ordinary citizens from 192 different countries including India, who lent time on their PCs for the project. This is the first deep-space discovery by an entirely voluntary effort (Science Express, 12 August 2010). The citizens’ PCs were used to process and analyse signals received from space at the Arecibo Observatory in Puerto Rico, which has the largest single-dish radio telescope on Earth.

Einstein@Home is a volunteer distributed computing project. Members of the public “sign up” their home or office computers, which automatically download “workunits” from the servers, carry out analyses when idle, and return results. These are automatically validated by comparison with results for the same workunit, produced by a different volunteer’s host computers. For the present discovery about 100,000 different computers downloads were processed each week.

Pulsars are rapidly spinning neutron

stars that emit lighthouse-like beams of radio waves that can sweep past the Earth as often as 716 times per second. They were discovered in 1967 by Jocelyn Bell and Antony Hewish in the constellation of Vulpecula. Pulsars that have orbiting companions are called binary pulsars. They have been used to verify



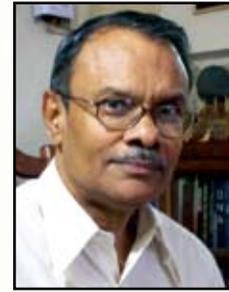
A newfound pulsar, the dense remnant of an exploded star, was discovered via the volunteer computing project Einstein@Home. It is depicted here in an artist's illustration. (Credit: F. Mokler)

Einstein's theory of general relativity to very high precision.

The new pulsar – called PSR J2007+2722 – was discovered on the basis of the processed data on 11 July 2010. It rotates 41 times per second and is located in the constellation Vulpecula, approximately 17,000 light years from Earth. Unlike most pulsars that spin as quickly and steadily, PSR J2007+2722 sits alone in space, and has no orbiting companion star. Astronomers



The Arecibo Observatory in Puerto Rico has the largest single-dish radio telescope on Earth.



Biman Basu

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consider it especially interesting since it is likely a recycled pulsar that lost its companion.

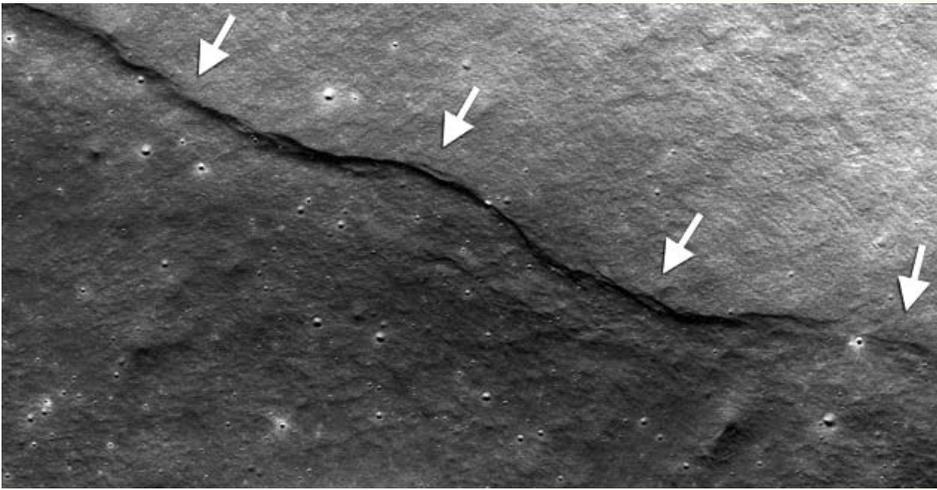
The new discovery is an example of how programs downloaded to home and office computers can help analyse mountains of data. It is an exciting development that highlights the importance of citizen science and demonstrates the capability of “consumer” computational power for realising discoveries in astronomy and other data-driven science.

The Moon is shrinking

Recent analysis of images received from NASA's Lunar Reconnaissance Orbiter (LRO) have brought to light numerous surface structures called ‘lobate scarps’ that scientists believe reflect significant contraction in the Moon's recent geological past.

In other words, it means that our Moon is shrinking, although the shrinkage is not much. Through analysis of the interaction of the scarps with other nearby surface features of known age, including craters, the researchers infer that the Moon has contracted radially by about 100 metres in the past 1 billion years (Science, 20 August 2010).

Lobate scarps are created when land on one side of a geologic fault line is thrust upward, creating a slanting wall that can be several metres high and several kilometres long. Based on their generally crisp appearance and lack of superposed large-diameter impact craters, lobate scarps are considered among the youngest landforms on the Moon. These structures have been observed on the surface of the Moon before, from images taken by the panoramic cameras aboard the Apollo 15, 16 and 17 missions. But these earlier missions were confined to the equatorial zone of the Moon's surface. Using the LRO camera it has been possible to acquire comprehensive images of the lunar



Over recent geologic time, as the lunar interior cooled and contracted the entire Moon shrank by about 100 m. As a result its brittle crust ruptured and thrust faults formed distinctive landforms known as lobate scarps. (Credit: NASA/GSFC/Arizona State University/Smithsonian)

surface at higher latitudes, which reveal a large number of lobate scarps present. After poring over images from LRO, a team led by Thomas Watters of Smithsonian Institution, Washington DC, USA, has identified 14 new scarps in addition to the three dozen already known, most of them at latitudes greater than 60°. The lobate scarps discovered by LRO escaped notice until now because they are only a kilometre or two long and just a few metres high, making them completely invisible to amateur telescopes and even to previous lunar-orbiting craft. Most likely, they are the outcome of the gradual contraction of the lunar interior as it cooled, a process that apparently did not end when the last maria filled with lava some 3 billion years ago.

These observations point to the fact that at one time the Moon must have been really hot, as it accreted by picking up the white-hot pieces after something enormous collided early on with Earth and led to its formation. Some researchers think the Moon did undergo substantial contraction early on, but those early surface scars have been erased over time. The recently discovered lobate scarps were probably formed later.

The new finding also changes the existing view on lunar geology. It was believed earlier that the Moon is geologically dead – that everything of geologic significance that happened to the Moon happened billions of years ago, but the new results suggest this is not the case. The Moon may still be geologically and tectonically active and still contracting today.

Monster of a star discovered

Astronomers have discovered the most massive stars to date, one that was more than 300 times the mass of the Sun at birth. At present the star has a mass about 265 times that of the Sun. Until now, experts had accepted that stars could be a maximum of 150 times the mass of the Sun. The monster star – known as R136a1 – was discovered in a star cluster designated R136, a cluster of young, massive and hot stars, located in the Tarantula Nebula, in the Large Magellanic Cloud, one of our neighbouring galaxies lying at a distance of 165,000 light years, by a team of astronomers led by Paul Crowther of the University of Sheffield, UK. The team used the European Southern Observatory's



This image provided by the European Southern Observatory shows a new near-infrared image of the R136 cluster. At birth, the three brightest stars in the image each weighed more than 150 times the mass of the Sun. The most massive star, known as R136a1, is located at the centre of the image. (Credit: ESO/AP)

Very Large Telescope (VLT) in Chile and archival data from the Hubble Space Telescope to closely study two relatively young star clusters. The other cluster was NGC 3603, a cosmic factory lying about 22,000 light years away, where stars form out of extended clouds of gas and dust.

From the study of the near-infrared image of the R136 cluster, the astronomers could reveal unique details of its stellar content. They found three of the brightest stars, each weighing more than 150 times the mass of the Sun at birth. R136a1 was the most massive of them. The team also found several stars with surface temperatures over 40,000 degrees, more than seven times hotter than our Sun, and a few tens of times larger and several million times brighter. Comparisons with models imply that several of these stars were born with masses in excess of 150 solar masses.

According to the researchers, not only is R136a1 the most massive ever found, it's also the brightest, almost 10 million times more luminous than the Sun. Giant stars produce powerful outflows that make them shrink as they give up some of their contents to space. R136a1 also loses mass quite rapidly and according to the researchers, it has already lost around a fifth of its mass, or more than 50 solar masses, since its birth just over a million years ago (Monthly Notices of the Royal Astronomical Society, 26 July 2010 | doi: 10.1111/j.1365-2966.2010.17167).

According to the astronomers, stars between about 8 and 150 solar masses explode at the end of their short lives as supernovas, leaving behind exotic remnants known as either neutron stars (pulsars) or black holes. The new findings raise the prospect of the existence of exceptionally bright supernovas that totally blow themselves apart, leaving no remnant and dispersing up to ten solar masses of iron into their surroundings.

The newly discovered massive stars also may shed light on the universe's first stars – objects whose masses are estimated to have ranged from 300 to 1,000 times the mass of the Sun. The earliest stars are thought to have formed 100 million years after the Big Bang – the enormous release of energy that researchers say gave rise to the universe some 13.6 billion years ago.

Earliest tool makers

Tool making was once considered to be the hallmark of modern humans Homo sapiens.

But recent finding of fossil bones that bear evidence of butchery marks made by stone implements indicate that tool making was practised by human ancestors nearly one million years earlier than previous evidence suggested, and long before *Homo sapiens* appeared. Fossilised bones of two animals show clear evidence of early humans using stone tools to remove scraps of flesh from the carcasses of large mammals. These bones were found at Dikika in Ethiopia in a region where the sediments are at least 3.2 million years old (Nature, 12 August 2010 | doi:10.1038/nature09248). The discovery was made by a team of palaeoanthropologists led by Shannon P. McPherron of Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany. The location and age of the butchered bones from Dikika clearly indicate that these ancient butchers were not members of our own genus, *Homo*, but the more primitive *Australopithecus*, specifically *A. afarensis*, since no other hominin lived in this part of Africa at this time. These fossils provide the first direct evidence that this species, which includes such famous individuals as Lucy and Selam (dubbed as “Lucy’s daughter”) used stone tools. What is interesting is that the species to which the celebrated Lucy fossil belongs.



Fossilised bones discovered at Dikika in Ethiopia show cut marks (arrows) indicating that stone tools were used by human ancestors as early as to butcher animals.

Till now it was believed that the *Homo habilis*, which lived from approximately 2.3 to 1.4 million years ago and fossils of which were first discovered at Olduvai Gorge in Tanzania, was the earliest to use stone tools. In fact, in 1964 Kenyan paleoanthropologist Louis Leakey and his colleagues named the earliest *Homo* species, *H. habilis* (‘handy man’), for its association with stone tools. Later evidence of stone tool use was found between 2.5 million and 2.6 million years ago. But exactly which member of the

human family made and wielded these older tools was unclear, mainly because no human remains were found in direct association with the tools and animal bones. The earliest example of a clear association between humans and tools till date was 2.3 million years old, and the human remains belonged to an early *Homo* species. The recent finding changes the whole scenario.

However, it is known that Lucy had a brain and body barely larger than a chimpanzee’s. So, if the animals had been indeed butchered by Lucy’s species it would mean that our ancestors began using sharp stones to carve meat long before they had developed big brains or specialised hands, once thought to be absolutely essential for tool use.

Many scientists are surprised that human ancestors were using tools more than 3 million years ago, because there is scant evidence of this behaviour until now. However, McPherron et al. note that early tool use was probably infrequent and did not result in the large accumulations of artefacts and bones and that is why not many such artefacts have been found. According to the researchers, there is the potential for discovering more evidence of this behaviour not only at Dikika but also elsewhere.

(continued from page 36) **Humphry Davy: Founder of Electrochemistry**



Benjamin Thompson (Count Rumford)

In her dissertation, *Humphry Davy: A Case Study in Science and Romanticism*, Julianne Tuttle wrote: “Davy’s science was motivated by questions about life, matter, God, thought, and immortality. He adamantly believed that the highest end of

human existence is intellectual achievement and that to intellectually penetrate the secrets of God’s universe is the highest achievement of all...Davy wrote poetry all of his life and in his last years he wrote two highly imaginative prose works which debated chemical, zoological, physiological, and geological issues in the search for answers to theological and metaphysical questions.”

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(The article is a popular presentation of the important points of the life and work of Humphrey Davy available in the existing literature. The idea is to inspire the younger generation to know more about Humphrey Davy. The author has given the 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.)

Sky Map for October 2010

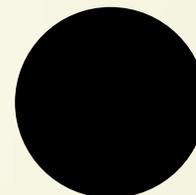
Moon-Last Quarter



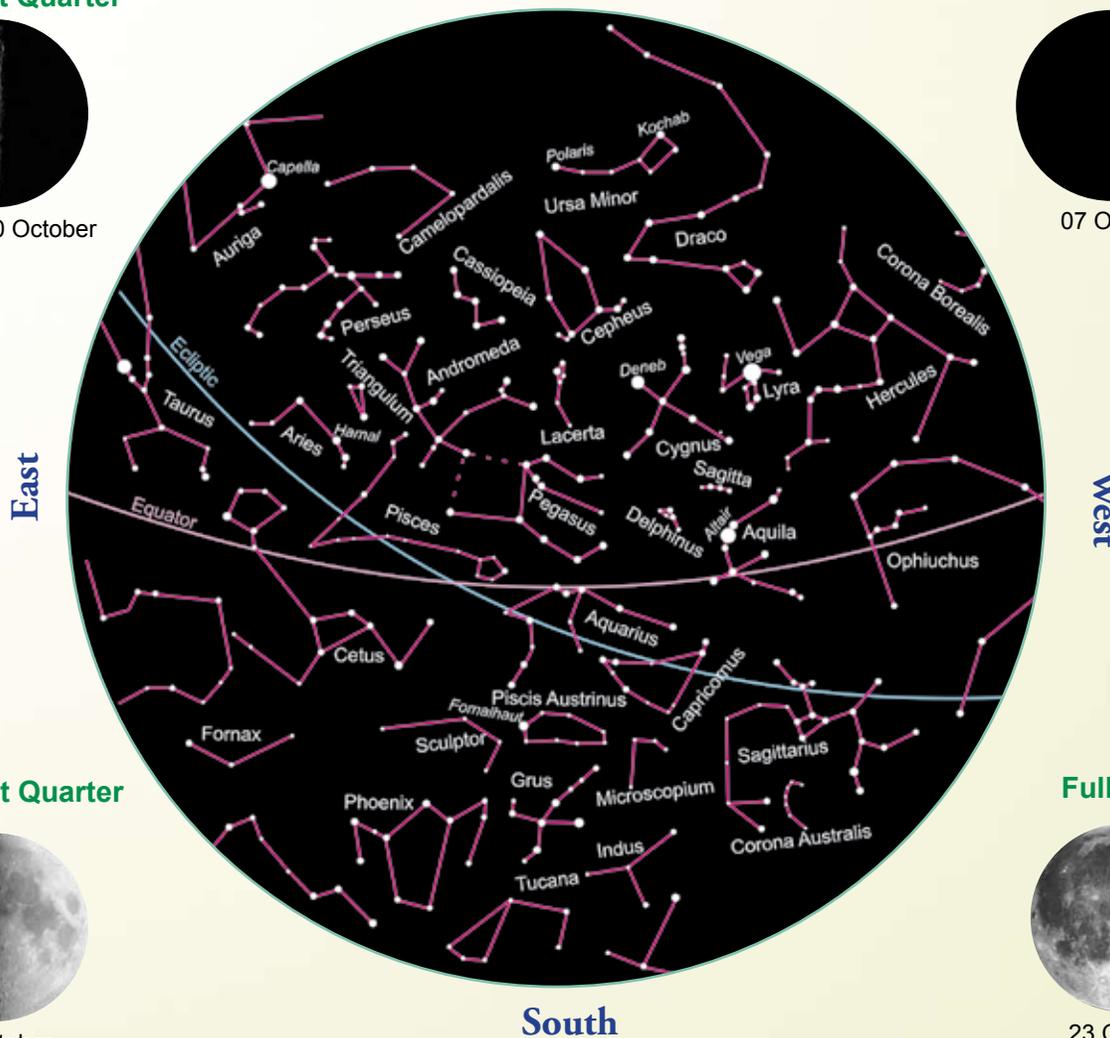
01 and 30 October

North

New Moon



07 October



Moon-First Quarter



15 October

South

Full Moon



23 October

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 northern 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 October, at 9 PM on 15 October and at 8 PM on 31 October.

Tips to use sky map:

- Choose a place away from city lights/street lights.
- Hold the sky-map overhead with North in the direction of Polaris.
- Use a pencil torch for reading the sky map.
- Try to identify constellation as shown in the map one by one.

Visibility of Planets! (IST)

	Rising	Setting	In the Zodiac
Mercury	06:03	17:47	Virgo-Libra
Venus	07:43	18:32	Libra-Virgo
Mars	08:18	19:24	Libra-Scorpius
Jupiter	16:26	04:23	Pisces-Aquarius
Saturn	05:18	17:15	Virgo
Uranus	16:30	04:32	Pisces
Neptune	14:50	02:15	Capricornus

!Time shown is subject to vary (± 1 hr) from place to place.

*Not naked eye object

Sky Event

Date	IST	Event
01	09:48	Saturn Conjunction
01	18:56	Venus-Mars
07	00:11	Moon Perigee
17	11:05	Mercury Superior Conjunction
19	04:48	Moon Apogee
22	02:20	Orionid Shower
29	11:33	Venus Inferior Conjunction

Arvind C. Ranade

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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:
“Can mosquito-borne diseases like malaria and dengue be eradicated, given the public apathy to sanitation and cleanliness?”

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* October 2010” should be clearly written on the envelope.



Vigyan Prasar

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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 July 2010

Topic: “Considering the vastness of our country and its large population, are we using the potential of satellite television in education adequately?”

Mehraj Ahmed Dar,

Department of Actuarial & Financial Mathematics,
 Islamic University of Science & Technology,
 Awantipora, Kashmir, J&K-192122.



In educational field, satellite television has been an attractive option for enthusiastic learning in India. The country's national television Doordarshan has travelled through different educational television projects, thereby nurturing its huge audience primary, secondary and university level students. Besides, it has reached the remotest possible areas.

Like developed countries that are taking full advantage of satellite television in education, India should give more thrust to reach new heights. The currently available stuff is not adequate enough to meet the growing needs. It should be more focussed at and new innovations brought in. Experts from corporate and educational sectors should be invited in this endeavour to bring about a revolution in satellite television in education.

K. Samantaray,

C/o Sushant Kumar Pany,
 B/59 Bhagirathi Vihar (Nuapokhari)
 Gudianali, Dhenkanal-759001 (Orissa)
 Email:- k_samantaray@yahoo.com



The use of satellite television in education is really revolutionary. Fortunately India has indigenous technology to provide satellite network. India has using satellite television in education for more than 20 years. Now the question is, whether we are using this facility adequately? In my opinion the answer is NO. We are not using the potential of satellite television in education adequately.

One of the main factors responsible for this is the non-

availability of electricity, especially in the rural areas. Even where it is available, the failure rate is high or voltage is very low. The alternative solution to this problem may be solar energy or generator set. This is an economical issue.

The second reason is our attitude. Although satellite television is used in extensively for entertainment, there is little effort to use satellite television in education.

Debapriyo Pal

Class-IX, School-Netaji Vidyapith
 State-Tripura
 District-North Tripura



Television constitutes an important medium widely used to disseminate information to its viewers. It has the unique feature of combining audio and visual technologies, and thus considered to be more effective than audio media. In India, since the inception of TV network, television has been perceived as an efficient force of education and development. With its large audience it has attracted educators as being an efficient tool for imparting education to primary, secondary and university level students. The IGNOU-Doordarshan telecast programmes, designed mainly for distance learners started in May 1991. Initially they were telecast on Monday, Wednesday and Friday from 6.30 to 7.00 AM through the national network of Doordarshan with the aim of providing tele-counselling to students of open universities in remote areas. Another educational channel is Gyan darshan. But most TV channels in our country provide only entertainment. So considering the vastness of our country and its large population, we can say that we are not using the potential of satellite television in education adequately.
