

Monthly Newsletter of Vigyan Prasar



# DREAM 2047

September 2005

Vol. 6

No. 12

Price: Rs. 5.00

## VP News

### Aisa Hi Hota Hai – A Science Serial for Children

**D**o you know that while peeled orange and unpeeled one does not differ much in their weight; densities are different and hence while the unpeeled one floats in water but the peeled one sinks? Do you know that acids and bases are found not just in chemical laboratories; but all around us? Lemon juice or Imli water is acidic. Want to “see” sound? Place a handful of thermocol beads on the surface of the speaker. Play the sound system and watch how the beads dance to the music. Isn't it amazing that with just a tub full of water and an inflated balloon you can “simulate” Tsunami? How? Why? **Watch Aisa Hi Hota Hai every Sunday 9-9.30 am on DD – National.**

Vigyan Prasar jointly with Development and Educational Communication Unit (DECU)/ ISRO has commenced telecast of a science serial for children and young people 'Aisa Hi Hota Hai' (AH3) on Doordarshan National since May 22, 2005. The serial has received wide acclaim and has proved to be a very popular programme, especially among children of age group 10-17 years.

Each episode of 22 minutes duration. Each episode is devoted to a specific topic, say, surface tension, magnetism, friction, buoyancy and so on. The programme is presented by two chatty and inquisitive kids, characterized as middle



A scene from AH3

school students, Deepika and Shivam, interacting with a lively young and skillful lady teacher. The teacher, referred to as K2 for she always asks the kids- 'Kyon aur Kaise', (How and Why) and leads them to conclusions through discovery approach. A topic is introduced and the story is built-up through a number of experiments and observations carried out by the bubbly kids guided by the teacher. Even the teacher is not portrayed as a usual teacher

(Contd. on page 25)



AH3 - Life around us

## Inside

### EDITORIAL

p.31

Erwin Schrodinger

p.30



Tenth Planet?

p.24



Indian Bay-leaf

p.22



Headaches

p.20



Recent Developments in Science &amp; Technology p.20



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

## Nature's Fury – We Compound It Further

Floods in the months of June or July are nothing new. But, the deluge that paralysed Mumbai and left hundreds of people dead in Maharashtra was an outcome of some of the heaviest of rainfall in the recorded history of our country. The downpour affected over 20 million people. The 94.4 cm rainfall that Mumbai received on 26 July 2005 surpassed even the highest rainfall recorded at Cherrapunjee in a single day in last hundred years.

In the aftermath of deluge, large parts of India's economic capital went without power or drinking water for several days. 1500 hundred lost their lives in various parts of Maharashtra and due to various flood related diseases. In Mumbai alone, over 500 people died. Water borne diseases that followed – leptospirosis in particular - claimed over 100 lives. Mumbai's infrastructure and those in charge proved to be too inadequate and inexperienced in coping with the deluge. It was reported in the press that there was hardly any communication between the various arms of the administration. It was the gritty citizens of Mumbai who played a major role in putting the city back on rails. Was this tragedy nature's fury alone? Or did we also play a role in compounding it?

In Mumbai, the so called development has swallowed the agricultural land and the coastal plantation over the decades. Mangrove swamps, wetlands, wastelands, and salt-pans act as sponges during floods and prevent sea erosion, but they are being systematically destroyed in the name of reclamation. Even the rivers flowing through the city were converted into drains, and later their banks were reclaimed to settle the slum dwellers! This has resulted in the destruction of the natural drainage channels and the local ecology. Where would the flood waters go, anyway, but flood the city and enter the houses of the poor?

It is reported that construction has already taken place on a sizeable portion of the Vasai – Virar - Nala Sopara buffer zone. A proposal for a golf course by clearing 550 acres of mangrove forests in Goregaon was cleared in 1996. Often, wetland is first declared as wasteland and then wasteland as 'No Development Zone' - or NDZ as it is called. Soon after, farm-houses or a township may show up on that land! No wonder, rampant unauthorized construction and unplanned land use in many parts of the city with little thought to the vital infrastructure like sanitation, drainage, schools and colleges, hospitals, and proper water supply have been the bane of our convoluted idea of 'development'.

Thousands were evacuated when the Yamuna threatened to spill over into Delhi recently. The city is built

on the banks of the river. Over the last three decades, enormous construction activity has taken place along the river banks. We now have four power plants, several new colonies, Commonwealth Games Village and the magnificent Akshardham Temple. Only the land on which these structures stand is fine, sandy soil with a high water table. Further, the Dwarka complex has come up in the catchment area of the Najafgarh Nullha, which is a natural rainwater system. "The flow of water has now been blocked by Dwarka, and could result in flash floods" says Dhunu Roy of Hazards Centre. The Noida flyover too has channelised the Yamuna. During Monsoon, the filling up of riverbed could lead to flooding. Sarai Kale Khan Bus Terminus is located on a landfill swamp. Landfills are not safe for construction. To make buildings structurally safe, foundations have to be strong and deep. In a city already laden with several problems, are we not asking for more trouble?

Kolkata is no exception. Floods have become an annual feature in Kolkata. A new colony, Rajarhat, is coming up in the city's last surviving wetlands. Mumbai's plight could be repeated in Delhi and Kolkata too! It reminds us of the disasters like the Gujarat earthquake; and the super-cyclone in Orissa in the last decade – and our unpreparedness every time the disaster strikes. Still, skyscrapers continue to rise in the reclaimed lands of Mumbai and Kolkata. Delhi is no exception. Both Mumbai and Delhi are sitting on a faultline – and hence prone to earthquakes besides floods!

How much prepared are we to face up to a Gujarat-type earthquake or a Mumbai-type flood, should it ever take place? It is clear that ecology is rarely considered when new construction is planned or approved. Building plans are sanctioned based only on architectural designs, the environment is never considered at all, laments an architect from Delhi. Even the master plans are not fully implemented. Yet another factor is the untamed urbanization due to migration from rural areas – one of the major causes of unplanned growth. This leads to more slums and loss of open spaces. Further, one needs to be careful while constructing houses in zones, which are prone to landslides. This became apparent during the recent Mumbai floods and is vital in the sub-Himalayan States that lie in the seismic zones.

A disaster management plan to deal with disasters - natural or manmade - needs to be put into place at the

**Contd. on page.....21**

**Editor** : V.B. Kamble

Address for correspondence : Vigyan Prasar, C-24, Qutab Institutional Area,  
New Delhi-110 016; Tel : 26967532; Fax : 26965986  
e-mail : vigyan@hub.nic.in  
website : <http://www.vigyanprasar.com>

*Vigyan Prasar is not responsible for the statements and opinions expressed by the authors in their articles/write-ups published in "Dream 2047"*

*Articles, excerpts from articles published in "Dream 2047" may be freely reproduced with due acknowledgement/credit.*



# Erwin Schrodinger

## The Founder of Quantum Wave Mechanics

□ Subodh Mahanti

e-mail : mahantisubodh@yahoo.com

“The introduction of wave mechanics stands...as Schrodinger’s monument and a worth one.”

The Times

“Schrodinger never liked the generally accepted dual description of atomic physics in terms of waves and particles, as proposed by Bohr, Heisenberg and Born. He tried to set up a theory in terms of waves only. Like Einstein, he sought throughout all his life to unify gravitation and electromagnetism.”

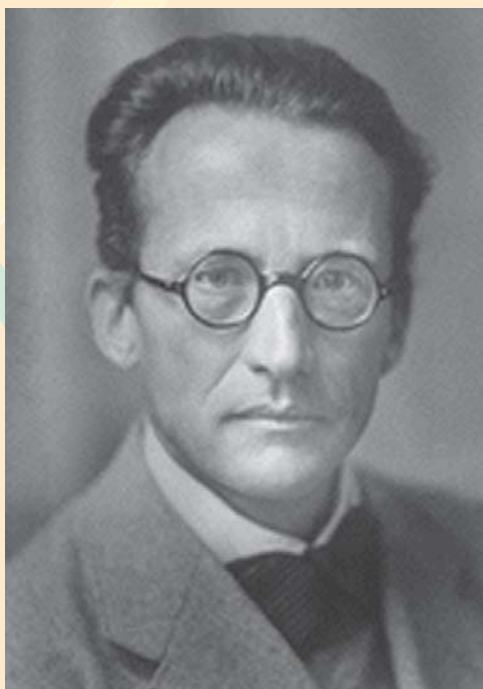
Mauro Dardo

“His (Schrodinger’s) private life seemed strange to bourgeois people like ourselves. But all this does not matter. He was a most lovable person, independent, amusing, temperamental, kind and generous, and had a most perfect and efficient brain.”

Max Born

**E**rwin Schrodinger was one of the main architects of quantum mechanics. Schrodinger developed the wave mechanics. It became the second formulation of quantum mechanics. The first formulation, called matrix mechanics, was developed by Werner Heisenberg. Schrodinger’s wave equation (or Schrodinger equation) is one of the most basic equations of quantum mechanics. It bears the same relation to the mechanics of the atom as Newton’s equations of motions bear to planetary astronomy. However, unlike Newton’s equations, which result definite and readily visualized sequence of events of the planetary orbits, the solutions to Schrodinger’s wave equation are wave functions that can only be related to probable occurrence of physical events. Schrodinger’s wave equation is a mathematically sound atomic theory. It is regarded by many as the single most important contribution to theoretical physics in the twentieth century. Schrodinger’s book, “What is Life?” led to progress in biology.

Schrodinger was an unconventional man. Throughout his life he traveled with walking-boots and rucksack and for this he had to face some difficulty in gaining entrance to the Solvay Conference for Nobel laureates. Describing the incident Paul Dirac wrote: “When he went to the



Erwin Schrödinger

Solvay Conferences in Brussels, he would walk from the station to the hotel...carrying all his luggage in a rucksack and looking so like a tramp that it needed a great deal of argument at the reception desk before he could claim a room.”

Schrodinger was born on August 12, 1887 in Vienna. His father Rudolf Schrodinger, who came from a Bavarian family, which had come to Vienna generations ago, was a highly gifted man. After studying chemistry at the Technical College in Vienna, Rudolf Schrodinger devoted himself for years to Italian painting and then he decided to study botany. He published a series of research papers on plant phylogeny.

Rudolf Schrodinger had inherited a small but profitable business manufacturing linoleum and oilcloth. Schrodinger’s mother, Georgine Schrodinger (nee Bauer) was the daughter of Alexander Bauer, an able

analytical chemist and who became a professor of chemistry at the Technical College, Vienna. Schrodinger was always grateful to his father for giving him a comfortable upbringing and a good education. He described his father ‘as a man of broad culture, a friend, teacher and inexhaustible partner in conversation.’

Schrodinger was taught by a private tutor at home until he entered the Akademisches Gymnasium in 1898. He passed his matriculation examination in 1906. At the

Gymnasium, Schrodinger was not only attracted to scientific disciplines but also enjoyed studying grammar and German poetry. Talking about his impression at the Gymnasium Schrodinger later said: "I was a good student in all subjects, loved mathematics and physics, but also the strict logic of the ancient grammars, hated only memorizing incidental dates and facts. Of the German poets, I loved especially the dramatists, but hated the pedantic dissection of their works." He was an outstanding student of his school. He always stood first in his class. His intelligence was proverbial. One of his classmates commenting on Schrodinger's ability to grasp teachings in physics and mathematics said: "Especially in physics and mathematics, Schrodinger had a gift for understanding that allowed him, without any homework, immediately and directly to comprehend all the material during the class hours and to apply it. After the lecture...it was possible for (our professor) to call Schrodinger immediately to the blackboard and to set him problems, which he solved with playful facility."



Ernest Solvay

In 1906, Schrodinger joined the Vienna University. Here he mainly focused in the course of theoretical physics given by Friedrich Hasenohrl, who was Boltzmann's student and successor. Hasenohrl gave an extended cycle of lectures on various fields of theoretical physics transmitting views of his teacher, Boltzmann. Schrodinger received his PhD in 1910. His dissertation was an experimental one. It was on humidity as a source of error in electroscopes. The actual title of the dissertation was "On the conduction of electricity on the surface of insulators in moist air." The work was not very significant. The committee appointed for examining the work was not unanimous in recommending him for the degree. After receiving his PhD, he undertook his voluntary military service. After returning from military service in autumn 1911, he took up an appointment as an assistantship in experimental physics at the University of Vienna. He was put in charge of the large practical class for freshmen. Schrodinger had no love for experimental work but at the same time he valued the experience. He felt that it taught him "through direct observation what measuring means." He started working in theoretical physics by applying Boltzmann-like statistical-mechanical concepts to magnetic and other properties of bodies. The results were not very significant. However, based on his work he could earn his advanced doctorate (Habilitation).

At the beginning of the First World War, Schrodinger was called up for active service. He was sent to the Italian

border. It was at the warfront that Schrodinger learned about Einstein's general theory of relativity and he immediately recognized its great importance. While in war field it was not possible for Schrodinger to keep him fully abreast of the developments in theoretical physics. However, he continued his theoretical work. He submitted a paper for his publication from his position on the Italian front. In the spring of 1917, Schrodinger was transferred to Vienna, where he again could start scientific work.

The First World War resulted in total collapse of the economy of Austria. It also ruined Schrodinger's family. Schrodinger had no option other than to seek a career in the wider German-language world of Central Europe. Between spring 1920 and autumn 1921, Schrodinger took up successively academic positions at the Jena University (as an assistant to Max Wien, Wilhelm Wein's brother, at the Stuttgart Technical University (extraordinary professor), the Breslau University (ordinary professor), and finally at the University of Zurich, where he replaced von Laue. Soon

after arriving at Zurich, Schrodinger was diagnosed with suspected tuberculosis and he was sent to an alpine sanatorium in Arosa to recover. While recuperating at Arosa, Schrodinger wrote one of his most important papers, "On a Remarkable Property of the Quantised Orbits of an Electr. At Zurich he stayed for six years. This was his most productive and beautiful period of his professional life.



Eamon de Valera

It was at Zurich that Schrodinger made his most important contributions. He first studied atomic structure and then in 1924 he took up quantum statistics. However, the most important moment of his professional career was when he came across Louis de Broglie's work. On November 03, 1925, Schrodinger wrote to Einstein: "A few days ago I read with great interest the ingenious thesis of Louis de Broglie, which I finally got hold of..." And then on 16<sup>th</sup> November he wrote: "I have

been intensely concerned these days with Louis de Broglie's ingenious theory. It is extraordinarily exciting, but still has some very grave difficulties." After reading de Broglie's work Schrodinger began to think about explaining the movement of an electron in an atom as a wave and eventually came out with a solution. He was not at all satisfied with the quantum theory of the atom developed by Niels Bohr, who was not happy with the apparently arbitrary nature of a good many of the quantum rules. Schrodinger did not like the generally accepted dual description of atomic physics in terms of

waves and particles. He eliminated the particle altogether and replaced it with wave alone. His first step was to develop an equation for describing the movement of electrons in an atom. The de Broglie equation giving the wavelength  $\lambda = h/mv$  (where  $h$  is the Planck constant and  $mv$  the momentum) represented too simple a picture to match the reality particularly with the inner atomic orbits where the attractive force of the nucleus would result in a very complex and variable configuration. Schrodinger eventually succeeded in developing his famous wave equation. His equation was very similar to classical equations developed earlier for describing many wave phenomena—sound waves, the vibrations of a string or electromagnetic waves. In Schrodinger's wave equation there is an abstract entity, called the wave function and which is symbolized by the Greek letter  $\psi$  (psi). When applied to the hydrogen atom, Schrodinger's wave equation yielded all the results of Bohr and de Broglie. However, despite the considerable predictive success of Schrodinger's wave mechanics, Schrodinger's had to overcome certain problems. First how he as going to attach some physical meaning to the ideas of an electron if it was nothing but wave and also he had to show what exactly represented by the wave function.

Schrodinger unsuccessfully tried to account these. He tried to visualize electron as 'wave packets' made up of many small waves so that these wave packets would behave in the same way as a particle in classical mechanics. However, these packets were later shown to be unstable. He interpreted the wave function as a measure of the spread of an electron. But this was also not acceptable. The interpretation was provided by Max Born. He stated that the wave function for a hydrogen atom represents each of its physical states and it can be used to calculate the probability of finding the electron at a certain point in space. What does it mean? It means that if the wave function is nearly zero at a certain point then the probability of finding the electron there is extremely small. But where the wave function is large the probability of finding the electron is very large. The wave mechanics cannot be used to determine the motion of a particle or in other words its position and velocity at any given moment. The wave equation simply tells us how the wave function evolves in space and time and the value of the wave function would determine the probability of finding the electron in a particular point of space.

He published his revolutionary work in a series of papers in 1926. Schrodinger's wave equation was the second theoretical explanation for the movement of electrons in an atom, the first being Werner Heisenberg's matrix mechanics. Schrodinger's approach was preferred

by many physicists as it could be visualized. On the other hand Heisenberg's approach was strictly mathematical and it involved such a complex mathematics that it was difficult to understand. Physicists appeared to be divided into two groups. However, soon Schrodinger showed that the two theories were identical but expressed differently.

Schrodinger's students at Zurich found his lectures 'extremely stimulating and impressive.' One of his students, who attended his lectures, later recalled: "...At the beginning he stated the subject and then gave a review of how one had to approach it, and then he started exposing the basis in mathematical terms and developed it in front of our eyes. Sometimes he would stop and with a shy smile confess that he had missed a bifurcation in his mathematical development, turn back to the critical point and start all over again. This was fascinating to watch and we all learned a great deal by following his calculations, which he developed without ever looking at his notes, except at the end, when he compared his work on the blackboard with his notes and said 'this is correct'. In summertime when it was warm enough we went to the bathing beach on the Lake of Zurich, sat with our own notes on the grass and watched this lean man in bathing trunks writing his calculations before us on an improvised blackboard which we had brought along.



Werner Heisenberg

At the time few people came to the bathing beach in the morning and those that did watched us from a discreet distance and wondered what that man was writing on the blackboard!"

After the retirement of Max Plank from Berlin University as Professor of Theoretical Physics, three persons were short-listed for the post—Sommerfeld, Schrodinger and Max Born. Schrodinger's testimonial drawn up for the purpose beautifully summarised his academic achievements till that time. It said: "For some years already he has been favourably known through his versatile, vigorously powerful, and at the same time very profound style in seeking new physical problems that interested him and illuminating them through deep and original ideas, with the entire set of techniques which mathematical and physical methods at present provide. He has proved this method of working to be effective in the treatment of problems in statistical mechanics, the analysis of optical interference, and the physical theory of colour vision. Recently he has succeeded in an especially daring design through his ingenious idea for the solution of the former particle mechanics by means of wave mechanics in the differential equation he has set up for the wave function....Schrodinger himself has already been able to deduce many consequences from

this fortunate discovery, and the new ideas that he has inspired with it in many fields are even more numerous...it may be added that in lecturing as in discussions Schrodinger has a superb style, marked by simplicity and precision, the impressiveness of which is further emphasized by the temperament of a South German." Sommerfeld was the first choice and when he declined to leave Munich the offer went to Schrodinger. Even for Schrodinger it was not easy for taking a decision to leave Zurich. Ioan James has written: "Every effort was made to persuade him to stay in Zurich. The physics students organized a torchlight parade around the university to the courtyard of his house, where they presented him with a petition. Schrodinger was deeply moved, but in the end it was a personal appeal from Planck that persuaded him to accept the Berlin offer; as the result of doing so he automatically became a German national." Before taking up the appointment at Berlin, Schrodinger traveled to Brussels to attend the Solvay physics conferences. This time the topic was electrons and photons. Schrodinger was invited to deliver one of the prestigious lectures. He took this opportunity to elaborate on his wave mechanics. His views caused considerable debate. Born and Heisenberg attacked it quite vehemently.

Schrodinger joined the Berlin University on October 01, 1927, where he became a colleague of Albert Einstein. The course given by him at the Berlin University was considered the best among the science courses at the University. His style of lecturing was informal. He lectured without notes while many professors at the University practically read their lectures. His dress was also quite informal compared to other professors. He was elected to the Berlin Academy of Science at the age of forty-two. He happened to be youngest member of this august body.

Like many other scientists Schrodinger had to leave Germany after the Nazis seized power. The Nazis had no problems with Schrodinger but it was Schrodinger who did not like policies pursued by the Nazis. In fact Schrodinger's disgust for the Nazis was so strong that he was prepared to leave Germany. Initially Schrodinger thought the Nazi madness will pass over within a couple of years but soon he realized that the Nazis are going to stay in power for a long time. Finally Schrodinger left Germany for Oxford. It was possible for intervention of Frederick Alexander Lindemann (1886-1957), the head



Max Theodor Felix Von Laue

best to make Schrodinger's stay at Oxford comfortable. However, Schrodinger was not satisfied with his status at Oxford. He had received an offer of a permanent position at the Institute of Advanced Studies at Princeton during his visit there in the spring of 1934 for giving an invited lecture. However, finally Schrodinger did not accept the offer.



Enrico Fermi

In 1935 Schrodinger's published a three-part essay on *The present situation in quantum mechanics*. It is in this essay the much talked about Schrodinger's cat paradox appears. This paradox was a thought experiment, where a cat in a closed box either lived or died according to whether a quantum event occurred or not. Schrodinger's appointment at Oxford was extended for another two years. But he did not stay there. He left for his own country Austria to take up an appointment at the University of Graz. While waiting for the official confirmation of his appointment at Graz he received an offer of a professorship at Edinburgh. However, the necessary permission for permanent British residence did not come before the official confirmation came from Graz. He finally moved to Graz where he was given a full professorship and also an honorary professorship at Vienna.

While working at Graz, Schrodinger was hoping that eventually he would get an appointment at Vienna. But this did not happen. In 1938, the Nazis extended their anti-Semitic policies pursued in Germany to Austria. The newly appointed Nazi Rector of the University of Graz persuaded Schrodinger to make a 'repentant confession'. The 'confession' began as follows: "In the midst of the exultant joy which is pervading our country, there also stand today those who indeed partake fully of this joy but not without deep shame because until the end they

had not understood the right course....” And it continued in more or less in the same vein. The confession duly appeared in the press. Many of his friends thought that Schrodinger could write such a confession only under pressure. But there was no pressure.

Afterwards Schrodinger, of course, always regretted his decision to write such a confession. Explaining the reason for writing such a confession to Einstein, Schrodinger wrote: “I wanted to remain free—and could not do so without great duplicity.” Schrodinger attended the celebration of the eightieth birthday of Max Plank, where he was warmly welcomed.

But he was no longer acceptable to the Nazi authorities because they did not forget the insult he caused to them by fleeing from Berlin in 1933. His so-called ‘repentant confession’ was of no use. First he was dismissed from his honorary position at Vienna and then on August 26, 1938 he was also dismissed from his regular post at Graz. The reason cited for his dismissal was his ‘political unreliability.’ The official in Vienna, whom Schrodinger consulted, advised him to get a job in industry. They also told him that he will not be allowed to leave the country. Schrodinger immediately realized the danger of staying in Austria. So he hurriedly left for Italy. They had no time even to take their belongings with them. They boarded the train to Rome with a few suitcases. Schrodinger was received at the station in Italy by Enrico Fermi, who also lent them some money. From Rome Schrodinger wrote to the Irish statesman Eamon de Valera (1882-1975), then President of the League of Nations (predecessor of the United Nations). Schrodinger met De Valera at Geneva. De Valera offered Schrodinger a position at the Institute of Advanced Studies that he was trying to set up at Dublin. De Valera also advised Schrodinger to leave Italy at the earliest and go for Ireland or England, as according to him the war was imminent. Schrodinger accepted de

Valera’s offer of appointment at the proposed Institute at Dublin. However, he did not directly proceed to Dublin. Instead he went back to Oxford, where he received an offer of one year visiting professorship at the University of Ghent in Belgium. At Ghent he wrote a significant paper on the expanding universe. From Ghent Schrodinger along with his family went to Oxford. Lindemann and others who had earlier welcomed Schrodinger at Oxford was no longer ready to welcome them again. Now Schrodinger was classed as enemy aliens. But Lindemann made it possible for Schrodinger



Max Born

to reach Dublin in October 1939. Schrodinger adjusted well in the new environs and under his leadership the Institute of Advanced Studies of Dublin became an important centre of theoretical physics. He remained in Dublin until he retired in 1956

At the beginning of his stay at Dublin, Schrodinger studied electromagnetic theory and relativity and began to publish on unified field theory. As we know Einstein was also working on the same problem at the similarly named Princeton University. In 1947 Schrodinger believed that he had a real breakthrough in his efforts toward creating unified field theory. Schrodinger was so

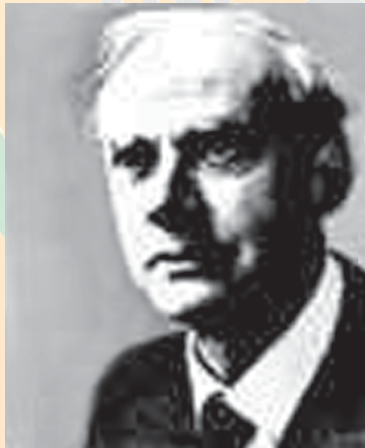
excited about his new theory that he decided to present it to the Irish Academy without examining it critically. Schrodinger’s announcement was widely publicized in the media as an epoch-making discovery. However, after seeing Einstein comments Schrodinger realized his folly. He was really devastated by the episode. It was certainly a great embarrassment. After this debacle Schrodinger turned to philosophy. His study of Greek science and philosophy is summarised in *Nature and the Greeks*, which was published in 1954.

Schrodinger’s most important contribution at the Dublin Institute was his book called *What is Life?* This was the

result of a series of lectures given at the Institute in 1943. The book was published in 1944. It is regarded as one of the most important scientific writings of the twentieth century. Francois Duchesneau wrote: “As a contribution to the Dublin Institute’s series of public lectures, Schrodinger, who was an engaging speaker, delivered several in February 1943 under the title “What is Life?” In these popular scientific lectures Schrodinger, who had only a very slight knowledge of the literature on the physical bases of life, dragged his audience into and then out of a series of blind alleys, leaving them at the end just about where he began.

Nonetheless these lectures, printed the

following year, achieved an immediate and great reputation with both physicists and biologists, and rank still today as one of the most overrated scientific writings of the twentieth century.” The book influenced a good many talented young physicists particularly those who were disillusioned by the destruction caused by atom bombs in Japan and wanted no part in atomic physics. Schrodinger showed these physicists a discipline, which was free from military applications and at the same time very significant and largely unexplored. The book represented the transfer of new concepts of physics into biology.



Maurice Dirac

Schrodinger presented a determinist vision of the role of genes. He wrote: "In calling the structure of the chromosome fibers a code-script we mean that the all-penetrating mind, once conceived by Laplace, to which every causal connection lay immediately open, could tell from their structure whether the egg would develop, under suitable conditions, into a black cock or into a speckled hen, into a fly or a maize plant, a rhododendron, a beetle, a mouse or a woman". It was Schrodinger who first used the word "code" to describe the role of gene. He also observed that "with the molecular picture of the gene it is no longer inconceivable that the miniature should precisely correspond with a highly complicated and specified plan of development." The book with such passages, written with more insight than that contained in most contemporary biochemical works inspired a generation of scientists to look for such a code and which was eventually found. The book helped to shape the discipline that we call today molecular biology. Michel Morange wrote: "Schrodinger's book was a remarkable success. Many of the founders of molecular biology claimed that it played an important role in their decision to turn to biology. Gunther Stent, a geneticist (and a historian of genetics), has argued that for the new biologists it played a role like that of Uncle Tom's Cabin. Schrodinger presented the new results of genetics in a lively, the book has lost none of its seductiveness: its clarity and simply make it a pleasure to read."

In 1955, Schrodinger returned to Vienna. On his arrival he was treated as a celebrity. He was appointed to a special professorship at the University of Vienna.

### Aisa Hi Hota Hai ....(Contd. from page 32)

knowing all answers. The emphasis is on activities that demand inputs only from every day objects and observations. Anchored by two children, each episode presents science the fun way - it entertains while it educates. Most of the activities shown in the episodes can be repeated by the viewers. The two-minute short programme towards end of each episode is an animation film dealing with environmental concerns, say, pollution, food chain, biodiversity etc.

Indeed, we are flooded with responses from viewers. We receive hundreds of letters/emails from far and wide every week at the DECU (ISRO) on AH3. Indeed, the first response arrived a few minutes after the telecast of the first episode. Now it is gradually turning into a deluge. Many want to have more details of the activities shown in the programme, many want their queries answered on other topics, many are interested in VP's publications. The responses reach us from every part of the country.

Ankit Parashar emails 'I am a student. I saw this programme. It is a fantastic programme. I get better understanding than through books'. Abdul Wahid from Gulbarga, Karnataka says that 'I rarely find time to watch TV. But, I watch AH3 without fail. The presentation and topics are simply excellent'. Ruchi Gupta Assistant Teacher (Science) Maharaja Agrasen Public School, Delhi writes "I

Though he retired from the university in 1958, he continued to be an emeritus professor till his death. In Vienna he wrote his last book describing his metaphysical views.

Schrodinger died on January 04, 1961. Commenting on Schrodinger's personal traits his biographer Walter Moore wrote: "...[Schrodinger] was a passionate man, a poetic man, and the fire of his genius would be kindled by the intellectual tension arising from the desperate situation of the old quantum theory...It seems also that psychological stress, particularly that associated with intense love affairs, helped rather than hindered his scientific creativity..."

### References

1. James, Ioan. Remarkable Physicists: From Galileo to Yukawa. Cambridge: Cambridge University Press, 2004.
2. Spangenburg, Ray and Diane K. Moser. The History of Science: From 1895 to 1945. Universities Press (India) Ltd., 1994.
3. Dardo, Mauro. Nobel Laureates and Twentieth-century Physics. Cambridge: Cambridge University Press, 2004.
4. Morange, Michel. A History of Molecular Biology. Oxford: Oxford University Press, 1998.
5. Oxford Dictionary of Scientists. Oxford: Oxford University Press, 1999.
6. Cambridge Dictionary of Scientists. Cambridge: Cambridge University Press,

• • •

am highly impressed by AH3." The programme introduces science through fun activities and is very interesting. Shri Manish Harwara writes that his daughter, a 6<sup>th</sup> class student, regularly watches the programme and is enthused by the serial. Rajkavar Singh from Chak Guru village in Hoshiarpur district writes that 'the children are inspired to do/ perform all the activities shown in the programme on their own.' In fact, VP and DECU value more not the praise showered, but the questions that AH3 has sparked in the minds of our young viewers. The objective of the serial is not just to provide answers but encourage viewers to ask questions and thereby nurture an inquisitive and curious bent of mind. Rajath wants to know why we close our eyes while sneezing. Kanti Satardekar from Goa is curious as to why do some people have black spots on their tongue. Rajathadri from Bangalore says that according to Einstein's equations when a body moves with speed of light its mass tends to infinity and is puzzled as to why then photon still remains small though it travels very fast.

Vigyan Prasar and DECU (ISRO) are in the processes of developing a mechanism to answer the queries from the viewers of AH3. Meanwhile a web site has also been launched: [www.vigyanchannel.com](http://www.vigyanchannel.com) to provide a forum for interaction with viewers. Hope you will continue to view and enjoy AH3.

• • •



## Tenth Planet?

□ Biman Basu

e-mail : bimanbasu@gmail.com

Is there a tenth planet in our solar system? This question has plagued astronomers for decades. After the discovery of the ninth planet Pluto 75 years ago, there have been frequent speculations about the existence of a planet beyond Pluto, but till recently no evidence was found of the existence of such a planet. Now comes the news of the real discovery

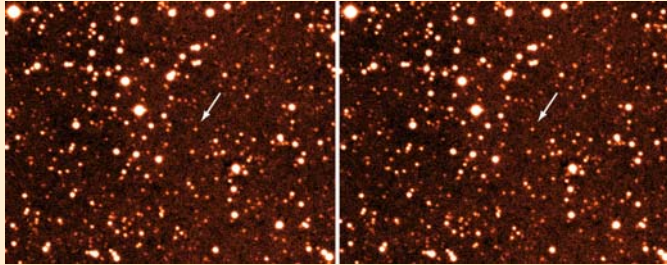


Fig.1. The new planet 2003UB313 (arrow) was discovered from its apparent displacement against the star field in the background.

of what could be the tenth planet of our solar system by American astronomers who have been studying the object beyond Pluto for almost two years. Although the announcement was made on July 29 this year by Michael Brown, a planetary scientist at the California Institute of Technology in USA, the new planet was first spotted by Brown in October 2003 with the Samuel Oschin Telescope at Palomar Observatory near San Diego, California, along with his colleagues Chad Trujillo at the Gemini Observatory on Mauna Kea, Hawaii, and Yale University's David Rabinowitz.

Astronomers use a novel technique to find new planets. They take photographs of the exactly same star field over several nights. Since from Earth the stars in the sky don't appear to move relative to each other, the apparent displacement of any spot in the series of photographs reveals movement of that spot, which can be detected by viewing several frames in rapid succession using a special viewing device. By measuring this movement over several months, astronomers can determine whether the object is an asteroid or a planet and can also compute the moving object's distance and orbital parameters. The same technique was used in the discovery of the newest planet of the solar system.

Currently known by the catalogue number 2003UB313, the newly discovered planet is 2,683 kilometres in diameter (compared to Pluto's 2,360 km) and orbits the Sun in a highly elliptical orbit. Unlike most planetary orbits, which lie more or less in the ecliptic plane, 2003UB313 goes round the Sun in an orbit tilted almost  $45^\circ$  out of this plane, and takes pretty long – 560 years to – complete one trip around the Sun. At its most distant, the planet is 97 times farther from the Sun than Earth. At its closest, it passes inside the orbit of Pluto at a distance of some 36 astronomical units. 2003UB313 is so far away that if you stood on it and held a

pin at arm's length the pin head would blot out the Sun! It is the first time an object so big has been found in our solar system since the discovery of Pluto in 1930 by the American astronomer Clyde Tombaugh. 2003UB313 is currently the most distant directly observed object known in the solar system.

The American team of astronomers took the first photographs of the new planet on 21 October 2003, with the Palomar Observatory's 48-inch Samuel Oschin Telescope, as part of a systematic survey. But the object appeared to move so slowly against the background of stars that the astronomers didn't notice its motion in the sky until looking at the same area 15 months later on 8 January 2005. Preliminary analysis of the near-infrared spectrum of 2003UB313, which provides information about the planet's surface properties, showed a surface covered in frozen methane, one remarkably similar to Pluto's. The presence of methane ice suggests a primitive surface that probably hasn't been heated significantly since the solar system formed 4.5 billion years ago.

The discovery of 2003UB313 has not come accidentally. It is now believed that there may be many similar planet-shaped objects orbiting our Sun well beyond the orbit of Pluto. In fact, since 1992, astronomers have become aware of a vast population of small bodies (including Pluto) orbiting the Sun beyond Neptune. There are at least 70,000 of these Trans-Neptunian Objects (TNOs) with diameters larger than 100 kilometres in the radial zone extending outwards from the orbit of Neptune (at 30 AU) to 50 AU.

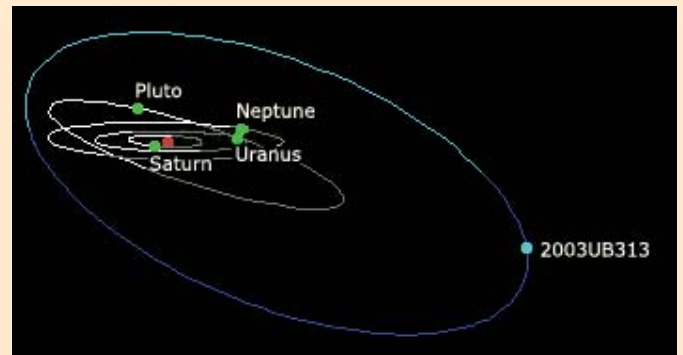


Fig.4. The orbit of 2003UB313 is inclined to the orbital plane of the other planets at almost  $45^\circ$ .

The study of the TNOs is a rapidly evolving field, with major observational and theoretical advances in the last few years. Observations have shown that the TNOs are mostly confined within a thick band around the ecliptic, leading to the realization that they occupy a ring or belt surrounding the Sun. This ring is generally referred to as the "Kuiper Belt." In the past few years Caltech astronomer Michael



Fig.2. With a diameter of 2,600 kilometres, 2003UB313 is larger than Pluto.

Brown and his team have discovered several of the so-called Kuiper Belt Objects (KBOs).

The discovery of one of the biggest Kuiper Belt Objects came in June 2002 when Chad Trujillo and Michael Brown at Caltech in Pasadena discovered Quaoar – a planet-like object with a diameter of 1,250 kilometres, orbiting the Sun about 1.6 billion kilometers further away than Pluto. Quaoar is just about the size of Pluto's moon Charon and hence cannot be called a planet. Just over a year ago, the discovery of another planet-like object, named Sedna, was announced by Brown, but it too turned out to be too small (dia. less than 1,600 km.) to qualify as a planet. Sedna, or 2003VB12, as it was originally designated, never approaches closer than 76 AU to the Sun and is currently 98 AU (1 AU = approximately 150 million kilometres) away. At the far end of its 11,500-year orbit, Sedna reaches a distance of 943 AU. At present the newly discovered 2003UB313 lies just a little bit beyond Sedna.

The latest announcement of the discovery of 2003UB313 came on the same day as the discovery of another Sun-orbiting object, 2003EL61, was announced. With a diameter of around 1,500 km, this object also appears to be much smaller than Pluto. 2003EL61 was first spotted by Jose-Luis Ortiz at the Sierra Nevada Observatory in Spain in March of 2003. Caltech astronomer Brown has been observing it since March 2004. Computation of its orbit showed the object to be about 51 AU from the Sun. Its eccentric orbit brings it as close as 35 AU from the Sun, which is closer than Pluto's average distance of 39 AU. What is most interesting is that 2003EL61 has a small moon with a mass about 1% of the mass of the former. The infrared spectra of 2003EL61 show that it is covered with water ice – similar to what is seen on the surface of Pluto's moon Charon.

Although 2003UB313 is being publicized as the tenth planet of the solar system, its status as a planet has not yet been cleared by the International Astronomical Union (IAU). While Pluto, which is smaller than 2003UB313, has been accepted as a planet since it was discovered in 1930, questions are now being raised as to its eligibility to be called a planet. Many astronomers feel it is too small to be called a planet. The recent discoveries will once again ignite the debate about the qualifications of an object to be called a planet, an issue the IAU is wrestling with as the official naming organisation for this area of science.

It may be of interest to note that Indian astronomer and astrophysicist Dr. J.J. Rawal, invoking his planetary distance law, had predicted two planets or belts of minor planets beyond Pluto at a distance of 52 AU (1 AU=Earth-Sun distance) and 92 AU respectively in 1992. Minor Planets nicknamed Smiley and Sedna were discovered beyond Pluto at a distance of 50 AU and 90 AU. The discovery of 2003UB313 as the "10th Planet" may give credence to his theoretical prediction. We shall, however, need to wait until 2003UB313 is "established" as the "10th planet". His work was first published in the *Bulletin of Astronomical Society of India* vol. 6, 1978. Dr. J.J. Rawal was associated with Nehru Planetarium, Mumbai, for many years and now has founded the Indian Planetary Society in Mumbai. He is also a science populariser and has been awarded NCSTC National Award for Science Popularization.



Dr. J. J. Rawal

-Editor



Fig.3. Artist's impression of 2003UB313 with the Sun in the background.

The IAU has announced that a Working Group for establishing a definition of a planet is looking into the subject in order to decide whether 2003UB313 is to be classified as a planet or not. Until then the object will not be given an official name by the IAU. So, until the report of the IAU Working Group is received, all objects discovered at a distance greater than 40 AU, including 2003UB313, will continue to be regarded as Trans-Neptunian Objects. However, once the IAU approves the still-secret name proposed by a trio of discoverers it would force astronomers to re-write their textbooks and give school kids a 10th planet to memorize. And only then will the enigma of the tenth planet would be solved.

...

# Indian Bay-leaf or Tejpatta

□ T V Venkateswaran

e-mail : tvv123@rediffmail.com

Called also as Indian cassia, Indian Bay-leaf or *Tejpatta* is strongly aromatic, somewhat reminiscent to cinnamon or cloves. In appearance, it is similar to the other bay leaves, but is culinarily quite different. Said to be indigenous to south slopes of the Himalayas, leaves of this plant, which belong to Lauraceae (laurel family)



*Indian Bay-leaf plant*

are used to flavour food. Occasionally the bark may be used as an inferior substitute of cinnamon or cassia. The leaves of this tree is the spice having clove like taste and a faintly pepper like odour.

## Etymology

The Sanskrit name *tamalapattra* means “dark leaf”; and the name of this spice in other Indian languages appears to be motivated by Sanskrit and thus Marathi *tamal patra* or Tamil *talishapattiri*. However in modern times the name of this spice in Hindi and some related tongues, is *tejpatta* or “pungent leaf”. In the Arabic Materia Medica the leaf is called as *sadhaj* or *sadhaji Hindi*.

Greek traders in the ancient times took that name to their own language, but falsely identified the Sanskrit word as a plural form: (ta) *malabathra*. Therefore they reasoned that the singular form to be *malabathron*. Thus

the name by Romans as *malabathrum* or *malobathrum*. The leaves are mentioned in the 1st century CE Greek text *Periplus Maris Erytraei* as one of the major exports of the Tamil kingdoms of southern India. In ancient Greece and Rome, the leaves were used to prepare a fragrant oil, called *Oleum Malabathri*, and were therefore valuable. This spice was well known to the Romans and used both for perfumery and in cooking; in recipes, they were often just referred to as folia “leaves”. Indian bay leaves were still available during the middle ages and used for beer brewing till the 16.th century but later they fell victim to the multitude of new spices available, and were forgotten.

In fact when Portuguese landed on the West Coast of India they took, perhaps not unnaturally, the pan or betel-leaf for the *malabathrum* of the ancients! Dean Vincent in his well-known work on the *Commerce and Navigation of the Ancients*, justified this in part. The name of the betel is *tambul*, which is taken from Sanskrit: *Tambula*; therefore as betel is *Tambula* hence betel-leaf is *tambula* or *tamala-pattra* so went the line of reasoning! However betel and Indian Bay-leaf has nothing in common.

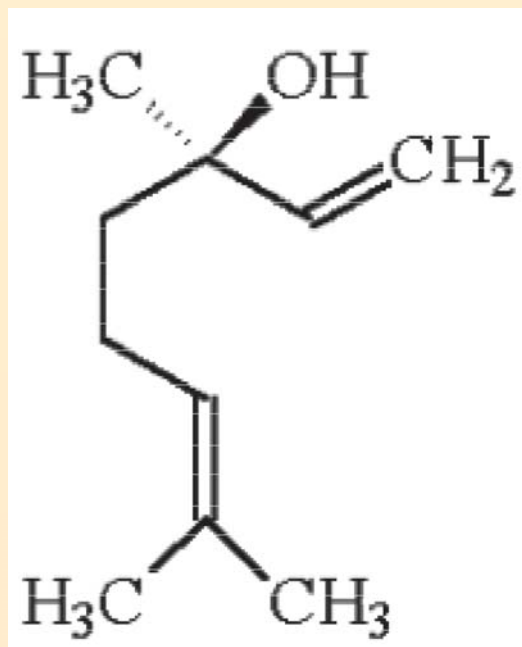
## Botany

Indian bay-leaves are the leaves of a tree closely related to cinnamon. The tough, three-veined leaves are very popular in Northern India, but are little known elsewhere. *Cinnamomum tamala* is a moderate sized



*Indian Bay-leaves*

evergreen trees which is the source of tejpatta leaves and the Indian cassia bark. The tree has height up to 7.5 mtr with zigzag branching, trunk up to 95 cm girth, bark rough, dark grey to reddish brown in colour. It is distributed in tropical and sub-tropical Himalayas, Khasi



Structure of Linalool

and Jaintia hills and in Eastern Bengal. Plants are raised from seeds sown in nursery beds in March-April. Seedlings are transplanted to the field in rows of 2m apart with a spacing of 3 – 3.5 m between plants. Leaves-opposite or sub-opposite, 5-7.5 by 12.5-20 cm. glabrous and are scaly, shining above. They are 3-nerved from the base to the apex. Flowers are small, and unisexual. Perianth lobes are 6, oblong and silky. Fruit oblong, dry or slightly fleshy, 13-17 cm. long and dark purple in colour. The leaves are harvested when the tree attains an age of 10 years, which continue for a century. Leaves are collected in dry weather every year from vigorous plants, dried in the sun and tied up into bundles for marketing.

### Main constituents

In the essential oil from the leaves, mostly monoterpenoides were found: Linalool (50%) is the major compound, whereas  $\alpha$ -pinene, p-cymene,  $\beta$ -pinene and limonene range around 5 to 10% each. Phenylpropanoids appear only in traces: Newer work reports 1% cinnamic aldehyde and no eugenol, whereas older literature speaks of traces of both compounds. The leaves contain an essential oil, eugenol, terpin and cinnamic aldehyde. Outer bark on distillation yields an essential oil (similar to cinnamomum oil) having a pale yellow colour. Cinnamic aldehyde is the chief constituent of bark oil. Roots contain an oil which has eugenol, saffrol, benzaldehyde and terpin.

Linalool is a common aroma chemical found in many commercial applications. Linalool is found in a natural and synthetic form. With the chemical formula  $C_{10}H_{18}O$ , linalool provides a floral scent with a touch of spiciness. It is commonly found in household and personal care products such as soap, detergent, shampoo, and lotion.

Linalool is also used as a chemical intermediate. One common downstream product of linalool is Vitamin E.

### Culinary use

Today, Indian bay-leaves are a spice used almost exclusively in the kitchens of Northern India, especially in the famous Moghul cuisine that was developed at the Imperial courts in Delhi and Agra. Befitting the grandeur of the Moghul empire and delicate Moghul architecture that contain elements derived from Arabic and Persian, the Moghul culinary and cooking too has elements of complexity and perfection with traces of Persian and Arabic cookery. Sweet and aromatic spices are pronounced in Moghul cooking style with a dash of spices such as Indian bay leaves, cinnamon, cloves and cardamom whereas chilli and other pungent and hot spices are used rather less as compared to rest of India. Indeed Indian bay leaf is a must in *biryanis* and Moghul *kormas* of Meat or occasionally vegetables braised slowly but for long time in rich, fragrant sauces. Indian Bay leaf is used in ground form only in the preparation of *garam masala* otherwise it is used as full leaf.

It is used in Indian system of traditional medicines. It possesses carminative, astringent and digestive properties and forms an ingredient of many formulations prescribed for gastrointestinal disorders and the spice is diuretic. It is widely used in pharmaceutical preparations because of its reported hypoglycemic, stimulant and carminative properties. The oil distilled from leaves is a powerful stimulant. It is used to reduce halitosis. It is also used as a clarifier in dyeing industry.

• • •

### Nature's Fury – We Compound.... (Contd. from page 31)

earliest for distribution of relief materials in time, restoration of water and electric supply, and rehabilitation of those affected. This would essentially mean evolving an effective contingency plan and mechanism in partnership with members of the community – or 'bhagidari' as it is called, organizations like NCC and NGOs. Mock drills and ham radio for setting up emergency communication network would also need to be encouraged. This would minimize the suffering of the affected people with faster relief and restoration of normalcy.

May be we shall never be able to fully and correctly predict floods. But, knowing the rain intensity in different places in the city and the amount of rain that has already fallen can help identify areas most likely to face flooding and take timely action. It is imperative that the lakes or water bodies that have fallen prey to the untamed growth are revived and ensured that the rainwater easily flows into them. Further, more attention would need to be paid to the coastal regions in view of the changing climatic pattern. We ought to treat nature with respect.

□ V. B. Kamble

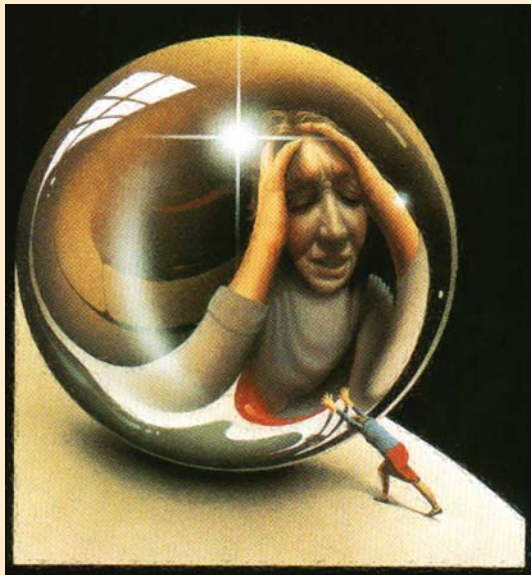
# HEADACHES

## Simple Recipes To Ease The Pain



□ **Dr. Yatish Agarwal**  
 e-mail: [dryatish@yahoo.com](mailto:dryatish@yahoo.com)

**H**eadaches are the most notorious of all human afflictions. They are ruthlessly non-sparing, and it's rare to find a man who has never suffered one. Many diverse conditions can split, throb or nag the head, and the list includes vascular disturbances, injuries, infections, intoxicants, hormonal upsets, tumours, and internal organ disorders.



Fortunately, in nine cases out of ten, headaches are a result of an uneasy and tense mind. Next prevalent in frequency is the migraine. More frequent in women, it leads to pounding arteries and a throbbing head. Close on the heels of migraines follow cluster headaches that are common in men and occur at night. Then there is a large and assorted group of conditions that present with a headache.

In general, physicians today prefer to follow a safe course and put you through a battery of diagnostic tests to find if the pain is due to a physical cause. Usually the tests draw a blank, but they help rule out conditions of a serious nature. In case you have already been through the diagnostic drill with a zero result, here are some helpful hints.

**Never sleep with your head under the covers :** Many people pull their head under the covers when they sleep. It is a habit you can do without. Because if you sleep like a turtle you receive less oxygen and that can give you a splitting headache. If it is the creepy crawlies that bug you, use an insect-repellant. But do not suffocate yourself.

**Stay out of stuffy smoke-filled rooms :** Are you forced to spend long hours in a place which is stuffy and filled

with smoke? Do your friends, colleagues and visitors light a cigarette once too often? If yes, the swirling tobacco smoke can give you a headache because it changes the chemical nature of the air you are breathing. Cigarette smoke builds up the carbon monoxide, ammonia and benzopyrene contents in air toxic levels. The remedy is simple. Either refuse do not allow the nicotine lovers to light up in your room or simply walk out.

**Keep your room well ventilated :** Even if your office is a 'no smoking zone,' you may still run into trouble if it is badly ventilated. An unaired room with a low oxygen level can make you uneasy, set your head throbbing, and impair your concentration. This threat particularly lurks in modern-day offices with sealed windows and central air conditioning that are subject to frequent power cuts. Windows that can be opened easily and the airing of the rooms are a must in this situation. Architects and builders should ensure such provisions.



**Sleep sufficiently :** Six to eight hours sleep each night is an excellent recipe for good health. But some people do even better. They sleep off a headache. You can try it too. It works—on most occasions.

**Too much of anything is bad :** This also applies to sleep. Extra hours of sleep can leave you with a heavy head. You let go of precious hours and feel miserable.

**Regular exercise helps :** Exercise is a wonderful antidote. It acts as an excellent stress-buster. A forty-five minute brisk walk, five times a week, can work absolute wonders for you. Try it. Take a forty minute quick walk every day and feel the big difference.



**Breathe deeply :** It works. Deep breathing is a great tension-reliever. You are doing it right if your stomach is moving more than your chest.

**Eat on time :** The lack of food is another head-buster. If you skip or delay meals it causes an automatic drop in your blood sugar and may result in a splitting headache. If you are prone to such attacks, beat them with frequent small meals and snacks, especially fresh fruit, salad and yoghurt.

**Protect your eyes :** Bright light—be it from the sun, television or a video display terminal—can lead to squinting, eyestrain, and finally a headache. Wear sunglasses if you are going to be out in the sun for a long time. And if you are working on the computer take frequent short breaks. Allow the eyes a moment of rest by looking away from the screen every now and then. Look into the distance or simply close your eyes.

**Avoid rush-hour traffic :** It is good for your health in general and head in particular. It allows you to escape traffic snarls and frayed tempers, but more importantly, you save yourself from high levels of carbon monoxide which causes headaches.

**Seek quiet :** Excessive noise is a common trigger for tension headaches and migraines. Avoid late night jagrans, disco-dandiyas, ear-splitting music and dance parties.

**Avoid late nights :** Many people land up in a severe headache simply because they stay up late at night. Watching a late-night movie, playing rummy or painting the town red may not seem such a good idea at the end of the day.

**Curtail cocktails :** Alcoholic beverages can cause severe headaches. Restrict yourself to a small amount and it probably will not hurt. If you hit your head on the rocks, do not take aspirin. It can irritate your booze-inflamed stomach and cause serious problems. Try a cold shower, instead. It may help by constricting the swollen blood vessels in your head.

**Pace yourself :** Overwork and fatigue are two common culprits that can give you a dull ache or a full-blown migraine. Watch out and do not overstep your limits.

## Identifying Headaches...

**Tension headaches :** The pain is generally generalised, but is sometimes limited to forehead, neck or back of the head. The head appears to be surrounded by a band or as if it's in a vice. There may be a feeling of tightness, aching, and is usually the pain is of non-throbbing kind. It may be continuous or there could be recurrent episodes—both during day and night. Fatigue, overwork, anxiety and nervous strain are the common precipitants. Can affect all ages: middle-aged adults, teenagers and children of both sexes.

**Migraine headaches :** The pain affects the forehead and temple—one or both sides, and may become generalised. It is a throbbing and (or) dull ache; worse behind one eye or ear, and may be accompanied by nausea and vomiting. The attacks may occur at any time: upon awakening or in later part of the day. The pattern is irregular. Bright light, noise, tension, tiredness, prolonged fasting, and some foods can act as precipitants. In women, hormonal changes just before periods can also provoke attacks. Migraine can occur in the teens, young people, and middle-aged adults of both sexes. It's three times more common in women. It may disappear on its own in late middle age.

**Cluster headaches :** Usually one-sided, they occur in the region of the eye or temple. The pain is intense, non-throbbing, and typically occurs at night within 2 to 3 hours of falling asleep. The attacks are nightly and affect for several weeks or months (cluster). Eighty per cent victims are adolescents and adult males; occasionally, women may suffer. Alcohol, prolonged strain, overwork, and emotional upsets can act as triggers.

**Eyestrain headache :** Recurrent, steady, aching pain in the area of the eyes, forehead, or temple, the pain occurs during the day following prolonged use of eyes. Can happen at any age, and both sexes.

**Sinusitis headaches :** Throbbing, or dull aching pain, and heaviness, around the forehead, over the upper cheek, round the eyes on one or both sides depending upon the affected sinuses. The pain occurs immediately on awakening and again in the late morning hours. Worsens on stooping, blowing the nose, jarring the head and during landing in air flights. Recurs and subsides at the same hours each day. May afflict at any age, and both sexes.

**Go easy :** Not just on your body, but on your mind too. Never nurture unrealistic expectations and you will breathe so much easier.

**Develop a sense of humour :** Laughter is the best medicine. This fact applies equally well to pains and aches. You can, quite often, laugh a headache away.

**Learn to relax :** If you experience tension headaches frequently, it is time you went to a yoga teacher or a psychotherapist, learnt relaxation exercises, and did them regularly.

**Make peace with moody weather :** Some people are weather-sensitive. They experience headaches and other unpleasant reactions if the weather and atmospheric conditions change. A big swing in any of the meteorological factors—relative humidity, air temperature, force and direction of the wind, and cloudiness—leaves them indisposed. They are knocked off their feet with a headache, an inexplicable low feeling, sleep problems, reduced working capacity, alteration in the mood, and, sometimes, pain in the joints.

If you suffer from such super-sensitivity to the vagaries of the weather gods, do not despair. You have no control over the weather, but you can avoid the splitting headaches by following a few simple rules. Lead an active life and stay out in the open as much as possible. Do plenty of exercises. If none of this works, take a sedative, or an analgesic pill, just as the weather shows the first signs of change. For those who suffer from pronounced weather reactions, it is best to rest and relax till the weather gods relent.

**Give yourself time to acclimatise :** Oxygen levels get rarefied at high altitudes. This can give even a robust and healthy person a headache. In order to avoid this, take rest and go easy on the first few days. The body needs a few days to acclimatise.

**Take a pill right away :** In case you opt for a paracetamol or some other painkiller, take it right away—as soon as you suffer the first symptoms. Otherwise, it will not do much good.

**Do not make painkillers a habit :** Never get into the habit of popping a painkiller every now and then. It is risky. Analgesic abuse has destroyed many kidneys and livers and claimed many lives.

Wear a headband. This age-old home remedy has merit to it. It decreases the blood flow to the scalp, lessens the throb and pain, and is an easy and practical device.

**Try Vitamin B6 :** Some women suffer from a premenstrual headache. This is due to the natural hormonal changes taking place around this period. If this is the trouble with you increase your daily intake of vitamin B6 to at least 2.5 mg. Take plenty of green vegetables, legumes, whole cereals and milk. Relief can sometimes come that easy.

**See an optometrist :** You sure could take an eye test. Optical errors of the eye are a potent cause of eyestrain and headache. You should exclude this possibility.

**Rule out sinusitis :** Inflammation of the sinuses is more common than you may be inclined to believe. So, in case you experience a recurrent pain in the forehead, cheek and nasal areas that gets worse on stooping and jarring of the head, think of it as a possible sign of sinusitis. Let an ENT doctor check it out.

**Check blood pressure :** Occasionally, it is a headache that calls attention to a high blood pressure. Limited mostly to the more severe cases where the diastolic pressure shoots up to 110 points or more, the characteristic feature of this headache is that it occurs



in the early morning and affects the back portion of the head. It is a kind of an alarm bell, which continues to ring for some hours, then stops. Do not ignore this warning sign.

**Mind your neck :** Spondylosis of the neck vertebrae can also lead to pain in the occipital region. This happens because the bony spurs pinch the nerve roots. Maintaining your neck in good health by keeping proper posture and strengthening the neck muscles through a regular exercise programme is the best way out. For more details, refer to section *Neck Pain*.

**Be Warned :** Occasionally, headaches are warning symptoms of a serious internal disease. Here are the red flags:

- You are above forty and never had recurring headaches before.
- The headaches have changed in nature—they are getting stronger, occur more frequently or have changed location.
- The headaches have begun to disrupt your life. You cannot sleep or have missed work on several occasions.
- The headaches are accompanied by suspicious symptoms such as nausea, dizziness, blurred vision or memory loss.

If you observe any of these symptoms, see a doctor. He would talk to you in detail, examine you thoroughly and may ask for a CT scan or MRI of the head. That can help identify if there is a physical reason for the headache, and guide the best course of treatment in good time.

• • •

## Recent Developments in Science & Technology

### Nanotech Cell phones and Molecular Transistor

Nano-technology could soon enhance cell phone with carbon – nanotube, vacuum tubes, microscopic microphone, liquid lenses, compass linked with global positioning system (GPS) satellite and even electronic noses. For instance, Bell Labs researches are developing nano-scale cell phones consisting of radio transmitters about the diameter of a human hair. The transistor could be used to look at process within living cell and measure chemical potential, electric field and pressures.

Transistors are a key component of electronic devices. By shrinking their level to molecular level, researches at the University of Alberta and University of Liverpool have discovered a way to make faster miniaturized gadgets. Today fastest transistor needs around one million electrons to switch a current. In the new discovery current flows through a single molecule a billionths of a meter, or nanometer, in size. And only one electron is needed to make the switch. With molecular transistors, devices like medical diagnostic equipments could run faster and more cheaply on a small scale.

Source :

### New Catalyst Produces Hydrogen from Water

The promise of a hydrogen economy, which would lessen dependence on nonrenewable energy sources such as fossil fuels, hinges on the ability to produce and store large amounts of the clean-burning element. New results from experiments on a novel catalyst suggest that it can be used to coax hydrogen from water without the need for severe reaction conditions.



The new catalyst can produce ready quantities of hydrogen without the need for extreme cold temperatures or high pressures, which are often required in other production and storage methods. Mahdi Abu-Omar and his colleagues of Purdue University used coordination complex based on the metal rhenium. Originally looking for a method to convert chemicals called organosilanes into silanols, the team combined organosilanes and water in the presence of

the rhenium complex at ambient temperature and pressure. After an hour, the reaction had produced hydrogen gas in addition to silanols. According to a report published in the Journal of the American Chemical Society, the method generates a large amount of hydrogen compared to the amount of water used. This new research will definitely help those scientists are looking alternative power for fuel cells.

Source: [scientificamerican.com](http://scientificamerican.com)

### Chimp Genome—and First Fossils—Unveiled

Many animals, ranging from the rat to the fish, have had their genome sequenced, and now humankind's closest living relative, the chimpanzee, has joined the group. The publication of a draft sequence of this primate's genome in the journal Nature provides the most detailed look yet at the similarities, and differences, between humans and chimps.



Previous studies comparing DNA between the two analyzed randomly selected regions of the genetic codes that comprised around 500 base pairs each. The Chimpanzee Sequencing and Analysis Consortium, made up of 67 scientists from around the world, set out to catalogue the chimp's entire genome, which contains some three billion base pairs. The researchers studied the DNA of Clint, a male chimp that lived at the Yerkes National Primate Research Center in Atlanta, Ga., until he passed away at the age of 24. Using the shotgun sequencing approach, they mapped 94 percent of the genome with a high degree of certainty; covering some parts of the sequence there. The scientists compared the chimp genome to the human one, focusing on points at which the two differ. When considering substitutions of one base pair for another, the results indicate that about 1.2 percent of the genomes are different, which agrees with past estimations that chimps and humans share upwards of 98.5 percent of their DNA. But when the investigators considered duplications and rearrangements of larger sections of the genetic code as well, they found an additional 2.7 percent difference between the two genetic blueprints.

Source: [Scientific American.com](http://Scientific American.com)

Compiled by : Kapil Tripathi