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Monthly Newsletter of Vigyan Prasar

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VP News

Astronomy Activity Workshop

Society of Pollution & Environment Conservation Scientists (SPECS) with support from Uttaranchal State Council of Science and Technology (UCOST) organized an eight-day training workshop for setting up Popular Science Clubs in Uttaranchal during 16-23 January 2006. The first five days were devoted to an Astronomy Activity Workshop, which was conducted by Vigyan Prasar (VP). This workshop was conducted at 'Youth Hostel' at Mussoorie. Fifty participants from all districts of Uttaranchal participated in the workshop representing NGOs from rural areas, schools, social workers, and college students. Technical support including resource material and resource persons were provided by Vigyan Prasar. Vigyan Prasar's software- *Hello Stars*, Astronomy Kit, *Myths and Legends related to Eclipses* - was given as resource material. Shri B. K. Tyagi, Scientist, VP, Shri Arvind C. Ranade, Scientist, VP, and Dr. T. V. Venkateswaran, Scientist, VP, conducted the workshop.

Participants aligning their telescopes

During the workshop, the participants assembled ten 70 mm Newtonian reflector telescopes. Talks and activities on astronomy and introductory lectures on various aspects of astronomy were also organized. Participants were trained to use the star dial for night sky observations and also for viewing planets and Moon through telescope.

Inside

Vigyan Prasar's Video Films Bag Awards

Video films on scientific themes produced by Vigyan Prasar bagged a number of awards at the 11th National Children's Audio-Video Festival organized by CIET, NCERT, New Delhi, at Bhubaneswar from 27 to 29 January 2006. 59 video films were received as entries for the competition, of which 22 were selected for the competition section by a screening committee consisting of eminent filmmakers like Mike Pandey and M.M. Chaudhury. Video films made by Vigyan Prasar selected were: 'Relativity and Quantum Era' (Pulse Media Pt Ltd), 'Discovery of X-Rays' (Vikalp Communications), 'Discovery of Radioactivity' (Credence Media Pvt Ltd), and 'Radio Waves' (Harkara). In addition, the TV serial 'Aisa Hi Hota Hai', jointly produced by Vigyan Prasar and DECU, ISRO, was also selected. A jury consisting of technical experts examined the screened video films and selected the winners for award.

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

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Editor : Dr. V.B. Kamble

Are We Losing the Battle Against Bacteria?

At sometime or another, almost every one of us has used an antibiotic – for a bad cut, pneumonia, or some other type of infection. Antibiotics are chemicals, which when introduced into our body, stop the growth of certain kinds of germs, called bacteria, and help our body fight disease. Indeed, human beings have been using antibiotics for over 3,000 years. The Chinese and the Egyptians stumbled over the discovery that some moulds could be used as a cure to treat rashes and wounds. Sumerians used beer soup mixed with snake skins and turtle shells. Indians and Greeks used many herbs to heal several ailments. All of these natural treatments contained some sort of antibiotic. With passage of time, people began to gain some insight of disease. In the 1860's Louis Pasteur showed that many diseases were caused by bacteria. He later recognized that one type of bacteria could be used to kill another type of bacteria.

In 1929, Sir Alexander Fleming, a Scottish bacteriologist, made the real breakthrough in antibiotics. He went on a vacation and left a petri dish of staphylococci bacteria uncovered. When he returned, he noticed that there was mould growing on it. Upon further examination, he saw that the area around the mould had no bacteria growing, thanks to a chemical produced by the mould. The name of the mould was penicillium, and hence the chemical produced by the mould was named penicillin - the first ever substance recognized as an antibiotic. Penicillin had proven that it worked against pneumonia, scarlet fever, and several other diseases; however, it had no effect on germs that caused typhoid, influenza, and many other diseases. As a result, scientists had to continue their search for other antibiotics.

After penicillin came the invention of the sulfa drug. It came from Prontosil, which is a substance used as a dye. When introduced into the body, Prontosil changes into an active germ-killing drug called sulfonamide. This drug could cure pneumonia, scarlet fever, and blood poisoning. In the late 1940's through the early 1950's, streptomycin (used in treatment of tuberculosis, typhoid fever and other infections), chloramphenicol (used in the treatment of typhoid fever, some form of meningitis and as drops or ointments for skin, eye, or ear infections), and tetracycline (prescribed to treat urinary infections, pneumonia, diseases such as typhus, sexually transmitted infections and conjunctivitis caused by the "chlamydia" bacteria) were discovered and introduced as antibiotics. However, it is interesting to note that almost immediately after penicillin was introduced, resistance in certain strains of staphylococci was noticed. By 1950's it was apparent that tuberculosis bacterium was rapidly developing resistance to streptomycin, which had commonly been used to treat it. In 1953, during a *Shigella* outbreak in Japan, a certain strain of dysentery bacillus was found to be resistant to chloramphenicol, tetracycline, streptomycin, and the sulfonamides.

As early as 1945, in an interview with *The New York Times*, Fleming warned that the misuse of penicillin could lead to selection of resistant forms of bacteria. Fleming had experimentally derived such strains by varying the dosage and conditions upon which he added the antibiotic to bacterial cultures. As a result, Fleming warned that the drug carried a large potential for misuse, especially with patients taking it orally at home, and that inadequate treatments would likely lead to mutant forms. How prophetic his words have proved!

The indiscriminate and improper use of antibiotics results in a survival-of-the-fittest selection process for bacteria, which can both inherit and acquire resistance to drugs, through mutation or by sharing DNA. This is just as in normal Darwinian evolution but accelerated umpteen times by the division of millions of microbes (microbe is an umbrella term for microscopic organisms that include bacteria, fungi and viruses). An infection treated with the wrong drug or for too short a time results in most bacteria being killed while the resistant ones survive to multiply. Antibiotics taken for viral infections, against which they are impotent, promote the growth and spread of resistant microbes in patients, their families, and the community. The lack of effective monitoring and enforcement of controls on the sale and use of antibiotics is cited by the World Health Organization (WHO) as one of the main causes of growing resistance of the world's microbes to antimicrobial drugs.

When first discovered, antibiotics were thought to be a miracle cure and they literally were. Infections that were fatal were reduced to mere inconveniences. In the early years, new antibiotics were developed faster than bacteria developed resistance to them. But the bugs caught up fast. In the 1950s and 60s, many new classes of antibiotics were discovered. But in the 1980s and 1990s, scientists could only manage to make improvements within classes. Today, some low-grade hospital bugs have become resistant to most antibiotics. Hospitals are not the only breeding grounds for these "superbugs", as they have come to be known. A marked rise in drug-resistant bugs has been observed in community homes and other places which are home to vulnerable groups of people. Worldwide, a new drug-resistant strain of tuberculosis is causing concern, particularly as

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Niels Henrik Abel

The Greatest Norwegian Mathematician

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"The story of the life of Niels Abel, one of the most brilliant mathematicians to emerge from Scandinavia, has often been told. All the elements of a melodrama seem to be present: the penniless genius dying of consumption in the arms of his childhood sweetheart, while the selfish academicians sit on his masterpiece and the news that he has been offered the position he so desperately needed arrives just too late. The true story is tragic enough."

Ioan James in Remarkable Mathematicians: From Euler to von Newman, Cambridge University Press, 2002.

"With Evariste Galois (whom he never met), Abel founded the theory of groups (commutative groups are known as Abelian groups in his honour), and his early death ranks as one of the great tragedies of 19th century mathematics…Abel's greatest work was in the theory of elliptic and transcendental functions…The study of elliptic functions inaugurated by Abel was to occupy many of the best mathematicians for the remainder of the 19th century. He also made very important contributions to the theory of infinite series."

A Dictionary of Scientists, Oxford University Press, 1999

"He (Abel) developed the concept of elliptic functions independently of Carl Gustav Jacobi, and pioneered its extension to the theory of Abelian integrals and functions, which became a central theme of later 19th-century analysis, although his work was not fully understood in his lifetime."

Chambers Biographical Dictionary (Centenary Edition), 1997

Niels Henrik Abel was one of the most prominent mathematicians of the world in the first half of the 19th century. He is probably the most well-known Norwegian mathematician ever. Abel founded the theory of groups. He showed that the general fifth-degree equation is not solvable algebraically. Abel's theorem and Abelian functions and equations were all valuable additions to the science of mathematics. He revolutionized the important area of elliptic integrals with his theory of elliptic and transcendental functions. He also contributed to the theory of infinite series. Abel on realising that much of the previous mathematical work was unproved, took it as his own responsibility to fill these gaps in mathematics by providing the proofs that had been left out. His most significant work was the first proof of the general binomial theorem, which had been stated by Newton and Euler. The adjective "abelian", derived from his name, has become a commonplace in mathematical writing. Abel's work in mathematics was so revolutionary that one mathematician stated: "He has left mathematicians something to keep them busy for five hundred years." Abel's life story is one of the most tragic in the history of science.

Niels Henrik Abel

Niels Henrik Abel was born on August 05, 1802 in Finnøy, an island near the Norwegian town of Stavanger. His family moved to Gjerstad shortly after his birth. His father Soren Georg Abel was a Lutheran minister. Soren Abel studied at the University of Copenhagen and he had a degree in theology. He was a prominent Norwegian nationalist who was active politically in the movement to make Norway independent. Abel's mother Anne Marie (nee Simonson) was the daughter of a wealthy merchant. Abel was brought up at Gjerstad, where his father was appointed as minister to succeed his father-in-law. Abel was taught by his father in the vicarage until he reached 13 years of age. Abel's father was a member of the session of the Norwegian Parliament (Storting) that was specially convened in 1814 with a specific purpose—rewriting the Norwegian constitution reflecting union with Sweden in place of Denmark. He again tried to enter the Parliament in 1816 but he failed to be elected. In 1818, he was re-elected but his political career ended in disgrace by making false charges against his colleagues in the Storting.

Abel was growing in a period when Norway was passing through a difficult period. At the end of the 18th century Norway was part of Denmark. During the Napoleonic wars Denmark decided to remain neutral. Accordingly they signed a neutrality treaty in 1794. However, in 1801 England considered this neutrality treaty as an aggressive act. The English fleet destroyed most of the Danish fleet in a battle in the harbour at Copenhagen. Denmark avoided wars until 1807. But then England feared that the French may use the Danish fleet to invade and they thought it will be in their own interest to attack Denmark. They captured the whole Danish fleet in October 1807. In this way Denmark was compelled to join the alliance against England. The war led to an economic crisis in Norway. Due to war restrictions they could neither export timber (which was largely to England) nor import food grains from Denmark. There were wide spread poverty and suffering among the people. In 1813 Denmark was attacked by Sweden from the south. Following a treaty between the two countries, Denmark handed over Norway to Sweden in 1814. After a few months there was an attempt by Norway to gain independence. This prompted Sweden to attack Norway. Sweden after gaining control of Norway set up a complete internal self-government for Norway. The seat of the government was at Christiania.

Sir Isaac Newton

At the age of 13, Abel entered the Cathedral School of Christiania (today's Oslo). At the time when Abel joined the school it was in a bad state. This is because most of the good teachers had left the school in 1813 to join the newly established University of Christiania. The environment of the school failed to inspire Abel and he was nothing but an ordinary student with some talent for mathematics and physics. Though he had developed some liking for mathematics but his mathematics teacher was very cruel. The teacher hardly cared for the students. One day he hit a student so badly that he died a few days later. This incident proved to be a turning-point for Abel. The teacher was suspended and the Bernt Michael Holmboe replaced him in 1817. He was an inspiring and caring teacher. Holmboe saw that Abel had special skills in mathematics and he helped and supported Abel as long as he lived. After recognizing the exceptional mathematical talent of Able, Holmboe persuaded Abel to study the works of great mathematicians like Leonhard Euler (1707-1783), Comte Joseph Louis Lagrange (1736-1813), and Pierre-Simon Laplace (1749-1827).Abel borrowed books and studied on his own. He went above the usual level and soon he attacked problems that were unsolved at that time, such as fifth degree equations. He went deep into the mathematics but he did not do very well in the other subjects.

Leonhard Euler

In 1820 tragedy struck Abel's family when his father died. Abel was still in School. His father's death left the family in dire poverty. There was now no money to allow Abel to complete his school education. His mathematics teacher helped him to complete his school education. A small pension from the state allowed Abel to enter Christiania University in in 1821. But before entering the University Abel made a contribution to mathematics. For hundreds of years, mathematicians had searched in vain to discover the general solution for the quintic (the fifth power) equation, $a x^5 + b x^4 + c x^3 + d x^2 + e x + f = 0$. Abel developed what he thought was the formula to solve the fifth degree equation. To see whether the answer was correct or not, Abel's paper containing the solution to the age-old problem was sent to the mathematician Ferdinand Degen in Denmark. However, before Degen could send his observations, Abel himself discovered a mistake in his figures and wondered whether there was really an answer to the problem. He eventually proved that an algebraic solution to the quintic equation was impossible. But his interaction with Degen proved to be useful in another way. Degen could not find anything wrong about it and he praised Abel's work but he also recommended him to take up the subject of elliptic integrals. This became the focus of Abel's subsequent work and the source of his fame.

At the Christiania University, Abel was patronized by Christopher Hansteen, professor of astronomy. Hansteen not only supported Abel financially but also encouraged him to continue his studies. Hansteen's wife cared for Abel as her own son.

After fulfilling the requirements for graduation in one year, he was left on his own to study. In 1823, he published his first important paper on definite integrals. This paper contained the first ever solutions of an integral equation. He also produced another valuable work on the integration of functions. His papers, though they were very important, failed to bring him fame or an appointment. In fact his papers were not read by important mathematicians of Europe.

This is because Abel wrote his papers in Norwegian while the leading mathematicians of Europe wrote in French and German.

In 1823, Abel visited Copenhagen. The purpose was to be familarised with the works of the Danish mathematicians. In those days Abel's own country Norway had no good school of mathematics. His visit to Copenhagen was possible because he received financial support from Christopher Hansteen. It was at Copenhagen, Abel met Christine Kemp, with whom he became engaged. The authorities of the University of Christiania taking recognition of Abel's mathematical talent provided necessary funds to Able for studying in Paris. As per the original plan Abel was to visit Gauss at Gottingen first and then go to Paris. However, this did not happen. The two great mathematicians never met. Gauss' biographer G. Waldo Dunnington wrote: "When Niels Henrik Abel (1802-1829) of Norway, one of the most important mathematicians of the nineteenth century, went to Germany in 1825, he had originally intended to visit Karl Friedrich Gauss (1777-1855). Abel was not well known at the time. A copy of his proof of the impossibility of solving the general equation of the fifth degree had been sent to Gauss, who did not consider it very important. As he did not get any response from Gauss, Abel cancelled his planned visit to Gottingen. Abel thought Gauss did not do enough to put him before the public. After this incident he had no further interaction with Gauss and was exceedingly critical of him". It is very unfortunate that the two great mathematicians did not meet. Besides meeting Gauss, Abel had wanted to use the splendid university library in Gottingen. Gauss did realize his mistake. But then it was too late. After Abel's death Gauss wrote to Schumacher on May 19, 1829: "Abel's death, which I have not seen announced in any newspaper, is a very great loss for science. Should anything about life circumstances of his highly distinguished mind he printed, and come to your hands, I beg you to communicate it to me. I would also like to have his portrait if it were to be had anywhere."

Pierre-Simon Laplace

Adrien-Marie Legendre

Comte Joseph Louis Lagrange

Abel, with some other students of the university went to Berlin before finally going to Paris. The year was 1826. It was not a good decision when we consider the fact that Abel spent most part of his grants for visiting Berlin. However, the most positive side of this visit was that Able met August Leopold Crelle (1780-1855), who had just founded the *Journal fur die reine und angewandte Mathematik* (*Journal for Pure and Applied Mathematics*). The journal was popularly called *Crelle's Journal*. Crelle became Abel's mentor. He encouraged Abel to publish his results in his *Journal*. The very first volume of the Journal had Abel's seven papers. Abel published most of his major works in *Crelle's Journal*. Abel's association with Crelle was important because Abel could not persuade the French Academie des Sciences to publish his work.

In 1826 Abel moved to Paris, where he stayed for about ten months. He met leading mathematicians of France. However, Abel's work was poorly appreciated, as his work was scarcely known. Abel managed to present his "masterpiece," a paper on elliptic functions and integrals which included Abel's theorem to the French Academy of Sciences. The Academy referred the paper to Adrien-Marie Legendre (1752-1833) and Augustin Louis Cauchy (1789-1857). Legendre, who was in his seventies, claiming that he had difficulty in reading the handwriting Abel left the entire work to Cauchy. Cauchy brought the work home for reading but he promptly reported that the work was misplaced. It is said that he 'misplaced' it intentionally. This is because Cauchy was much more interested in his own work and he was a little jealous of Abel. The paper was given its due recognition in 1830, a year after Abel's death. The French Academy awarded the grand prize. However, the paper was not published until 1841.

Commenting on his experience of the visit, Abel wrote: "Legendre is an exceedingly courteous man, but unfortunately as old as the stones. Cauchy is mad, and you cannot get anywhere with him, although he is the mathematician who knows at the moment how to treat mathematics. Cauchy is extremely Catholic and

bigoted. A very strange thing in a mathematician...Poisson is a short man with a nice little belly. He carries himself with dignity. Likewise Fourier. Lacroix is terribly bald and extremely old. On Monday I am going to be introduced to several of these gentlemen by Hachette. Otherwise I do not like the Frenchman as much as the German, the Frenchman is uncommonly reserved towards foreigners. It is difficult to make his close acquaintance. And I dare not count on such a thing. Everyone wants to teach and nobody to learn. The most absolute egotism prevails everywhere. The only things that the Frenchman seeks from foreigners are the practical...He is the only one who can create something theoretical...you can imagine that it is difficult to become noticed, especially for a beginner."

Johann Carl Friedrich Gauss

Because of financial compulsion Abel had to abandon his tour. After returning to Norway he taught for some time at Christiana. Abel failed to get the recognition that he rightly deserved. He had no appointment. A vacancy in mathematics department of the Christiana University arose but this was given to his teacher and mentor Holmboe. Holmboe wanted that the job should go to Abel. But when the university authorities threatened to give the job to a foreigner if he did not agree to take it, Holmboe accepted it. To increase his misery Abel was in debt and had contracted tuberculosis. Abel could manage to survive with meager grants and support from his friends. However, with all difficulties Abel continued to work. He produced several papers on the theory of equations, including sections that introduced a new class of equations, now known as the Abelian equations. In his study of elliptic functions and integrals Abel found a rival in Carl Gustav Jacob Jacobi (1804-1851) . He was also worried that his illness could end his life at any time. He was not deterred. He continued to work with a fervent zeal. His work laid the foundation of all further studies into the field. Eventually mathematicians had to take note of Abel's work. Legendre started a correspondence with both Abel and Jacobi, praising them as two of "the foremost analysts of our times." A demand for a professorship for Abel was raised by mathematicians all across Europe.

Augustin Louis Cauchy

Niels Henrik Abel died April 6th in 1829 of tuberculosis. Two days later, Crelle sent him a letter informing him that Cerel had finally succeeded in getting a position for Abel at the University of Berlin. Abel's works edited Holmboe were published in 1839 by the Swedish government. Later a more complete edition by Ludwig Sylow and Sophus Lie was brought out in 1881. After his death Abel became a national hero in Norway. His birth centenary (1902) was widely celebrated and a number of memorioals were erected—the most important among them was the monument by Vigeland which stands in the 'Abel Garden', the park of the Royal Palace.

We will end this write-up on Abel, one of the greatest mathematicians of all time by quoting August Leopold Crelle: "All of Abel's works carry the imprint of an ingenuity and force of thought which is unusual and sometimes amazing, even if the youth of the author is not taken into consideration. One may say that he was able to penetrate all obstacles down to the very foundations of the problems, with a force which appeared irresistible; he attacked the problems with extraordinary energy; he regarded them from above and was able to soar so high over their present state that all difficulties seemed to vanish under the victorious onslaught of his genius...But it was not only his great talent which created the respect for Abel and made his loss infinitely regrettable. He distinguished himself equally by the purity and nobility of his character and by a rare modesty which made his person cherished to the same unusual degree as was his genius".

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Alcoholic Beverages

Food Or Poison ?

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Alcoholic beverages have been widely consumed since prehistoric times by people around the world, for their relaxant and euphoric effects. Its psychic effects, both pleasant and unpleasant are most familiar. Its biological

effects are a cause for concern because it is toxic in different amounts for different people – the extreme effects being pathological changes in liver, disability and eventual death. Although in small doses alcohol is harmless, its continued intake develops into a habit; such a condition of addiction to alcohol is called alcoholism. Alcoholism is considered a major health problem in many nations, and in many Western countries, it is the third major health hazard after heart disease and cancer.

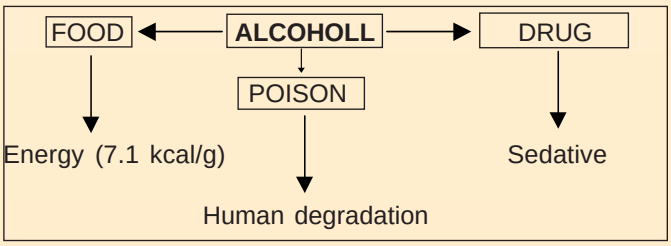
Types of alcoholic beverages

Alcohol is produced in alcoholic beverages by yeasts by anaerobic fermentation. The process of culturing yeast under conditions that produce alcohol is referred to as brewing. Whereas it is a waste product for the microorganism that produces it from carbohydrates, for humans it has become a valuable stuff for consumption. Humans must have encountered alcohol in early times in the form of fermented fruit juice and malted grains. There are two main types of alcoholic beverages – fermented drinks and distilled drinks. Fermented drinks (beer, wine) are low-alcohol content beverages containing 5-20 % alcohol produced by fermentation of sugar- or starch-containing products (grains, fruits, etc.). Distilled beverages, also called spirits or liquor (brandy, gin, rum, vodka, and whisky) are high-alcohol content beverages containing 12 to 55 % alcohol produced by distillation of a fermented product, concentrating the alcohol and eliminating some of the by-products. Beer is produced by a relatively short (incomplete) fermentation process and an equally short aging process (a week or two) resulting in an alcohol content generally between 3-8%. Wine is produced by a longer (complete) fermentation process, and a relatively long aging process (months or years) resulting in an alcohol content between 7-18%. Beer is generally made from barley, but sometimes from a mix of other grains. Whisky is generally made from barley and oats, or a blend of different grains. Among distilled beverages, vodka is distilled from any source (grain and potatoes), while gin is a distillate which is flavored with herbs and other plant products, especially juniper berries.

Alcohol as Food

Alcohol present in alcoholic beverages may be considered as food producing 7.1 kcal/g, which is nearly twice as much energy produced in the body by any carbohydrate. In contrast to other foodstuff, alcohol is readily absorbed in the gastro-intestinal tract without the need for digestion. While the body gets rid of alcohol mostly by oxidizing it, very little of alcohol can be disposed of as such through lungs and kidney. Thus, only a little of unmetabolized alcohol is excreted via urine, sweat and expired air. Unlike fats or carbohydrates, alcohol is not stored in the tissues; and unlike carbohydrates and fat, which can be metabolized by

almost all tissues, alcohol must be oxidized only in the liver. This organ-specificity of alcohol explains the localization of so many of alcohol's deleterious effects in the liver, which is the body's most vital organ, being a primary site of many metabolic processes.



Intoxication

Alcohol is a depressant of central nervous system (CNS). Alcoholic beverages have a relaxing effect that many people find pleasurable. Some tonics contain 10-20% of alcohol. Because of its sedative action, it finds use as a tranquilizer; and its consumption gives relief from neuralgia and pain. Although alcohol in small amounts brings about pleasant excitement, an excessive amount is a poison for the nerves; it affects the higher centres of brain and memory. The effects of alcohol on the nervous system are not necessarily related to the amount of alcohol consumed, but to the alcohol concentration in the blood. Very low blood alcohol levels produce mild sedation, relaxation, or tranquility. Slightly higher levels may produce behavioral changes, which suggest stimulation of brain – aggressiveness and excessive activity. At still higher levels, lack of coordination, confusion, giddiness, double vision, stupor, coma, or death results.

Effects of alcohol drinking

Alcohol concentration in blood (%)	*Effect*
0.05	Produces mild sedation
0.1	The drinker becomes tipsy
0.15	Lack of coordination sets in
0.2-0.3	The drinker becomes intoxicated
0.3-0.4	The drinker becomes depressed; may produce unconsciousness
> 0.5	Paralyses breathing centres and ultimately causes death

The amount of alcohol that a person can safely drink depends upon body weight, and circumstances of consumption play a large part in determining the extent of intoxication. Consuming alcohol after a heavy meal is less likely to produce visible signs of intoxication than consumption on an empty stomach. Hydration also plays a role, in determining the extent of hangovers.

Absorption and Distribution

Being highly hydrophilic alcohol can diffuse easily across biological membranes; thus, when ingested, alcohol is absorbed relatively quickly from all along the gastro-intestinal tract. Absorption is very rapid from the small intestine, while a lesser but substantial diffusion also occurs across the mucosa of the stomach and large intestine. Once absorbed from the gastro-intestinal tract, it is distributed to all body fluids and tissues via blood, in proportion to the water content of the fluid. Consequently, alcohol may be detected in blood, urine, cerebrospinal fluid and even water vapour of the expired air.

A number of factors such as alcohol concentration and other ingredients of the beverage, presence of food in stomach, speed of drinking, speed of gastric emptying and body weight can markedly influence absorption. Same dose of alcohol in the form of different beverages gives rise to different blood alcohol curves. For example, beer is absorbed much more slowly than whisky and brandy. Differences in the rate of absorption of various beverages are not due only to their differences in alcohol concentration. Even when diluted to the same alcohol concentration, gin is found to be absorbed more rapidly than whisky and both more slowly than the wines. Carbon dioxide is shown to enhance rate of absorption of alcohol. However, no difference in the blood alcohol curve is seen with gin or whisky diluted with carbonated water. Perhaps carbon dioxide, by shortening the time of gastric emptying, may enhance the rate of absorption of those beverages that are otherwise absorbed more slowly, while having little effect on those that are absorbed rapidly.

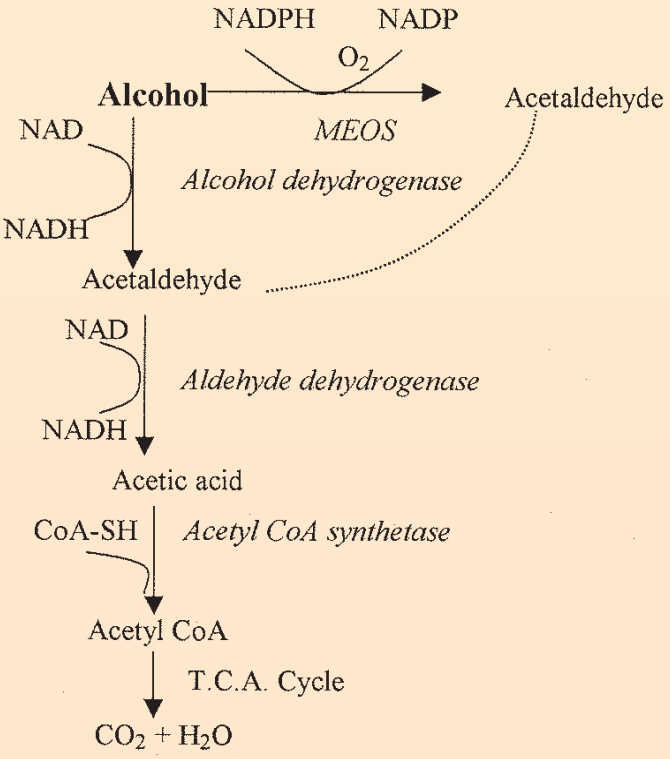
Cell membranes are highly permeable to alcohol. Once absorbed into the bloodstream, alcohol gets distributed uniformly throughout body fluids, both extracellular and intracellular, and diffuses rapidly into nearly every tissue of the body. Equilibrium is reached rapidly in brain, lungs, heart, and kidney, but much more slowly in skeletal muscle. Once equilibrium is reached, the concentrations of alcohol in all tissues are directly proportional to their water content. Distribution of alcohol between blood and alveolar air also obeys simple laws of diffusion and vapour pressure, so that measurement of alcohol in the breath permits a reasonably accurate estimate of its concentration in blood. While more than 90% of the absorbed alcohol is oxidized in the body, only about 5% of intact alcohol is excreted via urine, sweat and breath.

Metabolism of Alcohol

Once absorbed and distributed in the blood, over 90% of the ingested alcohol is disposed of by enzymatic oxidation to CO_2 and water in a series of steps. The main site of metabolism of alcohol is liver. The first step in the metabolism of alcohol is its conversion to acetaldehyde. Alcohol is oxidized to acetaldehyde

principally by the enzyme alcohol dehydrogenase of the liver and then is converted to acetic acid catalyzed by the enzyme aldehyde dehydrogenase. Acetic acid is then converted to acetyl-CoA, which eventually is used up to make fats or oxidized completely to carbon dioxide and water via tricarboxylic acid cycle. Acetaldehyde and acetate produced from alcohol oxidation in the liver are released into the blood and oxidized in peripheral tissues.

Alcohol metabolism in liver involves the enzymes alcohol dehydrogenase and aldehyde dehydrogenase responsible for the first two steps of oxidation. The addicting properties of alcohol are inter-related with its metabolic degradation by these dehydrogenases. A biochemical individuality of the enzymes responsible for the metabolism of alcohol could be responsible for such a predisposition to alcoholic addiction. From this point of view, the heterogeneity and the poly-morphism found in alcohol dehydrogenase have some implications for the metabolism and the effects of alcohol in normal and alcoholic individuals. Alcohol dehydrogenase found in women is less effective than that found in men, thus rendering them more susceptible for intoxication. People of East Asian descent have a genetic mutation in their



acetaldehyde dehydrogenase gene, resulting in a less potent acetaldehyde dehydrogenase. This leads to a buildup of acetaldehyde after alcohol consumption, causing hangover-like symptoms such as flushing, nausea, and dizziness. Such people are unable to drink much alcohol, and are therefore less susceptible to alcoholism.

Alcohol is also oxidized to acetaldehyde by the microsomal ethanol oxidizing system. Micro-somal ethanol oxidizing system is primarily located in the liver, and is more physiologically active than alcohol dehydrogenase. It utilizes molecular O_2 and is capable of adaptation to heavy alcohol consumption. Its induction is interrelated with the proliferation of smooth endoplasmic reticulum after prolonged alcohol ingestion; and this adaptive increase in microsomal ethanol oxidizing system and hence an enhanced rate of elimination of ethanol also contributes to alcohol tolerance. The alcoholic's capacity to drink more is, however, primarily due to brain tolerance, a progressive decrease in the effectiveness of alcohol's action on the brain.

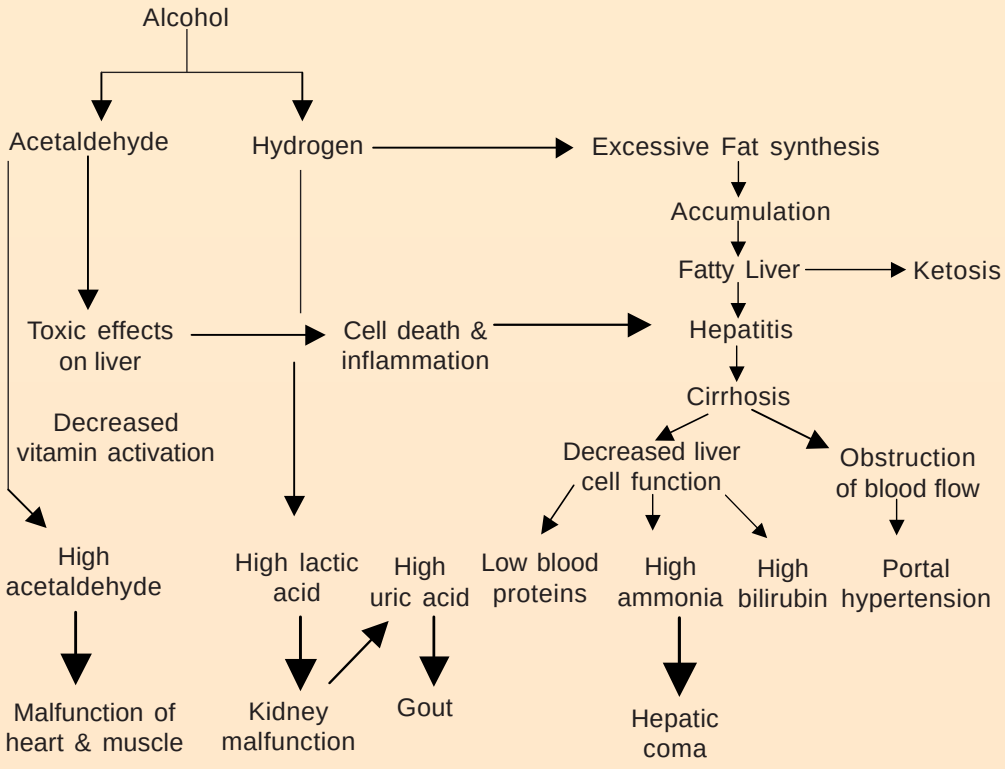
Biochemical Effects of Alcohol

A number of metabolic effects of alcohol are due to the first two products of its oxidation – hydrogen and acetaldehyde. Excess hydrogen derived from alcohol imbalances biochemical pathways in the liver cell, sometimes with deleterious effects. One such pathway is formation of glucose (gluconeogenesis) from aminoacids via pyruvic acid. In presence of excess hydrogen, pyruvate is reduced to lactic acid thus preventing gluconeogenesis. Blood sugar is derived from either dietary carbohydrate, breakdown of stored glycogen, or gluconeogenesis. If an alcoholic has not consumed any food, once glycogen reserves are used up, and if gluconeogenesis is also interfered with by diverting pyruvate to lactate, the level of blood sugar will fall. Hypoglycaemia is known to be a complication of acute alcoholism. Crucial organs including brain can be critically affected by lack of glucose and may lead to death. Lactate buildup in blood from excessive reduction of pyruvate leads to lactic acidosis. In kidney, it interferes with the excretion of uric acid and a consequential high uric acid level in blood exacerbates gout.

The excess hydrogen derived from oxidation of alcohol can also be shunted directly into the synthesis of fat that accumulates in the alcoholic fatty liver. If alcohol is ingested along with a diet containing fat, the fat of dietary origin accumulates in the liver; even when alcohol is taken with a low-fat diet, fat synthesized in the liver itself is deposited there. In addition, when alcohol is ingested in very large quantities, it can trigger hormonal discharges that mobilize fat from adipose tissue toward the liver. The fats are mostly deposited locally which leads to the characteristic 'beer belly'. Chronic drinkers, however, so tax this metabolic pathway that things go awry: fatty acids build up as plaques in the capillaries around liver cells and those cells begin to die, which leads to the liver disease cirrhosis.

Fat accumulated in liver can either get secreted into bloodstream, to provide fuel for peripheral tissues, or if surplus, can get deposited for storage in adipose tissue. Lipids are secreted into blood in conjugation with proteins as lipoproteins. The assembly of lipoproteins is carried out in the liver on the endoplasmic reticulum. With the proliferation of smooth endoplasmic reticulum in the alcoholic, the liver's capacity for secreting lipoproteins is also increased. A person who is adapted to heavy alcohol intake will have exaggerated secretion of lipoproteins producing hyperlipemia. Hyperlipemia is a major predisposing factor for heart attacks. Alternatively, liver also disposes of excess fat by converting some of it into ketone bodies and secreting them into the bloodstream. In susceptible people this may be exaggerated, resulting in an elevation of ketone bodies in blood that mimics the ketoacidosis condition of diabetics.

Toxicity of alcohol is also caused by acetaldehyde produced by its initial oxidation. Although most of it is converted into acetate, some acetaldehyde escapes into blood. Abnormal acetaldehyde level in alcoholics results from faster metabolism of alcohol to acetaldehyde (by adaptive increase in microsomal activity) or from slower disposition of acetaldehyde. Striking alterations in liver mitochondria produced during heavy alcohol consumption result in reduced capacity to metabolize acetaldehyde; high acetaldehyde impairs mitochondrial function in liver; its metabolism is decreased leading to accumulation that causes liver damage.



Acetaldehyde also affects other tissues, such as heart muscle and brain. It has been suggested that acetaldehyde is responsible for the development of the dependence that along with tolerance characterizes alcohol addiction. Acetaldehyde combines with the amines to form isoquinoline derivatives – potent psychoactive compounds that play a role in development of dependence. Acetaldehyde is probably involved in the predisposition to alcoholism; a predisposed person may be deficient in acetaldehyde metabolism that leads to a higher blood acetaldehyde level and a propensity to dependence because of the effect of the higher acetaldehyde level on the brain.

Certain symptoms of the 'hangover' after drinking have been attributed to acetaldehyde. Acetaldehyde is a very reactive compound, forming addition products with many aromatic amines including endogenous ones. Acetaldehyde can affect many facets of body metabolism including changes in carbohydrate and lipid metabolism. Ingestion of alcohol alters every aspect of the anabolic phase of carbohydrate metabolism, from absorption to disposition as glycogen and triglyceride. Catabolic phenomena are likewise universally affected by alcohol. Alcohol and its metabolites influence the processes of ketogenesis, lipolysis, and gluconeogenesis. The most important of these is an effect of acetaldehyde on biogenic amines – norepinephrine and seratonin. Acetaldehyde causes release of norepinephrine from neural depots.

Oxidation of alcohol favours the formation of lactic acid from pyruvate. Hepatic glycogenolysis is augmented after the ingestion of alcohol due to release of epinephrine from adrenal medulla. Glycogen reserves are often reduced in the livers of subjects with alcoholic cirrhosis as a result of reduced cell mass, and consequently the glucose release is less. Gluconeogenesis is the primary mechanism responsible for hepatic glucose output during periods of starvation, glycogenic amino acids being the main substrates. Alcohol has direct effect on the availability and uptake of gluconeogenic precursors by both liver and kidney. Alcohol lowers the circulating levels of important

glycogenic amino acids. Chronic alcoholics are prone to become hypoglycemic after alcohol intake and manifest a variety of neurological signs. Ketonuria and mild ketonemia frequently accompany alcohol hypoglycemia.

Undesirable Effects of Alcohol

Dehydration: Consumption of ethanol has a rapid diuretic effect, meaning that more urine than usual is produced, since ethanol inhibits the production of antidiuretic hormone. Over-consumption can therefore lead to dehydration. As large amounts of alcohol are consumed, the diuretic effect causes the body to lose more water than is contained in the beverage.

Ataxia: A classic condition of alcohol intoxication is ataxia, which results in jerky, uncoordinated movements of the limbs. Extreme over-indulgence can lead to alcohol poisoning and death due to respiratory depression.

Hangover: A common after-effect of ethanol intoxication is the unpleasant sensation known as hangover. Hangover symptoms include dry mouth, headache, nausea, and sensitivity to light and noise. These symptoms are partly due to the toxic acetaldehyde produced from alcohol and partly due to general dehydration. Drinking plenty of water between and after alcoholic drinks can mitigate the dehydration portion of the hangover effect. Other components of the alcoholic drink, such as the tannins in red wine also contribute to hangover.

Liver diseases: Fatty liver is the first stage of liver disease brought about by rather moderate consumption of ethanol and is characterized by striking changes in the ultrastructure of the liver cell – especially enlarged and distorted mitochondria and proliferated smooth endoplasmic reticulum. Fatty acids accumulate in liver because of the decrease in lipid oxidation. In addition, a low-fat diet enhances lipogenesis in liver. Decreased lipoprotein secretion also favours pathogenesis of alcoholic fatty liver. The fatty liver induced by intake of moderate amounts of alcohol with adequate diets is reversible. In the case of heavy drinking, fatty liver evolves toward more severe and irreversible liver disease – hepatitis and cirrhosis. In the first stage (alcoholic hepatitis), decreased liver cell function leads to death of cells, inflammation and even mortality (10-20%). Alcoholic hepatitis is characterized by extensive necrosis and inflammation, which in turn might initiate scarring (fibrosis) and eventually cirrhosis. The final stage of liver disease – cirrhosis is characterized by fibrous scars, which disrupt the normal architecture of the liver and give rise to potentially fatal complications. A final complication stems from the liver's inability to clear ammonia and other nitrogenous compounds from the blood. These toxic compounds that accumulate act on the brain causing functional disturbances, hepatic coma and death.

Though fat accumulation in the liver (fatty liver) almost invariably follows excessive alcohol consumption, not all alcoholics develop cirrhosis of the liver. In addition to the dose and duration of alcohol consumption, other factors probably modify the ultimate response of liver to alcohol. Dietary deficiencies, especially of protein and lipotropic factors can potentiate the hepatotoxic effect of alcohol.

Carcinogenic effects: Large amounts of alcohol greatly increase the risk of developing a cancer, especially cancers of the upper digestive tract, including the esophagus, the mouth, the pharynx, and the larynx. An estimated 75 % of esophageal cancers in the United States are attributable to chronic, excessive alcohol consumption. Nearly 50 % of cancers of the mouth, pharynx, and larynx are associated with heavy drinking. Alcohol consumption has also been associated with cancers of the liver, breast, and colon. Prolonged, heavy drinking has been associated in many cases with primary liver cancer. However, it is liver cirrhosis, whether caused by alcohol or other factors that is thought to induce the cancer.

Action on the brain: Ethanol absorbed into the bloodstream can reach the brain, since it is able to cross the blood-brain barrier. At low concentrations, it can actually stimulate certain areas of the brain, namely, the cortex, hippocampus and nucleus accumbens, which are responsible for thinking and pleasure seeking. Body relaxation effect of alcohol is possibly caused by heightened alpha brain waves surging across the brain. The euphoric effects of ethanol are probably due to its causing the release of endorphins, the body's natural response to pleasurable activity. The CNS depressant effect experienced with higher doses of alcohol is due to ethanol's secondary effect on γ-aminobutyric acid (GABA) receptors, (GABA is an inhibitory neurotransmitter) resulting in slow-down of nerve impulses. Ethanol increases the effectiveness of GABA acting through GABA receptors. GABA could also be responsible for the memory impairment that many people experience. Blurred vision is another common symptom of drunkenness. Alcohol suppresses the metabolism of glucose in the brain. With decreased glucose metabolism, the occipital lobe – the part of the brain responsible for receiving visual inputs becomes especially impaired, and its cells aren't able to process images properly.

Interactions Between Alcohol and Drugs

Proliferation of smooth endoplasmic reticulum of the liver after chronic alcoholic consumption would normally enhance the body's capacity to metabolize various drugs

and rid itself of these compounds. The increased capacity of the alcoholic livers to inactivate and detoxify foreign compounds would in turn necessitate the alcoholics to be treated with higher doses of many medicines. However, in alcoholics quite the opposite effect is observed because one of the drugs the endoplasmic reticulum metabolizes is alcohol itself, by way of an accessory pathway that supplements the enzyme alcohol dehydrogenase. Alcohol thus enters into competition with other drugs whose metabolism shares some components of the microsomal system, thereby slowing down the metabolism of those drugs and enhancing their effect. That is why simultaneous drinking and consuming tranquilizer drugs is particularly dangerous. Alcohol can accentuate the action of the drug not only because the effect of these two on the brain may be additive, but also because presence of alcohol can interfere with the liver's capacity to inactivate the other drug, so that at a given dosage, more of the drug remains active for a longer time.

Alcohol and Malnutrition

Both socioeconomic and physiological reasons make an alcoholic suffer from malnutrition. Excessive consumption of alcohol leads to disturbance of diet intake since when food is substituted by alcohol; the appetite for food is reduced. Another direct cause of malnutrition is that excess of alcohol irritates or causes inflammation of the stomach and small intestine so as to impair digestion of food and absorption of the nutrients. Malnutrition can in turn cause the intestine to function less effectively. As a result of reduced protein consumption, the liver function becomes inadequate. The liver is important both for storage and activation of vitamins to coenzymes, and interference with its functions by alcohol can therefore cause further nutritional deficiencies.

Alcoholism (Addiction to alcohol)

Alcoholism is a disease in which a person has an overwhelming desire to drink alcoholic beverages. This dependency on alcohol frequently has a genetic origin and is a major public health problem. It is believed that certain alcoholics may be born with a reduced level of endorphins – the peptide hormones present in brain and pituitary gland. Endorphins are morphine-like substances in the brain that control the perception of pain and stress, and relieve feelings of stress and pain and promote a feeling of well-being. People who lack sufficient endorphins may drink compulsively to regain feelings of well-being. But alcohol actually reduces the level of endorphins even more.

Alcoholics may be classified as of Type I, II, and III. Type I alcoholics are 'born alcoholics' who are born with a genetic defect in their endorphin-producing system. They drink to make up for the lack of endorphins, because alcohol temporarily creates a false sense of well-being. Type II alcoholics are 'stress-induced' drinkers. As a result of their drinking to relieve stress, their natural levels of endorphins are reduced resulting in temporary alcoholic behaviour. Type III alcoholics are 'drug-induced' drinkers. In their case, continued use of alcohol would have weakened the brain's ability to produce normal amounts of endorphins leading to a shortage of endorphins and to long-term alcoholic behaviour.

Prolonged heavy drinking of alcohol produces more serious effects other than liver cirrhosis. Withdrawal from heavy alcohol consumption can be fatal and is known as *delirium tremens*, characterized by mental confusion, hallucinations, violent trembling, and sometimes death. Korsakoff's syndrome is also associated with alcoholism and is characterized by confusion, hallucinations, and paralysis of hands and feet. Excessive alcohol consumption during pregnancy carries a heavy risk of causing permanent mental and physical defects in the unborn child, known as fetal alcohol syndrome. The child may also display learning difficulties later in life. Dependence manifests itself by a state of extreme discomfort often accompanied by physiological disturbances such as tremors and seizures, produced by withdrawal of a drug. Treatment for alcoholics includes care for their physical and emotional needs.

Benefits of Alcohol

It has been established that moderate drinking of alcoholic beverages is safe and confers some benefits. It improves digestion; and by dilating the peripheral blood vessels, causes a general redistribution of blood through out the body. It is one of the safest sedatives. It reduces pains of old age, tensions and worries. Moderate consumption of alcohol is known to be beneficial for the heart and circulatory system. It is said to reduce the risk of angina by dilating the coronary arteries thus lowering the blood pressure. As it dilates peripheral blood vessels, it is a deterrent to the development of atherosclerosis and is a protection against thrombosis. Moderate consumers have fewer heart attacks and strokes, live longer, have lower blood pressure, and generally enjoy better health. Alcohol, particularly in hot drink, seems to alleviate some symptoms of common cold. Wine is valued as a preventive against typhoid fever, cholera and other enteric infections. The antibiotic action of wine has been attributed to the anthocyanin pigments present in it. Alcohol, on occasions, has also proved valuable as a neuro-tonic in treating mental illnesses.

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Gas in the Belly

Facts and Remedies

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

Gas in the tummy is a non-sparing knocker. It upsets people of all ages and dispositions. The social discomfort – turned noses and piercing glances – apart, it is to many people's mind the cause of all bodily ills. Men and women think it to be the real miscreant, if they suffer a headache, seizure, difficulty in breathing, backache or even painful legs! 'It is the worrisome gas,' they say, 'that has played errant and wandered loosely into the affected organs!'

So much deep-rooted is the belief that if you were to visit a family physician, you would find this to be the commonest refrain. The fact of the matter, however, is that it is perfectly natural for about two-thirds of a cup of gas to churn, push and wend its way inside our guts at all times. That at times this makes us belch, burp, bleep and blush and leads to a bit of abdominal discomfort is a worry characteristic of the civilized world.

The hard truth is that there is no way anyone can possess completely gas-free guts, except, of course, brand new babies. Even they are quick to take in air, soon as they utter their first cry and begin to breathe independently.

On an average, in normal people, about 20-60 per cent intestinal gas is the swallowed air and almost all the rest is formed by fermentative action of intestinal bacteria on food residue in the intestine. Also, some small amounts are added to it by way of gas diffusion from the blood.

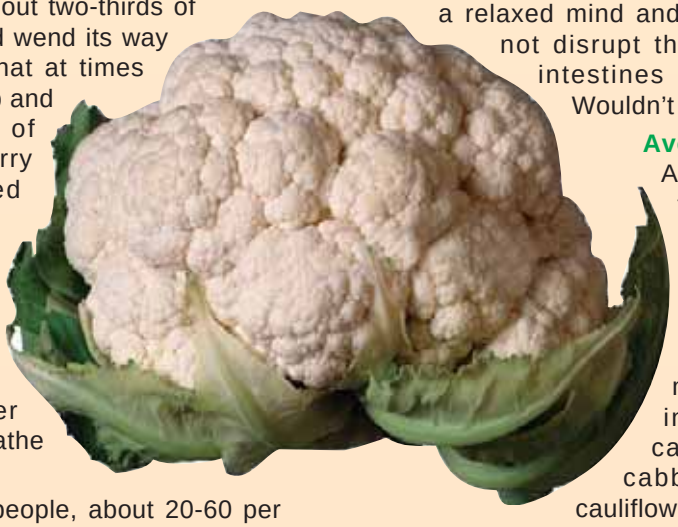
Chemically, the intestinal gas is composed of not one, but five basic gases: nitrogen, carbon dioxide, hydrogen, methane and oxygen. Together, they constitute 99 per cent of intestinal gas. And though it is hard to believe, all of them are odourless!

What makes the nostrils squirm and faces go red is just the one per cent, composed of trace gases such as hydrogen sulphide which carries the insufferable rotten eggs odour, and the inimical ammonia. These gases are so strong that the human nose can sniff out one part per billion in the air.

Of the many gases that rumble, roll and gurgle in the middle, a large volume is expelled rectally. It is quite normal for the air to exit this way a dozen or more times daily. This is a natural escape route for the gas, which is produced internally, though some swallowed air too wends out from this end. A much larger volume of the swallowed air exits the way it entered, in the form of a belch or burp.

Many factors govern the amount of air that passes in and out of our middle. The food we eat, the way we eat, the bacteria we harbour in our hollows, the stresses we live with and the clothes we wear affect the amount of intestinal gas and the extent of discomfort that we bear.

A few sensible changes in the food and eating habits, a relaxed mind and easy-fitting clothes that do not disrupt the movement of gas in the intestines make things much easier. Wouldn't you like to know more?



Avoid gas-promoting foods : A high-protein diet is notorious for smelly flatulence. The cause being two odoriferous gases – indole and skatole – which are produced in the gut from indigestible leftovers. So choose your menu with care and curtail the indigestible forms of carbohydrates. Beans, cabbage, Brussels' sprout, cauliflower, onion, radish, banana and some other foods are highly flatulence producing. They are best avoided or eaten in small amounts.

Some fruits such as apples and apricots contain a large amount of air. They also lead to burbulence (a group of symptoms of intestinal origin, including a feeling of fullness, bloating or distention, and flatulence) if eaten in large number.

Lay off dairy products : If you are short on lactase – the digestive enzyme that is vital in breakdown of milk sugar – you better avoid dairy foods or limit their consumption to small amounts.

Swear off fizzy drinks : All those little bubbles can add up to the problem quite a bit. Soda, beer and carbonated beverages, although popular as a home remedies for abdominal gas, actually add to the intestinal gas. You burp a bit of that out, but much air stays behind.

Fibre is good, but in limits : A fibre-rich diet is a healthy diet, but if you are a beginner, start with small amounts. Let your bowel get used to it, only then increase your intake.

Never wolf or slurp: Always eat your food leisurely and mind your table manners. Do not make loud slurping noises. If you nibble too big mouthfuls of food or slurp, you unwittingly swallow a large amount of air in the process. So turn over a new leaf – if not for the sake of civility, at least for the burbulence that you suffer.

Say 'no' to sizzlers : If you like your food piping hot, think afresh. Tagged to that, you will also find a bill for gulping down large amount of air! What is more, the hot food is unhealthy for your food pipe, which can suffer serious damage.

Avoid hot fluids and drink them slowly : As a corollary, you should also refrain from hot liquids. Drink slowly, with your lips close to the container. Remember a hot cup of coffee, tea or soup may feel good, but will always lead to more gas.

Enjoy your food : Never take your stress to the dinner table or you are sure to swallow a lot more air. Eat your food in a relaxed way. Put on music you like. If you must talk, talk of pleasant things. No heated debates or arguments, please.

Wear easy-fitting clothes : Always wear comfortable, right-sized clothes. Tight trousers, jeans, slack, pantyhose are best avoided because they keep the gas from moving, and thus, increase the discomfort.

Rest your chewing muscles : Skip paan masala, *supari*, cigarettes and chewing gum. Much as you may enjoy them, if you wish to cut down on gas in the middle, they are best avoided. The more you chew or smoke, the more air you swallow.

Get quick relief with gut relaxants : Gassy symptoms are not necessarily due to large amount of gas in the gut; they occur primarily when the gut clamps down and goes into a spasm in response to the air in its middle. This 'stuck-up' air is the commonest cause of belly-pain. Medicines, which relax the gut, can relieve the pain. Swallow an antispasmodic pill, or consult your doctor.

Exercise is good : A walk or jog is the simplest and the most effective remedy. It keeps the gut active and happy, and pushes the gas downstream.

Form IV (see rule 8)

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I, Subodh Mahanti do hereby declare that to the best of my knowledge and belief, facts mentioned above are true.

Sd/-

Subodh Mahanti

Recent Developments in Science and Technology

"10th Planet" Proves Bigger than Pluto

When astronomers announced the discovery of UB313, the so-called tenth planet, a little more than a year ago, they had a hunch it might be bigger than Pluto because of its brightness. But despite several attempts to observe more closely the mysterious object orbiting the Sun at a distance of more than 14 billion kilometers, accurate estimates of its size remained elusive. Now German astronomers working in Spain have determined that UB313 has a diameter of about 3,000 kilometers – roughly 700 kilometers larger than Pluto's.

Frank Bertoldi of the University of Bonn in Germany and his colleagues used the IRAM 30-metre telescope in the Sierra Nevada mountains of southern Spain to observe UB313 in the infrared range. Because visual brightness alone is not an accurate indicator of size – it could result from the body's surface being either actually large or highly reflecting – the researchers made observations in wavelengths longer than those of visible light. Outside the range of visible light, the scientists could measure the amount of light the object absorbs and then radiates back as heat. By combining the infrared and visible measurements, they could determine the object's size and its overall reflectivity, or albedo. Based on observations made over nine nights in August 2005, the team reports, UB313 appears to have a diameter of between 2,859 and 3,094 kilometres. Even the lower figure in that range would make the candidate planet's diameter more than 500 kilometres larger than Pluto's.

The finding adds impetus to the debate surrounding what constitutes a planet. The International Astronomical Union is currently working on a definition based on a minimum size so as to keep Pluto in the planet category, but this could open the possibility of the existence of even more planets in the outer reaches of the solar system.

Source : www.sciam.com

New Neurons Go with the Spinal Fluid Flow

Recent research has revealed that brains continue to produce new neurons throughout life, helping create new neural networks. This neurogenesis only takes place in a few specific areas, such as the area in which the brain and spinal column meet. The new cells, however, can migrate throughout the brain and turn up as far away as the olfactory bulb – a cluster of nerve cells at the front surface of the brain responsible for the sense of smell. A recent study in mice has revealed that these neurons make the long and complicated journey by going with the flow of spinal fluid circulating in the brain.

Neurologist Kazunobu Sawamoto at Keio University in Japan and an international team of his colleagues used fluorescent dye and India ink to trace the flow of spinal fluid in mice and found that it followed the whip-like waving of hair-like projections known as cilia from cells lining the route. They then tracked neurons as they migrated from region to region of the brain and found that new neurons oriented in the direction of fluid flow rather than the direction of their ultimate destination in the olfactory bulb.

But this did not provide definitive proof of how neurons migrate through the brain. So the researchers turned to mutant mice with cells that lacked cilia. In addition to suffering from a host of other problems like an abnormally large accumulation of this spinal fluid in the brain, these mice developed new neurons that did not have a clear sense of direction, pointing and moving in multiple orientations. Whereas 65 percent of new neurons in wild mice ended up in the olfactory bulb, little more than 9 percent of the mutants' neurons were able to complete the journey.

The scientists also found that the cilia's motion was important for the amount and efficiency of proteins in the spinal fluid that usher the new neurons on their way by chemically repelling them from certain sites. The research appeared in journal *Science*.

Source: www.sciam.com

Cosmic Rays Linked to Cloudy Days

If you love to moan about cloudy grey weather, you now have something to blame: cosmic rays. These high-energy particles originate in outer space and in solar flares, and can have a small but significant effect on the weather, increasing the chances of an overcast day by nearly 20 per cent.

Giles Harrison and David Stephenson from the University of Reading, UK, examined 50 years of solar radiation measurements from sites all over the country, enabling them to calculate daily changes in cloudiness. By comparing this data with neutron counts – a measure of cosmic ray activity – for the same period, the scientists have shown an unambiguous link between cosmic rays and clouds (*Proceedings of the Royal Society A*, DOI: 10.1098/rspa.2005.1628).

"The odds of a cloudy day increase by around 20 per cent when the cosmic ray flux is high," says Harrison, amounting to a few extra days of cloudiness per year.

When cosmic rays hit the atmosphere they produce charged particles, which seem to encourage the growth of cloud droplets. Compared with greenhouse gases the effect of cosmic rays on climate is small. But it could help explain some of the more mysterious changes in climate Earth has experienced in the past.

Source: www.newscientist.com

Compiled : Kapil Tripathi

Contd. from page 35

Are We Losing the Battle Against Bacteria?

the disease is enjoying resurgence. Even if resistance to some antibiotics does not prevent treatment because others are available, it still costs a large sum of money. Alternative drugs are more expensive and have greater side effects.

This emergence of resistant forms of bacteria, lacking sensitivity to once reliable antibiotics, signifies that variants untreatable by every known antibiotic are on their way and have thus moved one step closer to becoming unstoppable killers. The misuse, over-prescription and abuse of antibiotics have allowed resistant strains of bacteria to develop and once again threaten health and life. What is more, this practice may even kill those bacteria which are harmless and useful to us. With passage of time, bacteria defy not only single but multiple antibiotics and therefore become extremely difficult to control. WHO, in one of its reports has said that if nothing is done in this decade to tackle the problem, the window of opportunity may be closed for ever!

Why is it that there is increasing resistance to antimicrobial therapies? In the developed world it is overuse of drugs and in the developing world it is their underuse! As a result, bacteria that were virtually eliminated with the introduction of antibiotics are mutating, gaining strength and resisting treatment. In the early 1990's Indian microbiologists had attributed outbreaks of *Salmonella typhi*, resistant to many drugs, to the widespread abuse of antibiotics. About 10 per cent of tuberculosis (TB) patients today have strains resistant to the most powerful antibiotics. Penicillin has become virtually useless for treating gonnorrhoea. In developed countries, up to 60 per cent of hospital acquired infections are caused by drug-resistant microbes. The economic impact of drug resistance is enormous. It costs 100 times more to treat a patient with drug-resistant TB than one with normal TB.

A possible weapon for outwitting the resistant bacteria would of course be to develop altogether new types of antibiotics that may stop bacteria from multiplying by halting production of proteins vital to their growth early in their life cycle. There is also new hope from the analyses of bacterial genomic sequences that has shown that there could be several novel targets on the bacteria for attack by antibiotics. It is possible that the development of newer class of antibiotics may kill bacteria by binding to these newly discovered bacterial targets.

What could we do to reverse the growth of the resistant bacteria, then? True, antibiotics should be used only when they are truly needed and that too only under the supervision of a physician. Further, it is essential to complete the full course of antibiotic therapy to ensure that all the pathogenic bacteria are killed. Also one must not skip doses since this causes the level of antibiotic in the blood to drop and hence giving a chance to some to survive and develop resistance to this drug. Often, physicians prescribe antibiotics even when they are not required. Often, people "demand" antibiotics from their physicians or purchase from their friendly pharmacist over the counter – without any prescription – even for colds and other viral infections. This practice must be stopped since antibiotics have no effect on viruses. One should also consider seeking non-antibiotic therapies for minor ailments. Indeed, approximately one third to one half of all antibiotic prescriptions are not even needed. Indeed, the amount of resistant bacteria people acquire from food is quite significant; hence it is advisable to wash raw fruits and vegetables thoroughly. Washing hands frequently with regular soap and warm water is the best way to avoid spreading harmful microbes.

We have been waging a fierce battle against microbes for over a century. But, eventually it is the microbe that seems to be gaining the upper hand – for which *we* are largely responsible. To contain this scourge, we need to formulate stricter national control policies, strict control on administration of drugs, antiseptic conditions in the hospitals and clean environment. But, the most important is the education of the people to prevent rampant and indiscriminate use of antibiotics. This is a challenge for the science communicators to spread awareness to prevent misuse and abuse of antibiotics among the people.

❒ V. B. Kamble

Understanding Earthquakes- An Activity Kit

We cannot prevent Earthquakes, however, we can significantly mitigate their effects by identifying their hazards, build safer structures and communicate information on Earthquake safety among people. Identifying this as a necessity, Vigyan Prasar has brought out an activity kit on Earthquake, with the central message of "Earthquakes; we cannot avoid them. Let preparedness protect us". Quite a few activities like Cutout of Interior of the Earth and Seismological observatory; How to locate an epicenter, Flip books on various types of fault, simple demonstration of seismic waves with a slinky, three dimensional model of Earthquake faults, global mosaic of tectonic plates and on activity to understand the principle of seisomograph, colour activity sheet for seismic zones of India; Do's and Don'ts during and after an Earthquake; mini book on Earthquake related terms and activities to understand resistant structures, are the highlights at the kit.

Besides being an activity package, the kit is also useful for training programmes on Earthquake awareness. A comprehensive book entitled "Earthquake" also accompanies the kit. The Kit is available both in English and Hindi. The cost of this kit is Rs. 100/- plus Rs. 50/- postal charges. For more details write to the: **Director, Vigyan Prasar, A-50, Institutional Area, Sector-62, Noida-201 307 (U.P.)**

INDIA IN SPACE (An Interactive CD-ROM on Indian Space Programme)

Price Rs 50/-
+ Rs. 20/- postal charges

"India in Space" is an interactive educational CD-ROM on Indian Space Programme. The CD provides some of the interesting information and achievements of the Indian Space Programme from the beginning to till date.

The CD-ROM covers following major sections on Indian Space Programme :

- Introduction
- Satellites
- Space Industry
- Space Organisations
- People at Helm
- Space Programme
- Rockets
- Space R&D
- Education & Career
- International Scenario

DREAM 2047 (An Interactive CD-ROM on Popular Science Articles)

Price Rs 50/-
+ Rs. 20/- postal charges

The "Dream 2047" is an interactive CD-ROM on Popular Science Articles. It is a collection of all articles published in Vigyan Prasar Newsletter "Dream 2047" during the period 1998 - 2002.

There are eight major sections in the CD-ROM, with the following headings:

- India's Scientific Heritage
- Emergence of Modern Science
- Great Scientists
- Interview with Leading Scientists
- Recent Developments in S&T across hte globe
- History of Science
- World of Science
- Indian Scientific Institutions

Interactive DVD on "Vigyan Rail – Science Exhibition on Wheels"

Price:

DVD : Rs 100
CD* : Rs 50
Postal charge : Rs 20

The DVD includes all the exhibits of Vigyan Rail, coach-wise panoramic view, video gallery, photographs and newspaper clips of all the stations wherever Vigyan Rail visited. This is an interactive DVD with easy navigation, search, sitemap and print facility.

*CD version has limited Video gallery and newspaper clips.

Science activity kit on Astronomy

Price: Rs 70 + Rs 20 postal charge

The activity kit on Astronomy is useful to the people in general and students in particular to learn about Astronomy through different activities. Twenty five activities are provided in the kit. Make your own Sun Dial, model of Venus Transit, Measuring the altitude of stars, Star Dial, quiz on Astronomy are example of some of the activities.

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Vigyan Prasar's Video Films Bag Awards

Aisa Hi Hota Hai, Directed by Ms Seema Muralidhara of Beacon Television was selected as the best programme of the year for Secondary/Sr Secondary level. Technical awards, like the award for best stage design went to Aisa Hi Hota Hai, while the award for best sound was given to 'Radiowaves', Directed by Deepak Varma of Harkara Media. The best Graphics/ Animation award went to the video programme 'Discovery of Radioactivity' directed by Rakesh Andaniya of Credence Media. The participants appreciated the quality of production of the video films made by Vigyan Prasar. They also expressed their happiness that the programmes are informative and at the same time entertaining – setting the best example of an infotainment programme. Dr T V Venkateswaran received the awards from the Hon'ble Minster for IT, Science and Technology, Government of Orissa, on behalf of VP.

Orientation Programme for Science Teachers at National Bal Bhavan, New Delhi

A two-day orientation programme for science teachers was organized by Vigyan Prasar (VP) at National Bal Bhavan, New Delhi on 23-24 January, 2006. Forty teachers from 32 different schools in the walled city of Delhi participated. The main objective of the programme was to train teachers before organising science activities in schools. The focal theme of the programme was: "Physics in Daily life". The main components of the programme included topics such as 'Creating awareness', 'Physics through entertainment', 'Hands-on activities', 'Competitions', etc. Several sessions of demonstrations of different kits developed by VP, a workshop on food adulteration, hydroponics, and Nature activities were carried out during the programme. These activities are to be conducted in all the participating schools in course of time. Dr. V.B. Kamble, Director, VP, and Dr. Madhu Pant, Director, National Bal Bhavan, New Delhi also graced the occasion.

Shri B.K. Tyagi, Scientist, VP, interacting with science teachers

Edusat Interactive Terminal Inaugurated at Goa

Vigyan Prasar is establishing an interactive satellite network using the Edusat for science communication. As part of the network, the Edusat Talkback facility established at the Department of Science, Technology & Environment, Saligao, Goa, was launched on 17 January 2006 by Hon'ble Deputy Chief Minster Goa, Dr Wilfred A de Souza. In his keynote address, the Hon'ble Deputy Chief Minster expressed his happiness that the most modern technology has reached Goa and hoped that the initiative would go a long way in promoting interest in science and technology among Goan student community and general public at large. Dr V. B Kamble, Director, Vigyan Prasar, New Delhi, had a live interaction with the Deputy Chief Minster through the interactive satellite terminal from the studio at New Delhi. He expressed his profound appreciation and paid his compliments to the officials of the DST&E, Goa, for their initiative.

Dr. T.V. Venkateshwaran, Scientist, Vigyan Prasar, New Delhi, briefed the gathering on the objectives of the Edusat project. He informed that the Edusat (Education, Science and Technology) satellite is unique as it is the only satellite available in the world exclusively for education and science communication. He further said that around 20 centers are to be commissioned through the Vigyan Prasar network initially and the same would be further augmented to around 100 terminals in the future. He said that once the network is augmented and operationalised, it would facilitate the dissemination of a wealth of scientific information and would definitely enhance the scope of nurturing scientific temperament amongst children and the general public.

Dr. N.P.S.Varde, Director, Department of Science, Technology & Environment, Government of Goa, said that the rate of technology absorption is steadily increasing and the establishment of the satellite-based communication facility is a fine example. He further assured that the DST&E, Goa would make this technology accessible to the students and appealed to the teachers to harness this facility. Other dignitaries from other Government Departments of the state were also present on the occasion.

Around 100 students from various schools of Goa along with their respective resource teachers were present for the function. These students had an opportunity to have a live interaction with scientific experts sitting at New Delhi through the Edusat terminal. They included BK Tyagi, Sandeep Barua, Rajan and Dr VB Kamble, while, at the Goa terminal the program was conducted by Dr T V. Venkateswaran and Joseph De Souza. This was a significant achievement, as for the first time a viable video conferencing for science popularization was made operational in the state of Goa.

Joseph S.R De Souza, Scientist and Nodal Officer, Edusat-Goa, proposed the vote of thanks and Pansy Pinho compered the event. •••