ISSN : 0972-169X
Registered with the Registrar of Newspapers of India: R.N. 70269/98
Postal Registration No. : DL-11360/2005

Monthly Newsletter of Vigyan Prasar

DREAM 2047

October 2005 | Vol. 8 | No. 1 | Price: Rs. 5.00

VP News

Inside

EDITORIAL p.31

Hermann von Helmholtz p.30

Narcotics: An overview p.27

Mint p.22

Fighting Body Odour p.19

Recent Developments in Science & Technology p.17

WYP 2005 : VP-NSC Popular Science Lecture Series

Vigyan Prasar and National Science Centre, NCSM have jointly initiated a Popular Science Lecture Series as a part of world year of physics 2005 activities in the country. The inaugural lecture in this series was delivered by Prof V. S. Ramamurthy, Secretary, Department of Science and Technology on 07 September 2005 at National Science Centre, New Delhi. The topic of the lecture was "Excitement of Science". The central theme of the lecture was the indispensability of science in today's world. Quantum Mechanics, the Theory of Relativity and the Double Helical structure of the DNA, were the truly fundamental discoveries of the 20th century that have completely revolutionized our lives, he observed. The accelerated pace of scientific and technological developments have been at the heart of today's world. Developments in solid state physics, especially semiconductor technology, demanded constant upgradation of technical expertise, he stated. Prof. Ramamurthy emphasized the fact that we are students throughout our life and that science has now come much closer to the society. He urged all-especially the students to aim high. He concluded by highlighting that today's society is knowledge-based where scientific knowledge holds the key for a developed and a prosperous India. The lecture was attended by an audience consisting of a large number of scientists, teachers and students.

Prof. V.S. Ramamurthy

The second lecture in the series was delivered by Dr. Arvind Kumar, Director, Homi Bhabha Centre for Science Education, Mumbai. The topic of the lecture was "Albert Einstein – Glimpses of his life and work".

The lecture was a thorough account of the life and achievements of one of the greatest scientists ever in the world. Dr. Kumar began with explaining the reasons on why he chose to speak on this topic. The first and foremost reason was the UN declaration of celebrating the year 2005 as the International Year of Physics to commemorate the centennial year of the publication of Einstein's revolutionary papers on Brownian motion, Photoelectric Effect and the Theory of Relativity. He also wanted to bring out and clarify a few popular misconceptions

Contd. on page 17

Dr. Arvind Kumar addressing the audience. Also seen (on his right) Shri A.S. Manekar, Director, NSC

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

Published and Printed by Dr. Subodh Mahanti on behalf of Vigyan Prasar, C-24, Qutab Institutional Area, New Delhi - 110 016 & Printed at S. Narayan & Sons, B-88, Okhla Indl. Area, Phase - II, New Delhi - 110 020
Editor : Dr. V.B. Kamble

High Growth Low Development

Economic growth of a country is directly related to the national income. However, human development is much more than the rise or fall of national incomes. It is about creating an environment in which people can develop their full potential and lead productive and creative lives in accord with their needs and interests. Surely, people are the true wealth of a nation. Development is thus about expanding the choices people have thereby helping them lead lives that they value. Hence it is much more than mere economic growth. This implies helping people develop capabilities - the range of things that people can do or be in life and include capabilities for human development to lead long and healthy lives, to be knowledgeable, to have access to the resources needed for a decent standard of living and to be able to participate in the life of the community.

It was with these noble thoughts that the world's Governments signed a declaration - the Millennium Declaration - in a meeting at the United Nations at the start of the new millennium. It was a solemn pledge "to free our fellow men, women and children from the abject and dehumanizing conditions of extreme poverty". The declaration provided a vision and a shared commitment to universal human rights and social justice. It was backed by clear time-bound targets, called the "Millennium Development Goals" or MDGs. These goals included halving extreme poverty, cutting child deaths, providing all of the world's children with education, rolling back infectious diseases and forging a new global partnership to deliver results. The deadline agreed upon for delivery was 2015.

After five years, where do we stand today? Are the developing countries catching up with the developed ones in the areas like life expectancy, child mortality, and literacy? Well, this appeared to be so in 1980s. Not any more. Alarmingly, the rate of convergence is slowing globally as the Human Development Report (HDR) 2005 of the United Nations Development Programme points out. Between 1960 and today, life expectancy has increased by 16 years in developing countries as compared to six years in the developed countries. However, since 1990, the gap between the two has reduced only by 3 months! Child mortality rates in the sub-Saharan Africa (that is, part of the regions of Africa south of the Saharan desert) are 29 times those in rich countries today compared to 13 times in 1980! Income distribution is also getting more skewed. The world's richest 500 individuals earn more than the poorest 416 million! The richest 10 per cent account for 54 per cent of the global income, while 40 per cent of those living on $ 2 a day account for just 5 per cent of the world earning! 1 billion of the world's poorest live on only $ 1 a day. To lift them above this extreme poverty line, the estimated cost works out to $ 300 billion, or just 1.6 per cent of the income of the richest 10 per cent of the world's population. Eighteen countries, with a total population of 460 million, have in fact moved *backward* on the Human Development Index (HDI). Incidentally, HDI is a compendium of key indicators such as income, life expectancy, and education. 12 of these countries are in sub-Saharan Africa, and six from the former Soviet Union. While the countries in southern Africa were hurt by HIV / AIDS, the economic disruption after the collapse of the Soviet Union took its toll on countries like Tajikistan, Ukraine, and Russia.

Surely, there is little cause for celebration, says HDR 2005. There is urgent need for substantial progress in meeting the Millennium Development Goals by 2015. The Report states that for large sections of the world's population, freedom from extreme poverty will remain no more than a dream unless their governments show the political will to mobilise the resources needed for reaching the specified targets. Unless the developed countries urgently introduce policies to generate more international aid to poor countries, bring in pro-poor reforms in trade, and ensure security in conflict-ridden societies, the MDGs will be unattainable before the stipulated deadline. The report points out that aid, trade, and security are interlinked and that failure in any one area could adversely affect advances made in the other two. The report is critical about the assistance to poor countries coming from the rich ones – the aid is linked to purchase by poor countries of goods and services from donor countries! Further, what is startling is the fact that some of the richest countries are still among the least generous donors!

Where does India figure in? India has been widely heralded as a success story for globalization. Over the past two decades the country has moved into the "premier" league of world economic growth. High-technology exports are booming and India's emerging middle class consumers have become a great attraction for foreign investors. But, India is well below the average HDI value for developing countries, and is ranked only 127 among 177 countries – much below China (rank 85) and Sri Lanka (rank 93)!

Contd. on page.....18

Editor : **V.B. Kamble**

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Hermann von Helmholtz

One of the Most Versatile Nineteenth Century Scientists

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"To appreciate the scientific value of Helmholtz's little essay on the Conservation of Force, we should have to ask those to whom we owe the greatest discoveries in thermodynamics and other branches of modern physics, how many times they have read it over, and how often during their researches they felt the weighty statements of Helmholtz acting on their minds like an irresistible driving power."

James Clerk Maxwell

"In his (Helmholtz's) whole personality, his incorruptible judgment and in his modest manner he represented the dignity and truth of science. I was deeply touched by his human kindness. When in conversation he looked at me with his quite, searching but benevolent eyes, I was seized by a feeling of boundless, childlike devotion. I would have been prepared to confide in him anything which affected me deeply in the certainty of finding in him a just and mild counsellor, and an appreciative or even praising word from his mouth gave me greater happiness than all the success I could achieve in this world."

Max Planck

Hermann Ludwig Ferdinand von Helmholtz made outstanding contributions to two areas of science—physiology and a physics. He made epoch-making contributions to the physiology of the eye and the ear. He invented (1851) the ophthalmoscope for inspecting the interior of the eye and ophthalmometer for measuring the eye's curvature. He investigated colour vision and colour blindness. He also worked on hearing. He showed how the cochlea, the spiral-shaped part of the inner ear, resonates for different frequencies and analyses complex sounds into harmonic components. He is also well-known for his definitive statement of the first law of thermodynamics. He introduced the concept of free energy—the energy available to perform work.

Hermann Ludwig Ferdinand von Helmholtz

Helmholtz's investigations occupied almost the whole field of science—physiology, physiological optics, physiological acoustics, chemistry, mathematics, electricity and magnetism, meteorology and theoretical mechanics. R Steven Turner wrote: "Helmholtz devoted his life to seeking the great unifying principles underlying nature. His career began with one such principle, that of energy, and concluded with another, that of least action. No less than the idealistic generation before him, he longed to understand the ultimate, subjective sources of knowledge. That longing found expression in his determination to understand the role of the sense organs, as mediators of experience, in the synthesis of knowledge. To this continuity with the past Helmholtz and his generation brought two new elements, a profound distaste for metaphysical and an undeviating reliance on mathematics and mechanism. Helmholtz owed the scope and depth characteristic of his greatest work largely to the mathematical and experimental expertise which he brought to science…Helmholtz was the last great scholar whose work, in the tradition of Leibniz, embraced all the sciences, as well as philosophy and fine arts."

Helmholtz was born in Potsdam, a city in Eastern Germany, on August 31, 1821 in a lower-middle class family that stressed education and culture. His father, August Ferdinand Julius Helmholtz served with distinction in Prussia's fight against Napoleon. He studied at the newly established University of Berlin and worked as senior school master at the Potsdam Gymnasium. He taught German, classics, philosophy, mathematics and physics. It was a poorly paid job and Helmholtz was brought up in financially difficult circumstances. Helmholtz's mother Caroline (nee Penne) was the daughter of a Hanoverian artillery officer, who had descended in the male line from William Penn, the founder of Pennsylvania, one of the 13 original States. Helmholtz was the eldest son of his parents. He had two sisters and a brother. He inherited from his mother 'the placidity and reserve which marked his character in later life'.

Helmholtz was greatly influenced by his father, from whom came a rich, but mixed, intellectual heritage. From his father he learned the classical languages, as well as French, English, and Italian. It was his father who introduced him the philosophy of Immanuel Kant (1724-1804) and Johann Gottlieb Fichte (1762-1814) and to the approach to study the nature that flowed from their philosophical insights. This approach, which in the hands of early 19th century investigators, became a speculative science in which it was felt that for drawing scientific conclusions it was not necessary to gather empirical data from observations of the natural world because they could be deduced from philosophical ideas. Helmholtz's later work was devoted to refuting this point of view. However, his empiricism was always deeply influenced by the aesthetic sensitivity passed on to him by his father. Music and painting played a greater part in his science.

Helmholtz began his school education at the age of seven. This is because of his delicate health. He entered the gymnasium in 1832. His performances as a student was generally good and he showed particular interest in exact science. After completing his education at the gymnasium he was keen to study physics. However, his father, who could not afford university fees, persuaded his son to take up the study of medicine. The State subsidized medical education but the same facility was not extended to those students, who opted for pure science. Thus in 1838 Helmholtz entered the Friedrich Wilhelm Medical Institute of Berlin, the Prussian military's medical-training institute. Students at the Medical Institute were given some financial support in return for a commitment to serve five years as a military doctor after they qualified. They were also entitled to take classes at the University, a facility which was fully utilised by Helmholtz. He also studied a great deal on his own. Particularly he studied mathematics entirely on his own. He read works by Pierre Simon Laplace (1749-1827), Jean Baptiste Biot (1774-1862) and Daniel Bernoulli (1700-1782). At the Medical Institute he did research under the greatest German physiologist of the day, Johannes Peter Muller (1801-1858). He also learned to play the piano with a skill that later helped him in his work on the sensation of tone.

Immanuel Kant

Johann Gottlieb Fichte

In 1842 he was qualified to be appointed as house-surgeon at a hospital, where he completed his doctoral thesis on the structure of the nervous system in invertebrates, the histological basis of nervous physiology and pathology. On graduation from the Medical Institute in 1843 he was appointed assistant surgeon to the Royal Hussars at Potsdam. His army duties were few and he had enough spare time to concentrate in his studies and research. He conducted experiments in a makeshift laboratory he set up in the barracks.

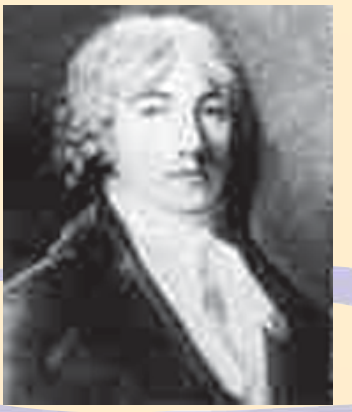
Pierre-Simon Laplace

In 1847 Helmholtz published a very important paper titled "Uber dire Erhaltung der Kraft (On the Conservation of Force)". In this paper Helmholtz argued in favour of conservation of energy. This paper, like all of his scientific works was characterised by a keen philosophical insight. He wrote: "….endeavours to ascertain the unknown causes of processes from their visible effects; it seeks to comprehend them according to the laws of causality. …Theoretical natural science must, therefore, if it is not to rest content with partial view of nature of things, take a position of harmony with the present conception of the nature of simple forces and the consequences of this conception. Its task will be completed when the reduction of phenomena to simple forces is completed, and when it can at the same time be produced that the reduction given is the only one possible which the phenomena will permit." In this paper Helmholtz showed how the principle of conservation of kinetic energy could be derived from the assumption that work could not continually be produced from nothing. He then applied this principle of conservation of energy to a variety of situation and demonstrated that wherever energy appeared to be lost was in fact converted into heat energy. In fact this exactly happened in collisions, expanding gases, muscle contraction and in many other situations. The paper was very important contribution. It is true that others had conceived the idea of conservation of energy but then it was Helmholtz who first formulated the principle clearly and demonstrated it conclusively by scientific methods. This 1847 paper marked an epoch in both history of physiology and the history of physics. For physiology, it provided a fundamental statement about organic nature, which enabled physiologists henceforth to perform same kind of material and energy balance as done by their counterparts in physics and chemistry. This was the first blow that Helmholtz delivered to the concept of vitalism. The vitalists or the follower of the concept of vitalism believed that it would be impossible ever to reduce living processes to the ordinary mechanical laws of physics and chemistry.

Helmholtz's 1847 paper marked an epoch in physical sciences because it provided the first clearest statement of the principle of conservation of energy; "Nature as a whole possesses a store of energy which cannot in any wise be added to or subtracted from." This is known as the first law of thermodynamics. The first law of thermodynamics is sometimes summed up as: "You can't get something for nothing" or "you cannot get more energy out of a reaction than you put into it" or "thermal energy input = useful energy + waste energy". This was a corollary to Lavosier's principle of the indestructibility of matter. Energy as matter cannot be created or destroyed. The first law of thermodynamics is one of the most revolutionary ideas in history of physics. A. C. Crombie, a science historian, wrote: "Its implications and the problems it posed dominated physics in the period between the electromagnetic researches of Faraday and Maxwell and the introduction of the quantum theory by Planck in 1900."

The significance of Helmholtz's contribution was widely acclaimed and it helped him to be free from his obligations to serve as a military doctor. The following year he was released from the military service to become lecturer at the Academy of Arts and assistant in the Anatomical Museum in Berlin. In

1849, he was appointed Associate Professor of Physiology and Director of the Physiological Institute at the Albertina University of Konigsberg. He married Olga von Velten on August 26, 1849 and settled down to an academic career. In 1849 he published the first part of his classic work on measurements of the time relations in the contraction of animal muscle and the rate of propagation in the nerve. The second part of this work was published two years later. This work of Helmholtz delivered another severe blow to the concept of vitalism. Helmholtz's teacher Muller, who was a vitalist, used the nerve impulse as an example of a vital function and which meant it would never be submitted to experimental measurement. Helmholtz in his paper demonstrated that the impulse was perfectly measurable. He found that the movement was remarkably slow—it moved at a slow speed of some 27 metres per second. The measurement was possible because of the invention of the instrument called myograph by Helmholtz. This also illustrated Helmholtz's ability to create new instruments. Helmholtz's demonstration of the slowness of nerve impulse also supported those who believed that the movement of nerve impulse involved the rearrangement of molecules and not the mysterious passage of a vital force.



Jean-Baptiste Biot

Daniel Bernoulli

In 1851 Helmholtz invented the ophthalmoscope. This invention, which took him only two months to design and construct marked the beginning of Helmholtz's studies on physiological optics. His studies dealt primarily with colour vision and dioptrics of the eye. The ophthalmoscope is still used as one of the most important instruments by physicians. It is used to examine retinal blood vessels, from which clues to high blood pressure and to arterial disease may be observed. He also invented the opthalmometer. The opthalmometer is used to measure the capacity of the eye to accommodate the changing optical circumstances and this way it enables among other things, the proper prescription of eyeglasses. With the combined knowledge of ophthalmology and physiological optics, Helmholtz was able to demonstrate the relationship between the direction of the incident and emergent light.

Johannes Peter Müller

Helmholtz's researches on the eye were incorporated in his *Handbook of Physiological Optics.* The first volume of his famed Handbook appeared in 1856 and a second volume in 1867. It was in German and its English translation appeared 60 years later. The great work was acclaimed worldwide. In this Helmholtz introduced the three variables to characterise a colour—hue, saturation and brightness. These are still used. It was Helmholtz, who first unequivocally demonstrated that the colours which Newton had seen in his spectrum are different from colours applied to a white base using pigments. The spectral colours possess greater saturation and they shine more intensely. While the spectral colours are mixed additively but pigments are mixed subtractively. In each case a different set of rules govern their combination.

Helmholtz was one of the first German scientists to appreciate the work in electrodynamics by Michael Faraday and James Clerk Maxwell. Summarising the contributions of Helmholtz and his illustrious student Hertz, David Cahan wrote: "Helmholtz's most gifted student was Heinrich Hertz…In the 1860s and 1870s, Helmholtz was much concerned with evaluating competing theories of electrodynamics. Hertz became Helmholtz's disciple in his visionary program to establish firm foundations for electrodynamics…Hertz's death in Bonn on 1 January 1894 and Helmholtz's in Berlin on 8 September 1894, marked the end of classical physics and its mechanical worldview. Helmholtz sought to unify physics, if not all the sciences, and indeed hoped for the ultimate unification of all culture. Hertz, by contrast, worked within the physics that Helmholtz had outlined. Together they cleared the ground in electrodynamics and mechanics and so paved the way for Max Planck, Albert Einstein, and others at the turn of the century. Furthermore, Hertz's results in electrodynamics proved as seminal for technology as for physical theory, for they set the stage for revolution in wireless communication."

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Narcotics : An Overview

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Narcotics are a group of substances having a strong depressant effect upon nervous system. The term 'narcotic' derived from Greek (när-kòt´îk) means 'to make numb'. Narcotic substances cause insensibility to pain, stupor, sleep, or coma, depending on the amount taken. Thus, a narcotic may be both an 'anodyne' - a drug that relieves pain by numbing the nerves and a 'hypnotic' - a drug that causes sleep or coma when given in large doses. Narcotics produce an analgesic effect by interacting with specific receptors in the central nervous system. Endorphins and encephalins – chemicals naturally present in the body interact with the same receptors, and control the brain's perception of pain. Narcotics although are extremely useful in medicine, also have dangerous effects when used in large doses. Narcotic substances are derived either from the opium poppy plant (*Papaver somniferum*) or the hemp plant (*Cannabis sativa*). The latter plant is the source of marijuana and hashish, while opium and the opiates come from the opium poppy plant.

Table -1. Nick names for narcotics

Narcotic drug	Nick name
Marijuana	Pot, Grass, Weed, Bud, Jay, Reefer, Joint, Ganja, Herb, Hope, Smoke, Booya, Red hair, Chronic, The green, The kind, Mary nane, Skunk, Thai sticks, Maui, Wowie, Hooter, Toke, Yesca, Budah, Bionic, Shwag, Indica, Herbage, Doobage, Wacky, Tobacky, Hemp, THC, Indo, Home grown, Hash
Heroin	Smack, Junk, Horse, China white, Chiva, H, Tar, Black, Fix, Speed-balling, Dope, Brown, Dog, Food, Negra, Nod, White horse, Stuff, Brown sugar
Morphine	M, morph, Miss Emma
Codeine	School boy, Juice
Opium	Chinese molasses, Dreams, Gong, Skee, Toys, Zero

OPIUM

Opium among narcotic drugs serves as the source of several medicines, including codeine and morphine. Opium is the dried milky substance obtained from unripened seedcases of the opium poppy plant (*Papaver somniferum*). Dried poppy juice is called raw opium; while refined opium is a brownish powder. Another extract of opium is a yellowish powder called morphine base. Drug manufacturers use refined opium and morphine base to make codeine, morphine, and other medicines. Heroin is also made from opium. Opium ranked as the most effective pain-relieving drug until the development of morphine in early 1800's. Opium was also used to stop coughing and diarrhea, to ease worry, and to cause drowsiness. Opium, when first used, can give users a feeling of extreme calm and well-being. Their troubles may seem unimportant, and they temporarily live in an unreal world of isolated contentment. People smoke, sniff, or eat opium for these effects. The misuse of opium or of drugs made from it can lead to addiction.

Flowers of opium poppy

The use of opium dates back to 4,000 BC in the Middle East, being prescribed by Greek and Roman physicians as drug. Arabian traders took opium to China in 600 AD and the Chinese used the drug chiefly as a medicine. European traders introduced opium smoking into China in the early 1600's. Even when the Chinese government outlawed opium in 1729, traders continued to exchange it for silk, porcelain, and other Chinese products. In late 1700's, opium addiction became widespread among the Chinese. The opium trade has caused the so-called Opium War (1839-1842), in which England defeated China; Hong Kong became a British colony; China opened up trade in opium. A second Opium War occurred in 1865, which forced the Chinese to legalize import of opium. During the 1800's, people in Europe and USA could buy morphine and other opiates without a prescription. By 1900, addiction to opiates became common, and particularly addiction to heroin increased in the late 1940's. Another distinction of opium is that a number of writers and musicians have composed their works under the influence of opium, e.g. Lewis Carroll - "Alice in Wonderland", Thomas De Quincey - "Confessions of an English Opium Eater", Edgar Allen Poe - "Pit & the Pendulum", Samuel Coleridge - "Kubla Khan".

OPIATES

Opiate is any drug made from or containing opium. Opiates are naturally occurring basic alkaloid molecules with a complex fused ring structure and they possess high pharmacological activity. Among the pharmacologically active

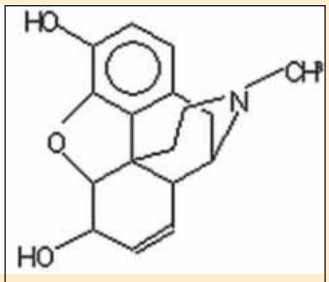
principles of opium, morphine constitutes about 10 % by weight of raw opium. Other active alkaloids such as papaverine and codeine are present in smaller proportions. Opium, morphine isolated from opium, and heroin prepared from morphine - all these three drugs have similar effects. However, heroin is the strongest and opium is the least powerful. Opium alkaloids are of two types, depending on chemical structure and action. Morphine, codeine, and thebaine, which represent one type, act upon the central nervous system and are analgesic, narcotic, and potentially addicting compounds. Papaverine, noscapine (formerly called narcotine), and most of the other opium alkaloids act only to relax involuntary (smooth) muscles. Morphine and codeine are opiates used as analgesics (painkillers) and are prescribed mainly for people with severe pain. Opiates also are used to help control cough and severe diarrhea. While morphine is prescribed to relieve severe pain, codeine - probably the most widely used opiate, stops coughing. The opiate paregoric controls diarrhea.

Physiological effects of opiates are: they slow respiration and heartbeat, suppress the cough reflex, and relax the smooth muscles of the gastrointestinal tract. Opiates exert their main effects on the brain and spinal cord. Their principal action is to relieve or suppress pain resulting in a pleasant, drowsy state. Immediately after injection, the feelings are most intense. Opiates not only alleviate anxiety by inducing relaxation, drowsiness, and sedation, they may also impart a state of euphoria (enhanced mood). Opiates achieve their effect on the brain because their structure closely resembles that of endorphins, which are natural neurotransmitter peptide molecules in the body. Endorphins suppress pain and enhance mood by occupying certain receptor sites on specific nerve cells that are involved in the transmission of nerve impulses. Opiate alkaloids occupy the same receptor sites, thereby mimicking the effects of endorphins in suppressing the transmission of pain impulses within the nervous system. Opiates help in diarrhea by binding to the numerous opioid receptors present in the gastrointestinal tract, consequently decreasing the motility and hence delaying the digestion of food in the small intestine. In the gut, propulsive peristaltic waves are diminished by opiate causing a delay in passage of contents, resulting in desiccation of feces.

Opiates are addictive drugs. They produce a physical dependence and withdrawal symptoms. Continued use of opiates can reduce their healing effects. With chronic use, the body develops a tolerance to opiates, so that progressively larger doses are needed to achieve the same effect. The opiates - heroin and morphine are more addictive than opium or codeine. The habitual use of opium produces physical and mental deterioration. An acute overdose of opium causes respiratory depression, which can be fatal. One of the greatest risks of being a heroin addict is death from heroin overdose. In a non-tolerant person the estimated lethal dose of heroin may range from 200 to 500 mg, but addicts have tolerated doses as high as 1800 mg without even being sick. A drug called methadone is in use to help patients overcome addiction to opiates.

Morphine

Morphine is an alkaloid having a complex ring structure naturally occurring in the opium poppy and is isolated from crude opium. Morphine is mainly used to relieve severe pain. People also use morphine to derive a feel of happiness. People who use morphine regularly may in time become addicted to it, and its stoppage results in withdrawal sickness. Withdrawal sickness may include abdominal cramps, back pains, chills, diarrhea, nausea, and weakness.

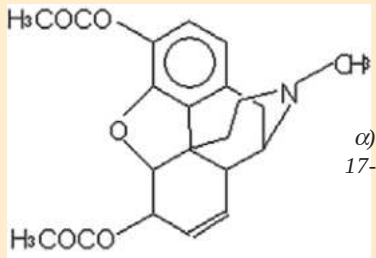


Chemical name: (5-α,6-α)-7,8-didehydro-4,5-epoxy -17-methyl morphinan-3,6-diol.

Morphine functions as a powerful analgesic by binding to the receptor sites of the natural neurotransmitter peptides - endorphins and encephalins, but is stable to the peptidases that inactivate these. Morphine's effect at the μ-receptors in the CNS is said to be responsible for analgesia, euphoria, dependence potential and respiratory depressions. Morphine also binds with k-receptors, which mediate spinal analgesia, miosis and sedation. Morphine makes severe pain bearable and moderate pain disappear. Morphine still is the drug of choice for the treatment of severe acute or chronic pain. It is mostly used parenterally for acute pain (myocardial infarction, multiple injuries, post-operative). For long-term treatment of terminally ill, pain-ridden patients, oral preparations of morphine are suited. Morphine can be combined with non-opioid analgesics or psychotropic drugs. The drug also stops severe cough and suppresses severe diarrhea (e.g., that produced by cholera), checks bleeding, and may help bring sleep. Morphine is available in the form of its water-soluble white crystalline salts - morphine sulfate and morphine hydrochloride. For moderate to severe pain the optimal intramuscular dosage is 5 - 20 mg / 70 kg body every four hours. The oral dose range is 8 - 20 mg; but with oral administration morphine has substantially less analgesic potency because it is rapidly removed by the liver immediately after absorption. The *i.v.* route is employed primarily for severe post-operative pain with a dose range of 4 - 10 mg, and the analgesic effect ensues almost immediately.

While morphine may be taken orally and can be injected (*s.c.*, *i.m.*, or *i.v.*); it can also be smoked or sniffed. When injected intravenously, morphine can produce intense euphoria and a general state of well-being and relaxation. Regular use can result in rapid development of tolerance to these effects. Profound physical and psychological dependence can also rapidly develop, and withdrawal sickness upon abrupt cessation of use; many of the symptoms resemble those produced by moderately severe flu. Besides being addictive, it interferes with breathing and heart action and may cause vomiting. Low Doses (5-10 mg by *s.c.* injection) of morphine produces suppression of the sensation of pain, euphoria, drowsiness, lethargy, relaxation, reduced physical activity in some and increased physical activity in others; mild anxiety or fear; papillary constriction, blurred vision, impaired night vision, suppression of cough reflex. These are also associated with slightly reduced respiratory rate, nausea and vomiting, constipation, loss of appetite, decreased gastric motility. Other effects are slight drop in body temperature, sweating, reduced

libido, and tingling sensation on the skin, all these effects lasting for 4 - 5 hours. Dependency potential of morphine is high; continued use results in both psychological and physical dependency. Morphine has the greatest dependence liability among the narcotic analgesics in common use, after heroin. Adverse reactions of morphine are many. Drop in blood pressure due to a cardiac infarction can have dangerous results. Constipation is the most important problem in long-



Alternate names: Diacetylmorphine, Acetomorphine
Chemical name: (5-α,6-α)-7,8-didehydro-4,5-epoxy-17-methylmorphinan-3,6-diol-diacetate

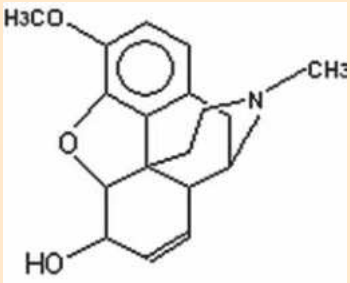
term treatment. Even therapeutic doses can reduce respiratory frequency and can cause urinary retention. Further potential side-effects are dysphoria, anxiety, pruritus, urticaria, bronchospasms and headaches.

Heroin

Heroin is a drug made from morphine, the bioactive chemical in opium. Like morphine, heroin relieves pain and brings sleep. But because it is stronger and more addictive than morphine, it is rarely used for medical purposes. Many countries forbid the production, import, and use of heroin. Drug addicts use heroin by snorting (sniffing it), by skin popping (injecting it under the skin), or by mainlining (injecting it into a vein). To addicts, heroin offers escape from a seemingly intolerable existence by providing a feeling of joy and relief. In time, the repeated use results in physical and psychological dependence on the drug. If an addict stops taking heroin, he suffers such withdrawal symptoms as body aches, diarrhea, muscle cramps, or nausea. The intensity of

Chemical name: (5-α,6-α)-7,8-didehydro-4,5-epoxy-3-methoxy-17-methyl morphinan-6-ol.

Alternate chemical names: Methylmorphine; Morphine monomethyl ether



these symptoms peaks in 2 - 3 days and addicts who resume taking heroin in the same amounts they took previously risk having a fatal overdose. The estimated doses for insufflation are probably 10 - 50 mg for less tolerant people and 20 - 80 mg for frequent users. The euphoric onset is within 10 -20 seconds and will last for a duration of 4 - 5 hours.

Codeine

Codeine, also called methylmorphine, is a drug prepared from morphine and is used to relieve moderate pain (an analgesic) and cough (an antitussive). The poppy plant although contains pure codeine, it is not in quantities large enough (0.7 - 2.5 % in opium) to provide the amounts required for use in medicine. Codeine is the most widely used, naturally occurring narcotic in medical applications. Codeine is also the starting material for the production of two other narcotics - dihydrocodeine and hydrocodone. It is a much less powerful analgesic than morphine, which is generally used to ease extreme pain. Codeine provides cough relief at lower doses than those required for pain relief. The drug is usually taken orally and often combined with other painkilling medications. Compared to morphine, codeine produces less analgesia, sedation, and respiratory depression. It is made into tablets either alone or in combination with aspirin or acetaminophen (i.e., Tylenol with Codeine). As a cough suppressant, codeine is found in a number of liquid preparations. Besides its medical use as a pain reliever, as relief for cough, codeine is also used as a anti-diarrheal agent.

Several other clinical effects occur with codeine including cough suppression, hypotension, and nausea. The antitussive effects of codeine are mediated through direct action on receptors in the cough centre of the medulla. Codeine also has a drying effect on the respiratory tract and increases the viscosity of bronchial secretions. Cough suppression can be achieved at lower doses than those required to produce analgesia. Hypotension is possibly due to an increase in histamine release and / or depression of the vasomotor centre in the medulla. Induction of nausea and vomiting possibly occurs from direct stimulation of the vestibular system.

Codeine is readily absorbed from the GI tract and is rapidly distributed to the various tissues, with preferential uptake by the liver, spleen, and kidneys. Its first pass through the liver results in very little loss of the drug. This contrasts with morphine in which over 90% of the drug is metabolized in the first pass through the liver resulting in a considerable loss of potency when administered orally. This is why codeine is a common opiate in the relief of pain. Effects of codeine start at 10-30 minutes after ingestion, peak within 1-2 hours and last 4-6 hours, depending on dose administered. The effects include suppression of the sensation of pain, euphoria, drowsiness, lethargy, relaxation, dizziness, difficulty in concentrating, decreased physical activity in some users and increased physical activity in others, mild anxiety or fear, nervousness or restlessness, papillary constriction, confusion, blurred vision, impaired night vision, hallucinations (e.g. 'corner-eye' hallucinations), suppression of cough reflex. These are also accompanied by reduced respiratory rate and gastrointestinal symptoms - nausea and vomiting, constipation, loss of appetite and decreased gastric motility, hiccups, and difficulties in urination. Other effects are dry mouth, allergic reaction (difficulty in breathing, closing of throat, and swelling of lips, tongue or face), slight drop in body temperature, sweating, reduced libido, prickly or itching skin, coma in lethal doses.

People who use high doses of codeine for extended periods of time may become addicted to it. Dependency potential of codeine is moderately low, continued use results in both psychological and physical dependency. Tolerance to the drug usually appears in chronic use. The withdrawal symptoms are minimal with codeine. Some common side

effects from codeine include drowsiness, light-headedness, dry mouth, urinary retention, constipation and euphoria. Adverse effects can include itchiness, confusion, nausea and vomiting. The dosage of codeine encountered by most people for the best euphoria is around 250 mg, with least side effects. The lethal dose is 800 mg in the average person. Death from codeine, unlike most opiates, is preceded by restlessness, seizures and eventually death results from respiratory arrest.

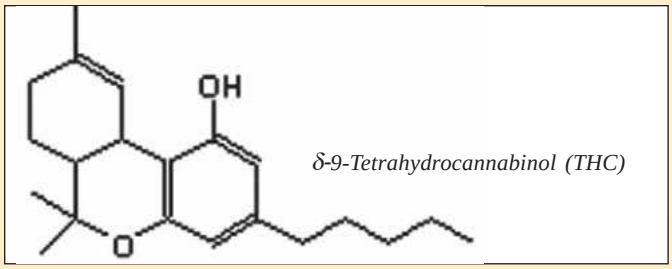
MARIJUANA

Marijuana is a drug made from dried leaves and flowering tops of the hemp plant (*Cannabis sativa*). Marijuana has been

***Cannabis sativa* plant**

used as a medicine and an intoxicant for thousands of years in many parts of the world. In spite of its prohibition in many countries, the drug became widely used during the 1960's and 1970's, especially among young people. In 1980, the U.S. Food and Drug Administration (FDA) approved the limited use of tetrahydrocannabinol (THC, the active ingredient of marijuana) pills to control nausea brought on by anticancer medicines. In a highly regulated programme, the FDA provided marijuana cigarettes to a few cancer and glaucoma patients. In 1985, the FDA approved Marinol, a drug containing THC as a prescription drug.

Marijuana is usually smoked as a cigarette or in a pipe (bong). It also is smoked in blunts, (cigars emptied of tobacco and refilled with marijuana). Marijuana smoke has a pungent, distinctive, usually sweet-and-sour odor. It can also be mixed with food and brewed as a tea. Chemicals contained in marijuana have a variety of short-term effects. THC (δ-9-tetrahydro-cannabinol) is the main active chemical in marijuana that causes the mind-altering effects of marijuana intoxication. The amount of THC determines the potency and therefore, the effects of marijuana. When a person smokes marijuana, THC rapidly passes from lungs into bloodstream, which carries the chemical to organs throughout the body, including the brain. In the brain, THC binds to specific protein receptors on nerve cells and influences the activity of those cells. Many such receptors are found in the parts of the brain that influence pleasure, memory, thought, concentration, sensory and coordinated movement. Once bound to these receptors, THC kicks off a series of cellular reactions that ultimately lead to the 'high' that users experience when they smoke marijuana. Short-term effects of marijuana include both psychological and physical reactions, which usually



δ-9-Tetrahydrocannabinol (THC)

last for 3 - 5 hours after smoking marijuana. The psychological reaction 'high' consists of changes in the user's feelings and thoughts. A marijuana 'high' although varies from person to person, in most cases consists of a dreamy, relaxed state in which people seem more aware of their senses and feel very slow passing of time. Sometimes, marijuana produces a feeling of panic and dread. The different reactions result partly from the concentration of THC in the marijuana. The short-term physical effects of marijuana include redness in the eyes and a rapid heartbeat. Other effects of marijuana include problems with memory and learning; distorted perception; improper judgment and loss of coordination. Therefore, driving a motor vehicle while under the influence of marijuana is particularly dangerous.

One region of the brain that contains a lot of THC receptors is the hippocampus, which processes memory. When THC attaches to receptors in the hippocampus, it weakens short-term memory. The hippocampus also communicates with other brain regions that process new information into long-term memory. In the brain, under the influence of marijuana, new information may never register and may be lost from memory in some people, marijuana can cause uncontrollable laughter one minute and paranoia the next. That is because THC also influences emotions, probably by acting on a region of the brain called the limbic system.

Regular use of marijuana produces a number of long-term effects, although not completely known. People who have used marijuana daily for several months develop serious long-term problems similar to those caused by smoking tobacco. These include bronchitis, obstructed airways (cough), increased risk of lung infections and frequent chest pains. The risk of heart attack quadruples in the first hour after smoking marijuana. Such an effect might occur from marijuana's effects on blood pressure and heart rate and reduced oxygen-carrying capacity of blood. Smoking marijuana increases the likelihood of developing cancer of the head or neck. Use of marijuana also has the potential to promote cancer of the lungs and other parts of the respiratory tract because it contains irritants and carcinogens. In fact, marijuana smoke contains 50 - 70 % more carcinogenic hydrocarbons than does tobacco smoke. It also produces high levels of an enzyme that converts certain hydrocarbons into their carcinogenic form that ultimately produce malignant cells. Other adverse health effects of marijuana occur because THC impairs the immune system's ability to fight off infectious diseases and cancer. Among males, prolonged use of marijuana can reduce their fertility. Among females, it can cause menstrual irregularity and reduced fertility. Extended use of marijuana in some people also has a long-term psychological effect resulting in loss of interest in academic pursuit, job, and social activities.

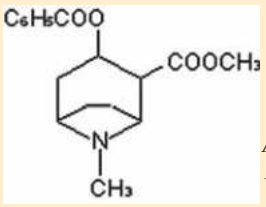
Long-term marijuana use leads to addiction; that is, they use the drug compulsively. Drug craving and withdrawal symptoms can make it hard for long-term marijuana smokers to stop using the drug. Withdrawal symptoms include irritability, sleeplessness and anxiety. They also display increased aggression, peaking approximately one week after the last use of the drug. Incidentally, marijuana was the main drug of abuse in the year 2000 (15 % of all admitted for treatment facilities) in USA. Although no medications are currently available for treating marijuana abuse, with the latest knowledge on the THC receptors, there is a prospect of developing medication that will block the intoxicating effects of THC.

HASHISH

Hashish is a narcotic drug also obtained from the hemp plant. Hashish is a sticky substance / resin obtained from the top of the hemp plant. While hemp grows in most parts of the world, hashish comes mainly from Middle East and other parts of southern Asia, where it has been used for thousands of years. Tetrahydrocannabinol (THC) is also the psychoactive ingredient in hashish similar to marijuana but contains 5-8 times as much THC as does marijuana. This active chemical in hashish, affects the brain and nervous system producing feelings of contentment and relaxation, but it may make a person sad and nervous. Large amounts may produce hallucinations / delusions, during which the user sees or hears things that, do not exist. In addition, THC decreases muscle coordination. The effects last for several hours. To a person who takes a large dose of hashish, colours may appear very bright and flowing. Sound and music may seem alive and touchable. Near objects may appear distant, and minutes may seem like hours. Most hashish users smoke the drug in a pipe, but some mix it with food or drink. The drug is most powerful when smoked. The effects also depend on the size and purity of the dose, the mood of the user, and the circumstances in which it is used. Hashish does not lead to physical dependence, as do heroin, alcohol, and some other drugs. But hashish users may become psychologically dependent on the drug and find it hard to stop.

COCAINE

Cocaine is not a narcotic (since not a depressant), but is a widely abused CNS stimulant, and hence needs mention in the present context. Cocaine is a drug extracted from the leaves of the *Erythroxylum coca* plant grown primarily in the Andean region of South America. Cocaine is a whitish powder that consists of cocaine hydrochloride, the active ingredient often mixed with other compounds and having a bitter, numbing taste. Cocaine is most commonly insufflated (snorted), though it can also be injected to produce rapid and powerful effects. Cocaine is also smoked in a potent pellet form called crack. The traditional method of coca use is to chew the leaves. It is also used in its more refined forms, either powder cocaine or freebase cocaine which produce much stronger effects than chewing the leaves. Powdered cocaine is generally insufflated and crack / freebase cocaine is generally smoked. Smoking freebase cocaine causes a strong, short-lived peak of about 3-5 minutes, while snorting cocaine provides a lower high with



Other names: l-cocaine, β-cocaine, benzoylmethyl-cognine
Chemical name:[1R-(exo,exo)]-3-(benzoyloxy)-8-methyl-8-azabicyclo[3.2.1] octane-2-carboxylic acid methyl ester
Alternate Chemical names: 3-β-hydroxy-1-αH, 5-αH-tropane-2-β-carboxylic acid methyl ester benzoate

effects lasting 15-30 minutes. Freebase cocaine, also known as crack, is created from powder cocaine for smoking. Freebase cocaine vaporizes at smoking temperatures providing more effect with less material, faster onset and a more intense high than powder cocaine.

The Andean Indians of South America have chewed coca leaves for thousands of years. This practice reduces fatigue and hunger, and helps to work more effectively in the high altitude of the mountains. When cocaine was first extracted from the coca leaves in the mid-1800, doctors considered it a miracle drug. During the late 1800's, it was prescribed for all sorts of physical and mental ailments, including exhaustion, depression, alcoholism, and morphine addiction. But its overuse caused many people to become dependent on the drug,. By the mid-1900, medical and nonmedical use of cocaine had become far less common. During the 1970's, however, claims of the drug's harmlessness and exciting effects triggered renewed popularity for its illegal use. As use of the drug increased, the number of cocaine-related problems also increased.

Cocaine is both a CNS stimulant and a topical anaesthetic. Cocaine is prescribed as local anaesthetic during certain kinds of surgery, since in addition to blocking pain sensations, cocaine tightens small arteries, thus reducing bleeding during surgery. Psychological effects of cocaine vary with dose and tolerance of the user. At mild doses, it increases alertness, elevates the mood, increases athletic performance, decreases fatigue, increases energy, and

***Erythroxylum coca* plant**

increases irritability. It also produces a feeling of well-being. People feel powerful, and their thinking seems better and clearer. Occasionally, strong feelings of anxiety and fear occur instead of the expected 'high'. At high doses, it exhibits psychosis with confused and disorganized behavior, irritability, fear, hallucinations, may become extremely and aggressive.

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Mint

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Mint...just the word evokes an image of cool and refreshing. A frosty glasses of lemonade garnished with curly sprigs of spearmint; the clean, chilling taste of a peppermint candy; even chewing gum, mouthwash with sweet and cool minty taste… Aha… There is nothing more refreshing than chewing on a fresh mint leaf or drinking hot mint tea. Peppermint's cooling effect makes it a popular flavor for candies and breath fresheners, and it also eases indigestion and clears the congestion due to winter colds. No wonder that most toothpaste companies use images of crisp, clean snowy slopes, or cool, green curls of mint to let us know how refreshing their mint flavored products are.

Most of us are most familiar with peppermint (Me*ntha* piperita) and spearmint (*Mentha spicata*), yet there are about 25 species, with some sources saying as many as 600 varieties. Mint species are indigenous to Europe as well as Asia, and some are used since millennia, mints interbreed so easily it is often hard for even the experts to distinguish and separate all the varieties. Exasperated, a monk as far back as 9th century lamented "would rather count the sparks in Vulcan's furnace than to count the varieties of mint.". In tropical Asia mint stock is derived from field mint and therefore are botanically removed from European peppermint. On the other hand Mints from Western and Central Asia are comparable to horsemint and applemint.

Figure 1: Peppermint

Minty flavour

The often used Mint leaves or Pudina in cooking are actually dried spearmint leaves of the species *Mentha spicata*. While Spearmint and peppermint are aromatic and fresh Pennyroyal is aromatic, pungent and acrid. Spearmint is generally a sweet flavour imparting a cool sensation to the mouth. The "doublemint" flavour of spearmint is minty but not pungent. Peppermint has a stronger menthol taste and the typical "mint scent" is most pure in peppermint. However Pennyroyal is strong with a medicinal flavour and therefore is usually harvested for its oil extraction and not for direct cookery.

Japanese mint (Mentha arvensis var. piperascens) and some varieties of green mint (*Mentha spicata*, but not spearmint) have strong mint flavour, whereas in most other mints additional flavour components are discernible; for example, crispate mint (*Mentha crispa*), though minty, somewhat reminds of caraway. There are, however, yet other mint varities whose fragrance bears no similarity with traditional mint aroma: Orange mint (*M. citrata*, also called *Eau de Cologne* mint, similar to the bergamot orange used to flavour Earl Grey tea), apple mint (M. *rotundifolia* very mild, slightly minty, hardly reminiscent to apples), ginger mint (M. *gentilis* neither minty nor ginger-like at all) and pineapple mint (M. *suaveolens*, weakly pineapple-like) are some of the notable varieties. Most of these herbs are more used as tea herbs than for culinary purposes.

Folklore

According to the Greek legend, Menthe a nymph was so beautiful that he attracted the attention of Hades, lord of the underworld. Infuriated Hades (Pluto) developed an illicit relationship with Menthe. When his wife Persephone found out, in a fit of jealous rage she turned Menthe into a lowly plant, to be trod upon. Hades could not undo the spell, but softened the spell by giving her a sweet scent, which would perfume the air when her leaves were stepped upon.

Mint has been used for many centuries. Mint was used by the ancient Assyrians in rituals to their fire god. Ancient Hebrews scattered mint on their synagogue floors so that each footstep would raise its fragrance. Ancient Greeks and Romans rubbed tables with mint before their guests arrive. Spearmint was used by the ancient Greeks and Romans as a flavoring herb, culinary condiment, and in perfumes and bath scents. The Japanese have distilled peppermint oil for several centuries and the oil is further treated to produce menthol. Spearmint has long been used for medicinal purposes. Hippocrates wrote of it and in medieval times it was commonly used to whiten teeth and soothe bites of all kinds. In India they hang fresh bunches of mint in doorways and open windows allowing the breeze to carry the scent throughout the house; sort of room fresheners. A symbol of hospitality and wisdom, "the very smell of it reanimates the spirit", says Pliny Ancient Greek Scholar. Sure the aroma of mint is nice if you were expecting company; the hospitality does not extend to rats and mice, rodents are repelled by mint! The smell of mint is known to keep mice away and pennyroyal is also regarded as an effective insecticidal against fleas and aphids!

Spice Description

The leaves of several species (there are over 40 varieties) of the plant Mentha, the commonest in culinary use being spearmint (mentha spicata or crispa). Pennyroyal (mentha pulegium) is also used in the kitchen and peppermint (mentha piperita) is cultivated for its oil. Spearmint (Mentha viridis) From creeping root-stocks, erect, square stems rise to a height of about 1 m, bearing very short-stalked, acute-pointed, lance-shaped, wrinkled, bright green leaves, with finely toothed edges and smooth surfaces, the ribs very prominent beneath. The small flowers are densely arranged

in whorls or rings in the axils of the upper leaves, forming cylindrical, slender, tapering spikes, pinkish or lilac in colour. The little labiate flowers are followed by very few, roundish, minute brownseeds. The taste and odour of the plant are very characteristic. Spearmint and peppermint leaves are deep green, long , pointed and crinkled. Peppermint is a hybrid of spearmint with spikes of mauve flowers and red tinged leaves. Pennyroyal is a smaller plant with pink flowers. Pennyroyal has small oval leaves, greyish in colour. Mints thrive in cool and moist places but will grow virtually anywhere. Mints are propagate by division, or transplant the underground runners.

Figure 2: Spearmint

Main constituents

Menthol and menthyl acetate are responsible for the pungent and refreshing odour of peppermint; they are mostly found in older leaves and are preferentially formed during long daily sunlight periods. On the other hand, the ketones menthone and pulegon (and menthofurane) have a less delightful fragrance; they appear to higher fraction in young leaves and their formation is preferred during short days.

The essential oil of peppermint (up to 2.5% in the dried leaves) is mostly made up from menthol (ca. 50%), menthone (10 to 30%), menthyl esters (up to 10%) and further monoterpene derivatives (pulegone, piperitone, menthofurane). Traces of jasmone (0.1%) improve the oil's quality remarkably. The world's most important source of menthol is, however, not peppermint but field mint. Field mint is the only mint species that became naturalized in tropical Asia; there are many different varities, some of which are grown for direct consumption, others for the distillation of essential oil.

The Japanese variety of field mint (*Mentha arvensis*), now introduced in India, may contain up to 5% of essential oil in its tips; more common, however, are 1 to 2%. Chief component of the oil is menthol (50 to 70%, in rare cases up to 90%). Other terpenes occur but in traces (piperitone, pulegone, â-caryophyllene, â-caryophyllene-epoxide, á-pinene, â-pinene, germacrene D, 1,8-cineol, linalool, menthofurane, camphene).

The chief constituent of Spearmint oil is Carvone. Spearmint, owes its aroma to carvone, limonene, dihydrocarvone, menthone, pulegone, 1,8-cineol and â-pinene. Esters of acetic, butyric and caproic or caprylic acids are also present. Other mints may contain rather different constituents: *Mentha pulegium* (pennyroyal) contains 80% pulegone, and M. *crispa* (crispate mint) contains 50% carvone.

Menthol

Menthol is a covalent organic compound made synthetically or obtained from peppermint or other mint oils. It is a waxy, crystalline substance, clear or white in color, which is solid at room temperature and melts slightly above. The main form of menthol occurring in nature is (-)-menthol, which is (1R,2S,5R). There are seven other stereoisomers. It is said that menthol has been known in Japan for more than 2000 years, but in the west it was not isolated until 1771, by Gambius. Menthol has local anesthetic and counterirritant qualities, and it is widely used to relieve minor throat irritation. The (–)-L-menthol in peppermint interacts with the body's thermal receptors to produce a cooling sensation using the same mechanism that makes spicy foods seem hot. Purified, concentrated menthol should not be ingested because it is highly toxic.

Menthol is contained in non-prescription products for short-term relief of minor sore throat and minor mouth or throat irritation, for example in lip balms and cough medicines. It is classed as an antipruritic, which reduces itching. Menthol is also contained in combination products used for relief of muscle aches, sprains, and similar conditions, as well as in decongestants. Menthol is a common ingredient in mouthwash. It is used in home remedies and traditional medicine to treat indigestion, nausea, sore throat, diarrhea, colds, and headaches. Menthol is used to prepare menthyl esters, for example menthyl acetate, used in perfumery, especially rose- floral notes.

Uses

Mint has been known as both a seasoning and a medicine for centuries. Used world over in teas, beverages, jellies, syrups, ice creams, confections, and lamb dishes, Mint is essential in Afghanistani, Egyptian, Indian, and Mid-Eastern cuisines and spice blends such as chat massala, mint sauce, and green Thai curry. For most culinary purposes spearmint is the preferred variety. Spearmint (*Mentha spicata*), with its sharp, pointed, toothed leaves is one of the most versatile of the mints. With its less intense, more herb-like flavor, it pairs well with a wide spectrum of foods. Mint combines well with many vegetables such as new potatoes, tomatoes, carrots and peas. A few chopped leaves give refreshment to green salads and salad dressings. In India fresh mint chutney is served with birianis. Mint tea is enjoyed copiously by Arabs and is common to Middle Eastern cooking. Pennyroyal is used to season haggis and black puddings. Peppermint is more commonly used in desserts, adding fresh flavour to fruits, ices and sherberts.

Bergmot Mint (*Mentha piperita var. critata*) also known as lemon mint, orange mint, or eau de cologne mint. With its sweet citrusy, lavender-like aroma and taste, it is a natural for flavoring teas or ice beverages. Bergamot mint is also used to scent soaps and perfumes, hence the name "*eau de cologne*" mint. Ginger mint (*Mentha spicata species*) is another mint that is as attractive as it is tasty, with its heart-shaped light green leaves variegated with gold and considered perfect for seasoning for both fruit and vegetables. The king of all mints: Peppermint (*Mentha piperita*) has the potent taste of the leaves

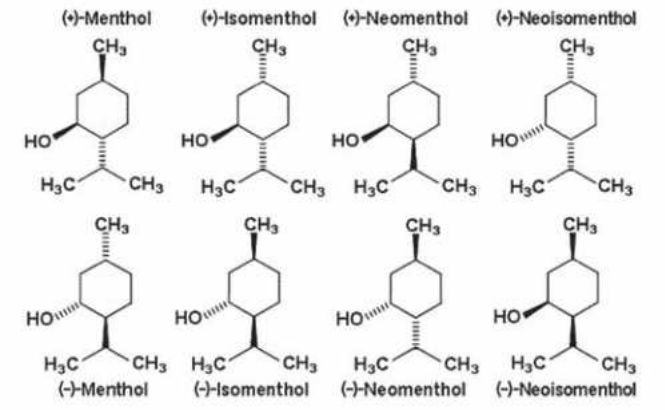

Figure 3: Menthol (naturally occurring is left bottom)

— very strong menthol – and very cool and clean. Peppermint is the mint that is most often used commercially — in liqueurs, toothpastes, soaps, and mouthwashes — because of its strong, pure qualities. Peppermint, although it was not even recognized until the early 1700's, provides the most widely used essential oil in medicines. In medicines, it is used not only as a pleasant flavoring, but also because it contains healing properties as well. The menthol is wonderful for clearing up a stuffy head cold, relieving headache, as well as being a strong digestive aid and a mild sedative. Peppermint is used to flavour toothpaste, chewing gum and liqueurs such as creme de menthe. Japanese mint is the source of menthol, a major essential oil used in flavoring prepared foods. Similar to peppermint yet of lesser quality, Japanese mint oil is sometimes used to stretch the more expensive essential oil of true peppermint.

Cool without mint?

Chewing gum laced with peppermint- crisp and refreshing sensation… cool. But think of chocolate with peppermint taste- may be not all would like it. Is it possible to have cooling sensation of menthol, without the minty taste or smell. Yes says, Thomas Hofmann and his colleagues at the German Research Center for Food Chemistry in Garching, Germany, who have recently identified four natural cooling compounds in malt. The team has now synthesized 26 compounds similar to the natural ones and tested the new compounds on trained tasters. The researchers found that substituting an oxygen atom for a carbon in one of the natural structure's rings increased the compound's cooling power. Other alterations, such as adding carbon and hydrogen atoms, decreased the cooling Sensation. The best of the newly designed compounds has 35 times the mouth-cooling power of menthol. When applied to the skin, it's 250 times!

Attributed Medicinal Properties

Mint is said to be carminative, stimulative, stomachic, diaphoretic and antispasmodic. Peppermint has the highest concentrations of menthol, while preparations of spearmint are often given to children. Mint is a general pick-me-up, good for colds, flu and fevers. Mint is said to stimulate stomach bile thereby aiding in digestion. There are also claims that a glass of *creme de menthe* helps with motion sickness. Whenever highly concentrated menthol is used, one must consider that menthol is toxic to infants and can (allegedly) induce apnoea.

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Narcotics..... Contd. on page.....23

Physical effects of cocaine are increased heart rate, temperature, blood pressure, sweating, increased rate of respiration, dilation of the pupil, decreased sleep and appetite. It is also associated with seizures, stokes and heart attacks in some individuals. The long-term use of cocaine may cause depression or psychosis which may continue for weeks after a person has stopped the drug. Cocaine use during pregnancy increases chances of miscarriage, premature labour, and stillbirth. Cocaine passes on to child during breast-feeding, resulting in irritability and lack of appetite in the baby. Overdose symptoms include agitation, hallucinations, convulsions, high body temperature, stroke, heart attack, and possibly death. People with latent congenital heart defects, high blood pressure, or thyroid problems are at higher risk of dangerous reactions and heart failure with the use of cocaine.

Complications of narcotic drug abuse and addiction

After continued use of narcotics, some people develop a condition called drug dependence. Drug dependence can be psychological, physical, or both. A person with a psychological dependence craves a drug for the feeling of well-being it might provide. A person with a physical dependence continues drug use chiefly to avoid the physical illness that results when drug use stops. The need for a drug may become so overpowering that nothing matters except getting more. Many people begin and continue to use drugs because they want a pleasurable change in their state of mind. Unfortunately, drugs only change the brain's perception of difficulties and problems. When a drug wears off, the user's real problems nearly always remain.

Many harmful effects often accompany abuse of narcotics which include failure to achieve personal or family goals, undesirable personality changes, physical illness, and death. Besides the personal damage the drug user suffers, a person's drug use can have a devastating effect on others. Many drug users turn to crime to support their habit. Many traffic deaths / injuries are caused under the influence of narcotic drugs. Drug abuse also damages families and personal relationships. Many addicts do not eat nourishing foods or maintain personal cleanliness. Also, the needle used to inject the drug is often unsterile and hence can result in AIDS, hepatitis, malnutrition, pneumonia, or skin infections. Babies born to mothers addicted to an opium-based drug are physically dependent on the drug. It is aptly said that "*No plant is a greater blessing or boon, yet at the same time, no plant is a greater curse than the opium poppy.*"

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This hot sultry weather is nobody's favourite. The hot and humid air makes life utterly insufferable. Your body sweats, and smells. With microorganisms proliferating and breaking down the body's secretions in the armpits, groin and feet, the air becomes stale and smelly. In case you wonder what you can do to smell good, here are some practical remedies:

Shower or bathe daily : A regular bath is the most refreshing remedy to prevent body odour. You must shower daily at least once in the morning and once before you retire for the night. Using a germicidal soap such as Dettol or Cinthol helps check the growth of germs and keeps you fresh.

If you want to smell like flowers or exotic essences, try out a spa. Though hard on the pocket, it can make you feel like royalty! The *maharajas* and *maharanis* of the yesteryears regaled much in them.

Keep the armpits and groin clean : Armpits and groin are two most vulnerable areas for sweat to accumulate. Thus, you must pay extra attention to their cleanliness while bathing.

Shaving underarm hair is also a good idea. It makes it easier to keep the armpits clean.

Dry yourself : Whatever may be the pressures on your time, always dry yourself thoroughly immediately after you step out of the bath. Wet anatomy invites microbes and fungi, and can make you smelly.

Opt for cottons and well-ventilated clothes : Wear loose fit clothes that permit adequate aeration. Clothing made of natural material, especially cotton, is best. It can easily soak moisture.

Take care about the hosiery you use. Those mad on silk and acrylic may look hip but are simply passé. Cotton is best since it can easily absorb wetness. Follow the basic rules of hygiene, and change underclothes each time you bathe.

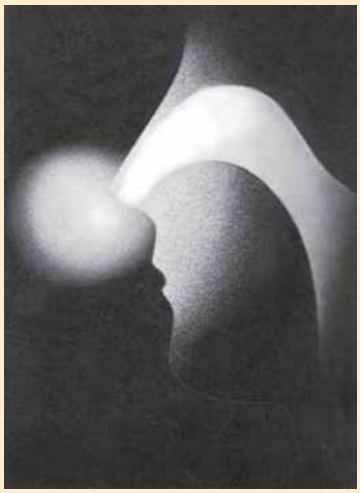
Use footwear that breathes : Sweaty feet are always a nuisance. If it doesn't breach the dress code, open footwear such as sandals is best. In case formal shoes are must, choose a pair made of natural material that breathes, such as leather. Always use cotton socks with them. They can help keep your feet dry whereas nylon socks just can't.

Dry your feet and air them : Microorganisms that lead to smelly feet tend to thrive in the damp spaces between your toes. You must therefore dry your feet thoroughly after a bath. Air them. Go without shoes when it's sensible. But when you can't, slip out of them from time to time. For sweaty feet, use over-the-counter foot powders to help absorb sweat.

Restrict hot curries, caffeine and alcohol: Consuming food soused with spices and condiments, hot beverages (particularly those with caffeine), and alcohol causes increased sweating. If you don't wish to sweat and smell, you must simply cut down on them. Foods with strong odours such as garlic and onions are obviously also passé.

Lose weight. Obesity has many disadvantages. Extra perspiration and body odour is least of them. If you are overweight, you must try to shed off some kilos.

Use antiperspirants and deodorants : If necessary, use antiperspirants (to stop the wetness) or deodorant



(to stop the odour) or a combination. Even though my grandma never thought it healthy, they make a perfect recipe by reducing both the body sweat and body odour. Natural fragrances such as sandal, rose, *chameli* make a wonderful choice. Change brands periodically, so that the novelty never wears off. If at any time your skin shows sensitivity to a particular item, switch to another.

A 0.5 per cent Neomycin powder is also an excellent deodorant. Apply it once or twice a day to the armpits and groins. There is simply no truth in the belief that dusting or talcum powders are injurious to skin. Their application actually helps: they keep the skin dry by absorbing the sweat and their fragrance also lingers on to keep you fresh. They should, however, be lightly applied.

Prevent infection : Excessive perspiration can cause chaffing of the skin. If you are not particular about cleanliness, suffer from being overweight, or diabetes, you are especially vulnerable. Skin folds and surfaces exposed to friction, wetness and remain under high pH, such as under the breasts or between the thighs, are particularly prone to chaff. Underarms, groins, navel, web spaces between the toes, and the region behind the ears are the major areas that can get affected. The affected surfaces become red and irritated and open themselves to germs.

Treating infection : If infection occurs, the skin becomes raw, oozy and may show deep and painful fissures. This needs regular medical help. Trying out creams and lotions on the hunch can make the situation worse. Local antibiotics, 1-3 % diiodohyroxyquinoline, or the good old 0.5 % solution of gentian violet often provides relief. They should be applied on the affected surfaces and allowed to dry, and then powdered with talc and boric powder to give best results. It is also most useful to apply a thin layer of gauze to separate the apposing skin surfaces. This quickens the process of healing.

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High Growth Low.... (Contd. from page 31)

However, our record on human development has been less impressive than the record on global integration. The HDR 2005 states that incidence of income poverty has fallen from about 36% in the early 1990s to somewhere between 25% and 30% today. But the pick up in growth has *not* translated into a commensurate decline in poverty. There is further cause to worry - improvements in child and infant mortality are slowing. Some of our cities may be in the midst of a technology boom, but 1 in every 11 Indian children dies in the first five years of life and India alone accounts for 2.5 million child deaths per year - or one fifth of the global total. As the HDR 2005 notes, India may be a world leader in computer software services, but when it comes to basic immunization services for children in poor rural areas, the record is less impressive. Even lower income countries like Vietnam and Bangladesh have much lower mortality rates. Malnutrition has barely improved over the past decade and affects half the country's children.

Gender disparity is yet another aspect where our record is poor. The under-5 mortality rate is 50 per cent higher for girls than boys. This implies that 130,000 young lives are lost each year just because they are girls! Similarly, the MDG was to eliminate the gender disparity in the primary school, but we have missed this target too. Then there are regional disparities. Girls born in Kerala are five times more likely to reach their fifth birthday, twice as likely to become literate and likely to live 20 years longer than girls born in Uttar Pradesh.

How shall we translate the economic growth of our country into human development? Surely, we must realize that economic growth cannot automatically lead to an improvement in human development. We shall need to put in special efforts to end inequalities based on gender and rural-urban divide. We shall require public policies aimed explicitly at broadening the distribution of benefits from growth and global integration. The lesson the HDR 2005 holds for India is that pervasive gender inequalities, alongwith rural poverty and inequalities between states, is undermining the potential for converting growth into human development.

❒ V. B. Kamble

WYP 2005 .... (Contd. from page 32)

about this great scientist. He laid special emphasis on the fact that the world perceived him as an old eccentric genius with his most famous dishevelled hair style while the reality is that Einstein – the ingenious creator was a well-groomed young man in his mid-twenties.

The audience mainly comprised of high school students. Dr. Kumar explained the differences between Newtonian Relativity and Einstein's Special Theory of Relativity, and gave an all-pervasive account of the life of Einstein, from his student days to his stay at different Universities and his brief tenure as a lecturer. The wide-ranging applications of the revolutionary equation $E=mc^2$ was also mentioned. He concluded by bringing out the role played by Einstein in the social milieu. His quotes on education, politics, religion and Gandhi were inspirational to everyone in the audience.

A Workshop on Physics Teaching-Learning

Vigyan Prasar has initiated a programme for in-service education of physics teachers in the World Year of Physics 2005. An on-line physics learning resource has been created for physics teachers at **http://learning-physics.com**, and The resource material has been developed by Profassor A.N. Maheshwari, a renowned physicist and educationist.

The focus of this programme is to build teacher competence and use their expertise for development of further resource material and a database of frequently asked questions and their answers. All the participating schools would be networked and access would be made available on the site.

In this connection, a workshop was organized for Delhi teachers on 10 and 11 September 2005 at CRPF public school, Rohini, with support from Dr. Suraj Prakash, Principal of the school. In this two-day workshop, sixty physics teachers from different schools of Delhi and Ghaziabad participated. Teachers were oriented towards the use of the resource material and taught how to participate in the on-line interactive programme. It is aimed to create initially a network of the teachers of Delhi. Gradually the programme would be extended to other parts of the country.

Prof. Maheshwari explaining the web resource

Recent Developments in Science & Technology

Nobel Prize for the year 2005

Physics

" For his contribution to the quantum theory of optical coherence"

Roy J. Glauber
USA

John L.Hall
USA

Theodor W. Hansch
Germany

" For their contributions to the development of laser-based precision spectroscopy, including the optical frequency comb technique"

Chemistry

Yves Chauvin
France

Robert H. Grubbs
USA

Richard R. Schrock
USA

"For the development of the metathesis method in organic synthesis"

Physiology or Medicine

Barry J. Marshall
Australia

J.Robin Warren
Australia

"For their discovery of the bacterium Helicobacter pylori and its role in gastritis and peptic ulcer disease"

Source: nobelprize.org

Compiled by : Kapil Tripathi