EVERYMAN'S SCIENCE

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COVER PHOTOGRAPHS ***(From the Left)***

Past General Presidents of ISCA

1. Prof. N. R. Dhar	**(1961)**
2. Dr. B. C. Guha (died pre-maturely)	**(1962)**
3. Dr. B. Mukerji	**(1962)**
4. Prof. D. S. Kothari	**(1963)**
5. Prof. Humayun Kabir	**(1964-65)**
6. Prof. B. N. Prasad	**(1966)**
7. Prof. T. R. Seshadri	**(1967)**

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CONTENTS

EDITORIAL

HUMAN SAFETY ON ROADS

Quest for human safety in a road crash involves a complex combination of several technologies which ultimately aim at designing for minimizing the chances of an accident and mitigating or reducing the collision damage in terms of human suffering - if it does occur. The cost of such accidents is enormous in terms of human suffering as well as in redressing its consequences in its trauma management, insurance, legal and related aspects. Ever increasing number of vehicles poses some serious issues of atmospheric pollution. With increase in general awareness and rapid scientific developments, the general public is becoming increasingly conscious that the safety in road crash has much improved since 1934 when GM performed the first barrier crash test, and much more can be done to alleviate the suffering. In what follows, I touch upon some aspects of the ongoing endeavors in making the human life safe on roads.

Road safety is increasingly becoming a matter of concern in today's world. Several comprehensive studies, based on carefully obtained and compiled data, have appeared in recent years, which give detailed analysis of the causes and circumstances of road accidents occurring in various developed and developing countries. Such studies form basis of further scientific studies and designs. The circumstances and the traffic pattern in the developed and developing countries are very different. In India, there is an ever increasing number of vehicles continuously being added to our already crowded roads, which are used by a heterogeneous mix ranging from pedestrian, cyclists, carts, motorcycles, motor cars, buses and trucks. Studies have shown that in such conditions the pedestrians and two wheelers are quite vulnerable in getting involved in a minor or a major crash. As the roads get more and more crowded some psychological affects begin to manifest in the road users, particularly reflected in the cases of road rage and impatient driving. Such studies provide useful data, which experts may take in to consideration for proper designing of roads and employing the available space optimally for safe and orderly movement of pedestrians, two wheelers as well as fast moving vehicles. Road designs need to be continuously improved for smooth flow of traffic and improving safety features like needed lighting, guard rails, widening shoulders, and eliminating spots where frequent accidents occur. There are issues related to drivers and the traffic, which need to be considered for formulating measures. These need to be implemented and continuously updated. Important issues may include fitness and proper training of the drivers, control on speeding, driving and drinking, fitness of vehicles and so on.

Automobiles are continuously experiencing dramatic improvement in providing inbuilt occupant safety. Over the years several devices and technologies have been designed and developed by the industry, which enable the motorcars to provide safety to passengers and the body structure of the vehicle both by avoiding an accident and when the accident does occur. These design include technologies, which provide what are known as active safety and passive safety features.

Active safety features in automobiles help in avoiding an accident by assisting the driver in better control of the vehicle as well as by some automatic controls of the vehicle itself. These include automatic braking, infrared night vision, adaptive lamps, sensors to maintain safe distance in front or reverse, warning system for any lane departure, tier pressure indicators and electronic control to help in situation when the driver may loose the control.

Passive safety features are those, which come into play when the accident has actually occurred. In accident between two vehicles or a vehicle and a roadside feature like a pole or a tree, the vehicles moving at some speeds come to rest in a short time. The kinetic energy of the vehicle and the forces generated need to be dissipated in such a manner that severity of injury to the driver or passenger caused by the impact is minimized. The ability of a car to keep its passengers safe when an accident does occur defines its crashworthiness. Crashworthy design of a vehicle enables the vehicle to absorb its impact energy in the structural deformation of its body structure in a predesigned manner. Crumple zones are specifically designed which absorb and dissipate the energy of collision in a manner that its impact on the occupants is minimized. Vehicles may include front, rear and possibly side crumple zones. Side impact beams are also provided to help in containing the damage to the occupants in the event of side collision.

Interior of the car passenger cabin needs to be designed such that the occupants do not collide with any hard or sharp surface within the passenger area as the vehicle comes to sudden rest. Most popular of the devices to prevent this is what is known as the seat belt. Three point seat belt developed by Volvo in 1959 for driver and passenger protection has been made mandatory by several countries. Child seats are of help in the safety of children. Improved headrests provide safety against whiplash or hyperextension of the neck in rear collision. Airbags are provided to protect against impact with the interior in front or side of the vehicle. Collapsible universally jointed steering columns reduce the risk and severity of driver injury in a frontal crash. Today's vehicular frames have been built with inbuilt intelligence so that in the event of an accident these would inflict less damage/injury to the occupants in the passenger cabin.

Pedestrian and motorcycle safety aspects in accidents are being researched by considering the involved ergonomics in design of the car frontals. Studies have appeared which analyze these aspects as well as the capacity of motorcycles to absorb the crash energy in its structure and thus improving the safety of the driver. Head injury is a major concern in these accidents, and helmets are mandatory in several countries.

Human response in an accident is important parameter in safety designs, and is being researched extensively. Technologies have made advances in the design of systems which help in studying and analyzing the response of human body during a crash trauma. The vehicle is subjected to crash testing for assessing its crashworthiness and possible response of the occupant to the impact. Such testing has helped in developing many parallel fields like biomechanics, light weight materials and instrumentation, which have contributed in the overall safety of vehicles. The crash test dummies or the anthropomorphic test devices (ATD) have helped in simulating the size, weight proportions and response pattern of the human body. These studies are important for providing the designer with valuable information for structural optimization and development of the life saving devices.

Computer aided design has revolutionized the way vehicles are tested and qualified for safety today. They have made testing relatively cheaper and contribute to overall reduction in the vehicle costs. As the costs reduce, more and more vehicles are fitted with safety design modifications.

Human safety on roads is a complex multidiscipline problem. Individual users of course have to be careful and considerate. Roads and associated infrastructure have to be built in accordance with our carefully researched traffic requirements and engineering practices. We need to develop rational traffic control methods, and an efficient trauma management. Designs of vehicles need to continuously improve for avoiding collision and protecting occupants when the accident does take place.

In the space available I have touched upon a few issues, relevant to achieving "no human suffering" in traffic collisions. Of course there are many more.

Prof N K Gupta

PRESIDENTIAL ADDRESS

SCIENCE AND THE UNIVERSITIES

PROF. D. S. KOTHARI

I feel it an honour and a great privilege to be asked to preside at this fiftieth session of the Congress. To present an address worthy of the institution and the occasion is no easy task for me ; and this feeling is sharpened when I think of the distinguished men who in the past have addressed us. To follow them is to follow far behind.

Since the last meeting of the Congress in January 1962, we have lost four of our past Presidents. Shri M. Visweswaraya, one of the greatest engineers of our times and a pioneer in many ways, presided at the 1923 Session of the Science Congress. He died in 1962 at the age of hundred years. Professor S. K. Mitra presided at the 1955 Congress. His contribution to Physics of the ionosphere has been of fundamental importance ; he was one of the earliest investigators of the subject. He founded the Institute of Radio Physics at Calcutta. Dr. B. C. Roy, a towering figure in the field of Medicine, education and public life was the General President in 1957. Dr. T. S. Venkataraman's contribution to research on sugar-canes has been of the highest value. He presided at the 1937 Congress. We lost by the death of Professor B. C. Guha an outstanding teacher and a leader of biochemical research, and in Professor N. R. Sen we lost one of our most eminent Mathematicians. We pay our respectful homage to their memory.

We are most grateful to Shri Jawaharla Nehru that despite an unusually heavy call on his time he has honoured us an Indian Science by his presence here today and given us his inspiring inaugural address. His is a unique contribution to the promotion and progress of Science, and in many ways it is unparalleled in our country or elsewhere.

About five years ago the Prime Minister, announcing the scientific policy of the Government, stated the following in Parliament.

SCIENTIFIC POLICY RESOLUTION

Science has developed at an ever-increasing pace since the beginning of the century, so that the gap between the advanced and backward countries has widened more and more. It is only by adopting the most vigorous measures and by putting forward our utmost effort into the development of Science that we can bridge the gap. It is an inherent obligation of a great country like India, with its traditions of scholarship and original thinking and its great cultural heritage, to participate fully in the march of Science which is probably mankind's greatest enterprise today.

And the statement continues :

The Government of India have accordingly decided that the aims of their scientific policy will be

1. to foster, promote, and sustain, by all appropriate means, the cultivation of Science,

* General President, Fiftieth Indian Science Congress, held at Delhi January, 1963.

and scientific research in all its aspects—pure, applied, and educational ;

2. to ensure an adequate supply, within the country of research scientists of the highest quality, and to recognise their work as an important component of the strength of the nation ;
3. to encourage, and initiate, with all possible speed, programmes for the training of scientific and technical personnel, on a scale adequate to fulfit the country's needs in Science and education, agriculture and industry, and defence ;
4. to ensure that the creative talent of men and women is dissemination of knowledge and for the discovery of new knowledge, in an atmosphere of academic freedom ;
5. to encourage individual initiative for the acquisition and dissemination of knowledge, and for the discovery of new knowledge, in an atmosphere of academic freedom ;
6. and, in general, to secure for the people of the country all the benefits that can accrue from the acquisition and application of scientific knoledge. The Government of India have decided to pursue and accomplish these aims by offering good conditions of service to scientists and according them an honoured position, by associating scientists with the formulation of policies, and by taking such other measures as may be deemed necessary from time to time.

This is a most heartening and welcome policy statement giving explicit recognition to the role and importance of Science and technology in the affairs and progress of the country. To give concrete shape to this policy is no easy thing, no royal road. It requires relentless effort and vigorous action by the Government, the scientific community and the public generally. There is no doubt that a great beginning has been made. We have taken the first steps, and in this venture the first steps are particularly difficult. As Science grows in the country, its influence and effectiveness increases extremely rapidly. The interaction between Science and society is a dynamic and an evolving thing.

THE SCIENTIFIC REVOLUTION

It needs no reminding these days that, in a historical sense, the most conspicuous feature of the modern world is Science. We do not quite understand why the Scientific Revolution—the term is used here in its broad sense—was not realised by the great civilisations of antiquity : why and how it originated in Western Europe only a few centuries ago and then spread and is spreading all over the world ? May be, to start with it was in the nature of a "spontaneous fluctuation" which because of a peculiar combination of socio-economic factors, aided by colonial expansion, revival of ancient learning and an atmosphere of religious ferment gathered momentum rapidly instead of evaporating away as probably happened with somewhat similar events in earlier times. We do not understand why the growth of Science during the preceding two hundred years or so has occurred at an almost terrific pace—the *doubling period* of Science is around 15 years. Much study and research in the history of Science and social sciences would be necessary before we could hope to understand these things.

Let us for a moment see the Scienctific Revolution against the backdrop of history—the evolution of the universe. It is meaningful to assign to the universe an age of 20-30 billion years (1 billion = 1,000 million), The sun is 10 billion years old, and it has about the same length of time ahead of it. As against this, the highly luminous B-type star has a lifetime of a few million years only. Incidentally, the sun is a second, or even, a later generation star as revealed by its chemical constitution. The first generation stars were originally of pure hydrogen which were transformed in their extremely hot interiors into different elements ranging from helium to uranium. Some of these stars explided in the course of their career, and scattered into space the elements synthesised in their deep interiors. These later found their way into new stars under formation—the second generation stars. One of them is our sun. The earth in its present form is about 5 billion years old. The most primitive forms of living organisms appeared on the earth perhaps 2 billion years ago ; the first birds and mammals are about 200 million years old. Man appeared between 1-2 million years ago. Agriculture seems to be no more than 10,000 years old ; and the first writing was invented some 6,000 years ago. Science, as an important element in determining man's economic, cultural and spiritual "climate", has been in operation for less than two centuries. Man is now harnessing, under controlled conditions, a source of energy million times more powerful than chemical energy. Harnessing nuclear energy demands deep insight and considerable progress in Fundamental Science, as distinct from empirical arts and crafts. If seems that man is now truly entering the *"age of homo sapiens"* when he can aspire to be a citizen not only of the One World in the making, but a citizen of the universe. And it is no mean universe. We do not know whether the universe is *finite or infinite*, but progress in radio astronomy is likely to provide an answer to this great question within the next few years. The explored part of the universe is populated by some ten billion galaxies, and each galaxy contains some hundred billion years. A typical galaxy has a diameter of hundred-thousand light years ; Inter-stellar gas makes one to ten per cent of its total mass. During recent years planetary systems other than belonging to our sun have been discovered. (It is easy to show that for a planet the maximum size (radius) cannot be larger that about that of Jupiter). It is almost certain that intelligent life is no monopoly of the earth. Maybe, at no distant date man may succeed in linking himself to a "cosmic telephone network".

SCIENCE STRESSES COOPERATION

The real strength of Science lies in its relentless, vigorous and fearless pursuit of truth. Scientific laboratories which less than a hundred years ago were a curiosity and a rarity are now studded all over the globe. Sience teaching in India first started in the Calcutta. Hindu College (which later became the Presidency College) founded in 1817 under the leadership of Raja Rammohun Roy. Any discovery made anywhere soon becomes the common property of all. The language of Science is a common language, and its achievements the heritage of all—the only truly common heritage. The world of Science is an open one, and this has not altered essentially despite certain aberrations it has suffered because of its close connection with the apparatus of war. An example of cumulative effort that at once comes to our mind is that all particles in nature, be those electrons, antiprotons, neutrinos, or what not, must belong to one of two classes. One class of particles are called *fermions* after Enrico Fermi (who first realised the nuclear fission chain reaction in December, 1942), and the other class is called *bosons* after Professor Satyen Bose. Bose and Fermi were the first to study, about 1942, the relevant quantum statistics. Science gives first place to cooperation and not competition, and its roots lie deep in man's highest capabilities and aspirations. With the growth of Science, further research generally becomes increasingly complex and costly. In some highly specialised and sophisticated fields, cooperative effort on a more or less world-wide basis becomes almost a necessity, e.g., manned flight to the moon or even the 1,000 billion electron-volt accelerator required for investigating the interactions between elementary particles (including such fundamental problems as whether in elementary processes the direction of the flow of time can be experimentally determined).

As a direct contribution of Science, the average span of human life (expectation of life at birth) has increased everywhere, and in some countries it is three times of what it was a few hundred years ago. Whatever the conflicts and bigotries that afflicts the world today, there is no denying that we are witnessing, for the first time, cooperation in Science and other fields on a scale and extent never attained before. Less than two years ago the U. N. General Assembly adopted a proposal that through concerted effort of the "rich" countries, the less developed countries be assisted to achieve by the end of the present decade an annual rate of growth of at least 5 per cent in their national economy (that is about 2.5 per cent yearly increase in per capita income). A five per cent rate of growth corresponds to a doubling period of 15 years. The growth rate of the national economy during recent years has been about 4 per cent for the USA, and about twice this for the USSR. To attain the above target the countries concerned would need probably an economic aid of the order of $ 10 billion on a long-term basis : this is about one per cent of the yearly national income of the rich countries. Incidentally, $ 10 billion is about one-tenth of the yearly expenditure of defence by them. One cannot be wholly rational in these matters, but it seems that world prosperity would be much easier to realise if there were world disarmament.

SCIENCE INTRODUCES UNPREDICTABILITY IN THE MARCH OF EVENTS

The overwhelming impact of Science on society has for the first time in human history introduced an element of unpredictability and uncertainty not present in earlier times. It arises from the basic fact that in the very nature of things, fundamental discoveries in Science are inherently upredictable. When in 1905, Einstein established as a direct consequence of the theory of relatively the equivalence between mass and energy—the famous equation $E = mc^2$–who could have even imagined that within half a century it would constitute the basis of nuclear weapons of colossal powers of destruction making nonsense of the classical concept of war. The abstract, the so-called "useless", is often the shortest road to the concerete and the "useful" but the road is not known in advance. Broadly speaking, we can only plan for Science but we cannot plan Science.

In passing, one may mention that the above reference to the unpredictability in history has no relation with the ultimate question of freedom and creativity *versus* necessity and determinism of historical events : do men direct and control the stream of history or is it that the steam carries man, like floating straw in a river, along a predestined course ? This is an unanswered question, but is it a valid question to ask, or it is a pseudo-question which we ask because we do not have knowledge enough not to ask it—we do not quite know. We may recall the observation of Einstein.

> I do not at all believe in human freedom in the philosphical sense. Everybody acts not only under external compulsion but also in accordance with inner necessity. Schopenhauer's saying, "A man can do what he wants, but not want what he wants," has been a very real inspiration to me since my youth ; it has been a continual consolation in the face of life's hardships, my own and others, and an unfailing wellspring of tolerance. This realization mercifully mitigates the easily paralysing sense of responsibility and prevents us from taking ourselves and other people all too seriously ; it is conducive to a view of life, which, in particular, gives humour its due.

Freud held that our conviction about freedom of choice is illusory. Where we feel we have exercised free choice "we actually leave the matter to be decided by our unconscious mind and then claim the credit for the outcome. If unconscious mind is taken into account, therefore, the rule of determinism is of general validity."

Apart from the element of unpredictability injected by Science in the march of events, the other two important characteristics of the Scientific Revolution are the rate of growth of Science and the new role and significance of the universities.

GROWTH RATE OF SCIENCE

Consider the rate of growth. The total achievement to date in Science and technology is indeed remarkable, but even more striking is the rate or pace of progress. A number of different indices indicate, as brought our clearly in the pioneering study of de S. Price, that over the last 200 years or so, scientific knowledge and things directly related to Science have been growing at an *average rate* of 5-7 per cent a year. This corresponds to a doubling time of 10-15 years. As an illustration, take the case of science journals, a key innovation of the Scientific Revolution. Beginning with a handful of journals about 1750 A. D., the number rose to about 1,000 in 1850 A. D. and is now nearing 100,000. Probably, it would reach a million by the end of the century. In the case of papers notified to be read at our Science Congress, the number was 35 at the first session of the Congress in 1914. (The Congress during the first year had an income of Rs. 883/- and an expenditure of Rs. 504/-). The number of papers rose to 900 at the Silver Jubilee Session in 1938, and it was 1,300 for the 1962 Session. These figures show an average doubling time of somewhat less than 10 years. (Curiously enough, even the number of elementary particles discovered during the last few decades show a doubling period of 10 years). The number of scientists has been rapidly increasing at about the same rate. It has been said that the number of scientists at any time is roughly one-third the number of papers published up to that time. This applies to the number, and also to the extent and depth of knowledge, but, of course, not to the quality of mind. We do not expect an Archimedes or an Aryabhatta of today to have a really superior mind than his predecessor. (The situation in this respect is somewhat similar to that of that of the life-span. The mean life-span as a consequence of Science has increased considerably but the maximum life-span has remained about the same).

Notice that a doubling period of 15 years means that about 90 per cent of the scientists who ever lived are with us now. Frankly, we do not understand why the doubling time of Science should be around 10–15 years. Of course, this exponential rate of growth cannot continue indefinitely. If the present rate of increase in the number of scientists were to continue for another hundred years or so, the number of scientists would exceed the total world population—an obvious impossibility. Sooner or later, therefore, the growth rate of Science would come down, and perhaps level of eventually with the growth-rate of population. In fact, the first signs of an onset of saturation are visible today in the countries which are in the vanguard of Science. A consequence of the exponentially expanding Science is that the time gap between basic discovery and its application is continually diminishing. It was a few decades in the last centure. It is now less than a decade as vividly illustrated by transistor and now by laser. So rapid is the pace of scientific progress that a scientific paper is often out of date by the time it is print ; a graduate is almost obsolescent on the day of his graduation ; a weapon-system already obsolete by the time it is in production.

RICH COUNTRIES AND POOR COUNTRIES

In the contemporary world, rich countries are those which are rich in Science and poor are those which are poor in Science. The division of humanity into rich and poor is relatively a new thing, and has arisen because some countries have been fortunate to exploit Science more fully than others : it is an unfortunate by-product of the Scientific Revolution. In the rich countries the economy is dynamic and in most of the poor, it is almost static. This implies that the gap between the rich and poor humanity is not only large but widening rapidly with time. Often the price of agricultural produce in the poor countries remains constant, whereas the price of industrial goods manufactured by the rich countries rises continually. This makes it all the more difficult for the developing countries to import the much needed capital equipment and machinery to raise their production. For instance (as Paul Hoffman pointed out), the under-developed part of the world received in 1938 a total of $ 2.4 billion in aid, but at the same time it lost $ 2 billion in import capacity for having to pay more for manufactured goods and getting less for its agricultural produce. Such things tend to dilute, to a considerable extent, the impact of aid given to developing countries. It should be possible, of course, to devise ways which would overcome this and related difficulties, but this will require great vision and courageous statesmanship. The wide gap between the developed and underdeveloped world is detrimental to the real interests of both. The earnings of a proportion of our population equal to that of the total population of U. K. are no more than what the people of U. K. spend on cigarettes and tobacco. It is now established that smoking raises considerably the incidence of lung cancer. If what is spent on smoking by the rich world were passed on to the newly developing countries to assist their food production, it would benefit both. In this connection it is good to remember that the prosperity of the rich countries is due in a small measure to the contribution in material resources, craftsmanship and brains made by other countries. As an example of the uncommonly high level of handicrafts in India, we many recall Halley's (Secretary of the Royal Society) letter of 1686 ; "I have seen a great curiosity viz., calicoe shirt brought from India, which is woven without a seam all of one piece, which I should have thought impossible had I not seen it. It explains the Scripture relation of our Saviour's coat which was without a seam."

"SEEDING NUCLEI" FOR EXPONENTIAL GROWTH

In former times when one country helped another, or was forced to assist another by political pressure or war, the "donor country" lost what was gained by the "recipient country". If it was a transfer of land or other material resources, one country could only gain it at the expense of the other. But in the contemporary world as progress and prosperity depend mainly upon harnessing Science and technology, the situation is very different. By imparting scientific knowledge and techniques to a less developed country, a donor country loses nothing—this is, of course, an over-simplification. It is of some improtance to recognise that an exponential growth rate of Science (with a doubling period much less than the population doubling period) fortunately makes it *possible* for an "advanced country", if it so desires, to make a major coutribution towards the rapid development of a newly developing country : it could supply an adequate number of technical men, material resources, etc. to serve as "seeding nuclei" for the operation of the exponential growth process in the recipient country, without sensibly affecting its own economy or rate of progress. Of course, aid is no substitute for local initiative and effort. In a sense aid is deserved only if one could do also without it, but the pace would be slower. This is not the place to pursue the subject further, but it is apparent that the main obstacles to rapid progress are now largely social and psychological : there is no lack of resources.

A country which has newly "taken-off" in Science can with determination achieve a growth rate higher than that achieved by the "early starters". Some countries have done it. It seems that the early starters and the late starters would, after some time, join together and have a growth rate corresponding to the stage of saturation.

SCIENCE AND AGRICULTURE

In countries where agriculture has been modernised the output has increased rapidly. Where agriculture has not been linked to Science, the output has remained almost stationary. Thus, as Lord Rutherford pointed out in his Address to the Silver Jubilee Session of the Indian Science Congress in 1938, the annual production of wheat in India had risen since 1914 from 8.3 million tons to no more than 9.5 million tons, while the exports in the same period had fallen from over a million tons to 1000 tons. The present yield of wheat is about 11 million tons. Rutherford said : "In view of these facts, it would seem clear that, in any national scheme of research, research on foodstuffs has a primary claim of India's attention. Quite apart from improvements in the systems of agriculture used in India, there is a vast field for the application of scientific knowledge to the improvement of crops, for example, by seeking for improved strains suitable for local conditions, by research on fertilizers and in many other directions". And all this is no less true today.

R & D EXPENDITURE AND SCIENTIFIC MANPOWER

Money spent on research and development is not an entiirely satisfactory index of the development of Science in a county. Much would depend upon the efficiency with which the resources are utilised. All the same, within limits, this is an index of considerable significance. The USA Government currently spends somewhat more than 2.8 per cent of the Gross National Product (GNP) on research and development and testing of new defence equipment. The amount is more than $ 15 billion that is Rs. 7,500 crores per year. (Industry contributes an additional $ 5 billion or so). More than three-fourths of the amount goes to work related to defence. The current level of research and development expenditure in our country is some 0.2 per cent of the GNP. In this context it is important to recognise that the research and development expenditure in countries which have passed the "take-off' stage in Science has been increasing very rapidly during recent decades : the doubling period is less than 10 years. About 20 years ago the USA, Government and Industry, spent about 0.5 per cent of GNP on research and development—it was 0.1 per cent in 1920. (In 1940 the Government spent $ 74 million, and $ 2 billion in 1953, on R & D).

The UK Government in 1939 spent on scientific research £ 3.5 million ; the current figure is £ 45 million, representing a four-fold increase in real terms. The total expenditure by government and industry on research and development was £ 300 million in 1956 and £ 630 million in 1962—a rise from 1.7 per cent of the GNP to 2.7 per cent. The present research and development budget exceeds the total government budget of some decades ago—In 1909 the total budget was about £ 150 million.

We can have more research only when there are more men to do it. In the USA the number of professionally qualified scientists and engineers constitute about 1.5 per cent of the population. (In 1940 the percentage was 0.6 only. By 1970 it is expected to be 2 per cent). *There is a clear and direct connection between the percentage of national income spent on research and development and the number of scientists and technologists expressed as a percentage of the total population.* We cannot have one high and the other low without leading to inefficiency and wastage. For more science do we need more scientists. Investment on science and investment on man go together (Fig. 1). This brings us to the third major characteristic of the Scientific Resolution.

SCIENCE AND HUMANISM

In the early days of the Scientific Revolution Science had hardly any place in the universities, though there were some individual contribution of the highest rank. Science was often sneered at and its votaries held it in ridicule. Steele wrote in *The Tatler* commenting on a paper on a brainless child, published in the *Transactions of the Royal Society*, that it was a pity the child did not live long enough for, otherwise he would have made a fit President of the Royal Society. To believe in magic and sorcery was an index of progressive views. Medical astrology was regarded as the crown of Medical Science. Objective and verifiable knowledge of nature which could liberate man's mind from

superstition, fear and shackles with authority was lacking. The reigning subjects in the universities at that time were theology, grammar, rhetoric and astrology. With the progress of the Scientific Revolution, Science found its way into the universities but it had to meet with opposition and it was admitted reluctantly. The situation now, of course, is completely different and, if anything, the pendulum tends to swing a little too much on the other side. Incidentally what happened once with Science is to some extent happening today with technology. Our Association can play an important role in bringing about an adequate recognition of the humanistic side of Science and technology. Properly taught, Science and technology have as much (if not more) humanising influence as any other combination of subjects. Our Association should also give serious attention towards creating a public awareness of the basic needs and requirements of Science—support of Science eventually depends upon enlightened public interest in Science.

BAROMETER OF SCIENCE

In the modern world, the universities make by far the largest contribution to Fundamental Science. This has given a new status and a new significance to the place and role of the universities in national economy. In fact, the level of Science and technology in the universities provides a reasonably good barometer to the standard and health of Science and technology in the country. In a developing country the strengthening of the universities is fundamental to everything else.

COMBINATION OF TEACHING AND RESEARCH

The experience of more than a century, beginning with the great German Universities, has clearly shown that teaching and research flourish best in combination : In isolation they both wither. The best of either is achieved in an environment where both are cultivated. In this combination of teaching and research, education and discovery, lies the real strength of the universities.

In the UK about 50 per cent of the expenditure in the universities, as also the time of the teaching staff, is spent on research. The US Government in 1962 spent nearly $ one billion (Rs. 500 crores) on research and development in the universities. This was seventy times larger than the amount spent in 1940. A recent Report on "Meeting Manpower Needs in Science and Technology" by the US President's Science Advisory Committee has strongly urged that in order to meet the nation's urgent needs the output of first degree holders in Engineering, Mathematics and Physical Sciences, as also the output of doctorates, be doubled by 1970. This would require a yearly expenditure of $ 8 billion ($ 2.7 billion on research) as against the present figure of $ 3 billion. In 1961 about 645,000 students were enrolled in the USA for degrees in Science and Engineering, and the number of teachers was about 10,000.

There was a time about a hundred years ago when a gifted individual could encompass the whole of Science. This is no longer true today. Science and technology are now divided into some 100–150 subjects. The division is often arbitrary. It is hardly possible for any person today to master even one subject. The fragmentation of Science, if it is not to become a self-defeating process, has to be supplemented by cross-communications cutting across subject-barriers. There must be a continuing reshuffling of boundaries between subjects. Fragmentation is artificial : Science, in a sense, is a unity.

REVOLUTION IN CURRICULUM

Let us for a moment turn to Physics. How are students and teachers to keep pace with the subject growing bigger every day at an exponential rate ? There is no much to learn today ; and there is so much more to learn with every passing year. It is apparent that if we are to cope with the explosion of knowledge we need a veritable revolution in curriculum, in methods of teaching and in methods of learning. Anything which is of a passing interest, which has only a limited relevance, which does not help to broaden and strengthen understanding, can have no place in a high school or undergraduate course. Also, we need greater stress on Mathematics as the basic tool for understanding Physics. To bring about the desperately needed revolution in syllabus and nothing short of a revolution will do—we require the combined effort of top university researchers, teachers and the school teachers. We need channels of communication between the schools and universities. The PSSC book production by a band of outstanding US physicists and teachers from universities and schools is a magnificent example of cooperative effort.

The book has been successfully tried in hundreds of schools in the USA. Even more important than the contents of the book is its highly commendable, novel and bold approach. Preparation of similar textbooks in Science subjects suited to our secondary schools is in hand. If the programme of the production of first-rate textbooks and other work is to succeed, the writing of such books should be given recognition (by learned societies etc.) same as to first-rate research. This has been also stressed by the Weinberg Report on "Science—Government, and Information" (1963). Scientific and technical books are generally very expensive. It is most important to arrange for the production of cheap editions and paper backs to bring them within easy reach of our students.

CLIMATE OF FREE ENQUIRY AND SCIENTIFIC TRADITION

Progress in Science requires a "climate" of free enquiry, frank and vigorous criticism and fearless expression of opinion. This becomes easier to organise, promote and foster if there are strong universities with front rank schools of postgraduate studies and research. It is important that a substantial proportion of the best men and leaders of Science in the country should be in the universities, in contact with and inspiring young minds and sharing in their joys and difficulties. Also every endeavour should be made to increase the proportion of men at the working bench to those at the administration desk ; to raise the proportion of small and modest laboratories doing big work to big laboratories doing small work.

To establish scientific traditions in a developing country needs deliberate effort and it also takes time. To quote Michael Polyani, "Those who have visited the parts of the world where scientific life is just beginning, know the back-breaking struggle that the lack of scientific tradition imposes on the pioneers. Here research work stagnates of lack of stimulus, there it runs wild in absence of any proper directive influence. Unsound reputation grows like mushrooms : based on nothing but commonplace achievements, or even on mere empty boasts ... However rich the fund of local genius may be, such environments will fail to bring it to fruition.

It is generally true that creativity of an individual continues longest in a university environment than elsewhere because of the continuing challenge of youth. A recent editorial in *Science* said—the path to new discovery for a scientist who has already made his reputation is often blocked by too much equipment, too much money, and too much seeking after status and security. There is (relatively) little danger of this happening in a university.

It has been said that a recipe for slowing down the progress of Science, there is perhaps hardly any better than to provide a big network of committees, give them great prestige, and put on them the best men, the most active scientists from the laboratories.

TEAM WORK IN SCIENCE

Scientific work is now increasingly becoming more and more of a team effort. In a sense this is inherent and instrumental in bringing about a rapid progress of Science. Problems have become increasingly complex needing increasingly elaborate equipment. The importance of team work in science was particularly brought out during world war II. It paid rich dividends. The most sucessful laboratories functioned almost like large families where the members shared together the joys and disappointments of work.

In developing and promoting this spirit of team work, the contribution of the universities is of special value. As Frederick Seitz, President of the U. S. National Academy of Sciences observed in a recent address, "What is emphasized here is that in the main the concept of team work in Science has evolved most rapidly and most effectively through university channels during the past forty years."

BALANCE IN ALLOCATION OF RESOURCES

It is apparent that if good results in education are to be achieved there must be a reasonable balance and coordination between resources allocated to teaching in Science, Engineering, Agriculture and other subjects. There has to be a proper distribution of resources over the whole educational spectrum. To unduly concentrate on one sector at the expense of others may put the machine out of gear and result in a waste of resources.

If research institutions outside the universities expanded at too rapid a pace this would result in depleting the universities of their men, and may be also the money which should go to them. In the long run weak universities would inevitably weaken the research institutions. In this context the report by the (U. K.) Institute of Physics and the Physical Society, just issued, is of considerable interest. Commenting on it *The Economist* (London) has said the following

The two learned bodies are alarmed at the way good physicists are absorbed into govenment establishments, lured by salaries and by research facilities that they could never hope to find outside them (few organisations pay scientists as well as, for example, the Atomic Energy Authority). Once there, they are lost forever to the universities, to teaching and to Science generally. The universities see their own teaching standards in danger because good scientists will stay to teach only if they have facilities for research, and the universities are denied the right to provide those facilities because they have already been installed behind some government security fence.

Underlying this complaint is the brutal fact that many of these government establishments have turned to university-type pure research because they are no longer required for their original purpose. Much of the work now done by the Atomic Energy Authority is of highly academic nature. So is the work done by the Ministry of Aviation's radar research centre at Malvern. They are openly poaching on the universities' preserves, but what would one have them do, leave their equipment idle and their skilled staff underemployed? The problem of providing for the free exchange of research staff between universities and government establishments is one that has exercised several committees of investigation and none has come up with any apparently workable solution, not least because, as the report stresses, the difference in salaries paid presents insuperable difficulties to all but the most unworldly. (*The Economist*, 31 August, 1963)

When there is a deficiency of competent men, it is wiser to invest them generally in the universities, thus combining teaching and research. If the investment and effort exceed a certain critical size (and with proper feedback), it would generate a sort of chain process providing many of more able men.

COST OF EDUCATION

It is an interesting fact that over a wide range of countries the cost per student on university education excluding board and lodging is comparable to the per capita national income. Thus, the expenditure per university student is roughly Rs. 400 in India as against $ 600 in the UK and $ 3,000 in USA. The USA figures faculty wise are : Humanities $ 3,200 ; Education $ 3,300 ; Social Science-$ 3,250 ; Biological Sciences-$ 3,374 ; Physical Sciences and Mathematics $ 3,380 ; Engineering-$ 4,020 ; *The President's Science Advisory Committed Report on "Meeting Manpower Needs in Science and Technology"*. A University lecturer's salary in the UK is about twice the per capita income. In India it is more than fifteen times the per capita income.

CENTRES OF ADVANCED STUDY AND RESEARCH

At the level of research and postgraduate work, expenditure even in newly developing countries has to be roughly comparable to that in more advanced countries. With limited resources of developing countries this can only be brought about by concentration of resources. By coordination amongst the universities and by careful selection it should be possible to develop a modest number of "centres of excellence". In other words, one should aim at establishing high peaks—"centres of advanced study" in carefully selected subjects and universities. These centres would serve as "breeders" for new centres of excellence. Concentration of effort in the initial stages is a vital thing for developing countries. Also, there must be close cooperation between universities, national laboratories and other research organisations so that in the establishment of the centres fullest use is made of all available resources.

Also as Lord Hailsham has pointed out in his recent book on *Science and Politics* (1963) a healthy relationship between government and universities is of central importance in ensuring a balanced and fruitful interaction between govenment and Science generally.

The *conclusions* are simple and apparent. But often it is the obvious things which are the hardest to implement.

1. Everything possible should be done to strengthen the universities (e.g., improvement of teacher to pupil ratio, library and laboratory facilities) specially at the postgraduate and research level ; this should be a key point in the plan and pattern and deployment of the country's resources in talent and facilities. In the context of the present meagre level of facilities, the layout on the universities should at least be doubled in five years.

   Strong postgraduate schools are our most urgent requirement ; and to organise these effectively all available resources of the universities, national laboratories and other agencies would need to be pooled together.

2. In the universities, good work, good teaching and good research should be energetically and generously supported at all levels. In Science the output in terms of achievement is directly proportional to the input in terms of hard and honest work.

3. Contacts (including movements and exchange of scientific staff) between the universities and national laboratories, scientific government (1960) departments, and industry should be vigorously promoted and strengthened. Any one who has a real competency and willingness to participate in university work should be encouraged to do so—so great and urgent is our need that all resources need to be fully exploited.

4. "Right Climate", leadership and dedication are important factors in promoting team work and in generating scientific work of high quality. Able and gifted men should be given every opportunity for concentrated and sustained work free from petty worries and distractions. In scientific establishments the administrative load and "routine" should be cut down to a minimum.

5. Our resources are limited, so one has to spend more thought to get more out of our resources—spending thought is more difficult than spending money.

The US President's Science Advisory Committee in its recent Report on "Scientific Progress, the Universities and the Federal Government" (1960) (prepared under the chairmanship of Professor G. T. Seaborg, now Chairman of the Atomick Energy Commission) states ; "Both basic research and graduate education must be suported in terms of the welfare of society as a whole. It is in this large sense that the role of the Federal Government is inevitably central. The truth is as simple as it is important : whether the quantity and quality of basic research and graduate education in the United States will be adequate or inadequate depends primarily upon the government of the United States. From this responsibility the Federal Government has no escape. Either it will find the policies—and the resources—which permit our universities to flourish and their duties to be adequately discharged—or no one will."

These are wise and powerful words, and they apply to us no less. And, there is perhaps no finer vision of a university placed before us than what Shri Nehru said at a University Convocation some years ago, "A university stands for humanism, for tolerance, for reason, for the adventure of ideas and for the search for truth. It stands for the onward march of the human race towards even higher objectives. If the universities discharge their duties adequately, then it is well with the nation and the people."

That Science has radically altered man's material environment needs no saying. It has brought within reach of common man (but not everywhere so far) a level of prosperity never attained before. At all times great seers and sages have dreamt of such a world, but till now the necessary means, depending as they do on Science and technology, have been lacking. In the great civilisations and cultures of antiquity, and as also of later times, slave labour was an integral element. Aristotle said slavery could only be abolished when machines could be invented to do manual work. This is what has happened, but it has taken more than two thousand years to do it. Just as machines have now liberated man of manual drudgery, so the new developments in cybernetics—computation and automation—could in the near future take away from him the burden of boring work and mental drudgery. Again, whereas till now it has been the pressure of environment which has influenced the course of organic evolution, now man using his unique faculty of mind and utilising the power that the discovery of Science has given him can, it appears, shape in a deliberate way his own destiny.

The pursuit of material affluence and power, which has been till now a dominant thing, is likely to give way to pursuit of higher values and fulfilment in a deeper sense—"fulfilment society" to use Huxley's term. This is what Achary Vinoba Bhave calls the age of Science and spirituality. All this would come if man can escape a nuclear holocaust. There is no hiding the grim fact that man today faces an unprecedented peril in depth and extent in the shape of a possible misuse, deliberate or accidental, of nuclear knowledge. The explosion energy released in war by man in all history totals to about 5 million tons (5 megatons) of chemical explosive, say, T. N. T. The total energy released in nuclear test explosions during these years of "peace" is equivalent to more than 500 megatons of T. N. T. If a full-scale nuclear war breaks out the explosion energy may reach tens of thousands of megatons, and hundreds of millions of fatalities in the first few hours to a few days of the outburst of war, 5–500–50,000 MT are the awesome numbers of our times. Atom and *ahimnsa*, or to put it differently man's knowledge of outer space and the space within his skull, are not in balance. It is this imbalance which mankind must seek to redress.

Man now faces himself. He faces the choice of rolling down an abyss to partial extinction or raising himself to new heights of fulfilment as yet unimagined.

ABOUT OUR ENERGY CONSUMPTION

Satya Bhama and SR Malhotra*

The conversion efficiency of food energy into physical power depends on the form of energy source and on the type of physical energy usage. This article discusses in details about the energy requirements and consumption in daily life.

Energy is necessary for human beings to carry out routine physical work, maintain body temperature, body's basal metabolism, build and replace body tissues, compensate for the excretory losses and allow physical activities.

Energy was traditionally been expressed as calories of kilocalories. Recently, the units of energy have been changed to kilojoules (4.184 kilojoules equal 1 kilocalorie). The energy value of a food item indicates its value to the body as a fuel. After the food is ingested, some of its energy may be 'lost' during digestion and metabolism. Although the energy value of some foods may be estimated by combustion in a bomb calorimeter where the macronutrients–fat, protein, carbohydrates and alcohol (ethanol) account for the energy Liberation. One joule is energy expended when 1 kilogram (kg) is moved 1 meter (m) by a force of 1 Newton (N). Approximately, 1 Calorie (kcal) equals 4.2 Joules (kJ) and 240 Calories (kcal) equal 1.0 megajoule (MJ)

The first system for giving energy values to the macronutrients was described by Dr W. O. Atwater in 1899. The Atwater factors' in kJ/g are as follows :

Fat–38, Short chain fatty acids – 28, Carbohydrates – 17, Alcohol – 29, Organic acids – 13, Polyols (sugar alcohols, sweeteners) – 10, Salatdims (reduced energy fat) – 25

The conversion efficiency of food energy into physical power depends on the form of energy source (type of food) and on the type of physical energy usage (e.g. which muscles are used, whether the muscle is used aerobically or anaerobically). The differing energy density of foods (fat, alcohols, carbohydrates and proteins) lies in their varying proportions of oxidizable carbon atoms. Release of energy from food follows transfer of electrons from carbon and hydrogen to carbon dioxide and water.

Swings in body temperature–either hotter or cooler—increase the metabolic rate, thus burning more energy. Prolonged exposure to extremely warm or very cold environments increases the Basal Metabolic Rate (BMR). People who live in these condition often have BMRs 5-20% higher than those in other climates. Physical activity also significantly increases body temperature which in turn uses more food energy. BMR is the number of calories your body burns at rest to maintain life. Instead, it is responsible for 60-70% of the calories expended through activities such as the beating of the heart, respiration, and body temperature maintenance.

Factors that affect BMR are as follows.

Genetics : This is one factor one cannot directly

* Department of Food Science and Nutrition College of Home Science CSH HPKV, Palampur-176062 (HP)

change. Some individuals have fast metabolisms while some others have slow metabolisms.

Gender : Due to greater muscle mass and lower body fat percentage, men have a 10-15% higher BMR than women.

Age : BMR of infants and younger children are more compared to adults.

Weight : Obese individuals have higher BMR values.

Height : Tall, thin people have a higher BMR values compared to short people of equal weight.

Fever : Fever increase the BMR. For every 10°F rise in body temperature, the BMR increases approximately 7%. Physical activity significantly increases body temperature.

External temperature : Prolonged exposure to extremely warm or very cold environments increases the BMR. People who live in these types of condition often have 5-20% higher BMR's than those in other climates.

Endocrine function : Thyroid glands that produce too much thyroxin can double the BMR, while BMR can drop by 30-40% in individuals with hypothyroidism, or inadequate thyroxin production.

Exercise : In addition to increasing body temperature, exercise increases lean muscle mass, which burns more calories than fat–even when you're not exercising.

REQUIREMENT OF ENERGY

The recommended daily energy allowanes are as follows :

Infants & children	Kcal	MJ
0.0–0.5	kg ´115	kg ´ 0.48
0.5–1.0	kg ´ 105	kg ´ 0.44
1-3	1300	5.5
4-6	1700	7.1
7-10	2400	8.4

Male			Female	
Age	**Kcal**	**MJ**	**Kcal**	**MJ**
11-14	2700	11.3	2200	9.2
15-18	2800	11.8	2100	8.8
19-22	2900	12.2	2100	8.8
23-50	2700	11.3	2000	8.4
51+	2400	10.1	1800	7.6

*National Research Council Recommended Dietary Allowance.

FACTOR AFFECTING THE ENERGY REQUIREMENT :

Men engaged in light activity require 300 Kcal (1.2 MJ) less energy while very active individuals require 500 Kcal (2.1 MJ) more energy. The energy expended during walking varies greatly, depending upon the body weight and the speed of walking.

The Basal energy expenditure (BEE) is easily accessed from the following Harris–Benedict equations of 1920 which are still valid

Women = BEE = 655 + (9.6 ´ W) + (1.8 ´ H) – (4.7 ´ A)

Men = BEE = 66 + (13.7 ´ W) + (6.8 ´ A)

W = denotes actual or usual weight in kilograms, H = height in centimeters, A = age in years.

The survey conducted by National Monitoring Bureau (NNMB) revealed that in India nearly 50% of men and women suffer from chronic energy deficiency.

- Energy requirement of an individual is based on daily energy expenditure. As mentioned earlier it also dependest on age, body weight, level of physical activity, growth and physical status. In India, 70-80% of the total dietary calories are obtained from food grains such as cereals, millets, pulses and tubers.

- Children and adolescents obtain 55-60% of their daily requirement of calories from carbohydrates.
- Adolescent require more of energy for healthy growth. For example, girls and boys in the age group of 16-18 require 2060 kilocalories and 2640 Kcal, respectively.
- During pregnancy, additional energy is needed to support the growth of foetus and the health of pregnant women.
- Energy inadequacy leads to under-nutrition and at the same time excess intake results in obesity.

Common energy rich foods include cereals, millets, pulses, tubers, vegetable oils, ghee, butter, oil seeds, nuts, sugar, jaggery, etc. Coarse inexpensive cereals like *jowar, bajra,* and millets like *ragi* are also good sources of energy.

A number of processes go on to ensure the continuance of life without any conscious effort. These include the beating of heart, circulation of the blood, breathing, the regulation of body temperature, glandular activities etc. These process are known as the basal metabolic processes. The energy needed to keep these going is BMR which is measured as energy used there unit time cK.cal/ kg. hr.

Energy is also consumed by voluntary activities, which include work related to one's occupation, profession or job, leisure activities such as reading, watching television, playing games, gardening, playing with children etc., and activities related to personal necessities, such as brushing teeth, bathing, eating, washing clothes, utensil etc.

Some energy is used to take the food into body, digest and carry the nutrients to the tissues and to eliminate waste. This is known as specific dynamic action of foods or the energy utilization.

Extra energy is needed during period of rapid growth for the building of tissues. These include pregnancy, early childhood and adolescence. The total energy need in pregnancy is estimated to be about 40,000 kilocalories. During lactation for secretion of milk mother need additional energy in the range of 700-1000 kilocalories per day. It has been observed that underfed mothers tend to have smaller babies, who have very little reserves of nutrients at birth. Inadequate food during infancy results in stunted growth.

Continued increase in weight in adult after the age of 25, indicates intake of energy in excess of body needs.

Most people add weight after the age of 35 or 40 years, because they continue the energy intakes that they needed at the age of 25 years. But with age the energy needs decreased, due to the lowering of BMR. Most of the people became less active at this age. They can afford the luxuries of life such as eating rich and expensive foods. Thus there is an intake of excess food energy which is not utilized and is deposited as far in the body.

It is necessary to take adequate amount of energy, it you are obese, reduce energy intake to a level lower than one's needs, to use up the deposited fat. Exercise in the form of active outdoor games, walking and indoor fitness exercise which will be helpful in weight reduction. But it must be accompained by consistent, regular, carefully planned reduction of energy intake.

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OBESITY–AN INVITED DISEASE

Salil Kumar Mandal

Obesity means excess deposition of fat in the body. It is caused by ingestion of greater amounts of food than can be used by the body for energy. The excess food, whether fats, carbohydrates or proteins, is stored almost entirely as fat.

DEFINITIONS AND MEASUREMENT :

WHO has adopted definitions of adult obesity based upon the body mass index (BMI weight in kilograms divided by the square of the height in meters (World Health Organization, 1998). Although generally acceptable for epidemiology, this method of defining obesity-cannot account for differences in muscle mass between subjects, and it is well known that heavily muscled individuals may fulfill WHO criteria to be labelled obese even though their total and percentage by fat content is low (e.g. most champion heavy weight boxers). This is a limitation with the WHO definition because the co-morbidities of obesity are probably more related to the amount of fat tissue that an individual carries than to their total weight. But for our country Dr. Mandal's formula is more acceptable than BMI. According to this formula maximum weight should be height in cm minus 100cm in kg. (which means if a person has the height of 165 cm his weight should not exceed 65 kgs. and the lowest weight should be 15% less ; here it is 55 kg). I think overweight should be expressed in percentage of overweight or by kg. of overweight instead of overweight, obese and morbid overweight as an index of overweight. This will give to idea about the overweight to the patient.

Department of Physiology, KPC Medical College & Hospital, Kolkata-7000 032.

Table–1 WHO definition of adult obesity by body mass index (BMI) in Caucasians.

	BMI (kg/m^2)
Underweight	<18.5
Healthy, normal or acceptable	18.5-24.9
Overweight	25.0-29.9
Obese	30.0-39.0
Morbid Obesity	^{3}40.0

In Asians a BMI of 27 Kg/m^2 is equivalent to a value of 30kg/m^2 in other groups.

Source : World Health Organization (1998)

EPIDEMIOLOGY OF OBESITY :

Obesity is a major health problem and rates have risen dramatically in recent years, in fact, it has been estimated that worldwide there are now more-obese individuals than malnourished, with about 22 million obese children under 5 years old. In Europe, the overall prevalence figures are around 20% in men and 15.25% in woman in 2004. The prevalence has increased by around 40% in most extent, a more sedentary lifestyle. In some developing countries there may also have been a concomitant increase in the consumption of energy or fat, but in Western societies, total energy intake has been falling. In the UK, the prevalence of obesity has more than doubled in women and tripled in men since 1980. In 2002, 22% of men and 23% of women in England were clinically obese and a further 43% of men and 34% of women were overweight.

Obesity is a major risk factor for a number of pathological disorders, including type 2 diabetes, hypertension and atherosclerosis.

Table–2 : Obesity associated diseases.

Co-morbidities principally causing morbidity rather than mortality	Osteoarthrosis Gall stones Bladder dysfunction. Psychological problems including depression etc. Polycystic ovary syndrome and other reproductive disorder Benign intracranial hypertension : 'Asthma', breathlessness and non-specific chest pain Increased risk with surgical operations Lymph edema Superficial infections such as intertrigo Low social status, unemployment and social disadvantage Low level of physical fitness
Co-morbidities indirectly causing mortality, mostly via cardiovascular disease	Obstructive sleep apnoea and other nocturnal hypoventilation Fatty liver Type 2 diabetes Dyslipidaemia (hypertiglyceridaemia, low IIDL-cholesterol, small dense LDL) Hypertension Thromboemobolic disease
Co-morbidities directly causing mortality or death	Cardiovascular disease including cardiomyopathies Obesity-related cancers such as colonic, uterine, ovarian, gallbladder

Cardiovascular disease in obese subjects may have a variety of presentations. These include :

- Atherosclerotic coronary disease
- Cardiomyopathies and heart failure
- Arrhythmias and sudden death
- Venous thromboembolic disease
- Stroke.

Clearly these presentations are not mutually excluside ; many patients may have more than one of these presentations. Atheroselerosis is common in obese subjects and can be shown frequently at post-mortem. However, perhaps because of coexisting cardiomyopathy, or coexisting type 2 diabetes, or perhaps because of low levels of physical exercise, morbidly obese patients often do not present with a 'classic' history of exertional angina.

As for the other clinical presentations of heart disease in obesity, the frequent presence of underlying co-morbidities, such as type 2 diabetes, hypertension, and nocturnal hypoventilation, may contribute to the clinical picture. In particulr, diabetes may lead to 'silent' ischemia as well as predisposing to arrhythmias, heart failure and stroke.

Childhood obesity :

Currently, obesity is one of the most common health problems among children and adolescents, with documented increases in prevalence in many countries including the UK. There is some uncertainty about how best to measure obesity in children. These problems notwithstanding, it appears that early onset obesity is a risk factor for obesity and its comorbidities and mortality later in life. Although the cause of obesity in children is similar to that of adults (i.e. an imbalance between energy intake and energy expenditure). Overweight is increasing in cities of India, but it is very few in villages because of adequate playing facilities in villages.

MANAGEMENT AND PREVENTION OF OBESITY :

Child overweight measurement is difficult. But when the child becomes 120 cm or more in height you take the detailed history of food it will be found that they are taking excess (instead of two meals and two tiffins they are also taking health drinks in between). Besides I want to remind that each bottle of 300ml cold drink contains 50g of sugar which will give equal calories of a tiffin. So whole awareness of food is essential for diet measurement both in children and adults.

THE BENEFITS OF A SUSTAINED 10% REDUCTION IN WEIGHT FOR THE OBESE

Mortality :

- 20–25% fall in total mortality
- 30–40% fall in diabetes–related deaths
- 40–50% fall in obesity-related cancer deaths.

Angina :

- Reduces symptoms by 90%
- 33% increase in exercise tolerance

Table–3 Management plan for obesity

BMI	Assessment	Advice
18.5–24.9	Weight steady in adult the gained – 5kg in adult life	Healthy eating plan, Weight maintenance with increase exercise
25–29.9	No other risk factors Risk factors present Waistline problem	Healthy eating plan + weight reduction plan Weight reduction plan + treat risk factor Weight reduction plan
^{3}30		Weight reduction plan
Prevention is better than treatment		

Dr. Mandal's formula can be applied to titrate the overweight. Each individual and each doctor should not wait for obesity for the guideline of treatment instead they should start to advise whenever there is slightest overweight according to BMI and Dr. Mandal's formula otherwise there will be difficulty in treatment. Besides everybody should remember that excess diet only is the cause of overweight or obesity if it is not burnt by exercise or work. Every mother will say that the child is taking nothing but is becoming overweight. But if

Blood Pressure :

- Fall of 10 mm Hg systolic pressure
- Fall of 20 mm Hg diastolic pressure

Lipids

- Fall by 10% in total cholesterol
- Fall by 15% in low-density lipoprotein (LDL) cholesterol
- Fall by 30% in triglycerides
- Increase by 8% in high-density lipoprotein (HDL) cholesterol.

Diabetes :

- Reduces risk of developing diabetes by > 50%
- Fall of 30-50% in fasting glucose
- Fall of 15% in HbA_1C

PLAN – 1 : WEIGHT REDUCTION

This aims to provide a 3 month structured management plan designed to meet the needs of each individual patient :

- Support from a trained health-care professional in a group setting since greater weight loss is achieved using groups than with individual consultations. This may reflect the interplay and mutual support of the individuals in the group.
- Diet consisting of a moderate reduction in energy intake of about 600 Kcal (2.5 MJ) less than expenditure assessed on weight, sex and age (published formulae are used). This produces a greater weight loss than stricter diets (e.g. 1000 Kcal) probably as compliance is better. Most diets aim to reduce fat intake. Starvation diets are potentially dangerous due to a risk of sudden death from heart disease exacerbated by profound loss in muscle and the development of arrhythmias secondary to elevated free fatty acids and deranged electrolytes. The dietary change should involve the patient's entire household. During dietary restriction minerals and vitamins should be suppliemented.
- Behavioural modification therapy which is designed to support a process of change in the individual's attitude, perception and behaviour as regards food intake, lifestyle and physical activity. The information box provides some examples of the topics covered in a structured programme.
- Promotion of increased physical activity which can be maintained long-term. Walking briskly for 30 minutes each day can contribute 100-200 Kcal (0.4–0.8MJ) of energy expenditure daily, resulting in an additional weight loss of 1 Kg. per month. If he cannot walk briskly he can walk slowly.

PRINCIPLES OF BEHAVIOURAL MODIFICATION :

Issues to be discussed in group behavioural therapy are :

Self-monitoring of daily food intake.

Need for long-term lifestyle change.

Need to modify eating habits

Need to assess present exercise level and ideas to increase this if necessary.

Importance of restricting occasions and situations when inappropriate types or amounts of food are eaten,

Planning of daily food intake

Understanding of food labels & adapting recipes with regard to fat, salt, sugar & fibre.

Possibility of changes to individual cating style.

Reduce the rice does not mean you are advised bread or biscuits etc.

PLAN–2 WEIGHT MAINTENANCE PLAN :

The weight reduction module is followed by a 3 month structured programme emphasising weight maintenance although continued weight loss may be an option for some. This again emphasises therapy in groups, with continued behavioursal therapy, promotion of exercise and diet modification. Exercise in this module is designed to prevent weight regain once weight has been lost by dietary restriction.

PLAN–3 DRUG THERAPY–USELESS

PLAN–4 VERY LOW CALORIE DIETS :

Very low calorie diets (VLCDs) produce weight losses of 1.5–2.5 kg/week compared to 0.5 kg on conventional diets. VLCDs are mainly used for short-term rapid weight loss. In the UK, the recommendation is that VLCDs should only be considered by those with a BMI>30 and under the supervision of an experienced physician/nutritionist. The composition of the diet should ensure a minimum of 50g protein each day for men and 40g of protein for women to minimise muscle degradation. Energy content should be minimum 400 Kcal (1.65 MJ) for women of height < 1.73 m and 500 Kcal (2.1 MJ) for all men and women taller than 1.73 m. Side-effects tend to be a problem in the early stages of the diet especially orthostatic hypotension, headache, diarrhoea and nausea.

PLAN–5 BARIATRIC SURGERY :

Two procedures now dominate surgical practice, namely vertical banded gastroplasty and gastric bypass. Vertical banded gastroplasty involves-the construction of a small stomach pouch fashioned by vertical stapling to restrict both gastric outlet and size. But such treatment is difficult and prolonged observation is necessary.

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FOOD FOR HEALTHY BRAIN FUNCTION

Jyoti. D. Vora, Dhanada D. Deshpande*

Food is an integral part of our life and it is required for the sustainance of the human subject. Besides been a source of energy, food can also help in improvement of growth and is particularly significant in optimal brain function. This article would help us understand how food can be used as a tonic for healthy brain function.

INTRODUCTION

Food not only satisfies our hunger but also protects us from acquiring wide range of diseases and infections. In certain cases, food serves as a natural means of defence against pathogens. As you know fruits and vegetables rich in vitamin C can lower the risk of H1N1 influenza which is a topic of great concern today.

Socrates has rightly said that ***"let thy food be thy medicine"***.

Based on this mindset, a new branch of science known as "NUTRACUETICALS" is developing rapidly and gaining lots of significance these days. ***"Brain foods"*** are those foods which improve brain function. A diet heavy in omega-3 fatty acids, for example can help keep the blood vessels of the brain clear of blockages and allow nerve cells to function at a high level.

NUTRITION AFFECTS THE BRAIN IN THREE WAYS :

The cell itself needs proper nutrition to carry on its functions just like any other cell in the body.

1. The myelin sheath covers the axon of the cell like insulation covering electrical wires. It speeds transmission of electrical signals along the axons, the "wires" of the brain. Deficiencies of nutrients that compose myelin, such as essential fatty acids, delay nerve impulse transmission.
2. The neurotransmitters, such as serotonin, dopamine, and norepinephrine, carry messages from one cell to the other and affect mood as well as thoughts and actions.
3. Some of the nutrients in the food we eat become part of the neurotransmitters that help us think. Neurotransmitters are probably the biological explanation for the food-mood connection.

HOW THE BRAIN USES NUTRIENTS ?

The brain uses carbohydrates for energy and omega-3 fatty acids for forming its cell structure. B vitamins play an essential role in brain function. In combination with folic acid, vitamins B6 and vitamin B12 help manufacture and release chemicals in the brain known as neurotransmitters. The nervous system relies on neurotransmitters to communicate messages within the brain, such as those that regulate mood, hunger, and sleep. In addition, foods rich in antioxidant nutrients, such as vitamin C and vitamin E and beta-carotene, help protect brain cells from free-radical damage caused by environmental pollution. Protection against free radicals is important in protecting the brain.

* Department of food Science and Quality Control, Ramnarain Ruia College, Matunga, Mumbai–19

FOOD GROUPS

Proteins : Protein is found in meat, fish, milk and cheese. Protein provides the building blocks for most of the body's tissues, nerves, internal organs (including brain and heart). Proteins are used to make neurotransmitters and are essential to improve mental performance.

Carbohydrates : Carbohydrates enhance the absorption of tryptophan, which is converted into serotonin in the brain which gives a feeling of calmness. Glucose is the brain's primary source of energy. Omega 3 fatty acids are essential to the optimum performance of the brain. Lack of omega-3 fats in the diet can lead to depression, poor memory, low 1Q, learning disabilities, and dyslexia.

Minerals : Minerals are also critical to mental functioning and performance. Magnesium and manganese are needed for brain energy. Sodium, potassium and calcium are important in the thinking process and they facilitiate the transmission of messages.

Vitamins : Different vitamins have following effects on brain functioning.

(1) Vitamin C is required by the brain to make neurotransmitters.

(2) Vitamin B12 is vital in maintaining healthy myelin, the tissue that covers and insulates nerve tissue.

(3) Vitamin B6 deficiency causes hyper-irritability and fatigue.

(4) Folic acid deficiency seems to affect neurotransmitter function, resulting in symptoms associated with depression.

Iron : The symptoms of iron deficiency include irritability and diminished mental alertness. Iron is necessary for healthy brain tissue and for adequate neurotransmitter function.

Calcium : Calcium is not only important to growing bones, but also to growing brains. Children with calcium deficiency may show impaired behavior and learning.

Fiber : Soluble fiber, such as fruit pectin, helps lower the glycemic index of foods, thereby having a stabilizing effect on blood sugar.

Water : Water is like a fuel for the brain. For proper functioning of brain optimum quantity of water should be consumed. Daily 1.5 to 2 litres is required to keep brain hydrated.

DHA (Docosahexaenoic Acid) as a Brain Food : DHA is the primary structural component of brain tissue, so a deficiency of DHA in the diet could lead to a deficiency in brain function. In fact, research is recognizing the possibility that DHA has a crucial influence on neurotransmitters in the brain, helping brain cells better communicate with each other.

FOODSTUFFS WHICH ARE GOOD FOR BRAIN :

Egg Yolks : A healthy benefit of egg yolks is that they contribute choline to the diet.

Spinach : Spinach helps protect the brain from oxidative stress while reducing the risk of suffering from an age-related decline in function.

Yellowfin Tuna : A cold-water fish, yellowfin tuna is a rich source of omega-3 fatty acids. Consuming foods rich in omega-3 fatty acids keeps cells' membranes flexible and maximizes their ability to allow important nutrients in. Yellowfin tuna is rich in the B vitamin niacin, which also protects the brain against Alzheimer's disease.

Cranberries : Animal studies suggest that cranberries protect brain cells from free-radical damage. Moreover, consumption of this tart fruit is associated with improvements in memory, balance and coordination.

Sweet potatoes : Sweet potatoes are especially brain-nourishing. They are rich in vitamin B6, carbohydrates and antioxidant nutrients.

Strawberries : It reduces the risk of age-related brain decline.

Kidney Beans : It improves cognitive function. One cup of cooked kidney beans contains almost 19% of B-vitamin. Kidney beans are rich in inositol. Inositol may improve symptoms of depression and mood disorders.

Raisin Bran : It prevent migraines and headaches. Raisin bran provids carbohydrates, iron, B vitamins, folic acid, calcium and magnesium. These are all important nutrients for brain fuel, as well as health and vitality. In addition, magnesium is a mineral that helps relax blood vessels, preventing the constriction and dilation characteristic of migraine and tension headaches.

Wheat Germ : Wheat germ is a powerful brain food because it is rich in vitamin E, selenium, choline and magnesium. Another good source of choline is peanuts.

IMPORTANCE OF BREAST MILK :

Protein of breast milk has high amounts of amino acid taurine, which has an important role in the development of the brain and the eyes.

Fats in breast milk are practically self-digesting, since breast milk also contains the enzyme lipase, which breaks down the fat. Fat is the main source of calories for babies—and babies need lots of calories to grow well ! Also, fat in human milk has large amounts of certain omega-3 fatty acids, which are important for brain development.

Vitamins and minerals in human milk are bioavailable that is they get absorbed well. Breast milk contains substances that enhance the absorption of minerals and vitamins.

Immune Boosters : In each feeding mother delivers millions of living white blood cells to her baby to help baby fight off all kinds of diseases. Breast milk also contains factors that prevent micobes from attaching, and a long list of other antiviral, antibacterial and antiparasitic factors.

CONCLUSION

The foods we eat directly affect the performance of the brain. It has been proven that by eating the right food, we can boost our IQ, improve our mood, be more emotionally stable, sharpen our memory and keep your mind young. If we give our brain the right nutrients, we will be able to think quicker, have a better memory, be better coordinated and balanced and have improved concentration.

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CALCIUM–AN IMPORTANT MINERAL FOR WOMEN

B. Karpagam*

Calcium is the most abundant mineral in the human body, with over 99% of the amount present in the bones and teeth. For the growth and maintenance of healthy bones it is essential that we have sufficient calcium intake, otherwise we are at risk of developing osteoporosis when calcium leaching is not balanced by dietary ingestion. But calcium is not only important for the skeleton, it also has a role to play in nerve function, blood clotting, muscle health, and other areas. While calcium is the key mineral for both sexes it is especially important for the health of women.

INTRODUCTION

Calcium is a major mineral found in our body. It constitutes 1.5–2 per cent of the body weight of an adult person. Our body contains almost 1,200 gm of calcium, of which 98 percent is found in bones, and about 10 mg/dl is found in blood. As we grow, our bone is constantly formed and reformed again. To maintain the calcium levels in our blood, the calcium fom our bones will go into our blood when we have a low calcium level. Then there are cells that make new bone to replace the 'lost' bone. As our bone is mainly made up of calcium, when we do not take in enough calcium, the lost bone is not replaced. When this carries on, our bones no longer become healthy and strong. Calcium deficiency in young girls can cause abnormal formation of bones, which can lead to problems during pregnancy and delivering babies.

ROLE OF CALCIUM

Calcium plays a role in :

- Strengthening bones and teeth
- Regulating muscle functioning, such as contraction and relaxation
- Regulating heart funcioning
- Blood clotting
- Transmission of nervous system messages
- Milk production
- Keeping cell membranes intact
- Transformation of light to electricl impulses in retina
- In metabolism of enzymes and hormones.

WHAT IS OSTEOPOROSIS ?

Osteoprosis is a bone disease that develops slowly and is usually caused by a combination of genetics and too little calcium in the diet. Osteoporosis is a disease in which bones become fragile and more likely to break. Osteoporosis can also lead to shortened height because of collapsing spinal bones and can cause a hunched back. Osteoporosis is particularly common in post-menopausal women. This means that it is especially important for women's bones to be in good condition and for calcium balance to be favourable well before the menopause. But there may still be a case for women, both shortly before and after the menospause to pay particular attention to their calcium intake. Rather than resort to calcium

Department of chemistry Madurai Institute of Engineering & Technology, Madurai, India. Email : bala karpagam @yahoo.com

supplements in the first instance, it is worth knowing which foods are good.

HOW DO I KNOWN IT I'M AT RISK ?

Several factors can put a young person at risk for developing osteoporosis. They include :

- Being white
- Being female
- Having irregular periods
- Doing little or no exercise
- Not getting enough calcium in the diet
- Being below a normal weight
- Having a family history of osteoporosis
- Smoking
- Drinking large amounts of alcohol

HOW MUCH CALCIUM DO I NEED ?

Children and teenagers between the ages of 9 and 18 should aim for 1,300 milligrams per day, which is about 4 servings of high-calcium food or drinks. Each 8-ounce glass of milk (whether skim, 1%, 2%, or whole) and each cup of yogurt has about 300 milligrams of calcium. Adults 19 to 50 years of age should aim for 1,000 milligrams per day.

WHAT FOODS CONTAIN CALCIUM ?

You probably know that dairy foods like milk and cheese are good sources of calcium, but do you know that tofu and beams contain calcium, too ? Even if you don't drink milk or eat cheese, you can get the calcium you need from other food.

WHAT IF I'M LACTOSE INTOLERANT ?

If you are lactose intolerant can't drink milk, there are plenty of other ways to get your calcium. These include fortified soy milk, fortified juice, or Lactaid milk (the lactase enzyme that you are missing has been added into the milk). You may also take lactase enzyme tables before eating dairy products to help digest the lactose sugar in the milk. Some people who are lactose intolerant can tolerate having small amounts of milk or other dairy products at a time.

WHAT IF WE JUST CAN'T GET ENOUGH CALCIUM IN MY DIET ?

It is best to try to meet your calcium needs by having calcium-rich foods and drinks, but some teens find it difficult to fit in 4 servings of high-calcium foods daily. If you don't like dairy foods or calcium fortified juice or soymilk, you may need a calcium suppliement. When choosing a supplement, keep the following things in mind :

- Most calcium supplements have between 200 and 500 milligrams of calcium.

  Remember, your goal is 1,300 milligrams of calcium per day.
- If you have to take more than one supplement per day, it is best to take them at different times of the day because your body can only absorb about 500 milligrams of calcium at a time.
- Don't count on getting all of your calcium from your multivitamin. Most basic multivitamin/mineral tables have very little calcium in them.
- Look for a calcium suppliement that has vitamin D added. Vitamin D helps your body absorb calcium.
- Avoid "oyster shell" or "natural source" calcium supplements. These may have lead or aluminium in them and are not recommended.

WOMEN NEED MORE CALCIUM THAN MEN

For some reason, women are more prone to osteoporosis or thinings of the bones than men. Bone consists of much more than calcium, and the factors affecting calcium levels in bone involve more than dietary intake.

The body's calcium balance and bone density can be affected by :

1. hormones

- Steroids including sex hormones
  e.g., cortisone (unfavouably)
  e.g., sex hormones (favourably)
- parathyroid hormones (unfavourably)
- calcitonin (favourably)

2. physical activity (favourably)
3. vitamin D (from food or formed under the influence of sunlight) (favourably)
4. food and beverage intake

- calcium (favourably)
- sodium (unfavourably)
- caffeine (unfavourably)
- protein (unfavourably)
- alcohol (unfavourably)

THE IMPORTANCE OF CALCIUM FOR PREGNANCY

Calcium needs increase to 1100 miligrams per day in the second and third trimesters of pregnancy and 1200 milligrams during lactation. During pregnancy, a variety of nutrients are vital to the development of the baby and health of the mother. One important nutrient is calcium which is important to both mother and baby and not getting enough can have serious consequences, particularly for mom.

Calcium is vital for the development of the bones and teeth. This is how calcium is best known by most people. But that's not all as it does to aid in fetal development. This nutrient is also used in muscle growth in the baby and is important for maintaining a regular heart rhythm in both mom and baby.

Your body will naturally store calcium during pregnancy. This happens to prepare the body for breastfeeding. The calcium stored in the body and from the diet will be used to make milk for your baby after it is born. Getting plenty of calcium in your diet during pregancy will provide enough for you, the baby and stored calcium for making milk for the baby later.

Getting enough calcium is especially important for mom. If your body isn't getting enough calcium from your diet, it will take it from bones. This is how the old wives' tale, "have a baby, lose a tooth" originated.

CONCLUSION

Calcium is needed for strong bones. It is also needed for your heart, muscles and nerves to function properly and for your blood to clot normally. An inadequate calcium intake is thought to play a significant role in contributing to the development of osteoporosis. However, nutrition surveys have shown that many women and young girls consume less than half the amount of calcium recommended for growth and maintenance of healthy bones.

Each day we lose some calcium in the urine and faeces and to a lesser extent through perspiration. These losses must be balanced by consuming adequate amounts of calcium. If the level of calcium in the blood drops below normal, the body takes what it needs from the bone, thereby depleting the calcium reserves.

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PLAGUE THAT NEVER WAS : A REVIEW OF THE ALLEGED PLAGUE OUTBREAKS IN INDIA IN 1994

N. S. Deodhar

The paper highlights the consequences of the mistaken diagnosis of plague which have resulted in exorbitant casts to the nature.

INTRODUCTION

In the second week of September 1994, when we read the news about plague epidemic in Beed District of Maharashtra, we were shocked. Our first question was how come plague is appearing in Beed when it was not one of currently known five or six foci of plague infection in wild rodents in India. Since plague is one of the most dreaded diseases which man has experienced, we were deeply concerned and decided to look into this epidemic. Then on the 23rd September 1994, there was startling news of many cases and deaths due to pneumonic plague in Surat town in Gujarat State. This was indeed unbelievable because neither cases of bubonic plague nor rat-falls were reported.

Now we were witnessing two outbreaks of alleged plague; the matter appeared to be serious. Confirmation of the diagnosis is the first step in epidemiology. The WHO definition of confirmed case of plague is, "the clinical and epidemiological features of the illness should be compatible with plague. This should be supported further by laboratory isolation of culture of *Y. pestis* from clinical specimen, confirmed by lysis with bacteriophage or by a biochemical profile indicative of *Y. pestis.* Failing this, one should demonstrate a four-fold difference in titres of passive haemagglutination antibodies in serum between specimens taken at appropriate intervals, specific for the Fl antigen of *Y. pestis* as determined by haemagglutination inhibition". The primary part of the definition, "the clinical and epidemiological features of the illness should be compatible with plague", is a very weighty prerequisite clause. As more and more information was available, it was coming clear that diagnosis of plague was not correct.

* 20 Pushpak Park, Baner Road, Aundh, Pune-411 007, e-mail : nsdeodhar@gmail.com

THE STORY BEFORE THE DECLARATION OF A PLAGUE OUTBREAK

Flea nuisance was reported by the Mamla villagers to the local medical officer on 5th August 1994. Next day, the medical officer confirmed the flea nuisance and noticed sporadic rat-falls. Fifteen persons reported having flea bites and the Additional District Health Officer directed to arrange for insecticide spray. On 26th August 1994, three patients attended the local Primary Health Centre with inguinal lymphadenopathy and were treated. The next day, house-to-house survey was carried out in Mamla village and 33 patients of lymphadenopathy were detected and treated. On 28th August, the District Health Officer visited the place and assessed the situation. The next day, DDT spraying and mass chemoprophylaxis were initiated to control infection. The Joint Director of Health Services (Health) was informed. On his directive, insecticide spraying was intensified, and blood samples of the affected persons and dead rats were sent for laboratory diagnosis. A team from Medical College, Ambajogai, visited Mamla village for further investigations. On 6th September 1994, four sera were sent to the Plague Surveillance Unit of NICD (National Institute of Communicable Diseases), located at Bangalore, for serological diagnosis. These were reported as PHA (Passive Haemagglutination Test) positive with a request for not disclosing the results pending confirmation. The Director of Health Services of Maharashtra at Mumbai, was informed. A team from NICD, Delhi, visited the affected villages on 11th September 1994. On 14th September, the Government of India declared Beed District of Maharashtra as affected by plague.[1]

It may be noted that mass prophylactic chemotherapy with tetracycline covering all people in the villages in the so-called "bubonic plague" affected areas was an instance of incorrect application of public health measure. Further, it set a bad precedence.

THE RESPONSE AFTER THE DECLARATION OF A PLAGUE EPIDEMIC

With modern mass-media communication, within hours of government declaration of plague outbreak, there was widespread panic. Every person with lymphadenitis imagined having plague. Entire stocks of tetracycline capsules in the market were exhausted as people consumed it prophylactically and/or stocked for emergency use. People had received the wrong message about the use of antibiotics for disease prevention.

The panic became mass hysteria when cases of lung infection in Surat were diagnosed as pneumonic plague and confirmed by the World Health Organization. A hundred thousand people, including the patients of suspected pneumonic plague, fled from Surat to distant places such as Mumbai and Delhi. Such was the magnitude and tenseness of the reactions.

Insecticides were widely used indiscriminately, and improperly. BHC dusting was done along the sides of the roads in metropolitan cities and many towns. At almost all of these places, there were neither rat-falls nor any suspected case of plague. The most ridiculous was the spraying or fogging of the office and other buildings in New Delhi and Mumbai where there was no evidence of plague, as confirmed by the WHO team.[2] Thus, hundreds of tons of insecticides were added to environment at high cost, further polluting it. The worse was that the community leaders took a clue and wanted their villages or election wards to be sprayed with insecticides as a preventive measure although there was no risk of plague.

As more and more information became available, many started to doubt the diagnosis, and scientists started gathering data. At the All India Conference of the Indian Association of the Medical Microbiologists, held in Pune on 12th Nov. 1994, the President of the Association, said in his presidential address, "there is not even a single convincing evidence of plague either in Surat or Beed".[3] Some Faculty Members of the All India Institute of Medical Sciences, New Delhi, questioned the tests used to diagnose plague and named other diseases that could have caused the symptoms.[4] We presented our paper entitled, Plague: That Never Was", at the third National Conference of Indian Association of Epidemiologists, held in Delhi, 7-8 February 1995.[5] Special features were published in the magazines, e.g., one entitled "Plague by Doubt," in Business India, October 10-23, 1994, pp. 54-59. The Health and Nutrition issue of March 1995, covered an indepth report on Surat "Plague" Inquiry, and expanded it under the titles, viz. "the gaping holes in the official report!" "The damning evidence the Government won't reveal!" and "the question that won't go away!" New Wave, News-Weekly, New Delhi, 25th June 1995, gave a detailed account of "The 1994 Indian Plague". It included, "Plague story : a cruel hoax".

There were questions in the Parliament. The Technical Advisory Committee on Plague (TAC) was constituted by the Government of India on llth October 1994. The terms of reference were : (a) To elucidate factors responsible for the current outbreak of plague and its spread, (b) To advise on strategies, policies and programmes for the control of plague, and (c) To recommend steps for prevention of such outbreaks in future. After about four months the Committee (TAC) submitted its Interim Report to the Government in the first week of February 1995. The Interim Report said nothing about causes, spread, etc., and it was silent on the episode in Beed District where the disease erupted first. It appeared that TAC wanted to prove that the Surat outbreak was indeed pneumonic plague. After a long interval of about nine months TAC submitted its final report to the Government of India in August 1995. Our critique on this report appears subsequently.

OUR INVESTIGATIONS

1. Methodology :

We reviewed all available published reports, papers and articles in the news-papers and journals. We were fortunate to have unpublished reports and video tapes. Apart from the analysis of the reports from the National laboratories, we had access to laboratory reports from the medical college and other laboratories. We were benefited through the deliberations of both official and informal meetings, and work shops. We had personal communications and discussion with many experts. The Directorate of Health Services of Maharashtra provided their data on field investigations and surveillance activities. We studied original laboratory data from the Haffkine Institute, Mumbai, and National Institute of Virology (NIV), Pune, and the tests done by the WHO Team at Haffkine Institute. One of us visited Mamla village and investigated cases suspected of plague. While we could not examine any case at Surat, we discussed the cases with the local consultants, and had the videotape and clinical records.

2. Clinical Diagnosis :

Plague is characterized by lymphadenitis, septicemia and petechial haemorrhages, often with toxemia, high fever, shock, restlessness, staggering gait, mental confusion, prostration, delirium and coma.[6] In bubonic plague, the most common feature is quite painful bubo, and a rapid progress on to septicaemia. By WHO definition and criteria, none of the suspected cases of either bubonic or pneumonic plague that occurred in the two episodes in India in late 1994, was confirmed as due to plague.

3. *What was the Clinical Picture in Beed District?*

None of the cases fitted in the classical description. Almost all the patients had mild illness. High fever was uncommon. A significant number of cases had no fever at all. The look of the affected persons failed to reveal that they were having a serious disease. Many patients were working on their farms. Many buboes were not only painless, but also not tender on pressure. Even the patients, who reported for treatment three days after the onset, did not show any increase in the severity of illness. None developed septicaemia. This was true even in the case of the supposedly seropositive patients who reported for treatment well after 72 hours after the onset. See Table 1.

Table 1 : Distribution of allegedly Seropositive (PHA) cases of Plague in Maharashtra by the Time Interval between Onset of Disease and Initiating Treatment

Interval between the Onset and Treatment (Days)	Number of PHA (+) ve Patients			Percentage
	Male	Female	Persons	
Nil	83	56	137	26.6
2-3	111	52	163	31.5
4-7	44	18	62	12.0
8- +	12	4	16	03.0

[Source : Analysis by the Office of the Jt. D.H.S. (Health), Pune]

The report of the Joint Director of Health Services (Health), Maharashtra, lists nine items which were against the diagnosis of plague.[1] It asserts that (a) the clinical picture of the cases in Mamla and other villages in Beed District showed aberration from the standard pattern observed in plague, (b) there was lack of familial clustering of the cases, (c) the clinical illness was quite mild and did not progress, even in untreated cases, (d) none of over 3,700 (as on 19th October 1994) cases of suspected plague in Maharashtra died, even among those who were reported serologically positive by the National Institute of Communicable Diseases, and (e) the familial incidence was only one per family. In this regard, it is important to note that the cases are generally severe in the early phase of plague epidemic.[7] In brief, there was no clinical evidence in support of bubonic plague in Maharashtra.

4. *What was the clinical picture in Surat town?*

With regard to the Surat outbreak of "pneumonic" plague, we had opportunity to review a video cassette prepared by the Surat medical consultants. While ruling out pneumonic plague, the consultants deliberated on possibility of melioidosis or Hanta virus infection. Apart from this, detail clinical data, fatality and autopsy findings were not available to us. We gathered that 1,061 cases in Surat were suspected of plague, about 71 were reported "seropositive" by NICD, and 54 died. But some extracts from the report of the International Plague Investigative Team (IPIT), December 1994, are revealing.[2] A medical chart review was made of a group of 51 patients in Surat admitted with a diagnosis of suspected pneumonic plague and reported as seropositive for plague. Radiographic evidence of pneumonia was found in 22 of 51 patients. Leucocytosis, a usual sign of pneumonic plague, was established in only three cases. A case-control study was conducted by the IPIT to identify major epidemiological features, etc. The study did not reveal any factors that placed cases (of suspected pneumonic plague) at greater risk than the controls. It was clear that most cases hospitalized with diagnosis of suspected plague did not have plague. Illnesses with fever which were common in Surat at the time of the outbreak, included tuberculosis, malaria, dengue, etc. It is believed that this accounted misclassification of cases as suspected plague.[2] In addition, evaluation of case records of 41 cases of suspected bubonic plague which were reported from Surat, revealed clinical and epidemiological features that were mostly inconsistent with bubbonic plague. Hence, the clinical evidence in support of pneumonic plague in Surat was quite weak.

5. *Epidemiological diagnosis :*

The known foci of plague among wild rodents in different States in India are: few areas of Kolar and Bangalore Districts of Karnataka, Dharmapuri District of Tamil Nadu, Chital District of Andhra Pradesh, and some areas of Himachal Pradesh and West Bengal. However, there was no evidence of Sylva tic plague activity in either Beed or Surat Districts. There was no clear evidence of epizootic of plague in the Mamla village in Beed District or else where in Maharashtra (or Gujarat). Even if the WHO Team estimates of more than 200 rat-falls in Mamla village are accepted, this was largely a one time episode. In epizootic of plague in domestic rats, the rat-falls continue to take place over longer period until all the susceptible rats die. Secondly, epidemic curve runs parallel to and precedes the plague epidemic curve in human cases by about 7 to 10 days. This was not the case in Mamla or other places where rat-falls were reported. Incidentally, finding a dead rat may not be necessarily a true rat-fall. After instituting surveillance, cases of suspected bubonic plague were reported from many districts of Maharashtra. But rat-falls were reported only from Beed District. Further, in Beed District, in many villages there were cases without any rat-fall, and villages reporting rat-falls without any case. Disclosure about rat-falls from Surat was ambiguous and indeterminate. The small number of dead rats and that too over a short period were not suggestive of zoonotic plague — the very source of infection to man. IPIT also failed to get any conclusive evidence in this regard.[2]

In Mamla village, the villagers did complain of the flea nuisance. The number and type of fleas on rats is another significant factor, but only if it is associated with plague infection. The flea index of five and over could be dangerous. The flea index in Surat was less than one. In Beed, it varied from 2.1 to 5.2 before insecticide spraying. See Table 2.

Table 2 : Data on flea index in the affected villages, before and after insecticide spray.

Sr. No.	Name of the Village	Insecticide used	Flea Index Before Spray	Flea Index After Spray
1.	B. Pimpalgaon	DDT	Not Done	2.40 (90)
2.	Arvi	DDT	Not Done	1.66 (42)
3.	Talegaon	BHC	2.60 (86)	1.10 (112)
4.	Kakndhire	BHC	3.20 (71)	1.60 (114)
5.	Murshidapur	BHC	3.15 (162)	2.00 (150)
6.	Aher Wadgaon	BHC	5.20 (88)	0.66 (33)
7.	Mamla	DM	2.10 (172)	0.33 (60)
8.	Wadwani	DM	2.23 (175)	0.50 (87)
9.	Katewad	DM	3.70 (160)	0.50 (112)

[Source : Analysis by Office of the Jt. D.H.S. (Health), Pune.]

Note : The figures in the parenthesis indicate the number of rats killed. DM = Deltamethrin.

Multiple cases in a family are very characteristic of plague. Seal[7] tabulated the distribution of cases in the affected families as : 72 per cent had one case, 25 per cent had two cases, two per cent had three cases, and little over one per cent of the families had four or more cases. But in Surat and Beed District, out of the thousands of families affected, almost all had only one case.

Pneumonic plague usually originates from bubonic plague complicated with plague pneumonia, perhaps after septicaemia. The subsequent spread is from case-to-case. This was not the case in Surat. There was no bubonic plague. There was neither index case nor secondary cases. Plague is liable to break out in winter rather than in summer. In Surat, it occurred in September and the climate was hot.

How did the infection spread? At most of the places where seropositive cases were reported, there were neither rat-falls nor any evidence of current Sylva tic plague. The possibility of an imported case of plague as source of infection in Surat was ruled out. The distance between Surat and Beed is about 400 km with hundreds of villages in between. But there were no cases along the way. Patients of pneumonic plague were residents of different areas of Surat. These cases occurred singly and without any indication of case-to-case transfer of infection.

The secondary' attack rate in pneumonic plague is high.[7] But in the Surat episode, there was not a single secondary case in spite of the fact that there were many contacts, viz. medical practitioners, medical and other staff of hospitals where these patients were treated, and others who came in close contact. Many patients and people who were presumably infected ran away from Surat hospitals. Thousands of people, including the patients from the hospitals, left Surat in crowded buses and railway compartments. Some patients with suspected pneumonic plague absconded and went too far of places such as Delhi, Mumbai, and native villages. About 20,000 people commute daily from Surat to Mumbai. Yet there were no secondary cases. In its report the WHO team explicitly declared, "if any pneumonic plague was there, it is believed that there would have been high secondary attack rate and high casualties within a very short time"[2]

Seal[7] observed that after its introduction, plague epidemic goes on lingering. In the rat population, depending on its size, it may take months or even years for epizootic to develop and then die out. In the epidemics in question, the outbreaks lasted only for some weeks. Even the World Health Organization declared India free of plague. Such a fast success in containing plague and its total disappearance itself raises an obvious question: was the disease really plague?

6. *Summing up :*

In brief, in the alleged plague outbreaks in India in 1994, both the clinical & epidemiological features of the illness were not compatible with that of plague. Thus, the weighty and prerequisite clause of the WHO definition of a confirmed case, was not satisfied. The illness in question was not plague. Matter should have ended there.

7. *Bacteriological diagnosis :*

The microbiology departments of the Medical Colleges at Ambejogai, Solapur, Nanded and Pune; Haffkine Institute, Mumbai; and National Institute of Virology, Pune, did the bacteriological examination of the fluid drawn from the buboes (before starting antibiotic treatment), and blood from the hospitalized patients. None of these fresh specimens were positive for plague, even on repeated attempts. A total of 115 samples were analyzed at Haffkine Institute, none showed presence of *Y. pestis*. It must be remembered here that at every stage standard stock cultures of *Y. pestis* were put for comparisons. Cultures of blood clots, and intraperitoneal inoculations in laboratory animals failed to indicate plague infection. The Haffkine Institute with over 100 years of experience, failed to obtain *Y. pestis* from any of the large number of dead and live rats, domestic and wild, they received from the Beed and other districts of Maharashtra prior to or during the alleged outbreak of plague.

In pneumonic plague, the lungs and sputum teem with *Y. pestis*, as if in a culture. But the sputum samples, and tissues obtained on postmortem elimination, were found negative when examined by the microbiology department of the Medical College, Surat. TAC reported that *Y. pestis* could not be demonstrated histopathologically in the lung sections available from the autopsy material[8]. Scientists of B.J. Medical College, Pune, isolated *Pseudomonas pseudomallei* from the lymphnode aspirates from 12 out of 40 patients admitted in the Sassoon General Hospital, Pune. But the National Institute of Virology, Pune, could not confirm identification. There is controversy about the species of the isolates, *Pseudomonas pseudomallei* or related organism[9,10]

The microbiology Department of Surat Medical College reported the isolation and biomedical characterization of *Y. pestis* from few suspected cases of pneumonic plague. But this was not confirmed by the National Institute of Communicable Diseases, (NICD), Delhi. Twenty samples were brought from Surat Medical College by the CDC team to the Haffkine Institute for confirmation where they tried culture and animal inoculation. Not a single sample showed presence of *Y. pestis*. Out of 20 mice only three died in 24 hours, which showed *Klebsiella* species.

TAC claimed that using modern techniques and with great efforts, it was able to obtain pure culture of *Y. pestis* from the old and highly contaminated autopsy specimens (which when fresh, were previously found negative) from Surat patients. If so, it is indeed highly creditable. But this was isolated instance to be considered conjointly with inability to produce any evidence of *Y. pestis* in hundreds of other suspected cases with similar clinical picture. In addition, an isolated finding like this could not justify confirming diagnosis of pneumonic plague, especially when both epidemiological and clinical features were either adverse or equivocal. And certainly not when, TAC itself, reported that the isolated organisms were non-pathogenic or weakly so.[8]

8. *Serological Diagnosis :*

The NICD, Delhi, tested the sera from the suspected cases of plague in Maharashtra and elsewhere, by Passive Haemagglutination Test (PHA) using the Fl antigen of *Y. pestis.* However, Haemagglutination Inhibition (HI) Test was not performed to rule out false positive results. With only a positive PHA test on single serum specimens, NICD confirmed the diagnosis of plague without carrying out an HI test. The PHA test is at best only of presumptive value, but the Government of India declared the outbreak in Beed District, to be plague.

Studies which were carried out on the test-kits at the Haffkine Institute, Mumbai, clearly indicated and testified that PHA test-kit with F1 antigen was not as specific in Indian situation as it might have been in the U.S.A. Many samples from healthy blood donors, normal persons, and controls from patients of other diseases like tuberculosis, malaria, etc., gave positive results with PHA test. A total of 17 controls were tested out of which eight showed a titre of 1 : 16. But adsorption with sheep RBC (SRBG) led to no reaction at all. In 63 test samples, only there showed of titre of 1 : 32. It must be noted here that the initial HA tests at the National Laboratory were done without adsorption by SRBG. Results on confirmatory HI test carried out at the Haffkine Institute were confusing and not consistent. At NIV, Pune, the HI positive sera were tested in Western Blot against the 14 KD F1 antigen obtained from CDC, Atlanta. No conclusive evidence of WB positivity was seen. The PHA test was thus, interpreted without any valid local data on sensitivity, specificity and positive predictive value.

During the epidemic in Maharashtra, sera for serological examination were sent to NICD, Delhi, not only from the suspected cases of bubonic plague, but also from healthy persons as a control. Of the sera samples from ten healthy blood donors from the Blood Bank of the General Hospital, Solapur, two were reported positive (titre 1 : 45). Samples of serum were collected from three patients suspected of bubonic plague and each sample was divided into two portions. The first lot of three samples was sent to NICD on 21st October 1994. All these were reported as positive (titre 1 : 45). The second portions of these sera were sent to NICD on 26th October 1994. All were reported PHA negative.

The serological verification and indication of current infection, as already stated, is demonstration of a four-fold difference in tire of passive haemagglutinating antibodies in serum, between specimens taken at appropriate intervals. This was not demonstrated in any patient, except in an exceptional case. None of the test results were corrected with clinical data. As regards the Office of the Joint Director of Health Services (Health), Pune, paired serum samples were collected from four suspected cases of bubonic plague from Mamla village and PHA test results reported by the NICD were analyzed (see Table 3).

Only about 517 patients from Maharashtra were reported as PHA positive. When WHO team performed latex agglutination assays from human blood samples collected from suspected cases of plague from three villages in the Beed District and from the Civil Hospital, Beed, out of 43 sera only three were positive.

Table 3 : PHA Test Results of Paired Serum Samples drawn at 12 days interval from Suspected Cases of Bubonic Plague from Mamla Village, Beed District

Sr. No.	Patient's Name	Titre : 1st Sample	Titre : 2nd Sample
1	Hiralal	1 : 45	1 : 45
2	Anjabai	1 : 135	1 : 45
3	Abhimanyu	1 : 15	1 : 45
4	Sadipan	1 : 45	1 : 15

[**Source :** Analysis by Office of the Jt. D. H. S. (Health), Pune.]

One can conclude from the data that serological results were questionable and the evidence is not in favour of the diagnosis of plague infection.

Collaborative reports

The Expert Committee on Plague of the Government of Gujrat, concluded that, "the majority of evidence does not support the initial suspected diagnosis of pneumonic plague". The Expert Committee of the Directorate of Health Services, Maharashtra, investigating plague epidemic deliberated and concluded on the basis of data available to it that the outbreak of plague-like illness was not of bubonic plague.

The WHO International Plague Investigative Team, in its quick appraisal, found no evidence to suggest transmission of *Y. pestis* in any major urban population other than in the city of Surat. The report clearly and explicitly stated that its operational conclusions were based on epidemiological grounds with clinical and laboratory findings that were supportive rather than confirmatory.[2]

The Technical Advisory Committee on Plague :

The TAC report is the only document which claims very strong evidence in favour of pneumonic plague being the cause of the outbreak and deaths in Surat. Instead of attending to its terms of reference, the TAC concentrated on searching out the causative agent, *Y. pestis*. After a long delay, TAC claimed to have isolated "*Y. pestis*" in 11 out of 82 samples from suspected cases of pneumonic plague from Surat. TAC has not elaborated on methods for isolation, characterization & animal inoculation. The inability of a large inoculum of pure culture of *Y. pestis* to kill susceptible laboratory animals raises doubt about its identification.[11] Even attenuated strains of *Y. pestis* kill mice in large numbers. TAC also claimed that 82.2 per cent of the serum sample from convalescing patients from Surat were positive on PHA and HI tests. In marked contrast, TAC reported that histopathological examination of tissue samples even from autopsies carried out at Surat, showed inconsistent pattern and *Y. pestis* could not be demonstrated.

Polymerase Chain Reaction (PCR) in itself, in absence of any basic evidence indicating plague, is neither valid nor conclusive proof. But the PCR test for molecular characterization was apparently used as a trump card. Five isolates were found to be positive for f1 genes and two for pla-gene. All this is evidently creditable, especially in light of the fact that in all these cases fresh clinical samples of sputum from acutely ill patients and lung tissues from autopsy, were negative for *Y. pestis* on repeated testing. Such sporadic finding in a few cases out of hundreds cannot justify confirmation of cases of plague without supportive clinical and epidemiological evidence. The National Institute of Virology (NIV), Pune, also showed PCR bands from DNA extracted from autopsy specimens of two patients from Surat. However, considering epidemiological, bacteriological and serological evidence, NIV declined to brand these cases as of genuine plague—for they needed more evidence. PCR is highly sensitive test, but specificity of PCR against plague needs to be verified under field conditions in India. TAC's own finding that the meticulously isolated plague bacilli were non-pathogenic, rules out these isolates as responsible for the lethal pneumonic plague. The ability of such organisms to produce pneumonic plague in man with high fatality, as claimed by the TAC, is incredible. TAC admits that there were many gaps in their knowledge of Indian plague outbreak of 1994.[8,12]

The Consequences of incorrect diagnosis

The consequences of the mistaken diagnosis of plague have resulted in exorbitant costs to the nation.[13] Billions of US dollars were lost. Colossal damage was done to India's tourist industry, diamond cutting, and exports. Internationally, India was quarantined, Indians were not allowed to land in other countries, and the foreign airlines canceled their flights to India. Persons from India to outside places, were vigorously checked under humiliating conditions in many countries. Millions of people *swallowed massive doses* of tetracycline as protection against plague, an effect of inexact information and panic. Loss to national pride, and psychological and emotional damage to the people cannot be quantified.[13]

CONCLUSION

The evidence presented in this paper clearly shows that what was going on in India in late 1994 was not plague and certainly not pneumonic plague. Whatever happened provides a very important lesson of the harm that can come nationally and globally from decisions based on inadequate or incorrect information. The appearance of a new serious disease in a previously healthy population should be confirmed unquestionably before the presence of the disease is declared. International confirmation is desirable, while this may require some days, the delay would provide the time to establish the epidemiological data and planning the control measures that may be required on decisive confirmation.

ADDENDUM

It is significant to record that a similar kind of outbreak of lymphadenitis and flea nuisance occurred in February 1995 in the Beed and Buldhana Districts of Maharashtra. A total of 32 patients were suspected for plague. Out of these, only six had fever, but disease was mild. All recovered. On serology none were positive for the PHA/HI test. Rat-falls and flea bites were there. On investigation, PCR gave positive result on two samples. However, *Y. pestis* could not be isolated from the clinical samples and rats. Considering the overall evidence plague was ruled out.[14] Within few weeks the outbreak died out. Information is not available as to the exact cause and infective agent of this fresh outbreak.

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LIVESTOCK DIVERSITY IN INDIA AND TOOLS FOR ITS MANAGEMENT

Keviletsu Khate, Amit Kishore, Manishi Mukesh and Monika Sodhi

Livestock play a significant role in the socio-economic development of nation. Use of recent technologies to evaluate the existing genetic deversity and positive attributes within a region is an important step for sustainable utilization and conservation of livestock resources. Genomic and reproductive technologies could generate valuable information on indigenous animal germplasm and highlight future possibilities and challenges to safeguard them.

INTRODUCTION

The various livestock species have been domesticated over thousand of years and contribute directly or indirectly to agricultural production. Livestock genetic resources are of economic, scientific and cultural interest to humankind in terms of food and agricultural production for the present as well as future generations. These are particularly vital to subsistence and economic development in developing countries as they continually provide essential food products, contribute draught power and manure for crop production and generate income as well as employment for most of the rural population. They also produce non-food items such as hides, skins, wool, traction power and fuel (from dung). In addition, livestock contribute towards environmental sustainability in well-balanced mixed farming systems. Further, subsistent farming communities depend upon genetic, species and ecosystem biodiversity for their livelihoods. Also, complex, diverse and risk-prone peasant livelihood systems need animal genetic resources that are flexible, resistant and diverse.

Cattle Genomics Lab, National Bureau of Animal Genetic Resources, Karnal–132001

LIVESTOCK DIVERSITY IN INDIA

The farm animal genetic resources in India are represented by a broad spectrum of native breeds of cattle, buffalo, goat, sheep, swine, equines, camels and poultry in addition to many more not characterized and accredited so far, besides populations/breeds of other species like pigs, mules, donkeys, yaks, mithuns, ducks, quails etc. These diversity of domesticated livestock and poultry breeds have been developed due to years of evolution within specific ecological niche as a result of adaptational selection to meet the local needs. The indigenous livestock breeds possess special adaptations and gene combinations, such as disease resistance, adaptations to harsh climatic conditions, and exploitation of poor-quality feeds, which generally are not found in high-producing exotic breeds. Under a given set of agroclimatic conditions it is important to utilize the maximal biological potential of these livestock genetic resources, which have been evolved through natural and human selection over the years and maintain substantial diversity.

LOSS OF GENETIC DIVERSITY

It is quite an irony that presently the population of some of the important breeds of livestock is either declining or breed characteristics are being diluted due to one or the other reason. Increase in demand and economic climate in recent years have promoted the use of breeds suited to intensive production systems, which has led to a few breeds becoming widespread while other breeds have declined in population size. There is also pressure to increase profitability of livestock farming by replacing less productive breeds with more productive ones and high-input/high-output breeds like Holstein have already and still gaining importance in many states of India for upgrading/ crossbreeding programmes. These have resulted in genetic erosion among the native livestock breeds and reduced the opportunities to improve food security, alleviate poverty and attain sustainable agricultural practices. Neglect and lack of accurate information on the diversity and status of the existing farm animal genetic resources are believed to exacerbate the alarming rate of irreversible loss of genetic diversity.

NEED FOR MAINTAINING DIVERSITY

The basis for the present as well as future sustainable utilization of indigenous farm animal genetic resources is the information on the extent of existing genetic diversity, characteristics and their use. Systematic information on existing diversity in a given region is essential to meet future challenges associated with environmental change, emerging disease threats, new knowledge of human nutritional requirement, fluctuating market conditions or changing societal needs. Additionally, an understanding of the extent and pattern of genetic variability among breeds may help in the development of more national breeding programmes and is a prerequisite to the conservation of genetic resources.

TOOLS FOR CONSERVATION

Characterization of livestock genetic resources is the first step to answer the emerging and important issues of conservation. The underlying assumption is that the taxonomically distinct breeds are most likely to have special adaptation and gene combination not found in other breeds. Amongst the molecular markers, microsatellites and mitochondrial DNA have been extensively used for genetic diversity analyses and to have deep insight into the phylogenetic history of livestock. They are also used to answer questions on taxonomy, evolution, domestication processes, management of genetic resources and setting conservation plans.

On the other hand, the approach of whole genome sequencing provide opportunities to understand and exploit the unique qualities of animal genetic resources such as milk quality attributes, disease resistance, heat tolerance etc. This can further be utilized to complement the methodologies of selection approach to correlate phenotype and genotype across the whole genome simultaneously rather than one locus at a time with high measurement precision. The availability of whole genome sequence also allows the use of single nucleotide polymorphism (SNP) chip to undertake whole genome scan in any breed (Figure 1) The technology has been successfully

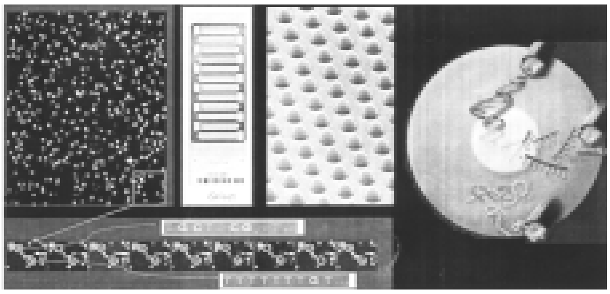

Figure 1. Whole genome scanning using high throughput sequencing technology.

applied in developing high density SNP chip in several species viz. Bovine 50K Illumina™ iSelect SNP chip, Illumina iSelect pig DNA chip, and the development is likely to grow as the availability of complete genome sequence in livestock increases. SNP platform and related databases also have a broad utility in defining existing diversity and in guiding conservation plans.

Advancement in microarrays in recent years provides opportunities to analyze polygenic funcional traits. This allows simultaneous evaluation of target genes up to the order of tens of thousands associated with functional traits in complex eukaryotic genome. Gene expression microarrays also serve as a platform to understand mechanisms and underlying egentic factors of biological functions that have not been fully established. Additionally, the technology can be utilized to investigate genes which are differentially up or down-regulated between different physiological, pathological and between cells of animal from different genetic background.

Conventional conservation of livestock genetic resources is undertaken through *in situ* and *ex situ* approaches. The approach of *in situ* conservation, maintaining live population of animals in their adaptive environment, will be effective with the participation of traditional keepers (farmers) of the breed. The success of this approach also depend on efforts of creating awareness among farmers and developmental organizations about the usage of indigenous animal genetic resources and the risk posed by upgrading/crossbreeding programmes in reducing within and between breed diversity.

Developments in cryopreservation and reproductive technologies have made a huge impact on conservation strategies. *Ex situ* conservation of genetic material from livestock through cryopreservation is an important strategy to conserve germplasm. Cryopreserved semen doses, ova or embryos and DNA sequences in frozen blood or other tissues from improtant and endangered breeds will serve as invaluable repository for indigenous livestock genetic resources. The biotechnological tools developed in recent years can also be effectively used for conservation of livestock genetic resources. Standardization of somatic cell nuclear transfer (SCNT) and cloning techniques in livestock breeds will serve as indispensable conservatory tools of important livestock and poultry breeds. Other reproductive technologies that can be used for conservation include embryo transfer, embryo micromanipulation and genome resource banking. Thus, participation of farmers, inter-disciplinary/ institutional coordination, policy decisions, access to technology by all levels of producers and financial support will be required to address the issues of genetic diversity and to realize the full impact of genomics on livestock genetic resources.

In India, need to maintain genetic diversity in livestock has been realized and Indian Council of Agricultural Research (ICAR) established National Bureau of Animal Genetic Resources (NBAGR). Presently, the Bureau is acting as a nodal agency for evaluation, documentation and conservation of livestock and poultry genetic resources in India. Till date, the Bureau has completed the gigantic task of characterization of almost all the recognized breeds of livestock and poultry and similar efforts are being put forth for the lesser known breeds. Among several molecular markers available, multilocus and non-species specific microsatellite markers using FAO recommended microsatellite markers has been extensively employed. Additionally, mitochondrial DNA has been analyzed to have insights on the genetic diversity and origin ; besides, estimating the time depth of domestication history of the distinguished livestock and poultry breeds. These developments have opened opportunities to frame effective breeding plans for long term conservation and continuous genetic improvement of indigenous breeds. Informations generated from these efforts may further be utilized within the country to strengthen Herd Registration Scheme, which has been launched by the Ministry of Agriculture ; Government of India. Further, finalization of breed descriptors and breed registration would go a long way for conservation of rare and endangered breeds.

Ex situ conservation measures on Indian livestock and poultry genetic resources have also been put in place by NBAGR. Semen samples from important livestock breeds have been cryopreserved and kept in Gene Bank for long term preservation of genetic resources at nominal cost. The Bureau has set up somatic cell bank of skin fibroblast as genetic stock and on the basis of this technology animal cloning programme is being taken at the institute.

The Indian livestock and poultry genetic resources present several unique characteristics, which are gaining popularity in the era of globalization.

Analysis of candidate genes associated with economically important traits by the NBAGR scientist have confirmed some of the unique genetic architecture of the Indian livestock and poultry genetic resources. Recently, it has been observed that fixation/near fixation of desirable milk protein beta-casein A2 allele in Indian buffalo and cattle breeds would have an upper edge over their taurine counterparts in meeting the global demands for A2 milk in the international dairy sector if the undesirable effects of β-casein A1 allele on health (type I diabetes mellitus, coronary heart disease, sudden infant death syndrome, atherosclerosis, schizophrenia and autism) are validated and demands for A2 milk increases. Additionally, fixation/near fixation of loci associated with milk production traits viz. milk protein cluster and diacylglycerol acyltransferase (DGAT) will add value to indigenous cattle and buffalo genetic resources. Further, prolificacy of Garole sheep, Pashmina goat for its wool (Cashmere shawl), Vechur cattle for its resistant to Foot and Mouth disease, Kadaknath chicken for its dark coloured flesh, cattle breeds for thermotolerance etc may find their place in international sector if exact mechanisms and the underlying genetic factors are established and proper mechanisms made to patent them.

OPPORTUNITIES AND CHALLENGES

The unique genetic make-up of indigenous livestock and poultry genetic resources provides opportunities for improving the economy of the country and international cooperation. However, membership of the World Trade Organization and its obligations make India face stiff challenges due to globalization of trade of all commodities. Besides, the development of biotechnology in recent years have made it possible to genetically alter the breeds and substituting the original breed with the new breed.

Today, in the era of globalization it is necessary to understand the genetic components of the unique characters in livestock species and develop ways to patent them. Identification/characterization of the existing genetic resources is an important step in this aspect. The recognition of patents on livestock genetic resources would prevent the chances of biopiracy. Further, it proper internationlly accepted legal system is developed, patenting of novel genes will bring about economic benefit to the livestock keepers in the intellectual property rights regime through benefit sharing.

The use of genomic technologies in livestock also calls for addressing environmental concerns and animal welfare in increasing intensive production system. It is also essential to address research ethics and species integrity related to cloning and transgenic technologies, and establishing a legal framework for farm animals in order to ensure proper use of genomic information. Thus, concerted efforts are required to put a mechanism in place to safeguard and to meet the need and aspiration of the future generations with respect to livestock and poultry genetic resources in India.

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KNOW THY INSTITUTIONS

INSTITUTE OF SCIENCE & MANAGEMENT, RANCHI

The Institute of Science and Management (ISM), formerly known as Indian Institute of Science and Management had, came into being in the year 1985 under the aegis of Dr. Sachchidanand, the then Vice Chancellor of the Ranchi University, with an idea of catering to the long felt need of management education to the upcoming youth of the developing region of Chotanagpur, now Jharkhand.

A two-year full time Management course leading to the award of Post Graduate Diploma in Business Management (PGDBM) started in 1988. ISM holds its formal approval from AICTE since 1994. The Institute since then had its steady progress and it transcended its original bounds, emerging as one of the best Management Institutes in India occupying the 52nd position as rated by COSMODE, a Hyderabad based accredition organization.

ISM is known for its highly qualified and dedicated faculty members eager to support the students.The faculty at ISM is an ideal mix of academicians and Industry Professionals. Sixteen batches of the students have already passed out from the Institute. Many of them are holding responsible positions in industry and business. A number of them have started their own business enterprises or joined their family business.

CAMPUS

The Institute, with a vision to impart education to develop the backward region of Chotanagpur area, has setup the campus in Pundag, a rural area, full of landscapes and greenery all around. The infrastructure of Business Management Department is based on a three floor building which consist of classrooms, library auditorium, conference room, computer lab and a sports room.

The Institute is about 3 km from the main road connector and rightfully connected to bus-stand, railway station and airport. One of the distinction of the Institute is its library, which is said to be an axle in any educational institution, where all other activities rotate around it. Library is full of resources including books journals, reports, thesis, magazines of world's best institutes, various newspaper, CDs, Cassettes, internet connection, etc.

AWARDS & SCHOLARSHIPS

Every year students are being awarded following Gold Medals and Scholarships :

- Veena Memorial Gold Medal to the Best Student in the Department of Business Management.
- V. Jha Trust Gold Medal to be Best Student in the Department of Hotel Management.
- Scholarship of Rs. 5000/- per semester to the most meritorious student Courtsey, Dr. M. L. Singh, HOD, BM.

SUPPORT FACILITIES

CLASS ROOMS

The institute has more than 8 class rooms of different seating capacities and are provided with spacious Green/White Boards, OHPs, LCD Projectors, Slide Projectors, Pull Down Screens along with network/internet facilities.

The institute has also a fully air conditioned classroom for Guest Lecture equipped with ultra modern teaching aids.

CONFERENCE HALL AND AUDITORIUM

To support various academics, Sports and Cultural activities, the institute has an auditorium with a capacity of 300 participants. It has all the modern facilities like PA systems, cordless microphones, LCD Projectors etc.

For conducting management development programmes, guest lectures, conferences and other academic activities ISM has a spacious conference hall with a seating capacity of 60 participants.

OTHER FACILITIES

PLACEMENT CELL

The institute has an active Placement Cell headed by the Deans of Departments. The Cell comprises of students representatives, Faculty Members and Professor Incharges. It has been established to help students in planning their career and to find the types of job opportunities available in the areas of their interest. The cell is especially responsible for correspondence wit perspective employers, arranging pre placement talks, personal interviews on or off campus and providing facilities that may be required by the visiting organizations.

ALUMNI ASSOCIATION

The association of alumni serves as a link between the department and its alumni. It has established close contact with the alumni of the department and encouraged exchange of ideas and experience among them with a view to maintain a high standard of professional efficiency and integrity.

INSTITUTE INDUSTRY INTERACTION

A significant step has been taken in initiating activities pertaining to industry-institute relations. One of the faculty members has taken up this responsibility to initiate the process and develop as a long term activity to build bridges between the practicing world and academia. This is based on conviction that the Institute will be playing a major role in establishing such relations for mutual benefit. It is believed that management eduction has a significant influence on the practice of effective management.

Joint project assignments, research, consultancy, internships of faculty and students, contribution both to practice and concepts through involvement of practitioners, executive development programmes and sharing of experiences are some of the activities proposed for industry institute relation.

CIVIL, ELECTRICAL MAINTENANCE & SECURITY CELL

The Institute has a civil and electrical cell with adequate number of staff under a qualified engineer to look after the building, horticulture, equipment, sanitary and public health works of the institute.

SOCIAL SERVICE

The institute has also taken up social service activities for the upliftment of the society. It has also a number of social service activities with the active participation of students, faculty, staff and non-government organizations.

PROFESSIONAL MEMBERSHIP

The Institute has the membership of number of professional bodies like :

- Association of Indian Management Schools.
- Association of Management Development Institute of South Aisa.
- Foundation for Organisational Research and Education.
- Indian Institute of Public Administration.
- National Institute of Entrepreneurship & Small Business Development.
- Indian Society for Training & Development.
- Indian Society for Technical Education.
- Indian Trade Promotion Organization.
- All Indian Association for Educational Technology.
- National Institute of Personnel Management.
- Federation of Hotel & Restaurant Association of India (FHRAI).
- National Association of Bakery Industry.

HOSTELS

The institute has separate hostel facilities for boys and girls. The girls' hostel have a capacity of accommodating 30 girls.

Each hostel is located in its own enclosed compound-with beautiful gardens–for security purposes.

Bus facilities is provided to carry the students from Hostels to institute and back.

LIBRARY

The ISM library has a growing collection of books, periodicals, including latest publications in management and related subjects. Library of ISM has a colledtion of about 10,000 (3659 Titles) volume of books both of foreign and Indian publications. In addition, the library subscribes to over 49 national and 27 international Journals. To provide more current information, the library has a collection of corporate annual reports, project reports and dissertation of students.

The Library has a good number of audio and video cassettes/CDs on management topics, manuals and software to aid faculty in classes.

The library collections are computerised and the users can access data independently, The library has been linked to internet facilities.

The library also maintains press clipping files on management and related subjects. The library is laid out speciously to provide clam and peaceful environment for serious reading with a seating capacity of 72 students.

Contact :

Institute of Science & Management
ISM Campus, Institutional Area
Pundag, Ranchi-834 004 (Jharkhand), India

Phone : +91-651-2242060

Fax : +91-651-2240630

Email : contact@ismranchi.org

Conferences / Meetings / Symposia / Seminars

International Conference "From Local Watershed Management to Integrated River Basin Management at National and Trans-boundary Levels" 9-11 March 2011, Chiang Mai, Thailand.

This conference sets out to answer the following questions :

- Why should watersheds be a component in Integrated Water Resources Management (IWRM) ?
- What are the political processes that drive watershed management, and how can these be influenced in positive directions ?
- What kinds of incentives exist for basin and watershed management agencies to increase their focus on watersheds ?
- What practical measures can be taken to empower and transfer responsibility for the management of watersheds to their resident communities ?
- It what ways can the MRC and partners contribute to the incorporation of watersheds into wider basin management and planning ?
- What can the MRC and partners do to support these kinds of processes ?

OBJECTIVES

The conference aims to address the challenges to watershed management (for example, rapid economic development, population growth, increased urbanisation, extensive hydropower and mining development, land use changes, deforestation, climate change, etc.) and make recommendations for the MRC, RBOs and other relevant actors in the Mekong Basin on :

- Best practices based on critical analysis of watershed management experiences to date, both in the Mekong Basin and elsewhere.
- Mechanisms needed to further develop and enable the formation of stakeholder platforms and their institutional set-up comprising government agencies, civil groups and communities to engage with each other and manage at the watershed level.
- Proposals for ways to establish institutional mechanisms to link River Basin Organisation (RBOs) or Committees (RBCs) with watershed managers to ensure coordinated implementation between all levels.

For logistical arrangements and registration please contact :

Ms. Latdaphone Phouthavong, Secretary, Technical Coordination Unit, Mekong River Commission, Office of the Secretariat in Vientiane (OSV), Lao PDR, Tel : + 856 21 263 263 ext 4701, Fax : + 856 21 263 264, Email: latdaphone@mrcmekong.org Website: http://www.mrcmekong.org

ICES/NAFO Symposium on the Variability of the North Atlantic and its Marine Ecosystems during 2000-2009, Santander, Spain, 10-12 May 2011.

Science Programme :

The symposium will run as a single multidisciplinary session organized by science area or on a regional basis, as appropriate.

The science programme will provide excellent opportunities to catch up with the latest observations of variability at all trophic levels; from the ocean climate/physics, through plankton to fish stocks, marine mammals, and seabirds. It will provide new insight into the importance of climate in regulating marine ecosystems of the North Atlantic compared with other drivers of variability.

The keynote talks will introduce each trophic level by describing the long-term and wide-scale patterns of variability and, where appropriate, our current understanding of the key drivers. This can then be used to put the information presented in specific talks into a wider spatial and temporal context.

Important Dates

- The deadline for submission of abstracts is 15th January 2011.
- The deadline for submission of manuscripts for the ICES Journal of Marine Science will be 27th May 2011.
- All abstracts will be reviewed and notification of acceptance for presentation will be made on 15th February 2011.

Contact person : Alicia Lavin

Instituto Español de Oceanografia (IEO) **- Centro Oceanografico de Santander**

Tel : +34 942 291 716 Fax : +34 942 275 072 E-mail : Alicia.lavin@st.ieo.es

S & T ACROSS THE WORLD

INDIA'S FIRST FULL-FIDELITY COPTER SIMULATOR CERTIFIED

India's advanced helicopter simulator, an HAL and CAE joint venture, today received the highest certification from both the Directorate General Civil Aviation (DGCA) and European Aviation Safety Agency (EASA).

The Bangalore-based Helicopter Academy to Train by Simulation of Flying (HATSOFF)'s Bell-412 chopper full-mission simulator was certified to Level D, the highest qualification for flight simulators, by both DGCA and EASA, an HAL press release said here.

"HAL and CAE are very proud of achieving Level D certification, which is the highest performance rating given for flight training equipment, from both the DGCA and EASA," HATSOFF Chief Executive Officer Wing Commander (retd) Chandra Datt Upadhyay said.

"The HATSOFF training centre is a first for India, and we are excited to begin offering simulation-based training that will prove to be one of the best approaches for improving safety, operational efficiency and mission readiness," he added.

The CAE built full-mission helicopter simulator at HATSOFF features CAE's revolutionary roll-on/roll-off cockpit design, which enables cockpits representing various helicopter types to be used in the simulator.

The first training program HATSOFF is offering is for operators of the Bell-412 helicopter. Additional cockpits for the Indian Army and Air Force variant of the HAL-built Dhruv, the Civil Variant of the Dhruv, and the Eurocopter Dauphin would be added to the HATSOFF training centre over the next year.

The HATSOFF training centre, located near HAL's headquarters in Bangalore, also features multimedia classrooms, computer-based training, brief and debrief facilities, and a training management information system.

The full-mission simulator features a common motion system, Vibration platform, and visual display system, along with the four separate cockpit modules that can be used in the full-mission simulator.

When a cockpit is not used in the full-mission simulator, it will be used as a fixed-based flight training device(FTD).

TULSI-BASED MEDICINE TO MINIMISE RADIATION EFFECTS

Used in many a home remedy, Tulsi will now help to minimise the effects of radiation on humans.

"We are working on developing a Tulsi-based medicine to minimise the effects of radiation on human, " DRDO's Institute of Nuclear medicine and Allied Sciences (INMAS) Director R P Tripathi told PTI.

The INMAS Director said leaves of 'Krishna Tulsi' plant, which has black leaves and is found mainly in southern parts of the country, are being used in the project.

"Active ingredients of the leaves have been isolated and used in the medicine," he added.

Tripathi said INMAS, which is celebrating its golden jubilee, is working on the project for the last five years and Professor Uma Devi, a former doctor at the Bhopal cancer hospital, is also involved in it.

Clinical trials of the medicine are likely to start soon.

The Tulsi plant is considered to be having antioxidant, anti-inflammatory and immune-enhancing properties and is used in many households for treating cold and cough and other minor ailments.

Tripathi said that similar work is being carried out on few other herbs found in the high altitude areas of Ladakh and Himalayas.

Once developed, the medicine will be given to armed forces and other agencies.

Tripathi said leading institutes from the United States have shown interest in working together with the Defence Research and Development Organisation on the project.

SOON YOU CAN FILL YOUR CAR WITH 'PETROL MADE FROM CO_2'

Scientists are inching closer to produce a new fuel from carbon dioxide and sunlight which they claim will help meet world's energy needs and minimise carbon emissions.

A team at Sandia National Laboratories in Albuquerque, New Mexico, is developing the technique which will produce "synthetic liquid fuels" in solar powered reactors.

Experiments have also shown that the reactors can absorb carbon dioxide (CO_2) and turn it into carbon monoxide. The same reactors can also be used to turn water into hydrogen and oxygen.

The two can then be reacted together with a catalyst to form hydrocarbon fuels, in a technique known as the "Fischer-Tropsch" Process.

According to the researchers, fuels made in this way are sufficiently similar to those currently used in cars, and major redesigns of engines and refuelling stations is not necessary, New Scientist reported.

This innovative fuel production techniques could inch motor vehicles towards carbon neutrality, it said.

Ken Caldeira of the Carnegie Institution of Washington at Stanford University, California, said that creating usable fuel from solar energy is a promising way of keeping the world's energy demands satisfied while minimising carbon emissions.

This area holds out the promise for technologies that can produce large amounts of carbon-neutral power at affordable prices which can be used where and when that power is needed," he said.

"It is one of the few technology areas that could truly revolutionise our energy future."

The Sandia team has created a machine called the "Counter Rotating Ring Receiver, Reactor Recuperator (CR5)", which captures carbon dioxide from power plant exhaust fumes.

In future, however, they hope to use CO_2 extracted directly from the air, although they are not developing their own carbon-capture technique to do so.

"That is a huge challenge in itself, and we opted to focus on one hard problem at a time," says James Miller, a combustion chemist at Sandia.

IMAGE OF ENTIRE UNIVERSE RELEASED

European Space Agency has released what it says is the first ever image of the entire universe which will give scientists new insight into how the stars and galaxies form.

The all-sky image produced by space telescope Planck can also tell how the Universe itself came to life after the Big Bang some 13.7 billion years ago.

The satellite was launched last year by the ESA under a 600-million euros project to record the origins of the universe.

While the satellite was sent nearly a million miles into space, the Planck observatory's job was to look at the age, contents and evolution of the cosmos by studying the heat left behind by the Big Bang.

ESA Director of Science and Robotic Exploration, David South wood, said : "This is the moment that Planck was conceived for."

"We're not giving the answer. We are opening the door to an Eldorado where scientists can seek the nuggets that will lead to deeper understanding of how our Universe come to be and how it works now," he was squoted as saying by the Daily Mail.

"The image itself and its remarkable quality is a tribute to the engineers who built and have operated Planck. Now the scientific harvest must began."

From the closest portions of the Milky Way to the furthest reaches of space and time, the new all-sky image, for which Planck took six months of time, is an extraordinary treasure chest of new data for astronomers, the scientists said.

The main disc of our Galaxy runs across the centre of the image. Immediately striking are the streamers of cold dust reaching above and below the Milky Way.

This galactic web is where new stars are being, formed, and Planck has found many locations where individual stars are edging toward birth or just beginning their cycle of development, the report said.

Less spectacular but perhaps more intriguing is the mottled backdrop at the top and bottom. This is the "cosmic microwave background radiation (CMBR)", the scientists said.

The CMBR covers the entire sky but most of it is hidden in this image by the Milky Way's emission, which must be digitally removed from the final date in order to see the microwave background in its entirety.

When this work is completed, Planck will show us the most precise picture of the microwave background ever obtained, the ESA Said.

The different colours represent minute differences in the temperature and density of matter across the sky. Somehow these small irregularities evolved into denser regions that became the galaxies of today.

Planck will continue to map the Universe and will produce four all-sky scans till its mission ends in 2012.

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THE INDIAN SCIENCE CONGRESS ASSOCIATION

14, Dr. Biresh Guha Street, Kolkata-700 017, INDIA

;th/Telegram	:	SCICONG : CALCUTTA	V¢m/Fax	:	91-33-2287-2551
=hCtM/Telephone	:	(033) 2287-4530, 2281-5323	R-bj/E-mail	:	iscacal@vsnl.net
JcmtRx/Website	:	http://sciencecongress.nic.in			iscacal_2004@yahoo.com

m=ôg;t fle N;| yth m=ôgt fle ÂJNMtÂ"flth/Terms of Membership and Privileges of Members :

mô:t fle m=ôg;t WI mCe jtdt fl ÂjY Fj n st ôIt;fl gt Wmfl mbtI ô;h vh NGÂKfl gtÉg;t ysI flh afl n yth Âsàn Cth; Âfl ÂJÒttI fl ;h¢fle b ÁÂa n›

Membership of the Association is open to person with *Graduate or equivalent academic qualification* and interested in the advancement of science in India.

1. **JtÂMfl m=ôg &** st ôgÂÿ Ig Áv m JtÂMfl m=ôg;t dnK flhIt atn;t n Wm JtÂMfl m=ôg;t NÖf Á 200/- fl mt: C;e NÖf Á 50/-* (ÂJ=ÂNgt fl ÂjY** U.S.$ 70) btºt =I vzd› JtÂMfl m=ôg;t NÖf ŒÂgfl JM fl 01 yŒj flt =g nt stYdt› st Ce 15 sjtR fl Ce;h yvIe m=ôg;t NÖf Ine y=t flh vtYdt Jn Wm mtj fl ÂjY yvIe Jtx =I fle Gb;t m JÂa; nt stYdt yth/gt Jn Wm JM fl ÂjY mô:t fl fltgtjg flt Ce ÂIgºtK Iné flh vtYdt› Yfl m=ôg st JtÂMfl m=ôg NÖf ydj mtj fl bta fl y; ;fl Iné = vtYdt Wmfle m=ôg;t mbtË; nt stYde›

   m=ôgdK yvIt vvh fltdm mºt fl mbg vN flh mfl; n› Wàn JtÂMfl ÂJÒttI fltdm mºt fle fltgÂJJhK fle Yfl ŒÂ; ÂcItbÖg b ŒtË; nt mfl;e n› Rmfl mt: J mô:t fl htsItbat IIYJhebIm mtRm00 Ce ÂcItbÖg Wvjç" flh mfl; n›

1. **Annual Member :** A person willing to be enrolled as new Annual Member has to pay an annual subscription of Rs. 200/- along with an admission fee of Rs. 50/-* (for foreign** U.S.$ 70) only. The annual subscription of a Member shall become due on the 1st April of each year. Anyone who fails to pay the subcription on or before the *15th July* in any year shall lose the right of voting and/ or holding any office of the Association for that year. A member failing to pay the annual subscription by the end of March of the following year shall cease to be a Member.

   Members may contribute papers for presentation at the Science Congress. They will receive, free of cost, reprints of the Proceedings of the Session of any one section of their interest and also the bi-monthly journal of the Association "Everyman's Science".

2. **m°t m=ôg &** gÂ= fA fthKt m JtÂMf m=ôg yvle m=ôg;t Wm JM f 15 sjtR f y=h =tnhtlt Cj stY ;t Wlfle m=ôg;t m°t m=ôg;t f Áv b Âclt Jtx ztjl fle Gb;t b meÂb; fh Â=gt stYdt› JtÂMf m=ôg yvle m=ôg;t =tctht ydj mtj Âclt C;e NÖf Â=Y yvle m=ôg;t NÖf ft Xef mbg vh =f vl& Œtˆ; fh mf;t n›

2. **Sessional Member :** If for some reasons, Annual Members fail to renew their Membership by remitting subscription prior to 15th July each year, their Membership for the year would be restricted to Sessional Membership without voting right. Annual members can renew their Membership without paying the admission fee in the next year by remitting subscriptions in time.

3. **At°t m=ôg &** st ÔgÂÿ ôlt;f ô;h f lea vZtR fh hnt n Jn JtÂMf m=ôg;t NÖf Á 100/- bt°t =l vzd› yvlt ltb At°t m=ôg f Áv b ÂjFJt mf;t n cN; Wmf ytJ=l v°t vh Wmf Œtatg/ÂJCtdtŒgG/mô:tl f Œ"tl f nô;tGh nt› Yf At°t m=ôg ft gn yÂ"fth Â=gt stYdt Âf Jn yvlt vvh ftdm m°t f mbg vN fh mf cN; Jn vvh Jn Âfme JtÂMf m=ôg gt mô:t f ftR yJ;Âlf m=ôg f mt: vN fh› Wm Jtx fhl ft gt ftgtjg ft ÂlgºtK fhl ft yÂ"fth Œtˆ; lné ntdt› At°t m=ôg ft ÂJCtdt f ÔgJmtg cXft yth mt"thK cXft b Ctd jl fle gtÉg;t Œtˆ; lné n›

3. **Student Member :** A person studying at the under-graduate level may be enrolled as a Student Member by paying an annual subscription of Rs. 100/- only provided his/her application duly certified by the Principal/Head of the Institution/Department. A student member shall have the right to submit papers for presentation at the Session of the Congress of which he/she is a member, provided such papers be communicated through a Member, or an Honorary Member of the Association. He/she shall not have the right to vote or to hold any office. A student member shall not be eligible to participate in the Business meetings of the Sections and the General Body.

4. **ytseJl m=ôg &** Yf m=ôg yvl CÂJíg fle mthe ctÂMf m=ôg;t NÖf Yf cth b Áv 2000/- (ÂJ=ÂNgt f ÂjY U.S.$ 500) bt°t y=t fhf vt mf;t n› Yf ÔgÂÿ st 10 mtj gt Wmm yÂ"f ÂlgÂb; Áv m m=ôg;t Œtˆ; fh af‌t n, Wm Wmfle mgÿ m=ôg;t NÖf f Wvh ŒÂ;JM Á 50/- fle Ax =e stYde, cN; Âf Wmfle mgÿ NÖf Á 1,200/- m lea l nt (ÂJ=ÂNgt f ÂjY U.S.$ 12.50 yth U.S.$ 300 fbN&)› Yf ytseJl m=ôg ft Wmf vh seJl ftj b m=ôg;t fle mthe ÂJNMtÂ"fth Œtˆ; ntd›

4. **Life Member :** A Member may compound all future annual subscriptions by paying a single sum of Rs. 2000/- (for foreign** U.S.$ 500) only. Any person who has been continuously a member for 10 years or more, shall be allowed a reduction in the compounding fee of Rs. 50/- for every year of such membership, provided that the compounding fee shall not be less than Rs. 1,200/- (for foreign** U.S.$ 12.50 and U.S.$. 300 respectively). A life Member shall have all the privileges of a member during his/her lifetime.

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* C;e NÖf Á 50/- ÂmVl Yf lg JtÂMf m=ôg f ÂjY sÁhe n› gn m°t m=ôg/ytseJl m=ôg/mô:tl m=ôg/At°t m=ôg/=t;t f ÂjY sÁhe lné n›

* Admission fee of Rs. 50/- is needed only for becoming a new Annual Member and not for Sessional Member/Life Member/Institutional Member/Student Member/Donor.

** (Yf ÂJ=Ne m=ôg flt y: n st Cth;JM f ctnh flt ItdÂhf nt)›

** (A Foreign Member means one who is normally resident outside India).

5. **mô:tI m=ôg &** Yf mô:tI st Á 5,000/- m=ôg;t NÔf f Áv b = Jne mô:t f mô:tI m=ôg cI mf;t n (ÂJ=ÂNgt f ÂjY U.S.$ 2,500)› Rmb Jn ÂcÒttI fltdm f JtÂMf mºt b yvI Yf ôgÂÿ flt Itb ItbtÂf; flh mf;t n st WIflt ŒÂ;ÂIÂ" nt› Yf mô:tI m=ôg flt JtÂMf ÂJÒttI fltdm mºt fle fltgÂJJhK fle Yf vK ŒÂ; ÂcItbÖg b ŒtË; nt mf;e n› Rmf mt: J mô:t f htsItbat IIYJhebIm mtRm00 Ce ÂcItbÖg Wvjç" flh mf; n›

5. **Institutional Member :** An Institution paying a subscription of Rs. 5,000/- (for foreign** U.S.$2,500) only, can become an Institutional Member of the Association. It shall be eligible to nominate one person as its representative to attend Annual Session of the Science Congress. An Institutional Member shall be eligible to receive, free of cost, a copy of the complete set of Proceedings of the Annual Science Congress Session as also a copy each of the Association's journal "Everyman's Science".

6. **=t;t &** fltR Ce ôgÂÿ st Yflmt: Á 10,000/- (ÂJ=ÂNgt f ÂjY U.S.$ 5000) btºt = Jn mô:t f =t;t cI mf; n› Yf ôgÂÿd; =t;t flt Jn mthe yÂ"flth yth ÂJNMtÂ"flth Âbjd st Yf m=ôg flt Wmf vK seJI fltj b ŒtË; nt; n› Yf mô:tI st Yflmt: Á 50,000/- (ÂJ=ÂNgt f ÂjY U.S.$ 25,000) btºt = Jn mô:t f mô:tI =t;t cI mf;t n, Âsm Yf ôgÂÿ flt ItbtÂf; flhf Wm yvI mô:tI f ŒÂ;ÂIÂ" f Áv b ÂJÒttI fltdm f JtÂMf mºt b Cs mf; n› Yf mô:tI/ôgÂÿd; =t;t JtÂMf ÂJÒttI fltdm f fltgÂJJhK yth mô:t f htsItbat IIYJhebIm mtRm00 Ce ÂcItbÖg Wvjç" flh mf; n›

6. **Donor :** Any person paying a lump sum of Rs. 10,000/- (for foreign **U.S. $5000) only, can become a Donor of the Association. An ***INDIVIDUAL DONOR*** shall have all the rights and privileges of a member during his/her lifetime. An Institution paying a lump of Rs. 50,000/- (for foreign U.S. $25,000) only, can become an ***INSTITUTIONAL DONOR*** of the Association, which shall have the right to nominate one person as its representative to attend Annual Session of the Science Congress. An Institutional/Individual Donor shall be eligible to receive, free of cost, a copy of the complete set of Proceedings of the Annual Science Congress Session as also the Association's journal "Everyman's Science".

(y) **vvh vN flhIt &** Yf vK vvh fle ŒÂ; Wmf mt: ;eI mthtN fle ŒÂ; st 100 Nç=t m ßgt=t I nt yth Âsmb fltR ythF gt VÌbjt I nt, Jn ŒÀgf JM 15 Âm;öch f y=h bntmÂaJ (bÏgtjg) ;f vna stIt atÂnY›

(A) **Presentation of Papers :** A copy of complete paper accompanied by an abstract in triplicate not exceeding one hundred words and not containing any diagram or formula, must reach the General Secretary (Hqrs) latest by September 15, each year.

(c) mCe Jdt fl m=ôg st ÂJÒttI fltdm mºt b Ctd jI fl vëat; jtx; mbg fl Âxflx b Âhgty; ŒtË; flh mfl;t n cN; Âfl WIfle gtºtt fl Fa flt :tzt Ce Ctd mhflth (flŠeg gt htßg), fltR fltIIe mútt gt fltR ÂJëJÂJ'tjg gt fltR IdhvtÂjflt I WXtY›

(B) Members of all categories are entitled to railway Concession of return ticket by the same route with such conditions as may be laid down by the Railway Board for travel to attend the Science Congress Session provided that their travelling expenses are not borne, even partly, by the Government (Central or State), Statutory Authority or an University or a City Corporation.

(m) mô:t fl vô;fltjg b mCe Jdt fl m=ôg flt vZI fle mÂJ"t mcn 10,00 cs m Ntb flt 5.30 cs ;fl mCe fltb fl Â=It b (NÂIJth yth hÂJJth) flt Atzflh ŒtË; ntde›

(C) Members of all categories are entitled to reading facilities between 10.00 a.m. to 5.30 p.m. on all weekdays (except Saturdays & Sundays) in the library of the Association.

(z) mbg mbg vh mô:t Ãtht ;g fle dR bÕg vh ÂJ¶tbdn, mCtdth ytÂ= mÂJ"tyt fle ŒtÂË; Ce mCe Jdt fl m=ôg vt mfl; n›

(D) Members of all categories may use Guest House facilities, Lecture Hall hiring at the rates fixed by the Association from time to time.

(R) CÂJíg b Cth;eg ÂJÒttI fltdm mô:t Ãtht ytgtÂs; vÂhmJt=, möbjI yth JtÂMfl fltdm b mCe Jdt fl m=ôgt Ãtht Ctd jI fl ÂjY yvIe-yvIe m=ôg;t vºt flt jtIt sÁhe n›

(E) Members of all categories should bring the Membership Card always for attending any Seminar, Conference and Annual Congress organized by ISCA in future.

ÆgtI = & mCe cfl ztÜx "Treasurer, The Indian Science Congress Association" fl Itb m ne ÂjFt stY yth fltjflt;t fl Âflme Ce NtFt b =g nt› m=ôgt m gn ÂIJ=I Âflgt st hnt n Âfl J yvIe m=ôg;t mÏgt flt W¨F Cth;eg ÂJÒttI fltdm mô:t fl fltgtjg fl mt: vºttath fl Ôgÿl yJëg flh›

Note : All Bank Drafts should be drawn in favour of "Treasurer, The Indian Science Congress Association" Payable at any branch in Kolkata. Members are requested to mention their Membership No. while making any correspondence to ISCA office.

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THE INDIAN SCIENCE CONGRESS ASSOCIATION

14, Dr. Biresh Guha Street, Kolkata-700 017, INDIA

;th/Telegram	:	SCICONG : CALCUTTA	VU¢m/Fax	:	91-33-2287-2551
=hCtM/Telephone	:	(033) 2287-4530, 2281-5323	R-bj/E-mail	:	iscacal@vsnl.net
JcmtRx/Website	:	http://sciencecongress.nic.in			iscacal_2004@yahoo.com

m=ôg;t fU ÂjY ytJ=I - vºt/Application Form For Membership :

mJt b/To

bntmÂaJ (bÏgtjg)/ The General Secretary

Cth;eg ÂJÒttI fUtdm mô:t/The Indian Science Congress Association

14, ztO ÂchN dnt ôxex/14, Dr. Biresh Guha Street,

fUtjfUt;t - 700 017/Kolkata - 700 017

bnt=g/Dear Sir,

b Cth;eg ÂJÒttI fUtdm mô:t fUt ytseJI m=ôg/JtÂMfU m=ôg/mºt m=ôg/Atºt m=ôg/mô:tI m=ôg/ =t;t/ yvIt Itb ÂjFJtIt atn;t / atn;t n›

I like to be enrolled as a Life Member/Annual Member/Sessional Member/Student Member/Institutional Member/Donor/of The Indian Science Congress Association.

b RmfU mt: Á ________ m=ôg;t NÕf fU Áv b IfU=/cfU ztÜx mÏgt ___________ Â=ItÂfU; __________ Œatjf cfU ____________ 01 yŒj —— m 31 bta —— ;fU Cs hnt/hne n›

I am sending herewith an amount of Rs. ——————— in payment of my subscription by Cash/Bank Draft No. —————— dated ———— issuing bank from the year 1st April —— to 31st March ——.

b ÂIöIÂjÂF; ÂJCtd b ÁÂa hF;t/hF;e n (ÂfUme YfU b fUvgt ÂINtI jdtY)/ I am interested in the following section (Please tick any one).

ÂJCtd/Section

1. fUÂM yth JIÂJ'‘t ÂJÒttI/Agriculture and Forestry Sciences
2. vN, vNÂaÂfUÀmt yth bÀôg ÂJÒttI/Animal, Veterinary and Fishery Sciences
3. btIJNtôºteg yth ytahK ÂJÒttI (Âsmb mÂöbÂj; n vht;ÀJ-ÂJÒttI yth bItÂJÒttI yth NÂGfU ÂJÒttI yth mIt ÂJÒttI/Anthropological and Behavioural Sciences (including Archaeology and Psychology & Educational Sciences & Military Science)
4. hmtgI ÂJÒttI/Chemical Sciences

5. C-võÂ; ÂJÒttl/Earth System Sciences
6. yÂCgà;t ÂJÒttl/Engineering Sciences
7. Jt;tJhK ÂJÒttl/Environmental Sciences
8. malt yth mathK ÂJÒttl yth Œt'tÂdfle (flövxh ÂJÒttl mÂöbÂj;)/Information and Communication Science & Technology (including Computer Sciences)
9. CtÂ;fl ÂJÒttl/Materials Science
10. dÂK; ÂJÒttl (mtÂÏgfleg mÂöbÂj;)/Mathematical Science (including Statistics)
11. ÂaÂflÀmt Ntôºt (Nheh ÂJÒttl mÂöbÂj;)/Medical Sciences (including Physiology)
12. lgt seJÂJÒttl (seJ hmtgl, seJ CtÂ;fle yth ytKÂJfl seJÂJÒttl yth seJ-Œt'tÂdfle mÂöbÂj;)/ New Biology (including Bio-Chemistry, Biophysics & Molecular Biology and Biotechnology)
13. CtÂ;fleg ÂJÒttl/Physical Sciences
14. JlôvÂ; ÂJÒttl/Plant Sciences

(flvgt xÂfl; flh gt çjtfl yGht b Ch/Please type or fill up in Block Letters)

ltb/Name (çjtfl yGht b/in block letters) :

flj ltb/Surname	Œ:b ltb/First Name
bÆg ltb/Middle Name	

NtGÂKfl gtÉg;t/Academic Qualifications :
(ŒbtK sbt flhlt n/Evidence to be submitted)

v=ltb/Designation :

mövfl flt v;t/Address of communication :
(htßg, Nnh/ldh yth ÂvI fltz mÂn;/including state, city/town and pin code)

=hCtM mÏgt yth R-bj/Phone No. & E-mail :
(ydh fltR/if any)

ô:tge v;t/Permanent Address :

ÂxËvKe (ydh fltR)/Comments (if any)

CJ=eg/Yours Faithfully

Â=ltfl/Date :

nô;tGh/Signature

Ægtl =& (i) mCe cfl ztÜx "Treasurer, The Indian Science Congress Association" fl ltb m ne Âj Ft stY yth fltjflt;t fl Âflme Ce NtFt b =g nt›

Note : (i) All Bank Drafts should be drawn in favour of "Treasurer, The Indian Science Congress Association" Payable at any branch in Kolkata.

(ii) *10 yÿlch, 2004 fl fltgtÂhKe mÂbÂ; fl Œô;tJ fl ylmth Cth;eg ÂJÒttl fltdm mô:t fle m=ôg;t fl Âj Y ytJ=l b Âflme yàg ÔgÂÿl fl lbtVl;0 flt mtbtàg;& n;tÀmtÂn; Âflgt dgt n› vh; ÂVlh Ce gÂ= ytJ=lvºt b lbtVl;0 flt v;t Â=gt hndt ;t Wmb Âsm ÔgÂÿl flt ltb Â=gt hndt Wmfl nô;tGh Ce sÁhe n›

(ii) *As per resolution of Executive Committee in its meeting held on October 10, 2004 application for membership of ISCA in 'Care of' of some other person is generally discouraged. However, if in the application from "care of" address is given then there should be also signature of the person in whose name "care of" is given.

(iii) *C;e NÔf Á 50/- ÂmVl Yfl lg JtÂMfl m=ôg fl Âj Y sÁhe n› gn mºt m=ôg/ytseJl m=ôg/mô:tl m=ôg/Atºt m=ôg/=t;t fl Âj Y sh!he lné n›

(iii) *Admission fee of Rs. 50/- is needed only for becoming a new annual member and not for Sessional Member/Life Member/Institutional Member/Student Member/Donor.

(iv) m=ôgt m gn ÂlJ=l Âflgt st hnt n Âfl J yvle m=ôg;t mÏgt flt W¨F Cth;eg ÂJÒttl fltdm mô:t fl fltgtjg fl mt: vºttath fl Ôgÿl yJëg flh›

(iv) Members are requested to mention their Membership No. while making any correspondence to ISCA office.