

The evolution of life created a "homo" species, which was different from other animals. It had developed a greater ability to learn from the environment and "think" on that experience. This essential difference has set man apart from all the other animals. Biologically man is an animal and his body mechanism is not very different from many other animals. This is why it is possible for us to use them for our researches on disease and their treatment.

But the development of intelligence in man evolved much faster than the biological evolution of the species and today's man is very much different from the early man much more in mind than in body. He has developed a way of thinking the scientific way and ability to do with his hands as per his thoughts. This twin skill of thinking and doing has produced a different kind of evolution leading to what we call as the modern civilisation, -the history, literature, arts, sciences and the philosophy. Man is not a passive animal, drifting in the flow of evolution. He has developed the ability to steer his own course and set the direction.

But this also puts on him the responsibility that if he makes a mistake, he may destroy, not only himself but also what has been produced by evolution over crores of years. Nature may have to start all over again?

Origin of Man

In the evolution, how do we pin point where "man" begins and the ape like creatures end? Man is an animal that stands and walks erect and searches for food with his hands and makes use of tools.

The origin of such a man goes back 2,00,000 years in history in Central Africa. This is where the early evolution of man began. The skulls end bones found there, have a hole in the skull joining the skull to the spine, which shows that that creature was walking erect unlike the apes of the same period. Also his teeth and other bones show that he used his hands, and not the mouth to search for his food.

Compared to the skeletons of other animals of two million years ago, man has undergone more change in his biological evolution also, apart from the much more rapid cultural evolution. Is this because of the changes in his surrounding nature that he produces for himself? We shall try to understand how these two evolutions have affected each other, and produced the human race and civilisation of today.

Unlike most other animals, the human baby is quite helpless when born. It slowly begins to learn first how to use its muscles to grasp and to move forward, how to stand and then walk. This takes two years, much more than any other new born animal. But it has learnt also other things that no other baby learns. It began to learn from its experience and build its own understanding of the outside nature. And all this learning is recorded in its brain. Even while it was learning to use its body and muscles, it used its ability to grasp with fingers and suckle with its mouth, to learn valuable lessons about the properties of all in the things around it that; .it came contact with. From this experience it begins to form its own model of the outside world and how it should react to it

For the first two years, it learns how to gain control on its muscles and use its body to the advantage. Simultaneously it lays the foundation for its thinking, by learning how to join different experiences to each other. It begins to represent every thing it comes across by symbols-picture, sound, smell touch and all information associated with-it. The memory of the mother becomes a picture of the mother and all experiences associated with her. This beginning of thought is by recalling this symbol of the mother even when the mother is not present.

As the child grows, it begins to do with the symbols, what it does physically with the objects and finally it begins to think that is manipulate the symbols in place of the objects themselves. This adds to the effectiveness of its actions because the thinking saves much time and effort in action. The beginning of thought is with memory.

As the child grows, it combines all its experiences -knowledge into a begins to do consolidated picture of the outside reality. It tries to understand the cause and effect relationship and relates each experience with others through such cause -effect

chain. Whatever, it has learnt well and found dependable in use it assimilates as part of its being. The lessons it learns are used to anticipate the effect of each of its action and gradually it extends this anticipation to more distant future as it becomes adept at thinking. Intelligence is this ability to consider alternative and new arrangements of existing experiences. By always looking for newer and better explanations for one experiences, one develops the intelligence. Thus the three main steps in the development of the intelligence are 1. Physical activity with focussed observation 2. Curiosity- trying to find out cause-effect relations and considering new causes. 5. Anticipate future effects of its actions and deliberately test ones beliefs.

This natural way of learning gradually got formalised into what we consider as the scientific approach, by which all our knowledge has been gathered.

Over thousands of years, man went on adding to his knowledge and skills. This experience helped man to survive difficult conditions in nature and use nature for his own benefit. During the last 2 million years of mans existence, the earth has undergone many changes due to the forces of nature, storms, rains, floods, droughts, fires, earthquakes. Mountains have come up, islands submerged in the sea; ice ages have come and gone; many new kind of animal species develop and many become extinct. All these posed a challenge to all forms of life and only the fittest survived.

From his "birth place" in Africa, the ancient man migrated to all the continents then open to him. The further evolution, both biological and cultural took place separately, giving rise to different racial groups. There were also many ancient civilisations- the Egyptian, Babylonian, the Indus, the Chinese and the civilisations in America, before the Europeans rediscovered it. Many times the same discoveries were made independently by all them. Some of them developed, others were destroyed or absorbed in other civilisations.

Some of these discoveries have proved very significant for the development of man as we know him today.

Milestones in Mans Development

Compared to other animals, man is physically weak and had to hunt in groups to survive. This made it necessary that man communicate to others so that they can act together. This helped develop language. Man has a better developed language. And by more use of it, his biological evolution gave him more a more developed throat and ability to reproduce sounds. Other animals may have better smell and hearing and sight but man has a better ability to control his sound to make language understandable to fellow men. As man spread out and formed different settlements, his languages developed differently and from the study of languages, we can trace his migrations. Thus from many similarities in languages we know that there is a common background to many of the Indo-European people.

About 40,000 years ago came the discovery of fire. The fire was, there in nature, but man did not know how to control it, how to use it and how to tend it, and later- how to make it at will, by rubbing certain stones. To escape from hostile climatic changes, and natural calamities, and to explore for more food man had to move all the time. He moved with other herds of animals and their life was interdependent. Some eskimos still are like that, they move with and depend on the reindeer.

Some of these, climatic changes produced the Ice-Ages, when ice covered large tracts of land. Man had to migrate but with his already acquired skills, managed to survive. When the ice started melting, many new plants evolved through mutation, sprouted. Among these man found some grasses that had developed heavy-seeds, that were not blown away easily like other grasses, but fell on the ground nearby. For the plant, it would be a bad thing because its spread would be less and its species could be destroyed by being all in one area. But for man it was a boon-he could collect his food from these seeds. He soon found out that what he did not collect from the ground sprouted again in the next season and produced more food. Thus he discovered, agriculture and started intentionally leaving some seeds in the ground for the next crop and taking the rest for his food.

With agriculture came more settled life. He stopped wandering from place to place for food and instead built settlements where he could build homes. He tried to keep some animals with him from among those that were wandering with him. Thus came the, domesticated, animals, the cows, buffaloes, dog and hens etc.

The discovery of agriculture took place separately in different parts of the world around the same time after: the Ice Age. Thus corn/maize was discovered in the Americas, rice in Asia and wheat around the Mediterranean, where the civilisations, had grown.

With more settled life and agriculture man learnt how, to domesticate some animals that were traveling with him often- the dog, .the cows, the goats and sheep, but not yet the horse. The horse came later. With more prosperity and also harder work, the need to know what others before him had done as also the desire to communicate with those who are not present, increased. Man started drawing pictures, and express his thoughts. First he drew pictures that showed how he hunted and how he lived. Gradually, over hundreds of years, he drew a series of pictures where each picture meant a word and thus he made up sentences, Still later about 5000 years back, in. the times of the Egyptian civilisation, he used these pictures to represent not the meaning of the word but the sound of the word. Thus for example, the picture of a mother and child would meeaan not "maa" meaning mother but just the sound "maa". These are the hieroglyphics, or the picture alphabets. The need for many more sounds increased and somewhere man changes over from pictures to simple line and curve combinations to represent different sounds. The breaking up of the sounds into consonants end vowels must have been a great discovery, which led to alphabets and scripts came into existence. Man had taken a big step in spreading the knowledge gathered by thousands of years of earlier generations.

With agriculture, effort went into making things easy-by inventing more and better tools for doing tough jobs and saving labour. He first made tools using, stones. He fixed sharp stones in wood handles to make axes and sickles. Then he found copper and tried to use it. It was easier to shape than stone but was too soft to make any usable tools. But he learnt that he could, make copper from some mineral stones by putting them in fire. Accidentally, he found that in some areas, with different kinds of stone minerals, (Cotaining both copper and tin) he got not a soft metal, but something that he could shape by pouring in a mould. He had discovered bronze. Bronze was much harder and gave rise not only to works of art but also tools.

There was another metal that man found in places, steel from meteorites that was harder and tougher but needed more hot fires. Man found that by heating this steel in different ways he could make it soft, or hard; in moulds or by hammering into shapes. By about three thousand years ago, he had learnt, even to obtain it from some minerals. The steel age had began. Weapons, spears and swords from steel could be made. Making these weapons was a secret as sought after as the nuclear bomb arid rocket technology today. Around the same time the horse was also available as a domesticated animal and was being used as a weapon of war - the horse and rider combination was feared.

Around this time man had made substantial progress all round. He had built structures that would be strong and majestic- many of them exist even today- the pyramids, the Greek and Roman monuments; the Mohenjodaro and Haraappan cities and so on. He had mastered agriculture-discovered plough, and methods of harvesting and grinding the grain cooking and making bread etc. He had also learnt that he could irrigate land and get more crops rather than depend only on the rains. He learnt how to move large quantities of water in open channels over miles. He had built even at that time many reservoirs and irigation canals. Many of them are usable even today. With this came technology. But he was now also interested to know about the sky and the stars and the sun and the moon. He observed and found there were things that were happening regularly like the day and night; the full moon and the new moon; the high and the low tides; the seasons of the years. the had in this, a

way of measuring time. Even 2000 years ago he had made remarkable progress in mathematics particularly geometry. Our decimal system of writing numbers had not yet come. But they knew how to make the calendar and had months and weeks and days of the week. He could even anticipate eclipses. Those who could predict eclipses were looked upon by others as nearer to God and so they had more power and thus the hold of religion among men who studied the knowledge books. This store of knowledge included mathematics, philosophy and religion, not the arts and crafts, which were considered trivial. This was the culture of the times.

Man could now produce more than enough for himself and others, who did not engage in agriculture. These other people then devoted themselves to crafts or study of knowledge or even traveling and trade. So already by this time there were many big cities, travelers and traders and some form of government and collection of taxes. Kings and landlords and their subordinates, the rich and the poor; the masters and the slaves; the educated few and the ignorant many; the cheaters and the cheated.

There were two major ambitions of man to discover the "elixir of life" that would save him from death and the "touch stone" that would make him rich by converting everything into gold. In his search, he went on doing 'experiments' and recording his observations. He developed methods and also equipment. These were the alchemists, who started the experimental sciences and also the laboratory.

How did this scientific approach develop? We know now that this is in fact the natural way of thinking for man, when he has curiosity and wants to satisfy it. This is what you and I do when he get curious and want to find out why. We "guess" the reason, (make a hypothesis). Then find out if we are right by doing some thing and finding out whether things happen as we expect, (experiment). This experimenting went on with greater and greater momentum. Came Galileo, Newton, Copernicus and Kepler and lots of people who devoted their life to finding out about secrets of Nature. This is the basis of science.

About 200 years back came another big breakthrough. Till now man had only used energy from animals or his own muscles. He had also used water and wind power. But his ability to make things bigger or faster was limited. Now he found out how to use the coal and then the petroleum. He learnt how to use fire in a boiler and use the steam to do the work for him. Then came electricity and petrol and diesel engines. These were all parts of what we call the "Industrial Revolution". Now things were happening faster and faster. Soon came the wireless, the television, the rockets and the satellites and all the wonders of science and technology we see and read about as modern.

All this prosperity started with agriculture. In agriculture, land became the most important- who ever controlled the land, controlled power. Thus arose Landlordism. With the Industrial Revolution, money capital became the critical resource. Those with Capital became all powerful. But the progress of science continues. Now with the coming of the computers and the microelectronics, what is known as the "second industrial revolution" is taking place. The processing of information is bringing so many changes that this is becoming more important than merely owning land or capital.

India was at the forefront of civilisation when agriculture came, it was at the front, when steel age came. But we missed the industrial revolution - we have yet to catch up with it. We should not miss the new information processing revolution. For this we need to develop our Human Resource, it must become an asset. If it is not educated, in the methods of science, it will be a liability. Then we should learn to think and act together as a team and not as separate individuals.

What are these methods of science?

1. We must learn to observe. My work, howsoever trivial, can be a learning lesson, if we observe and think about the work and have curiosity about the how and the why

of it. 2. Secondly we must think quantitatively, we must measure and record. This gives us much more information than only observation. 3. The recorded information is then classified to look for any patterns. This is where the intelligence comes in. We have to try different ways of looking at the same information, to find new meanings in it. 4. When we see some new pattern, we reason what it may signify. This is a hypothesis. 5. This is then tested by collecting more information, by further observation and experiments. This method of science is not to be confined to only the science subject. We must understand that this method of thinking is needed in every action we do throughout the day.

The store of knowledge of the human race has grown up so much that it is impossible for any one to know about all the subjects in detail. But if we do not know what is the direction of progress, we shall not know, if we are being led in the wrong direction. In a democracy, we should exercise our rights with proper understanding of the issues. Most of the issues will be affected by the progress in science and we should understand the language of science. For this reason, we are giving some basic understanding, about what concerns all of us in life, the important changes being brought about by science and technology.