VIMS-8
A GLIMPSE OF SCIENCE IN ANCIENT INDIA — RESTROSPECTION FROM IISc.

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Abstract:

Indian Institute of Science (IISc), Bangalore is not only a centre of excellence of scientific culture in Bharata Varsha, but also a centre of Vedic culture. There is a Samskrita Sangha in this institute established in the year 1972, which upholds the unity in diversity of Indian culture. At one time, the activities of this Sangha crossed the barrier of the institute and became universal. Rashtrapati Dr. A.P.J. Abdul Kalam has rightly said that this institute would be the second Nalanda. Objective of this Sangha is to examine critically all the branches of knowledge *(Paraa and Aparaa Vidya)* belonging to mankind particularly which were originated in India and preserved in sanskrit viz. Ayurveda, Yoga, Astronomy, Astrology, Mathematics, Cosmology, Vimana Shastra, Natya Shastra, Vastu Shastra, Kama Shastra etc., many of which have been recognised as the positive science of to-day. The present article is primarily based on the contributions of various scholars in Samskrita Sangha activities during 1977-78 (when the authors were the office bearers of the Sangha), depicting a glimpse of the ancient Indian sciences.

Key words: science in ancient India, veda, purana, shastra, philosophy

1.INTRODUCTION

Recognising that one basic commonality in culture in different parts of our country is in Sanskrit language and the literature in this language, Samskrita Sangha was established at Indian Institute of Science, Bangalore in 1972 for unity in diversity of cultures. The principal objective is to propagate the culture represented through sanskrit in various forms. Sanskrit is the oldest language in India and so in order to get any information about the remote past, we have to dig into the literature written in this language. Various scholars stressed upon this language because our Indian culture is entwined in this language.

(i) Our first Rastrapati Dr. Rajendra Prasad rightly said,

"Our whole culture, literature and life would remain incomplete so long as our scholars, our thinkers and our leaders and educationists remain ignorant of Sanskrit".

(ii) Md. Sadiq Ali, Ex. Governor of Maharastra opined,

"In many parts of the world people were anxious to know about ancient Indian heritage and they desired that India preserved this wealth. But the knowledge of that culture was possible only through the study of Sanskrit language in which were written the great epics of Ramayana and Mahabharata. Even Jainism and Buddhism

had to adopt Sanskrit in their cultures"
(iii) On July 24, 1977, the then Prime Minister of India, Sri Morarji Desai said in a conference at Pune,

" I do not know any language which has got the magnitude and width of literature embracing all walks of human activities, as is found in Sanskrit and enquiries have led me to believe that even the search of atom had its origin in the study of Vedas in German".

Although rationalists often ignore the past and jeer at it, Dr. Arun Kumar Biswas,
a DSc. from MIT, USA[1] opined that 'the past has a future', because we learn
from the past and go beyond that.

Once upon a time India was the pioneer of all knowledge whether it be spiritual (called *Paraa* i.e. higher) or mundane in nature (called *Aparaa* i.e. lower/ordinary).
'Dve Vidye veditavye iti ha sma yad Brahmavido vadanti Paraa chaiva Aparaa cha"

Paraa vidya helps to know the imperishable or the eternal while *Aparaa vidya* helps to know things which are changing and perishable but necessary for our daily life. Vedic seers reached beyond the material life in search of knowing thyself. Scientific truths were also known to them.

The famous German thinker Maxmuller said,

" Whatever sphere of human mind you may select for your special study whether it be language or religion, mythology or philosophy, laws or customs, primitive art or primitive science, every where you have to go to India, whether you like it or not, because some of the most valuable and most instructive materials in the history of man are treasured up in India and in India only".

Swami Vivekananda said, *" Like the gentle dew that falls unseen and yet brings into blossom the fairest of roses has been the contribution of India to the thought of the world. Here is the life giving water with which must be quenched the burning fire of materialism, which is burning the core of the hearts of millions in other lands"*

So, as true patriotic Indians it is our duty to preserve, propagate and assimilate these unseen blossoms, the wisdom of India in all spheres of life. Samskrita Sangha has been aptly organising lectures by eminent scholars, on various aspects of science, medicines and technology as found in ancient India. There are various study circles viz. Astrology, Yoga, Bimana Shastra, various other sciences in Vedic literature and so on. On seeing such topics as palmistry and astrology being discussed by scientists, engineers of a premier institute like IISc., Bangalore, it is natural that many rationalists would find it difficult to appreciate, but it is to be noted that the study group kept an open mind having no aptitude to submit to any fashionable slogan of rationalism, nor to be swayed away by fanatic dogmas and beliefs.

Science deals with the relationship between cause and effect of any phenomenon through experiment / minute study and observation; and any theory is developed based on the truth obtained. From that view point, even 'Bhagavad Geeta' is a science[2-6], the science of personality integration—physical, mental and intellectual level; 'Grammar' is a science of language, 'Music' is a science of harmonic tone and so on. Now-a-days we talk about political science, social science. Similarly Veda, Vedanga and 64 Kalas are all sciences. Traditionally recognised 14 knowledge of learning are given in the sloka[7,8a,b]:

"Angaani (sat) Vedashchatvaaro Meemaamsaa Nyayavistarah, Puraanam Dharma Shaastram cha Vidyaahetaashchaturdasha"

Four Principal Vedas viz. Rig-, Sama-, Yajur-, Atharva – vedas + 6 Vedangas viz.(i) Shiksha (the science of phonetics), (ii) Kalpa (consisting of code of rituals i.e. Shrouta Sutras, Rule of domestic ceremonies (Grihya Sutras) and Principles of Law (Dharma Sutras) (iii) Vyakarana (grammer), (iv) Nirukta (Etymology), (v) Chhandas (Metre) and (vi) Jyotisha + 4 Secondary Vedas viz. Gandharvaveda, Ayurveda, Dhanurveda and Artha Sastra + 64 Kalas i.e. those arts which are needed for social harmony, peace and happiness in life e.g. Sangeet Shastra, Natya Shastra, Kama Shastra (art of love making), Palmistry etc. and many other occult sciences.

The present article highlights some remarkable contributions of the ancient Indians in positive and occult sciences primarily based on the work done by Samskrita Sangha, IISc. Bangalore.

2.0 CONTRIBUTION OF ANCIENT INDIANS IN VARIOUS FIELDS OF SCIENCES

Ancient India has immensely contributed to the civilisation of human race by laying foundation to the following important disciplines: (i) Philosophy, (ii) Phonetics, linguistics, grammar, (iii) Astronomy (iv) Number Theory (v) Life Science (Ayurveda and Yoga). Apart from these, there are contributions in almost all other fields encountered in a social life e.g. Arthashastra, Neetishastra, Sangeet, Natyashastra Kamashastra, Vastushastra, Architecture, Sculpture, Archery, Chemistry, Metallurgy etc. Each topic is vast. Covering all the aspects is beyond the scope of this paper. In the following section a glimpse of science in ancient India is given in brief.

2.1 MATHEMATICS

Finding remarkable contribution in mathematics, A.L. Basham wrote in 'The Wonder That was India',

"The debt of Western world to India in the field of mathematics cannot be over estimated. Most of the great discoveries and inventions of which Europe is so proud would have been impossible without a developed system of Mathematics in India, and this in turn would have been impossible if Europe had been shackled by the unwieldy system of Roman Numerals. The unknown man who discovered the new system was from the world's point of view after Buddha, the most important son of India".

The most important numerical figures and the decimal systems were invented by Indians only, who were the teachers of Arabs in Arithmetic and Algebra. The Europeans got this knowledge from Indians via Arabians. Alberuni wrote,

" I have studied the names of the orders of the numbers in various languages with all kinds of people with whom I have been in contact and have found that no Nation goes beyond the thousand. The Arabians too, stop with the thousand. Those , however, who go beyond the thousand in their numeral system, are the Hindus. They extend the names of the order of numbers up to 18th digit. The 18th order is called Paraardha i.e. half of the heaven, or more accurately the half of that which is above."

In Vedanga Jyotisha, mathematics is considered to be the most pre-eminent and essential science:

" Yathaa shikhaa mayuraanaam naagaanaam manayo yathaa, tadvadvedaanga Shaastraanaam Ganitam Moordhanisthitam"

As the crest on the heads of peacocks, as the gems on the hoods of serpents, so is mathematics (to be reconed) at the crown of the sciences known as Vedanga.

Ancient people were engrossed in the studies of stars and planets out of curiosity. In fact calculations of the movements of the celestial beings and working out their positions gave birth to the science of mathematics. It is well known that the development of number theory was an outcome of the development of astronomy in ancient India and most results in number theory formed part of the treatises in Astronomy. The development in number theory have been so significant, vital and revolutionary, one can say that without these the art of digital computation, as we know to-day, would not have existed at all. These fundamental contributions can be put together as follows[9-12].

A. The development of place value notation and consistent definition of zero
B. Arithmetic algorithms –square rooting
C. Arithmetic error- detection and correction
D. Continued fraction expansion and the solution of equation in integers
E. Quadratic equations – Pell's equation.

Although some of these fundamental contributions listed above seem to have evolved as early as 500BC, intense developments are attributed to the four outstanding mathematicians of India during the following periods: **Aryabhata**- 476 AD, **Brahma Gupta** – 600 AD; **Mahavirachariya** – 800 AD and **Bhaskaracharya** – 1100AD. Aryabhatta gave the formula for the sum of natural numbers, their squares, cubes etc. He had a great insight in Trigonometry and computed the trigonometric ratios such as Sin, Cos etc., to two or three decimal accuracy. Brahma Gupta was the first to propose a solution for the diophantine equation (or equations whose solutions are integers). Bhaskara gave us the formula for the manipulation of zero including $a/0 = \text{infinity}$, $a \pm 0 = a$, $0^2 = 0$, $v0 = 0$.

Mahavirachariya wrote Ganitasara Sangraha dealing with geometrical progression. The construction of alters according to the strict rules in different shapes for various sacrifices made geometry a part of Brahmanical rite.

Place value notation: It is one of the fundamental contributions_for integers which simultaneously led to a consistent definition of zero and a fixed alphabet system for number representation. According to Bernal,

"This technical device had almost the same effect on arithmetic as the discovery of the alphabet on writing; before that arithmetic was a mystery".

That a definite or infinite sequence of these basic symbols could represent any number is indeed a remarkable discovery! Apart from this, this notation turned out to be the most compact, precise and the most suited representation for the mechanisation of the arithmetic algorithms.

Arithmetic algorithms: These are wonderful inventions. These algorithms used to be carried out on a special device called 'Dust Abacus' **(Dhuli Karma)** and so these were so designed that the result can replace one of the operands. This laid the basis for the modern digital computer with a single address accumulator. Also the algorithms for subtraction was based on the complement notation for negative numbers which is currently used in digital computers.

Error checking: The fact that the intermediate steps in a long sequence of operation were erased on the various forms of Dhuli Karma made it impossible to review the work. It was therefore necessary to devise simple checks to determine the probable accuracy of a result. The inverse operation was generally too long and hence other methods known as '**Modulo checks**' were developed. It is a forerunner for the modern developments in coding theory for error correction and detection. In fact, the present day 'Parity-bit-concept' used in the digital computer was derived from this idea.

Solution of diaphantine equation: The solutions of equations of the form $ma - nb = 1$ where m and n are known integers and a and b are unknown integers, posed a problem for many centuries. It was a brilliant Indian discovery that linked the apparently unrelated problem such as the solution of a diophantine system with the continued fraction expansion of m/n (and its convergent) in a beautiful way. In fact the last but one convergent of the continued fraction expansion of m/n (m, n relatively prime) gives one of the solution and the other solutions are derived from this. For example, $127a - 24b = 1$ has a solution $a = 7$, $b = 37$ as may be seen from the expansion $127/24 = [5 + 1/\{3 + 1/(2 + 1/3)\}]$ whose last but one convergent is 37/7. The theory of continued fractions is an important milestone in many areas of modern mathematical analysis and the theory of approximation.

Solution of Quadratic equation: The solution of quadratic equations were seem to be known as early as 500 B.C. **Sulba Sutra** which is a part of Shrouta Sutra dealing with geometry. **Sridharacharya** propounded the quadratic equation. The solution of the quadratic equation $x^2 + px = q$ is given as $x = v\{(1/4)p^2 - q\} - (1/2)p$. Besides this, the solution of diophantine equation (Pell's equation) of the form $x^2 - D^2y^2 = 1$ was known to Brahma Gupta. In fact he remarks that a person who can within a year solve the equation $x^2 - 92y^2 = 1$ is a mathematician. Solution is x=1151, y=120. All these reveal the very high standard of mathematics in ancient India and how much importance was laid on pure mathematics and related sciences.

Arithmetical mode of expression in the Vedas

Numbers are expressed in additive method. For example, *"Treeni Shataa treesahasraani tringshachcha nava cha* = 3339 (Rigveda X, 52,6)

Vedic reference to fractions

"Sahasrasheersa purushah sahasraakshah sahasrapaat, paado asya vishva bhutaani tripaadasyaamritam divi" (Rigveda X,90, 4). .

We can trace the knowledge of fractions as far back as the Vedic period. In Rigveda (X,90,4) we find one term called Tripada' in the Maitrayani Samhita (III, 77) the term Kala (1/16), Kustha (1/12), Pada (1/4), Sapha (1/8). The word Kala has been frequently used in the Sulba Sutra to denote fraction.

Bhaskaracharya's Leelavati and Wonders of Numbers[13]

In the year 1172 AD the great mathematician Bhaskaracharya in his two sections **Leelavati and Bijganita** of his work 'Siddhanata Siromani' made some lasting contributions to Indian Mathematics. This also contains two other sections Grahaganitam and golah. Bhaskaracharya constructed **Magic Squares** from the following sloka (in magic square, numbers added up both horizontally and vertically should be same):

"Vaanchhaa kritaardham kritamekaheenam dvayanke grahe sodasha sapta naageh, tithou dishaayaam prathame cha koshte dvi sapta sat tri asta ku veda vaanah" —(Bhaskaracharya).

Suppose we want a magic square of 100, according to the sloka, the 2nd house will be filled up by (100/2) – 1 = 49, 10th house by 48 (less by one than the previous number). Each successive house mentioned in the sloka has to be filled up by successive decreasing number starting from 2nd house number. The remaining eight houses (3rd to 6th and 11th to 14th counted from left hand corner) to be filled up by the numbers mentioned in the sloka, sequentially. Thus the magic square of 100 is as follows:

42	49	2	7	100
6	3	46	45	100
48	43	8	1	100
4	5	44	47	100
100	100	100	100	

The above rule is valid for even numbers. The following sloka is valid for both odd and even numbers.
"Astaika Shunyam dasha rudra shunyam, chatvaari pancha dvigu sapta nandaa, shunyadvayam dvaadasha sat trayancha, istaanka panktim munayovadanti"
(Rudra = 11, Nanda =9).

2.2 ASTROLOGY AND ASTRONOMY

The movements of the stars and planets were studied from very early period and their influence on the weather, the plant life and human life were also recognised and studied. They have seen that in the new moon and full moon there is tide or ebb, they have also observed the change of animal behaviour in those days. So they have developed the shastra called Astrology that reveals the past, present and future of man by means of astronomical positions of some specific stars (called 27 Nakshatras) and planets at the time and place of birth. The astrologers need the positions of what is known as Ascendant or Lagna which is the sign of zodiac rising in the eastern horizon and the position of the planet at the time and place of birth. It is also necessary to know which planet is more influential in particular time of interest. According to Vimshottari dasha's system, it is assumed that the most man's life lasts for 120 years and the period is divided into nine parts viz. Sun 6, Mars 7, Ketu 7, Moon 10, Mercury 17, Rahu 18, Satern 19 and Uranus 20 years,. At the moment of birth the period of any of these planets operate, depending upon the Janma Nakshatra. These positions should be astronomically correct for accurate prediction. In this sense, Astrology has the scientific basis. Till now there is controversy whether astrology is a science or not. To say that Astrology has a scientific basis is totally different from saying that Astrology is a science. Astrology is not a science like chemistry or physics. The stars and planets of Astrology are only significators. Scientifically one may be able to accurately map the heaven, but prediction depends upon one's experience, wisdom and intuition, although there are some thumb rules based on the individual's astronomical data. So the readings are likely to be different from Astrologer to Astrologer. Further research is needed to get scientifically accurate predictions. Since ancient Indian Astrologers had enough wisdom and experience, they flourished in this shastra at that time.

Astrology has another basis [14] . Indians believe that there is a profound philosophy in it entailing the **Law of Karma** It operates with the precision and uniformity with the law of science. Much of the criticism on Astrology can be traced to a complete ignorance or a misunderstanding of the operation of this law of Karma. Karma means efforts, action, act, work. Even thought is a Karma. It has an effect on the quality of mind (chitta) or samskara. Every event, every experience, has a cause behind it. Destiny is moral power generated by man's own thoughts and actions (Karma) and it is, therefore, man's own creation. Destiny will be pursuing him wherever he goes, like a shadow, birth after birth, with a view to reward or punish him as per his Karma. Astrology claims to interpret an individual's whole destiny by means of map of the heavens at the time and place of birth. Every man has likes and dislikes, he has strongly developed tendency, attraction and repulsion. All these are collectively called as Buddhi (intellect) and this is dependent on or indicative of his Karma. Man has thus bound himself by this (seemingly) never-ending chain of cause and effect. Is there an end to this bondage? Definitely yes, but this discussion is beyond the scope of this paper.

Rationale of Astrology[14-16] is based on the Rasi Chakra i.e. Zodiac. This is divided into 12 parts. Each part is known as Rasi which is a group of stars or a constellation. Each Rasi is supposed to have certain characteristics and to represent certain cultural types. Accordingly there are 12 houses of the horoscope, each house connoting certain departments of life and experience. For instance, the 1st house (whose mid-point is Lagna) represents the body, mind, health, character, culture etc., while the 2nd house represents finance, eye-sight, family affairs etc. There are 11 planets those are assigned certain characters and functions. Their jurisdiction over the affairs of life is also defined. These factors constitute the basic astrological data. The choice of these data may be the result

of spiritual intuitions and realisations of the saints and sages who gathered this knowledge through intuition and experience. In any case the reasons for these attributes are not found in any literature. This is a matter of further research. On the basis of these data, detailed instructions are given as to how to make use of these data for purposes of prediction. There is need for great care in collecting, collating, analysing and weighing the evidence and coming to conclusions.

Different facets of Astrology[15]: Astrology dealing with (i) the judgement of individual horoscope, (ii) results of transits of planets, (iii) prediction of annual chart, (iv) marriage agreement and muhurta or electoral purpose, (v) mundane astrology to predict general events like wars, revolutions, floods and incidents which directly affect a state or organisation, (vi) horary astrology answers the questions of human life in the light of planetary events, (vii) medical astrology, (viii) astrology in every day life etc.

In Astrology, true positions of the planets are necessary. Sputanirnaya-Tantra deals with the astronomical computation, to wit, the accurate determination (nirnaya) of the true positions (sphuta) of the planets. The author **Achyuta** (A.D. 1550-1620) was an astute astronomer hailing from Kerala in South India. He was a versatile scholar and original thinker on astronomy who enunciated , for the forst time in Indian astronomy, the correction called "Reduction to the ecliptic", composed in 1593, and later explained its rationale in another work "Rasigolasphutaneeti", composed specially for that purpose. The sphutanirnaya belongs to that class of astronomical texts called Tantra, which are charcaterised by the enunciation of the planetary revolutions etc. in terms of the aeon (yuga) and the commencement of the calculations from the beginning of the current Kali-yuga[17]. The other two types of astronomical texts , the Siddhanta-s commence their calculations from the beginning of the kalpa (which is equal to one thousand chaturyuga), while the Karana texts take as starting point any convenient current date, for which the true positions of the planets have been accurately calculated for use as zero positions.

Aryabhata (born at Kusumpura in 476 A.D.) was the earliest of the Indian Astronomers whose works have been preserved. 33 stanzas of his book are on mathematics while others are astronomical in content. He wrote Aryabhatiyam in 499 A.D. He says that the earth is sphere and it rotates around its own axis. He also had a correct conception of eclipse[18] . His stanzas on mathematics show considerable progress of the Indians in that field. It is good that the Indian Government has launched a satellite in his name called "Aryabhata".

Varahamihira was the greatest authority in Indian Astronomy and Astrology. His great work Pancha Siddhantika gives an account of the five schools of Astronomy viz. Paitamaha Siddhanata; Romaka Siddhanata, Pailisha Siddhanta, Surya Siddhanata and Vasistha Siddhanta The most accurate among these is Surya Siddhanata. The Brihad Jatakam of Varahamihira populrly known as Hora is an authoritative work on Astrology. He is also the author of Brihad Vivaha Patalam about marriage and the most outstanding contribution of Varahamihira is his Brihatsamhita in 106 chapters which treats Astrology, Geography, Weather, Characteristic marks on the bodies of men and women and many such things.

As regards Astrology and Astronomy the ancient Indians attained some progress independently, but soon they came under the influence of Greek Astronomy and Astrology. In the matter of Astrology, Varahamihira often referred to the views of Greeks. He mentioned **Asita, Devala, Garga, Vriddha Garga , Narada, Parashara** as the early Astronomers but their works are available only in fragments. Saravalee, Phaladeepika, Jatakadesha, Jatachandrika, Brihat Parashariyam etc. are some of the popular works on Predictive Astrology. Garga Samhita was known to the Greeks who came, along with Alexander but it is now lost for us, having probably been carried away by the Greeks. **Prithuyasha, son of Varahamihira** is the author of Hora Satpanchashhika which along with the works of his father has been commented upon by Bhattopala of 10th century A.D. Palmistry and Prashanamargaha began to develop as two independent branches of Astrology from 12th century onwards. They are used for predictions of future but its scientific authenticity is still under investigation.

Astrology is a vast subject, which is not possible to cover here. It is also controversial to many. But ancient seers had lot of demand in King's palaces to advise them in various matters. Probably in those days Astrologers were not money mongering as of to-day and they had sufficient wisdom to predict accurately.There is a famous saying about Astrology, " Fools obey planets while wise men control them". For further information readers are advised to go through the astrological texts[16].

2.3.PHYSICS & COSMOLOGY

2.3.1 Velocity of Light[19]

The velocity of light, as given in the Bhashya of Sayanacharya on Rigveda 1/50-54 is given thus:

"Yojanaanaam shahasre dve dve cha yojane, ekena nimisaardhena kramamaano namohstute"

The sun's rays travel 2202 yojans in half a nimisa. Now a nimisa as calculated from srimad Bhagavat 3-11-5-8, is 16/75 second, while a yojana = 16,000 yards = 9.09 miles. In other words, light travels 2202 X 9.09 miles in 8/75 seconds, from which the velocity of light = 1,87,670 miles per second which is very close to the value found by modern science. i.e. 1,86,000 miles per second.

2.3.2 The Age of the Earth

The problem of determining the age of the Earth is one which attracted the attention of men for thousands of years. Attempts have been made to solve the problem by various methods- physical, astronomical, geological and historical— all of which give conflicting results. Even at the beginning of the present century the problem seemed to these scientists to be reconciliation of these estimates (1) by physical method of Lord Kelvin gave the age as 20-40 millions (2) G.H. Darwin's astronomical method based on the rate of accumulation of sodium in the oceans of the world gave 80-90 millions. Historical estimate gave only 5-10 thousand years[20].

So the statement of the Hindu Shastras that the present creation dates about 200 crore years back, was looked upon with

ridicule and was pointed out as an instance on ' the attempt of Hindus to exaggerate periods of chronology'. The discovery of radioactivity had cut at the very root of previous scientific calculations and a new method of determination based on the disintegration of atoms were adopted. The evidence of radio active elements is now considered the most trustworthy of all the methods. This indicates the age of the Earth to be 2000 million years, which was already mentioned in Hindu Shastras, while Prof. Harold Urey over shot the mark and estimated 3,000 million years.

2.3.3 Creation of the Universe

Among the different physical phenomena, the question of the creation of universe stirred the mind of Vedic sages since the time immemorial. Vedic view is— creation proceeded according to an order called "Satya" and a law called "Rita". This universal law and order govern change. According to the laws of Manu 'The ether engenders the atmosphere, the atmosphere transforming itself engenders light, the atmosphere and light giving rise to heat produce water, and water is the mother of all creatures says Maeterlink in "The Great Secret". The vedic view is in perfect agreement with what Prof. George Gamow observes that the word creation is not in the sense of making something out of nothing but rather as making something shapely out of shapelessness. Something cannot be created out of nothing, *"Naasate vidyate bhavah"*. Scientifically speaking, there is no such thing as creation, it is manifestation and we understand the significance of this as we follow the description of creation as offered by Rigveda (X, 129), the most sublime hymn in the entire vedic revelation. The Nasadeeya Sukta in the Rigveda 10th Mandal and 129th hymn comes closest to explicating the process of manifestation and expansion. It holds that there was primordial chaos in the beginning, there was neither Asat (the manifested cosmos) nor sat (the first stage of material evolution from priomordial matter), nor were there nabulae, nor the sky beyond them,

"Na Asad aaseet na Sad aaseet tadaaneem na aseed rajo na vyomaa paroyat"

What did then exist?

The Vedic Sages answered "There was something which covered all, like a haze involved in huze and unbounded collapse. There was no death, nor immortal like, there was no night nor day. God alone himself breathed by His own inherent might although no wind existed"

"Kimaavariva kuhakasya sharman, ambhah kimaasidgahanam gabheeram; na mrityuraaseedamritam na tarhi, na raatraa ahna aaseet praketah, aaneedavatam svadhaaya tadekam tasyadhyanyanna prah kim cha naasa"

Lot of scientific information particularly on the subjects of creation of the universe has been dealt in many puranas (written in Sutra period 800 – 200 BC according to Tilaka) viz. Padmapurana, Vishnupurana, Brahmavaivarta purana, Markandeya purana, Bhagavat purana etc. At the end of the Kalpa, the self illuminous Lord manifested the total universe which was enveloped by blinding darkness wrought by time, through his self illuminating power—Bhagavata Purana,

"Kalpaante kaalasristena yo andhena tamasaavritam, abhivyaanak jagadeedam svayam rochih svarochisa"

The expansion and contraction theory of the universe was stated by Dutch Astronomer De Sitter. Yajurveda also (XL,1) says the universe is expanding and contracting and is continuously in motion..

Various theories of creation, relationship between animate and inanimate objects as given in Mundaka, Svetasvatara and other Upanisads has been elaborately discussed by R.D. Ranade[21].

2.4 CHEMISTRY[22] AND METALLURGY[19,23]

Since the time immemorial **Chemistry** has been looked upon as a practical art and was cultivated by all the people of ancient world. India was one of the industrial workshops of the world for the supply of a variety of chemicals and industrial products up to the 17th century viz. up to the time of industrial revolution in the Western world. India was looked to even by Imperial Rome as the most skilled of the Nations in such chemical industries as dying, tanning, soap making, glass and cement. By the sixteenth century A.D. Indians were far ahead of Europe in **industrial chemistry**. They were masters of calcination, distillation, streaming, sublimation, fixation, the preparation of metallic salts, compounds and alloys. The tempering of steel was brought to perfection unknown in Europe till the middle of 19th century A.D. Every one knew about the chemical excellence of cast iron produced in ancient India.

The use of chemicals for medical treatment was extensibly practised in India.
Vedic texts on chemistry reveal that gold, silver, copper and iron were frequently used in medicines. Copper was known as lohitayasa i.e. red metal; gold as harita i.e. yellow metal; silver as rajat i.e. white metal. Atharva veda XVIII, 13 makes references to these metals as they were used for the fulfilment of sacrifices:

The **preparation of Bhasma** in which the metal mineral is subjected to refinement and differential thermal analysis is an old feat of Hindu chemistry. The red hot metal is plunged into liquids like buttermilk, sour gruel, cow's urine or seasamum. Later, the metal is killed, and converted to ashes, to be used as medicinal tonic. Such a Bhasma confirms to the following tests:
a) Nishchandra, Katava—there should be no shining particles left, to be examined with the naked eye.
b) Rekhapurnatva—the test is conducted by rubbing the powdered mineral between the thumb and the finger; it should enter the fine lines on the thumb and the finger
c) Varitaram—the chemist should see that the powder floats on the surface when sprinkled in water
d) Colour test—the chemical expert should ensure that the powder yields the following colours: Gold—like that of champak flower; Silver – black, Bull metal – light blue colour as of tag, Bead—like that of a pigeon, Tin- white, iron—like that of a Jambu fruit, Mica- Brick colour. The above mentioned four tests are physical tests.
Of the chemical tests, the most important is the Apurnarbhava test which implies that the powder which when heated with jaggery, powdered seeds of Abrus, Precatorious, Borax,

Honey and Ghee, does not get converted in to the original substance. The colour of flames as a help to diagnose metals was well known in India long before the knowledge spread in Europe.

A regular **science of mercury** was developed as a branch of chemistry in ancient India. Iron and mercury was developed as a branch of chemistry in ancient India. Iron and mercury are mentioned as aphrodisiacs and tonics by Varahamihira (587 AD). There were several preparations of Fe, Cu, Hg and other metals which were utilised in medicine. Knowledge of practical chemistry came to an end climax in 12th century AD.

The metallurgical skill of the ancient sages is evident in a passage of Chhandogya Upanisad. In which the qualifications of Brahma the supervision of the sacrifice are enumerated:
"Tadyathaa lavanena subarna sang dadhyaat suvarnena rajatang, rajatena trapu, trapunaa seesang, seesena lohaa, lohena daaru, daarung charmanaa.

Yajurveda XVIII, 13 makes reference to gold, iron, lead,
"Hiranyam cha me ayashcha me shyaamam cha me lohashcha me seesam cha me trapu cha me yajnena kalpataam"

As gold is corrected by borax, silver by gold, tin by silver, and lead by tin, as iron by lead and wood by iron or leather, so both the majesty of these regions of these gods and of these three systems of knowledge, correct the improprieties of the sacrifice.

Visitors have frequently admired the art of Indian metallurgy. Megasthenes commented that Indians were well skilled in the arts. More recently, Fergussion, speaking of the Ashoka Pillar at the Kutub Minar, Delhi was amazed to find the Hindus at that age capable of forging a bar of iron larger than any that have been forged even in Europe up to a very late date and not frequently even now. It is almost equally startling to find that after an exposure to wind and rain for more than 14 centuries, it is not rusted, and the capital and inscription are as clear and as sharp now as they were then.

2.5. YOGA AND SCIENCE OF LOVE[24]

Maharshi Patanjali (3rd century B.C.) was the pioneer in writing Yoga Sutras. Later on Yoga Sutra Bhasyam was written by Vyasa and commented by Vachaspati Mishra of 9th century A.D. There are many other works in this field of yogic science. Patanjali presented a model of yoga known as Astanga yoga covering most of the aspects of yogic life. The eight constituents of yoga are like eight steps of a ladder e.g. 1. Yama (restraints), 2. Niyama (observances), 3. Asanas (physical postures), 4.Pranayams (control of vital airs), 5.Pratyahara (withdrawal of the senses), 6. Dharana (concentration), 7. Dhyana (meditation) and 8. Samadhi (super consciousness). One has to ascend one by one. Any yoga text deals with the methodologies, and so they are not discussed here.

Yoga is a science. It deals with the inter relationship among the body, mind and behavioural aspect of daily life i.e. the food we take, the activity we do etc. Once upon a time this was also thought to be an occult science, but recent investigations here and abroad have removed this misconception. Lot of scientific researches are being done by Vivekananda Kendra (at Kanyakumari and Bangalore) and many other spiritual centres in India and abroad on various applications and scientific aspects of yoga. So details are not given here. Interested persons can contact these organisations.
Only two very important aspects of yoga are dealt here which are generally neglected by people.

The first two parts of Astanga Yoga i.e. Yama and Niyama occupy an important position as per every school of philosophy or religion. If one observes only these two, will certainly get some benefit. There are five parts of Yamas and five parts of Niyamas. Non-violence, truthfulness, non stealing, celibacy and non-covetousness are five Yamas. Purity, self contentment, austerity, study of scriptures and worship of God are five Niyamas. Mahatma Gandhi strictly followed these principles in life. It will not be out of the place to discuss some salient points on this for the benefit of the spiritual seeker. He prescribed eleven commandments[25] i.e.Vratas for self purification and fruitfulness of this life viz.,

(i) Satya : There are 3 kinds of untruth:
1st kind—during fun, jokes and non-serious discussions some people make some false utterances some time
2nd kind—in worldly dealings some people make false statements.
3rd kind—untruth practised for the interest of others.
(ii) Ahimsa —non-violence: 2 kinds, 1st is for defence and the 2nd is for offence
(iii) Brahmacharya i.e. complete control of the sensory organs.
(iv) Asteya i.e. non –stealing ; in broad sense it this practice does not allow enjoying food, clothes etc. without participating in production process and giving away part of it to others.
(v) Aparigraha. This practice expects one to constantly think and identify the things without which one can live and avoid their use. Stocking of things beyond one's immediate needs for living is also prohibited as per this Vrata.
This makes life simpler and simpler.
(vi) Abhaya — fearlessness, required for any Vrata. One should not be afraid of anybody—king, government, public, thief, boss or even death , when one is selfless and has conviction of one's character. One should be able to defend oneself and others in the true spirit of a Satyagrahi.
(vii) Aswada - controlling one's tongue. Over eating brings about disease, loss of intellect, drowsiness etc.; similarly no intake of food also weakens the body and memory both. Yoga has stressed upon less but quality food for purity of body and mind.
(viii) Swadeshi— complete self reliance.
(ix) Sharira parishrama —physical work is required for survival
(x) Sparshabhavana —untouchablity is considered as sin.
(xi)Sarvadharma-samabhava —practising of secularism.
Gandhiji's biggest programme was renunciation that is related to the above factors.

Love in ancient India was a science and an art. **Will Durant** said, *"Kamasutra is the most famous in a long list of works revealing a certain pre-occupation with the physical and mental techniques of sex"*.

Ancient seers prescribed four objectives of life viz. Dharma, Artha, Kama, Moksha. **Vatsayana** said, "Unfolding success

awaits that prudent and wise man or woman who after thoroughly learning the sexual science pays due attention to Dharma and Artha ans also practises Kama without indulging in excess, and who applies the principles of this science in an appropriate manner". The greatest work that has persisted against the onslaught of time is the Kama Sutra written by sage Vatsayana (3rd century A.D). He wrote Kama sutra while leading the life of contemplation and meditation perhaps while at Benaras. Man and woman are both desirous of enjoyments of coitus; both have this enjoyment as their ultimate goal. Since woman is the centre of sexual enjoyments, therefore this shastra deals with the subject of woman's goal of sexual pleasures. Sages of the olden days did not consider it immoral to write and preach on sex and love. They gave the earnest attention to this socially important theme, because they realised that without proper art and proper control of sex , it is not possible to get good child and make them glorious. Child marriage was prevalent in those days. So the art was shown publicly on the temples.

According to Vatsayana, kama is the enjoyment of appropriate objects by the five senses of hearing, touching, seeing, tasting and smelling assisted by the mind together with the soul. The ingredient in this is a peculiar contact between the organs of sense and its object, and the consciousness of pleasures which arises
from that contact which is called kama. Vatsayana has incorporated in his work
the various schools of thought scientifically and meticulously. Covering the entire spectrum of love- making the classification of males and females according to their passion and build, the various possibilities in love making and sexual union for greater joy and satisfaction, the instruments of love making, the psychology of sex and the role of a wife and courtesan. Sex is a peephole on universal experiences. A man and a woman in a sexual congress are like clashing of two comets in the sky which give birth to a new star. According to **Justice Khosla**, " Sexual experience is closely connected with spiritual realisation". **Bhagavan Rajanis** (Osho) also opines this and followed this principle in attaining highest bliss. Tantra also supports this view. Pleasure of sex must be treated as a perfectly legitimate activity of normal human beings for the sake of creation of progeny. On the other hand, man must rise higher from sexual congress to an association of ideas with the universe.

Man is after all an animal and it is only natural for him to have that urge for procreation. As a matter of fact this procreation is the quality of life and nature has placed this biological urge or desire for progeny as the fundamental cause of life. By an ideal union between husband and wife, the conscious minds of both rise from the biological urge to the enlightened sphere of intellect. Due to excess union, women suffer from stubborn constipation which creates many disease in the female body and men take on giddiness on slight exposure to the sun, catch cold at slight exposure to cold and gasp for breath just walking only couple of kilometres. Unbridled sex hunger brings about more harm and loss in men than in women. The body resistance against disease is depleted as a result of unrestricted waste of semen.
By practising various techniques of Astanga Yoga men and women can win over the disease of uncontrolled sex hunger and can take the highly pleasurable ablution in the current of divine love by dint of their power of retention. The regular practice of several yogic postures e.g. Vajrasana, Vistrita Pada Vajrasana, Supta Vajrasana, Gomukhasana, Ekpada Shirsasana Janushirasana, along with some pranayams, tones up not only the neuro-muscular structure of organs concerned, but also steadies and rehabilitates the mind as well.

2.6 AYURVEDA[26-28]

The Indian system of medicine had its origin in the Vedic period. **Rudra** is spoken as a doctor of Gods. The **Asvins** are spoken as the physicians who gave eye sight to the blinds and made the lame to walk. The Atharva Veda has sections dealing with health and hygiene and the Puranas and Smritis contain account of medicines.

In ancient India, Ayurveda developed in close association with Dharma Shastras and the systems of philosophy like Sankhya and Yoga. The three qualities of matter Sattah, Rajah and Tamah are closely related to and greatly influenced by the three humours of the body viz. Vayu, Pitta and Kapha.

Charaka wrote the earliest treatise on Ayurveda "Charaka Samhita ".Opinion of his time differs. Indians say he was born in 3rd century BC. Buddists record says he belonged to 1st century A.D. during Kanishka. Charaka Samhita consists of eight parts and has thirty chapters in the form of prose and verse. It was translated into Persian and Arabic in the early period of the Christian era. Apart from the great contribution of Charaka to Ayurveda, it is said that the sages **Atreya, Kashyapa, Hareetaha, Agniveshaha and Belaha** wrote texts on Ayurveda but their works are now lost. According to Charaka samhita, **Punarvasu**, one of the many sages who studied Ayurveda under Bharadwaja Rishi, imparted the knowledge of that science to his disciples among whom one was Agnivesha who taught it to Charaka. Almost all the text books on Ayurveda speak of **Atreyapunarvasu** as the formulator of the system. The Buddhists' record show that the physician Atreya lived in Taxila before the birth of Gautam Buddha. Among the many works on Ayurveda, mention may be made of Rugvinishchaya of **Madhavakara** of 8th century A.D. which is also known as Madhavanidanam Siddhiyoga on the treatments of animals, birds and trees. **Surapala**'s Vrikshayurveda , **Narayana's** Matangleela, dealing with the diseases of elephants, the asvayurveda of Ganga and Asvachikitsa of Jaya Dutta and nakula are some of them. The Rajanighandu of Narajhari and Dhanvantarinighantu of unknown author are some of the Nighantus in the subject of medicine. Nagarjuna of uncertain date is the author of a treatise on ayurveda called Yogasarah. The chineese pilgrim **Hieuen Tsang** refers one **Nagarjuna** who was an authority on medicine and chemistry. He is said to have written a book on Metallic preparations of Mercury and iron. That work is called Rasaratnakara. **Sushruta** is the author of Sushruta Samhita which stresses the importance of surgery. He speaks of surgical instruments and surgical operations for the first time in India. His fame spread to foreign land in 9th century A.D. **Vagbhata** was the author of the most popular and authoritative treatise on Ayurveda called Astanga Hridaya. He was also the author of Astanga Sangraha.

Ayurveda is spoken as having 8 parts:

1. Shalya – surgery and midwifery
2. Shalakya – disease of the eyes, ears and other parts

of the head 3. Kayachikitsa —treating the bodily ailments with medicines 4. Bhutavidya—psychotherapy

5. Kumarabhritya—treatment and rearing up of children, 6. Agam—antidots,

7. Rasayanatantra—Elixirs, 8. Vajeekarana—Rejuvenation.

Bagbhata's book contains the above.

2.7 ARCHITECTURE[29] AND VASTUSHASTRA[30-31a,b]

Indian temple architecture is famous in the world. It is based on certain philosophy. To appreciate and enjoy any temple, it is necessary to have a basic knowledge of the religious beliefs of the people. Indians believe in the existence of an omnipotent power (Nirguna Brahman) devoid of any material, visible aspect (Guna). Realisation of this invisible power is possible through meditation; but it was found beyond the reach of the common people. To follow this disciplining the mind. The Hindus, therefore, conceived of some tangible Gods and Goddesses. These are the Saguna Brahman, the power in material form with different characteristics. Coming under this category are the Trinity : Brahma, Vishnu, Shiva and their consorts : Saraswati, Lakshmi and Parvati respectively. With the passage of time, many other Hindu Gods were conceived of like Kumara, Ganesha and others. This concept of Saguna Brahma helped the average man in concentrating his mind on a particular figure through aradhana or worship or nama - sankeertana. In order to give the deities a super- human character, they were also provided with more limbs carrying a variety of weapons.

The Chalukyas who reigned from 6th to 12th century A.D. were the great patrons of arts. They appeared to have built replicas of the temples of the conquered states with a motive to provide them with the raw materials for conceiving their own individualistic school of architecture , e.g. replicas of Aryan side by side with Pallava school at Pattadakal, famous for the simplicity of design, the grandeur of architecture and the intelligent placing of the sculptures. The Chalukyan as a whole did not believe in huge monolithic structures but rather in small, compact, graceful and beautiful temples. The sparseness of adornment, virility of sculptures, plasticity of poses, am most of all, the expressions on the faces of the figures leave an indelible impression. Megutti temple, and Badami caves are important landmarks among thousands of beautiful Chalukyan temples.

Architecture attained a very high stage of development in Ancient India and we have a good literature on the subject. Ramayana speaks of town planning and the construction of places and forts with fort-wall, moats and towers for defence. In Mahabharata, the town of Indraprastha was built according to a very detailed plan. The huge temples of south India, the Stupas, Chaityas and Viharas of the Buddhists and Jains are monuments of Indian Architecture. Along with this there are beautiful paintings in temples and caves of India. Paintings of Ajanta cave rear the testimony to the perfection achieved in this art. There are many references to paintings in classical literature and there is no drama in Sanskrit in which painting is not mentioned. King Bhoja (11th century A.D.) wrote Samarangana Sutradhara. Srikumara wrote Shilparatnam (16th century A.D.), Mayamatam, Sanatkumara, Vastushastram and Manasarah are some of the early works on Architecture and Sculpture. There are also other works such as Manushyalaya Chandrika, Vastumandana, Prasadamandana etc.

Artha Shastra of Kautilya not only discusses the principles of state-crafts i.e. administration and economics[32] but also speaks of yantras in connection with battles and incidentally with architecture also. Details on this aspect is available in reference (33). Research work about the existence of Vimana in ancient India has been done by Samskrita Sangha, IISc, Bangalore which did not show any positive result [34-35].

2.8 GRAMMER AND LINGUISTICS[26]

The science of grammar is the most important supplement of the Vedas. This science is equally important for the study of spoken and literary sanskrit and it has developed as a separate branch of sudy in the post Vedic period. (Vedic period is 6000 B.C. to 600 B.C. as per Tilaka). The grammar of Sanskrit language is so elaborate , accurate, complete and comprehensive that it has become one of the most important and independent branch of learning while in other languages, grammar is treated as a part of their literature.

The great monumental work of Panini (8th century B.C, other opinion 6th century B.C) dealing with systematically and completely with the grammar of the Vedic as well as the spoken Sanskrit perhaps totally eclipsed the earlier works which disappeared in course of time on account of sheer neglect. Panini's Astadhayee is the earliest treatise on Sanskrit grammar that consists of 8 chapters containing about 4000 sutras. He has also written the Dhatupatha which contains a complete list of roots and the Ganapatha which contains group of words that have some common grammatical features. Later on Panini's work was developed by Katyayana also known as Arashruchi Patangali etc. Siddhanta Koumudi was written by Bhattoji Dikshita in the 17th century A.D.

2.9 SCIENCE OF MUSIC

In this section attention is given to present the science of Raga[36] .

Like language, music also has its own grammar. Though the word Sangeeta is found in Ramayana, Mahabharata and Natyashastra (2 B.C to 2 A.D.), the word Raga appears few times first in Natyashastra. It is derived from the dhatu "ranj" meaning tinge (not in the sense of colouring but in the sense that it leaves an impression on the minds of living beings). A Raga is not just a melodic pattern generated by permutations and combinations of the swaras. Following sloka defines Raga:

"Yo ayam dhvanivishesastu svaravarnavibhusitah, ranjako janachittaanaam sa raagah kathyate budhaih"

The sound waves which are decorated with swaras and varnas and rejoice the heart of the listeners, is called Raga by the learned men.

Swaras originate from the vibrations that evolves from the vital air or prana vayu coming in contact with the different

internal parts of the body. These notes are 7 in numbers e.g. Sadaja, Risabha, Gandhara, Madhyama, Panchama, Dhaivata, Nisada and Sadaja again. In Mardukisiksha, the origin of swaras has been described by the following verse:

"Kanthaat uttisthate sadaj, risabha shirasaastathaa, nasikaayastu gaandhaarah uraso madhyamastatha. Urah shirobhyaam kanthachha panchamah svara uchyate, dhaivatashcha lalaata dvai nishaadah sarvarupavan"

The note sadaja is born when the vital air is in friction with throat; risabha emanates from the seat of the head, gandhara from the nose etc.
It is interesting to note that Naradisiksha (1 A.D.) has mentioned the couplets like 'Sadajam vadati manyuro' etc. meaning, the seven swaras are associated with the call of animals as follows: Sadaja—peacock, Risabha- bull, Gandhara—goat, Madhyama—crane, Pancham—cuckoo, Dhaivata—horse, Nisada – elephant.

The seven swaras are also associated with different rasas or emotions. For example, sadaja is associated with valour, furious or amazing, risabha with fearful, gandhara with pathos, mdhyama and panchama with romance or humour.

The notes are of two types—Shuddha (pure) and Vikrita (displaced). Though there was a change in the number of Vikrita Swara from time to time, Pandit Venkatamakhi (1620 A.D.), the well known musicologist, reduced the number of displaced notes to five only. To-day in the modern system of Indian Music, the following notes are followed:
saa, re gaa maa paa dhaa ni saa; and (komal i.e. soft) *re, gaa, dhaa, ni* also *teevra maa* = 12 notes in totality.

Sadaja and Panchama are "achal" i.e. fixed. Risabha, Gandhara, Dhasivata, Nishada—these take a lower tone so are called the "komal' (soft) form of the suddhaswara whereas Madhyama takes a higher tone so is called the teevra (hard) form of the original swara. The names for the vikrita swara differ in Karnataka style and Hindusthani style of music. In Hindusthani Paddhati (style) these are called *Komal Rishabha, Komal Gandhaara, Teevra Madhyamaa, Komal Dhaivata, Komal Nishaada.*

Pandit Venkatmani showed on the basis of mathematical analysis that out of these 12 swaras, seventy two independent combinations of seven swaras can be formed. These are called 'melakartas'. The 72 melakartas published in Chaturdani Prakashika form the basis of origin and determination of Ragas in the Karnataki style. Based on the Venkatamakhi's 72 melakartas, Pandit Bhatkhande (20th century musicologist) prepared thirty two melas of Hindusthani style music. Based on the following rules of mela or thata, he established ten thatas as given in his book "Hindusthani Sangeet Paddhati".

(i) Thata must be sampurna (complete) and must have seven swaras
(ii) The swaras in thata must be in succession
(iii) Thata need not be ranjak
Various other issues of Raga are available in reference (36) and in music texts.

3.0 DISCUSSION

If we analyse the Indian history, we will immediately realise that the Indian intellectual impulse is not confined to philosophy and theology, but extends over logic and grammar, rhetoric and language, medicine and astronomy etc. – in fact all arts and sciences, from architecture to zoology. We find that for Indians, everything useful to life or interesting to mind had been an object of enquiry and criticism. Even such minute as the breeding of horses and the training of elephants had their own shastras and literatures. In fact in the realm of positive science, the actual achievements of India are second to none in the world. Ancient Indians laid the foundations of mathematical and mechanical knowledge. They measured the land, divided the year, mapped out the heavens, traced the course of the sun and the planets through the zodiacal belt, analysed the constitution of matter, and studied the nature of birds and beats, plants and seeds. The invention of Algebra and its application to astronomy and geometry is due to Indians; so is the case with the decimal notation which have rendered untold service to the progress of arithmetical science. In medicine, as in astronomy and metaphysics, the Ancient Indians kept pace with the most enlightened Nations of the world. Little is known that plastic surgery is not a modern achievement. Centuries ago, ancient medico-experts like Dhanvantari, Charaka and Shusruta discovered not merely various medicines of different potencies but also introduced plastic surgery for the handicapped and the wounded soldiers.

It is true that ancient Indians did not invent any great mechanical appliances. For this, the kind nature which gave them the great water courses and Let us also remember that abundant supplies of food, is responsible, for, necessity is the mother of invention. Let us also remember that these mechanical inventions belong, after all, to the 16th century A.D. and after, by which time India had lost her freedom and began parasitic. For millennia however, she could hold her own arts, crafts and industries, not to speak of mathematics, astronomy, chemistry, medicine, surgery and those branches of physical knowledge practised in Ancient times. She knew how to chisel stone, draw pictures, burnish gold, and weave rich fabrics. She developed all arts, fine and industrial, which furnish the conditions of civilised existence.

Although ancient India was a treasure house of every branch of knowledge, a genuine question comes why India could not prosper in those fields later on. Will she prosper again? The reasons may be many. Some probable ones are given below:

1) The 1st and foremost reason seems to be that knowledge preserved in sanskrit language was essentially an exclusive and secret preserve of the priestly or royal communities. The higher form of knowledge was denied to the lower echelons of society. It is a fact that knowledge flourishes only if it is an open mass commodity, rather than remaining a secret class commodity.

2) Secondly, the lack of innovations in science can be attributed among other things to the benevolent climatic conditions that served to maintain the inhabitants in a general state of euphoria: plenty of food and excellent water resources. The ready availability of cheap human labour from the out castes and untouchables would account for the ab-

sence of any effort towards mechanisation. By 16th century A.D., mechanical inventions flourished in Europe and by this time, India has lost her independence and became parasitic, and this situation continues even to-day. The day India lost her freedom and began to flirt with other Nations, she became petrified.

3) Thirdly, the British imposed their science and deliberately destroyed all that is Indian. For example, ancient Indians famous industry manufacturing iron and steel of a quality not attained anywhere in the world was crushed during the British rule when large scale, factory produced iron and Steel began to be dumped in India. The alien British administration in India strangled the indigenous iron and steel industry because of its superior and unique quality not only by discouraging and prohibiting manufacture in several ways but also by systematically destroying all products of ancient manufacture. For example, the British administration ordered the confiscation and destruction of all swords, knives, and weapons in Kerala The war-knives were sent up to the Beypur Iron Works in Bullock carts from Calicut and all were destroyed by melting. Similar destructive action was taken by the British all over India to obliterate from the world's memory ancient Indian expertise in iron and steel manufacture and processing. A similar story could be told about indigo manufacture and all other Industries in India.

Thus came the end of the scientific glory that was India.

The question then is : "Could we revive the glory, can we revitalise the people?" There is no point in simply brooding over the past. But the past has to be preserved for the future. It will have some value only if we can dig out the details from our treasure books and make it useful for the future. An attempt has been done in this present paper. Our people should have true patriotism without any adverse politics among each other. Sanskrit culture should continue all over the country which can unite the India in a better way For that, we should have will to do.

Swami Vivekananda said, *" To succeed, you must have tremendous will 'I will drink the ocean' 'at my will mountains will crumble up'. Have that sort of energy, that sort of will, work hard, and you will reach the goal".*

4.0 CONCLUDING REMARKS

In conclusion, the authors emphatically want to draw the readers' kind attention that there is no branch of human knowledge that has not been dealt in sanskrit literature. The knowledge and culture of a highly civilised and intellectually advanced people inhabiting a vast country from 3000 B.C to about 18th century A.D. has been recorded in this language which is rich and well developed to express any idea in any branch of learning in clear terms. In this short survey the authors have only touched upon some work in some popular branches of learning.

Sanskrit literature is the greatest treasure of India. Foolish people only say that Sanskrit is dead. People from all parts of the world have come to India in search of that treasure in the past and have benefited by it. Knowledge is unlimited, but life is short. So a perspective of the vast knowledge of yore is highlighted here.

Some quotes in praise of India's contribution to the world are given below:

Albert Einstein: "We owe a lot to the Indians, who taught us how to count, without which no worth while scientific discovery could have been made.

Mark Twain: India is the cradle of the human race, the birth place of human speech, the mother of history, the grand mother of legend, and the great grand mother of tradition. Our most valuable and most instructive materials in the history of man are treasured up in India only.

Roman Rolland: If there is one place on the face of the earth where all the dreams of living men have found a home from the very earliest days when man began the dream of existence, it is India.

Hu Shih, former Ambassador of China to USA: India conquered and dominated China for 20 centuries without ever having to send a single soldier across her border.

Facts about India's contribution to the world can be summarised as follows:

1. Sanskrit is the mother of all the European languages. It is the most suitable language for computer soft ware— reports the Forbes Magazine, July 1987.

2. When many cultures were only nomadic forest Dwellers over 500 years ago,
Indians established Harappan culture in Sindhu Valley (Indus Valley Civilization).

3. India never invaded any country in her last 10000 years of history.

4. The world's first university was established in Takshila in 700 BC. Here more
than 10,500 students from all over the world studied more than 60 subjects.

5. The earliest reservoir and dam for irrigation was built in Saurastra. According to
Saka King Rudradaman I 0f 150 CE, a beautiful lake called "Sudarshana" was constructed on the hills of Raivataka during Chandragupta maurya's time.

6. The art of navigation was born in the river Sindh 6000 years ago. The very word " "navigation" is derived from the Sanskrit word "NAVGATI". The woed "Navy" is also derived from Sanskrit "Nou".

7. The University of Nalanda built in the 4th century BC was one of the greatest achievements of ancient India in the field of education.

8. Ayurveda is the earliest school of medicine known to humans. Charaka, the father of medicine consolidated Ayurveda 2500 years ago. To-day Ayurveda is fast gaining place in our civilization.

Shusruta was the father of surgery 2600 years ago. He together with many other health scientists of his time con-

ducted complicated surgeries like delivery by scissoring, artificial limbs, fractures, urinary stones, cataract, and even plastic surgery and brain surgery.. Usage of anaesthesia was well known in ancient India. Over 125 surgical equipment were used. Deep knowledge of Anatomy, Physiology, Embryology, Digestion, Metabolism, Genetics and Immunity was also found in many texts.

9. Although modern images of India often show poverty and lack of development, India was the richest country on earth until the time of British invasion in the early 17th century.

10. According to the Gemological Institute of America, until 1896, India was the only source for diamonds to the world

11. Chess (Shataranja or Ashtapada) was invented in India.

12. India invented the number system. Zero was invented by Aryabhata.. The place value system, the decimal system was developed in India in 100 BC.

Algebra, Trigonometry and calculus came from India. Quadratic equations were formulated by Sridharacharya in the 11th century.

The largest numbers the Greeks and the Romans used were 106 whereas Hindus used numbers as big as 10 ** 53 (10 to the power 53) with specific names as early as 5000 BC during the Vedic period. Even to-day the largest number is Terra 10** 12 (10 to the power 12) only.

The value of ð (pi) was first calculated by Baudhayana, and he explained the concept of what is known as the Pythagorean Theorem. He discovered this in the 6th century long before the European Mathematicians. The basis of computer 'the Abucus' was invented in India.

13. Bhaskaracharya accurately calculated the time taken by the earth to orbit the sun several hundred years before the Astronomer Smart in 5th century. As per his calculation, the time taken by earth to orbit the sun is 365.258756484 days.

14. USA based IEEE has proved what has been a century old suspicion in the world of scientific community that the pioneer of wireless communication was Prof. Jagadish Chandra Bose and not Marconi.

15. The fine art YOGA of keeping the body fit and develop immunity against even dreaded diseases was practised in India during early years. Maharshi Patanjali's Astanga Yoga is well known to-day.

16. Kamasutra, now being accepted of all the basis of the art of sex has its base in India and it was supported well by Khajuraho temple and many other time-destroyed arts.

"All the above is just the tip of the iceberg, the list could be endless" reports a German Magazine which deals with World History.

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