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Swapan Kole

## What makes ancient Indian Contributions unidentified and unrecorded worldwide

The seminar on '**Indian Contributions in Mathematical Sciences**', organised by Institute of Science, Education and Culture (ISEC) in collaboration with Birla Industrial and Technological Museum (BITM), held on 25 February 2017 witnessed a spontaneous query on the probable reasons that make the scientific literature the world over to remain silent on ancient Indian discoverers and the place of discovery, in spite of very rich contributions made by ancient Indians towards science. In fact, for long we too were not well aware of Indian-origin of many discoveries. For many it's a surprise and for some it's a matter of disbelief or an aspect with a big question mark. First of all I would like to point out that rightfully there are many reasons for the claims on ancient Indian contributions. It is not only Aryabhata who was neglected by fellow Indians and future generations for several centuries or even some millennia, the history of science is full of such incidents. I took an opportunity to review some of such incidents in the context of writing the articles 'Evolution of Science: From Ancient Beliefs to Basic Truths – a few Examples' (Indian Science Cruiser, ISEC, Vol 29, No 4, pp 29-44, 2015) and 'Evolution of Science: Energy-

conservation Principle and Modern Era' (Indian Science Cruiser, ISEC, Vol 29, No 5, pp 36-49, 2015). I shall point out some of them with a few additions.

Well, I shall start from Aryabhata, Aryabhata I, or Aryabhata - the elder. We all are acquainted with images or statue of Aryabhata, an act of artists' imagination as no information about his appearance is known and usually we prefer not to reflect this bitter fact in our writings. Apart from very rich contributions in many areas of mathematics, he championed in several aspects of physical science also. He had phenomenal achievements and made in-roads in the studies of natural optical phenomena. Our schooldays learning of optics starts with rectilinear motion of rays of light, law of reflection, solar and lunar eclipses, Snell's Law, Fermat's least path principle, dispersion of light, rainbow formation by dispersion and total reflection of light, Huygens's principle, etc. The premise of rectilinear motion of light led to many discoveries in ancient India. The reflection of light by moon and the phenomena of solar and lunar eclipses were explained by Aryabhata. These facts of Indian achievements do not find any mention of discoverer even

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in texts compiled by Indians. Vachaspati, a Mithila (a region of ancient India and ancient Nepal) based 10<sup>th</sup> century Indian philosopher, suggested that light is an emission of minute particles (the modern corpuscular theory is strongly reminiscent of this ancient doctrine or hypothesis) of certain kind by a substance, which are on striking our eyes causes a sensation of vision. We are hardly aware of this ancient Indian hypothesis. This typical attitude of us tunes the mindset of young ones to think that we have no original contribution towards scientific knowledge, while in reality the converse is largely true, particularly in ancient period. Similarly, we are mostly ignorant of the fact that Aryabhata implicitly made the transition for switchover from the geocentric model for the universe to the concept of heliocentric planetary system. He used geocentric model for the calculation of distances of heavenly bodies, but his observations of planetary periods in relation to the Sun was the acceptance of a heliocentric model. He also correctly interpreted that our observed diurnal motion of the heavens is the manifestation of Earth's rotation about its own axis. He made marvelous work in solving indeterminate equations of the type  $Ax + By = C$ , quadratic equations, geometric functions, and many other things related to astronomy, mathematics and physical science. His writings include Aryabhatiya and Arya-Siddhanta. Arya-Siddhanta, a lost work, is referred only in some writings of his contemporaries. Probably he made some more compilations as revealed by modern researches.

Now I shall try to look into the most probable or the obvious reason(s) that refrained us from appreciating our own works and made us too much self-critical. Based on the nature of the problem, one can justify that the need of the moment is to build self-esteem. To find out the reasons of the problem, one should look through the past history. Repeated devastating foreign invasions changed the mindset of the

survivors very badly and psychologically. The vast majority of our documented scientific knowledge was destroyed and people were busy escaping invasion and saving their lives. It gave us a self-deprecating attitude which ultimately led to self-deception. Details are being found out by historians and yet an area of research.

While we suffer from self-depreciation and an under-estimation of the nation as a whole, there are examples of extreme public disrespect and violent vociferous disputes worldwide over an individual discovery owing to its incompatibility with traditional religious, philosophical and psychological beliefs. Socrates, Bruno and Galileo are some of such extreme examples. The equation  $pV = \frac{1}{3} m Nc^2$  for the pressure of a gas was derived by Swiss mathematician Daniel Bernoulli (1700-1782) using some kinetic-molecular hypotheses. This great achievement was however overlooked by the scientific community of the subsequent period for about 120 years owing to a strong belief of the majority in continuum theory, in contrast to atomic theory. Robert Boyle was very badly criticized by people from many walks of life for his work with vacuum pump, claim of generation of vacuum, and his gas law. Previously it has been discussed elaborately [1]. Avogadro's hypothesis, which is now Avogadro's law, was not recognized for about 50 years after its enunciation. There are several such examples.

Kanada, an Indian philosopher of around 8<sup>th</sup> century BCE and an ancient founder father of chemical science, is an example of grand negligence of Indians by Indians. Although the scientific knowledge related to his contribution has been fully understood or rediscovered, his name finds no proper mention in our science texts even after some millennia. Being a person devoted to chemical science, I reviewed critically the contribution made by Kanada [1]. He clearly hypothesized that matter consists of some indivisible particles which are now

called atoms. He also suggested several types of such particles. He also pointed out that the particles for each of some special substances (the elemental substances) are identical. The same or different types of particles may combine in some definite numbers or proportions to form the molecules of elemental or compound substances respectively. All these he attributed to chemical changes. He linked ripening of fruit, change in colour on burning earthen pots, etc to chemical changes. The concepts of indestructibility of matter, chemical equations, and molecular formula were inherent in his ideas. While Antoine Lavoisier has been considered as the 'Father of Modern Chemistry', it should also be carefully noted that Kanada's concepts of indivisible particles as constituents of matter, the existence of different types of such particles, distinction between atoms and molecules and also between elements and compounds, assignment of molecular

formula and recognition of chemical changes to produce new substances were all very precise and instructive, and he was far ahead of his time. In fact his concepts laid the foundation of chemistry and chemical sciences in ancient times. May I take an opportunity to designate Kanada as 'Father of Chemistry and Chemical Sciences' and to request you to make a proper review for its genuineness?

It's a matter of hope that the present generation is curious to know about our ancient contributions. However, we must be cautious. The atmosphere is changing now. The role of the present generation is illustrative in building self-esteem and confidence. I am hopeful.

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We, the members of the Institute of Science, Education and Culture (ISEC) deeply mourn the demise of our beloved life member Nikhileswar De who passed away on the 27th May 2017 leaving behind his wife and children. Sri Nikhileswar De was born on the 18th May 1943. He had his postgraduate degree in Electrical Engineering from Jadavpur University. He had his training in Computer Teaching at Ohio University on UNESCO Fellowship. He had a record of excellent service at the National Institute of Technical Teachers' Training and Research (NITTTR), MHRD, Kolkata as a member of faculty.

Shri Nikhileswar De was a very popular, sincere, hardworking and efficient staff member of the NITTTR. Apart from teaching he was a very good singer, musician and lover of Rabindrasangeet. We pray to almighty that his immortal soul may rest in eternal peace. We, the readers of Indian Science Cruiser and members of ISEC convey our deep condolence to his bereaved family.

**Anil Kumar Ghosh**  
President, ISEC  
Chief Editor, Indian Science Cruiser

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