

regarding the quality of these bhasma preparations.

For standard bhasma preparations, there is need for a scientific approach, which may be defined by: (1) physical standardization and elemental analysis of raw material and finished products; (2) determination of oxidation state of metals and association of these metals with acidic radicals in the finished product; (3) Pharmacokinetics of the prominent metallic component of bhasma using tracer techniques or by metal extraction from tissues; (4) metal accumulation studies in different tissues and organs; (5) acute and chronic toxicity; (6) expression of heat shock proteins; (7) effect of bhasmas on normal physiological and antioxidant parameters; (8) therapeutic response of bhasmas on the recommended disease model at cellular and molecular level (based on claims written in ayurvedic texts); (9) the role of bhasmas as drug carriers, and (10) the role of bhasmas in body immunomodulation and physiology of gastrointestinal tract (GI) (site of jataragani). These studies will provide evidence for the safety behind the use of bhasmas and also provide knowledge regarding their mechanism of action. The standardization of manufacturing practices currently

in use must also be compared with the old traditional methods and then standardized for common use by the industrial houses. Not many reports are presently available in this regard.

To achieve this mission, there is no need to establish a new laboratory with all these gadgets, but to develop a strong networking among well-equipped laboratories, headed by basic scientists of biology, materials science and physicians. This may be supervised by a group of people with experience in both the systems, i.e. ayurveda and biology, and also experience in industrial houses. We have found⁴⁻⁶ that Tamra bhasma, when given in higher doses to rats, does not get absorbed in the GI tract, but gets excreted. Although we do not have any explanation for this effect, this observation provided us a new area of research to explain the safety behind the use of bhasmas compared to inorganic salts of these metals, which are toxic when given in high doses.

Bhasma preparations must be further classified into two groups, namely (1) those prepared from heavy toxic metals, and (2) those prepared from calcium-like elements, because elements of the second group are not very toxic. Secondly, an effort should also be made among doctors of

the allopathic system of medicine about the cost-benefit ratio in the use of good quality ayurvedic products, both as a replacement therapy or as supplementary 'add on therapy'. Besides, the regulatory authorities and consumers must be educated about this fact, so that they can judiciously differentiate between the myth and reality associated with these products.

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Einstein – contradictions and paradoxes?

The special issue of *Current Science* on Einstein is a treat to serious students of Einstein's work.

Over the last half a century since Einstein's death, so many people have written about him that often it is difficult to picture the true Einstein. Everybody has his/her own interpretation, of even authentic written material. Add to this the existence of embellished material. Nevertheless, one must find one's way out of the literature some of which is a quagmire.

Banerjee's article¹ purports to point out 'contradictions' in Einstein's work, thoughts and life. I wish here to argue that what the writer calls contradictions and paradoxes are not so.

One 'paradox' is that the genius Einstein was dull in school. It was not that at all; it was that he just did not like the rigid educational system and rote teaching in Germany. One reason for this was

that his mother had insisted on having him tutored at home longer than was prevalent practice in German society². His teachers in Luitpold Gymnasium, Munich, only complained that 'He answers questions after thinking and, after answering, moves his lips as though he is verifying an answer for himself, and that he always has a smile on his lips that tends to lower the other students' esteem for teachers'. Even so, he did not get low grades. There is no straightforward authentic statement anywhere that he was academically dull. At 17, he graduated from the Aarau School in Argau, Switzerland, with 4.91/6.0 (82%) that by no means is the grade of a 'dull' student. He found the Swiss academic system conducive to self-study².

Banerjee describes the 1905 work as 'Einstein's play with light and mathematics'. Both of Einstein's papers on special

theory have hardly any mathematics. It is all conceptual physics. The beauty of special relativity lies in its two invariant principles, the novel concept of synchronization of clocks, and the logic that follows, not mathematics.

Banerjee says 'Light has *weight*' (italics mine). Mass (whether inertial or gravitational), not weight, is the intrinsic property of anything, including light. As teachers we know how important it is to use these terms carefully lest students continue with their ill-gotten concepts. Anything that has gravitational mass will have 'weight' only in a gravitational field. In gravity-free space, light (or anything) would not have 'weight'.

It is impossible to agree with Banerjee that Einstein's not knowing the possibilities of $E = mc^2$ is a paradox. First of all, in *Evolution of Physics*, Einstein and Infeld mention that 'The quantity of heat

able to convert thirty thousand tons of water into steam would [be] about one gram³. Clearly, Einstein knew the possibilities well. Several such references can be given. Second, there was no earthly way for Einstein or anybody to dream that fission can occur. It was only after Meitner began analysing Hahn's experimentally observed discrepancies in nuclear reactions that the idea of fission arose in her mind. Both Wigner and Szilard have recorded that when they met Einstein in 1939, while he was holidaying in Long Island, to convey their concerns about Hitler's Germany laying hands on Belgian Congo uranium, Einstein had not known about Meitner-Hahn fission, but that in less than fifteen minutes he understood not only what fission and (yet-to-be-realized) chain reaction were, but also what havoc there would be if Hitler made the bomb first². Wigner has written that he was amazed that Einstein grasped the entire problem in less than fifteen minutes. Wigner has further stated what we all know, namely that Einstein, after coming to USA, was least bothered about anything in physics except unified theory and read no journals. Weekly copies of *Nature* and *Science* which arrived at 112 Mercer Street were filed away without Einstein having touched them⁴. 'Knowing' is a matter of acquiring information, 'understanding' is innate. There is no paradox here at all. T. S. Eliot said, 'We have lost wisdom in knowledge/knowledge in information'. (Today, of course, we must add 'We have lost information in information technology'!)

Banerjee writes '[Einstein] said that both space and time are altered on approaching the speed of light'. The point of special relativity is that they are altered no matter what the non-zero relative speed is. At small speeds, the alteration cannot be measured by today's means. We scientists ought to be accurate.

Not knowing the mathematical techniques of non-Euclidean geometry until they were needed for general relativity is no paradox either. It is well known that until about 1909, the level of Einstein's higher mathematics was nowhere near that of Lorentz, Planck, Sommerfeld, Born and von Laue.

Much has been made over half a century, especially by people looking for shortcomings (छिद्रान्वेषण, as it is called in Sanskrit logic) in Einstein's personality and life, of his signing that letter to Roose-

velt and later turning pacifist. This is an unkind cut. Einstein was always a pacifist². In 1939, the issue was whether the Allies should let Hitler destroy the world or, to save it, develop the bomb before he developed it. British scientists led by Tizard, acting on intelligence gathered by MI6, had already, months before Szilard and Wigner began their efforts in USA, approached the then Prime Minister Chamberlain, and Churchill on the same issue^{4,5}. The men in USA behind 'make-the-bomb' effort in 1939 were Fermi, Bethe, Teller, Szilard and Wigner, all brilliant scientists in their own right, but none had the status of Einstein to write to Roosevelt.

It is generally not realized that Einstein had signed, in all, three letters to Roosevelt⁴. The first two were written when the possibility of a nuclear weapon had seemed, at least to Einstein, dim. It was the third, written when intelligence reports about Nazi Germany's efforts had come in, that was instrumental in launching the Manhattan Project.

My most serious reservation is regarding what Banerjee has written on the Einstein-Tagore interaction and taken to untenable conclusions. Throughout the millennia of the development of Western and Eastern philosophies, different people have looked at the cosmos in their own different ways. It is futile to look for agreement among people, find disagreement and then choose a line of thought that suits oneself as the truth. The Einstein-Tagore fundamental disagreement was regarding objective reality. Once a Canadian child wrote to Einstein in a letter, 'We would like to know, if nobody is around and a tree falls would there be a sound, and why'⁶. Einstein's reply – of which the full text is not available – is easily a model of putting in simple words a complicated and controversial matter.

The Einstein-Tagore tête-à-tête is looked upon differently by different people. A report in *New York Times* mentioned that it was Einstein who shone by his clear thinking⁷. As to the sound of the falling tree (that has become a symbol for such discussion), for Tagore and his ilk, including most ancient Indian thinkers, there would be no sound. For Einstein and science, 'There would be' because he held that 'The human mind acknowledges realities outside of it, independent of it. This table would still be here even if nobody were in the house'. So Tagore said, 'It remains outside the individual mind, but not the universal mind'. By

Popperian criterion of falsifiability Tagore's position is false, for one would have to ask 'What is "universal mind"?'. And the polemic will go on forever like *Vedanta* discussion, the long and short of which is that (i) one must believe in the universal mind before starting the discussion, and (ii) Tagore said what the ancient Indians had said, and so he was right.

Banerjee's mentioning that 'It is the God-intoxicated realized souls who perhaps can feel in their every breath that ... everything stems from the universal consciousness alone ... For others, it just ends up in contradictions or vain talks' is tantamount to accepting philosophical defeat.

The last paragraph in Banerjee's article – that science and scientists are a passing phase – applies to literally everything that man has ever evolved, including 'infinite consciousness' that Tagore believed in and Banerjee apparently believes in!

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4. Clark, R. W., *Einstein: The Life and Times*, Avon Books, New York, 1972, ch. 20.
5. Bodanis, D., *E = mc²: Biography of the World's Most Famous Equation*, Berkley Books, New York, 2001.
6. Calaprice, A. (ed.), *Dear Professor Einstein (Albert Einstein's letters to and from Children)*, Prometheus Books, NY, 2002.
7. Robinson, A., *Einstein: A Hundred Years of Relativity*, Henry N. Abrams Inc., 2005, p. 98.

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Response:

I thank Parasnis for giving me an opportunity to broaden my understanding of Einstein – in the light of others' views. I would, however, like to respond on some of the points he has raised, viz. (a) Whether Einstein was dull; (b) Whether light has weight; (c) Whether Einstein shone for his clear thinking during a discus-

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sion with Tagore; (d) Whether accepting God-intoxicated man's understanding, mentioned is to be considered tantamount to philosophical defeat; (e) Whether the question of 'infinite consciousness' is to be considered just as, and only as a 'belief' of Tagore. I would like to offer my submissions on the above, according to the authentic biographers of Einstein – referred to in my article, as well as based on my perception.

(a) Certainly, Einstein was not dull. I never mentioned it so. What I had written was that he was a systematic non-performer in academics, contrary to his genius. That was the story not only in his school days in Germany, but in Switzerland as well. He failed in the first admission test of ETS (wherein he did well later, as mentioned to have secured 82% marks). His class friend and his first wife, was rather a better student than Einstein. Because of his poor academic records, Einstein missed assignments in academic

institutes, despite his best efforts and had to remain content as a junior patent officer – till he became famous overnight (vide ref. 2 in my article).

(b) This information (weight of sunlight, etc.) is available in p. 20 of reference 3 in my write up. I simply quoted him...

(c) The question of who shines better – Tagore or Einstein does not arise. Both are such great personalities in their own respective fields. I simply mentioned what they talked about. It is significant that Tagore, a non-scientific person hinted at the question of uncertainty – in which Einstein remained biased in his scientific pursuits, rather with a belief (if not a dogma) than with logic (vide the comments of Niels Bohr quoted in my article on this respect).

(d) About philosophical defeat, etc. mentioned, I would like to point out that seekers of truth do not consider winning or defeating. One reaches from a lower

truth to higher truth – for which philosophical pursuits are taken up – absolute truth being always elusive.

(e) It was rather the realization of Tagore – which to ordinary unrealized persons like us tantamount to belief and there lies the difference between wisdom and knowledge.

In fact, my last sentence – whether a scientist is a passing phase in the evolution of mankind – is not a conclusion but a question posed to my readers to seriously ponder over.

Once again, I thank Parasnis for his approach of looking at my writing in a different perspective and thereby enlightening me and my readers.

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NEWS

National awards for science communication

The National Council for Science and Technology Communication, Department of Science and Technology, Government of India announced its annual national awards for science and technology communication. The recipients are: (a) *The Jan Vignana Vedika, Hyderabad*, a science communication-based voluntary organization, for its contribution 'towards scientific awareness and building a knowledge-based society by publishing popular science literature, organizing popular science events and developing low-cost

teaching aids'. (b) *Mohan Sundara Rajan, Bangalore* for 'writing popular science books and articles, science fiction and columns in newspapers'. (c) *Bhola Nath Dwivedi, Varanasi* for 'writing numerous research papers and articles for various globally prestigious journals on difficult scientific topics for layman'. (d) *Mohammed Khalil, New Delhi* for 'his pioneering contributions through his books, biographies of great scientists, editorials and science columns in popular science magazines, articles in newspapers, and radio

talks, especially Urdu'. (e) *Gadadhar Misra, Orissa* for 'his yeoman services through translation of a number of popular English books on scientific topics into Oriya'. (f) *Pallava Bagla, Delhi* for 'diligently putting across developments in Indian science and technology to the common man through newspapers and journals'.

Individuals are awarded Rs 100,000 each and the Jan Vignana Vedika, Rs 200,000.