Applied cognitive neuroscience: Pitfalls of funding an ideology

A debate is on in the US cognitive science and education circles which is more relevant to India, now than ever before, as we stand on the threshold of a new era – an era of putting neurosciences from the 'neglected' list to the 'priority' list. With the initiatives of setting up of NBRC, Manesar, the excellent neuroscience groups in NCBS, Bangalore and a cognitive science school in Allahabad, cognitive neuroscience in India has had a 'spurt' in recent years. The rightly skeptical Editorial and News[1] in *Nature* on the US National Science Foundation (NSF) effort towards 'bringing neuroscience to the classroom' sets the stage for this very debate. While initiatives that look at the neuroscience of learning, reading and cognitive development are welcome, those with the explicit purpose of translating the results into superior education strategies, can, at best, be termed premature. This bent of fast-track translation of concepts and ideas of a discipline as nascent as cognitive neuroscience is potentially damaging for the discourse and society. We have had ample experience of this kind in the past, when 'science', notably the Freudian[2] variant, has been unleashed on society, causing decades of setback to the science of the mind. And if one looks back to contemporary commentaries of those times, there is an unmistakable positivist arrogance of solution providing, which hardly ever arose from the naked facts of the discourse. It is this obscurantist dissociation that cognitive neuroscience has to avoid. There are neologisms already when an impending explosion of findings in 'learning science' is talked about! The present respectability and excitement cognitive neuroscience has gathered from the monumental works of Michael Gazzaniga and others, are to be preserved at all costs.

NSF scheme of granting US$ 90 million to such projects has a connotation to it. One might realize that it is not a simple, happy issue of increased funding for some focus areas within cognitive neurosciences, but the express idea behind this funding and the implications thereof, which are deeply troubling. The NSF plan almost conjures up images of the following scenario – Cognitive Neurosciences Inc – Smart Educational Technology Providers since 2005. This might as well be an expectation, but never a vision – and the philosophical divide between those two positions is important. The difference is essentially between a spin-off and a start-up.

At another level, such drum-beating would invariably spawn many homegrown 'brain-smart' solution providers, who will claim scientific basis for their products. The way ageing research is misrepresented daily for peddling dietary supplements, is a ready example. Initiatives in disseminating the present state of knowledge about issues like cognitive development, learning, memory, reading, numerical ability, etc. with explicit mention of the wide gaps that exist in our understanding of the same would go a long way to clear things up. Funding agencies and the powers-to-be in India might do well to create a more shining example of pursuit of knowledge, as India 'arrives' in the neuroscience panorama.

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IndCollections: biological specimens in Indian collections

Specimens housed in the natural history collections across the world are the fundamental underpinnings of all biological information. They are time capsules to analyse conditions from the past and compare them with our present-day state of affairs. This information provides baseline data against which biological variations and environmental changes can be measured. Therefore, collections are absolutely essential to biodiversity research and education[1].

India, which is one of the megadiversity countries, harbours rich floral and faunal diversity. Several government agencies such as Zoological Survey of India, Botanical Survey of India, Forest Survey of India and academic institutions, universities, as well as non-governmental organizations are involved in floristic and faunal surveys[2]. Majority of these agencies also maintain biological collections. It is estimated that over 200 herbariums, 100 zoological collections, and 40 microorganism collections spread across the country together house more than 10–15 million specimens[1]. However, due to changing trends in biological sciences coupled with unavailability of sufficient funds, majority of these collections are experiencing survival crisis.

Though this applies to the collections both from developed and developing as well as under-developed regions of the world, the collection community in developed regions has put its hands together to overcome the crisis by adopting newer tools and techniques offered by information and communication technologies. In order to secure increasing resources, these museums are ensuring wider visibility to the data associated with the specimens that they house by releasing them in public domain through the net. Some of these regional initiatives include ENBI[3], BioCASE[5], Species Analyst[6], and ENHSIN[7]. These initiatives together with the Global Biodiversity Information Facility (GBIF)[8], ensure that data associated with specimens from other regions of the world are shared with the countries of their origin. GBIF alone is able to pull together over 74,000,000 specimen records from 533 collections[8]. There is a rich promise for novel research and conservation results based on natural history collections data. Further, the data can be integrated into other research programmes that are trying

to answer questions pertaining to phylogeny, phylogeography, evolution, and ecological niche modelling as has been pointed out by Graham *et al.*[9].

To provide integrated access to Indian specimens in museums overseas, we developed ABCDIO (Access to Biological Collections Data of Indian Origin), which collates information, and digitized images of specimens that are housed in these museums[10]. While this is happening across the globe, it is equally important that countries of origin too initiate appropriate steps in digitizing their own collections that would be complementary to these initiatives. Currently, we do not have data, in public domain, about specimens housed in Indian collections, making it difficult for academicians, researchers, especially taxonomists to ensure access to right specimens from any of these collections when they need it the most. In order to fill up this gap, we developed an easy-to-use, user-friendly software called 'SAMPADA', which is in compliance with the emerging standards for biological collections management. We believed that this would encourage the museum curators to undertake digitization of their specimen collections[1]. While several museums and collections within and outside India are using SAMPADA to digitize their repository, we are able to release data associated with one such collection, thereby providing a first glimpse to the valuable data associated with the vouchers of these specimens housed in Indian collections and museums.

The Department of Zoology, Modern College of Arts, Science and Commerce, Pune holds an identified and unidentified collection of some animal taxa or species such as insects, amphibians and fishes. These specimens were collected for research purpose under various projects and have been preserved for over a period of last 15–20 years. Postgraduate students of entomology collected some of the insect specimens. Using SAMPADA, we digitized the data associated with over 800 identified specimens housed in this collection. Specimens themselves were also digitized, which resulted in the collection of over 2000 images linked with the data associated with the respective specimen. In order to launch this information in public domain, we developed a web-based data portal called 'IndCollections', which is accessible at http://www.ncbi.org.in/indcollections/.

We believe that IndCollections would be a step ahead in achieving the dream of the 'National Natural History Management Information System (NHMIS)'[1], as it would encourage other small and big collection managers to launch their data in public domain, as it is happening in other regions of the world. Academic and research institutions and NGOs can use SAMPADA freely to digitize their own collections. Once digitized, these collections can use 'IndCollections' to launch their data in public domain.

Importance of such a digitized data need not be overemphasized. Traditional taxonomy work needs to be supported by modern technology and exposed in public domain on the internet. As discussed by Godfray[11], the new technology can make 'grassroots' taxonomy more accessible and useful because at present, results of taxonomical work are not available to end-users, especially ecologists, conservation and evolution biologists as well as amateur naturalists. Hence, we appeal to museum curators, collection managers and taxonomists in particular, to join this initiative by undertaking the task of digitization of their collections, and release the associated data in public domain.

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Astrophysical inaccuracies

I was disappointed reading Miller's recent book centred on the Eddington–Chandrasekhar controversy. The basic tenet of the book, that Eddington's persistent opposition to accepting relativistic degeneracy in stars and its remarkable consequences, and his open ridiculing of Subrahmanyan Chandrasekhar, hindered 'the progress of astrophysics for nearly forty years', is at best arguable and more likely, to be dismissed by astrophysicists. I found the book flawed on several counts, not just on its wrong historical emphasis. Reading it, a serious student of stellar physics may actually develop quite a wrong notion of the historical development of the subject, with particular reference to the end states of stars. With all due respects to the author, I should like to say, his comprehension of the subject matter has left much to be desired. His statement of the mass–luminosity relation – 'the more massive a giant star, the brighter it is' (p. 62), or his assertion Chandra 'had overthrown Fowler's theory' (p. 93), and 'Fowler's theory of non-relativistic degeneracy, on the other hand, predicts that the smaller the radius of a white dwarf, the bigger its mass', totally contradicting what is observed. If Fowler was right, we would expect to see