Future of taxonomy in the 21st century – whither or wither

I appreciate Mariappan and Balasundaram[1] for taking a lead in highlighting flaws in taxonomical literature which have not only led to wrong scientific interpretations, but also monetary loss. Mistakes of this kind are a result of poor knowledge on the subject, because of which we are unable to estimate how many species of animals and plants exist today.

We often talk of biodiversity loss, but unless we have a detailed account of the existing species the loss cannot be pinpointed. Numerous examples can be cited where wrong classification has led to misinterpretations. Taxonomy plays an important role in the management of pests and weeds. To illustrate this point, *Salvinia molesta* (kariba weed), native of Brazil, is an aquatic fern and one of the world's worst weeds. The environmental damage caused by it has been enormous. It chokes lakes, reservoirs, slow-moving rivers, irrigation systems, rice paddies, fishponds, etc. with continuous metre-thick mats of dense vegetation. In addition to rendering the water useless for normal use, its presence can lead to the breeding of mosquitoes. Initially, the weed was identified as *Salvinia auriculata*. A weevil, *Cyrtobagous singularis*, from Trinidad was used in Africa to control it, but the effort failed. Later, this weed was identified as *S. molesta*, whose growth in Queensland was controlled by *Cyrtobagous* from Brazil. It is evident from these examples as to how effective control or mitigation measures could be implemented[2].

Similarly, identification of an effective biological control agent for *Azolla* depended on expert taxonomic work. Floating water fern/fairy fern (*Azolla filiculoides*) has for years been a highly effective invasive species in South Africa, creating problems in inland waterways. The weevil, *Stenopelmus rufinasus* was found effective in cleaning up sites heavily infested with *Azolla* within months. Proactive taxonomy of biotypes of whiteflies *Siphonius phillyreae* and *Bemisia tabaci* causing viral epidemic in crops in Argentina allowed effective implementation of biological control programmes via natural enemies such as *Encarsia hispidia*, *E. protransvena* and *E. transvena*[3].

In spite of its importance as an inevitable field for all types of research, taxonomy faces many challenges and remains a neglected subject. There is no national repository centre, museum, or maintenance of taxonomic collections. Many museums have no curators and several universities have no faculty positions for taxonomists. A demand for taxonomy is on the rise in the wake of the global biodiversity crisis. There is a need to promote scientific identification and documentation requires immediate attention. Due to lack of infrastructure at academic institutions and a well-structured research programme, seldom are students willing to pursue taxonomy. There are a handful of job openings for taxonomists and pay scale is low. Further, inadequate funding in taxonomy largely diverts students to studying phylogeny. It is also difficult to publish in the field as there are only a few journals dedicated to taxonomy research. The miniscule journals however do not accept large revisionary work or monographs.

This calls for building a network among institutions and organizations involved in taxonomic collections. It is high time that the national institutes and funding agencies encourage taxonomic work and provide financial assistance to strengthen the knowledge base in taxonomy.

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D. P. ABROL

Division of Entomology,
Faculty of Agriculture,
Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Chatha,
Jammu 180 009, India
e-mail: dharam_abrol@rediffmail.com

Lack of efficacy of MVA85A TB vaccine candidate: potential outcomes

It is disturbing to see the leading vaccine candidate against tuberculosis (TB) shows a near total lack of efficacy in the recently concluded phase 2b trial in Cape Town, South Africa[1]. The implications of these results are many and enormous – some of them are enlightening and will give us constructive future evidence towards conduct of similar exercises[2]. The immediate and most profound of these is that the immunogenicity parameters measured in earlier human studies[3], calibrated and optimized for the phase 2b trials, have been clearly shown in this study to have no correlation with protection against clinical disease per se. This implies that these markers/methods are questionable and should not be used as the primary end point determinants any more. The use of these antigens as vaccine candidates is limited. Earlier vaccine candidates evaluated with the same markers and determined as unsuitable need to be relooked again. Any of them may well be the answer to our need for a vaccine, their initial bid for this being rejected by faulty measures.

In every vaccine development programme, establishment of an end-point is critical for assessing the performance of the vaccine. The best end-point is the incidence of clinical disease (against which the vaccine is directed) in vaccinated and

unvaccinated arms of the study sample (a phase 2b/3 study) – a surrogate to this measure being immune parameters developed in the course of vaccination which have a tight correlation with the development of disease or protection to the disease itself. This standard methodology is limited in diseases that are chronic (such as TB and HIV), where the disease process itself may take a long time to manifest and therefore use of surrogate immune markers seems more 'practical', although it may be questionable.

Experts in immunology have recommended a panel of tests for evaluating the efficacy of candidate vaccines against tuberculosis. Immune responses to Ag85 (the predominant secretory antigen) appear to be the basis of this selection. We see this in this study as well. Ag 85 specific polyfuntional cd4+ T cells expressing IFN gamma, IL2 and TNF have been a consistent response to this secretory antigen of *Mycobacterium tuberculosis*[4]. This does not however seem to square with the immune picture of the Hepatitis B virus – although HBsAg is the predominant secretory antigen, antibodies to this are protective. In the case of *M. tuberculosis*, both the antigen secreted and the predominant immune response appear to be immune smoke screens offering little protection against illness[1].

What is irrefutable however, is the competency of the agency executing this study, with regard to openness and scientific correctness. The progress of the study has been published periodically either in medical literature, newsletters or on websites from time to time. The lack of objective evidence for vaccine efficacy tests has however sullied their reputation.

The larger fallout however is the initiation/continuance of future studies with these antigens and without a reliable endpoint assessment. Despite the several modifications suggested[2], the fact remains that we need to spend more resource, modifying approaches with a candidate which shows primary failure to the antigen itself (dose escalations, changes in vector, adjuvant, etc.).

Finally, this challenge invokes the need for a response from the scientific community as a whole to systematically approach this problem with clear target-driven approaches. Involvement of funding agencies in segregation and allocation of resources towards the grand challenge of identifying a bio-signature corresponding reliably with protective efficacy is also essential.

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JOHN KENNETH

Division of Infectious Diseases,
St Johns Research Institute,
Bangalore 560 034, India
e-mail: johnkennet@gmail.com

Standardization of family Cucurbitaceae

There is a growing interest in medicinal plant research worldwide. Plants and plant-derived products are widely used in the traditional system of medicine. Often herbal drugs are considered unsafe, found less effective and fail to meet the quality standards due to several reasons. Primary among them are: (i) insufficient expertise in plant identification and lack of pharmacological knowledge; (ii) adulteration and use of substitutes as a result of over-exploitation of medicinal plants; (iii) variations in growing conditions; (iv) genetic variability and (v) diversity in harvesting methods and processing of extracts. It is therefore essential to establish internationally recognized guidelines for assessing their quality.

Cucurbitaceae is an economically and medicinally important plant group. It represents 36 genera and 100 species and is distributed in the tropical to subtropical regions of India. Some of them are cultivated commercially for their edible fruits, whereas others are known to be bitter and poisonous. Genera *Benincasa* Savi., *Bryonia* L., *Bryonopsis* Arn., *Citrullus* Schrad., *Coccinia* Wight & Arn., *Corallocarpus* Welw., *Cucumis* L., *Lagenaria* Ser., *Luffa* Miller, *Momordica* L. and *Trichosanthes* L. are being used in the Indian system of traditional medicine over centuries to cure a wide array of health-related problems[1]. It is observed that some of the closely related species or varieties of these genera bear non-bitter and bitter fruits. Medico-practitioners utilize most of bitter plant species for formulations[2]. *Bryonia*, *Bryonopsis*, *Citrullus*, *Corallocarpus* and *Momordica* bear only bitter fruits, whereas *Coccinia*, *Cucumis*, *Lagenaria*, *Luffa* and *Trichosanthes* bear both bitter and non-bitter fruits. Bitter varieties were found wild on wastelands where human interference was negligible.

Consumption of fresh or canned fruit juice is gaining popularity as an alternative and complementary medicine therapy. But several reports question the toxicity of these juices. In June 2010, a 59-year-old male died in Delhi while his wife was hospitalized after consuming a mix of bottle gourd (*Lagenaria siceraria* (Molina) Standl.) and bitter gourd (*Momordica charantia* L.) juice. An investigation committee reported that the juice contained toxic complex, cucurbitacin, that gave it a bitter taste. Cucurbitacin (tetracyclic triterpiniod) is frequently found in this family. The level of cucurbitacin is intensified by many environmental factors such as high temperature, uneven watering practices, low soil fertility and low soil pH[3].

At present, bitterness of fruit is the only known parameter to differentiate these plants from each other. The voluminous work on the family Cucurbitaceae has been reported with respect to its therapeutic uses as well as phylogenetic relationship and molecular evolution[4–9]. However, species-specific characters for identification of these plants are lacking. Diagnostic characters are important to differentiate plants which bear bitter as well as sweet fruits to check the quality and identity of raw materials and their