Where do the hybrids go?

With great interest, I read the letter by Subbarao[1] in *Current Science*. The author of the said letter and those cross-referenced[2,3] are stalwarts and eminent personalities, i.e. all of them are 'on the other side of the table'; they are job-givers, policy-makers and the like.

May I humbly submit the opinion of one who is on 'this side of the table'. I was, until recently a job-seeker. Having recently returned from the US after a longish postdoctoral stint, I was scouting for jobs and after landing on one after much heartache; the experience made open my eyes to a few realities and I am submitting the same via this letter.

(1) Outside India, research in modern biology is interdisciplinary in nature. It is not a 'buzzword', but a reality. In India, however, I was told by not one, but several universities that despite having a Ph D in biosciences, I cannot become a research guide in 'Biochemistry', 'Biotechnology' or 'Biology' because my M Sc is in physics. The same precludes me from being a lecturer at a college also (pers. commun.). Clearly 'interdisciplinary' has not even become a buzzword in India; becoming a reality is far cry. By the same token, a chemist cannot become a research guide in pharmacology, even if he holds a Ph D in Pharmacology.

(2) The same goes for jobs. For example, to attend the ARS examinations/job interviews held for the various jobs advertised by ICAR, prior M Sc degree in any one of agricultural sciences is a must (see Appendix V of notification-for-ars-2015.pdf)[4]. Why? It is not a competitive process. Is passing a technical examination so easy that the door has to be closed through apriori scrutiny? What if an M Sc in chemistry, has a Ph D in Pharmacology/Toxicology and has carried out advanced zebra fish genetics and wants to work in fish genetics? Where does he/she go?

Hence the question where do the hybrids go?

Luckily for us hybrids, the grant-giving bodies are more open and the ad-hoc grants are really life-saving. However, those are available only after we get a job; thus we have a chicken and egg situation.

(3) Many Indian states (please check web-pages of the various State Governments) do not even have a Department of Science and Technology. How is alternative energy or indeed waste management or water management or modernization of agricultural practices going to be possible without science and technology?

I understand when the author says that the ambience is right in the TIFRs, IITs, IISc and IISERs[1] and chances are, we might find India's next Nobel Prize winner from there. However, I doubt if the above-stated institutes can accommodate all the Ramalingaswamy or Inspire or Swarna Jayanti fellows through various batches, for example. So, should we not try to improve the ambience in other institutes as well? It will increase the probability of bringing the Nobel prize home.

Thus although scientific research is funded by the various Government agencies, the Ministry of Higher/Technical Education/UGC too has to play a hand in rectifying the lacunae stated above. I do hope that all of them come together to promote a better scientific temper in India.

1. Subbarao, E. C., *Curr. Sci.*, 2016, **110**(2), 130–131.
2. Rao, C. N. R., *Curr. Sci.*, 2015, **109**(5), 844.
3. Mashelkar, R. A., *Curr. Sci.*, 2015, **109**(6), 104.
4. http://asrb.org.in/images/asrb/pdfs/notification-for-ars-2015-and-net-2015.pdf

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How well are we managing laboratory waste in India?

The contribution of Indian scientific research establishments in the scientific and technological development of the country is significant. Today, India houses a good number of Central Universities, State Universities, Private Universities, Indian Institutes of Technology (IITs) and other scientific research laboratories and institutions (autonomous, private sector or affiliated to bodies such as CSIR, ICMR, ICAR, DRDO, etc.), having facilities for scientific research. While they are contributing to the progress of science and technology in the country, they are also generating considerable amount of laboratory waste which is generally hazardous. It contains toxic, concentrated chemical solvents, biological materials of animal, human, plant or microbial origin, contaminated materials (such as filter papers, gloves, tissues, glassware, etc.) with hazardous materials adhering to them, old or unlabelled chemicals, broken glasses, contaminated sharp objects, radioactive materials, cytotoxic materials, nanomaterials, and so on[1,2]. Laboratory waste is characterized by its inherent toxicity which necessitates specific attention towards its environment-friendly disposal. Here we wonder are there proper waste treatment plants in every institute in India having facility for scientific research in order to treat the complex laboratory waste responsibly? Considering the diverse, yet distinct nature of laboratory waste, how efficient are these plants towards averting environmental contamination? How aware are the researchers in these institutes towards responsible disposal of the waste generated through their work? Or is it the case that we are simply ending up polluting the environment while finding solution to a specific problem of scientific or environmental significance?

Our experience in the field of laboratory research in India illustrates a disappointing picture. Consequently, here we caution that Indian research establishments are yet to behave responsibly while handling their laboratory waste.

While in some laboratories there are strict protocols concerning the disposal of the waste they produce, most others are largely ignorant. However, we can no longer afford to be ignorant considering the depth of the problem. Further, while some research institutes do have facilities to manage or treat their laboratory waste, the efficiency of the same is questionable. For instance, a number of large Central and State universities in the country house scientific research facilities across diverse fields such as life sciences, physical sciences, chemical sciences, biotechnology, environmental sciences, earth sciences and so on. Waste generated from each of the above facilities is characteristically different. Therefore, the same laboratory waste-treatment plant may not be able to address the diverse waste categories. Considering that most of the waste is extremely hazardous to human health and the environment, we doubt whether these universities actually have special laboratory waste-treatment facilities according to the characteristics of the waste produced. The last few years, for instance, have observed a significant growth in nanoscience and nanotechnology research. Some nanoparticulate forms show unusually high reactivity, especially for fire, explosion and catalytic reaction. Therefore, disposal of waste produced from nanomaterials requires specific handling considerations. Are research establishments in India equipped enough to take care of such distinct waste streams? The answer to the question remains unsatisfactory.

Laboratory waste is a complex category of waste. Considering its hazardous nature, its management and treatment are equally complex. Through this letter, our aim is to attract attention of the generators of laboratory waste, policymakers and other associated stakeholders towards addressing this grave concern in an adequate detail. Stringent implementation of laboratory waste management protocols is the need of the hour. We believe that the growth of scientific research should be accompanied by responsible actions towards managing the waste produced from various experimental activities. Otherwise, our scientific research laboratories would end up creating a complex problem simultaneously while trying to find solution to an issue of scientific significance.

1. http://www.uow.edu.au/context/groups/public/@web/@sci/@chem/documents/doc/uow016883.pdf
2. http://www.ncbi.nlm.nih.gov/books/NBK-55878/pdf/Bookshelf_NBK55878.pdf

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Drones: new tools for natural risk mitigation and disaster response

When a natural disaster occurs (earthquakes, tsunamis, volcanic eruptions, landslides, hurricanes, tornadoes, floods, avalanches, wildfires, etc.) emergency rescue operations are critical to save lives. Many people trapped after such disasters, for example, under collapsed buildings, may have a good chance to survive if they are rescued on time. It is well known that the probability of success of the rescue operations decreases exponentially as function of time to be close to zero after about a few hours. As reported by the Tokyo Fire Fighting Department Planning Section (New Fire Fighting Strategies, Tokyo Horei Publ., 2002), the survival rate reduces as time passes; rescue in 3 h is desirable and the survival rate becomes drastically low after 72 h (the golden 72 h).

Promptness and effectiveness of rescue operations are then essential to minimize the number of disaster victims. Maps of damage distribution might allow to drastically improving the effectiveness of rescue operations. Maps constructed quickly in the wake of a disaster are useful tools for identifying and assessing damage, especially when combined with images of the area before the disaster. The centres for post-event emergency management could use these maps to decide the action priorities in order to minimize the loss of human lives, along with optimally managing the available resources, thus reducing the impact of the natural disaster on an urbanized area.

Unfortunately, in the aftermath of a disaster, mapping may take too long using satellites or traditional manned aircraft. Currently, satellite imaging technology cannot penetrate cloud cover, often leading to delays in image capture after extreme weather events. However, the recent technological developments in the field of drones might overcome the limitations of satellites or traditional manned aircraft, contributing to an efficient system for natural risk mitigation.

Drones, also referred to as unmanned aircraft systems (UAS), unmanned aerial vehicles (UAV) or remotely piloted aircraft (RPA), are aircraft without a pilot on-board. Drones are generally remotely controlled by a pilot located on the ground or on-board another aircraft, or by an autonomous piloting system. In recent years, the miniaturization of sensors and control systems has provided a boost in the development of aerial drones.

Aerial drones are some of the most promising and powerful new technologies to improve disaster response and relief operations. Drones could complement traditional manned relief operations by helping to ensure that the operations can be conducted in a more safer, faster and efficient manner. Rapid deployment of drone-based remote sensing systems after a disaster, combined with high-resolution 'before disaster' maps, could help the disaster relief groups to obtain situational awareness and knowledge about which infrastructure is at the greatest risk. Drones could provide unique viewing angles at low altitudes, not possible from manned aircraft.

The main benefits of drones in an emergency are reach, speed, safety and cost. They can provide the needed aerial data in areas considered too hazardous for people on the ground or for manned aircraft operations, such as sites with nuclear radiation contamination, or those in close proximity to wildfires. Drones can fly through the dark, along a programmed path that covers the whole