Are IITs world class?

'There is hardly any worthwhile research from our IITs. The faculty in the IIT is not world class. It is the students in IITs who are world class,' said Jairam Ramesh, an IIT Bombay alumnus, and Union Minister for Environment. 'The IITs and IIMs are excellent because of the quality of students not because of quality of research or faculty.' This sparked off a huge controversy, mostly free of evidence or data.

Actually, data is available (http://sciencewatch.com/inter/ins/10/10febTOP-20ENG/) in Science Watch (a Thomson Reuters product). It is in a listing of the top 20 institutions in engineering which during a ten-year period (1 January 1999–13 October 2009) attracted the highest total citations (*C*) to their papers (*P*) published in Thomson Reuters-indexed engineering journals. These institutions are chosen out of a pool of 1084 institutions comprising the top 1% ranked by total citation count in this field. All the IITs put together appear on top of the list if only papers are counted (7115 papers). However, as the 'top 20' list was drawn up on the basis of citations, the University of Illinois heads the list with 44,094 citations for the 5821 papers they published for an impact (*i*) of 7.57 citations/paper. As impact is the nearest proxy we have as a measure for quality, Stanford University leads this select list of 20 with 10.50 citations/paper whereas our IITs are right at the bottom with 3.57 citations/paper, if this is the criterion for ranking.

Table 1 is based on the top 20 list put out by Thomson Reuters, but now rearranged using the exergy indicator[1], $X = iC$. This is arguably the best indicator for research performance, taking into account quality and quantity. The University of California at Berkeley heads this list.

Table 1. Performance ranked by exergy of the most-cited institutions in engineering, 1999–2009 (1 January 1999–31 October 2009)

Rank	Field	Papers *P*	Citations *C*	Citations per paper *i*	$X = iC$
1	UNIV CALIF BERKELEY	4,517	43,003	9.52	409,399.60
2	STANFORD UNIV	3,531	37,086	10.50	389,513.28
3	MIT	4,586	42,264	9.22	389,499.72
4	UNIV ILLINOIS	5,821	44,094	7.57	334,011.48
5	UNIV CALIF LOS ANGELES	2,561	24,991	9.76	243,869.61
6	UNIV MICHIGAN	4,534	30,545	6.74	205,777.91
7	GEORGIA INST TECHNOL	4,803	30,042	6.25	187,907.93
8	UNIV LONDON IMPERIAL COLL SCI TECHNOL & MED	3,555	25,429	7.15	181,894.25
9	UNIV CALIF SAN DIEGO	2,635	20,850	7.91	164,980.08
10	NASA	4,064	24,848	6.11	151,924.98
11	NATL UNIV SINGAPORE	5,031	27,626	5.49	151,698.64
12	PURDUE UNIV	3,765	23,863	6.34	151,246.42
13	CNRS	3,817	23,530	6.16	145,051.32
14	PENN STATE UNIV	3,602	22,464	6.24	140,097.53
15	NANYANG TECHNOL UNIV	5,912	28,516	4.82	137,544.36
16	UNIV WISCONSIN	3,130	20,511	6.55	134,409.30
17	CHINESE ACAD SCI	7,057	29,624	4.20	124,356.15
18	TEXAS A&M UNIV	4,113	20,760	5.05	104,784.25
19	UNIV TOKYO	4,752	21,342	4.49	95,850.37
20	INDIAN INST TECHNOL	7,115	25,386	3.57	90,576.11

Source: *Essential Science Indicators* from Thomson Reuters.

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Bt brinjal: need for a consensus

In the past few issues of *Current Science*, the *Bt* brinjal controversy has been discussed. Authors have mainly highlighted the possible negative impacts arising out of it[1,2]. The basic question is – should we go for it or not? To justify either of the two options, people will fill the pages of journals with argument–counter arguments; but for commoners the side favouring *Bt* brinjal seems to be more attractive. Logic is simple – go for it, enjoy the benefits and take the risk of losing the biodiversity (which, however, may not happen at all) or reject it and be happy with the pesticides! However, the related issues should be properly addressed. The biosafety issue is of utmost importance; a strict regulation and regulatory authority has to be there to look after every step of the biosafety tests. Biodiversity issue is much debated; however points raised against cultivation of *Bt* brinjal[1,2] are not very convincing. Selection and rejection are two normal processes even in conventional crop improvement. Farmers have been favouring agronomically desirable varieties, rejecting others to be lost. It is unlikely that introduction of *Bt* brinjal will be significantly different from this; at the most, it may result into monocultures. In a country like India where multiple crops are released and raised each year, this should not be of any concern[3]. Gene flow to wild relatives through different mechanisms has been taking place in nature throughout the evolutionary history. Even if it happens in the case of *Bt* genes, the possibility of the gene maintaining in the wild relatives will depend on the presence or absence of continuous selection pressure from the same pest[4]. If pollen flow occurs between *Bt* and non-*Bt* land races, the 'transformed' land races may thrive well to enhance the wild gene pool of the crops[5]. Development of resistance against Cry protein cannot be ruled out; scientists have to be ready with other strategies like *Cry* gene stacking[6]. At the end it must be pointed out that the products of technology are never 100% perfect. Let us have a healthy debate based on unbiased scientific data and make a consensus.

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Snake abundance: the limits of occupancy-based estimates

Field studies that have focused on estimation of animal species abundances have for long been confronted by the problem of not counting an individual that was actually present in the habitat or locality. More than 30 years ago, Preston[1] demonstrated how the detection probability of birds increased with enhanced effort wherein a team of field biologists working simultaneously in a site might detect more birds than a solitary observer would. That the problem of estimating the proportion of elusive individuals in a local population of animals continues to haunt field biologists is evident in the series of recent publications on the subject[2–4].

One suggestion common to all the authors who have discussed the subject is that the probability of detecting an animal increased with greater effort. Increased effort can be achieved by increasing the size of the team[1,2] (as appropriate) or by increasing the number of visits within a prescribed period[2,4]. Recent studies also lay emphasis on estimating 'occupancy'[2–4]. Occupancy is defined as the 'fraction of sampling units in a landscape where the target animal species is present'[2].

While it seems a simple task, ascertaining the absence of a shy and elusive species in a sampling unit is not by any means easy. Considering the limitations of time, manpower and funds, field biologists studying elusive and shy species have reiterated that it is 'profitable' to search for signs of their presence[4]. They also suggest that, under such circumstances, the detection probability can be treated as the average probability of detecting a sign (in replicated samples) that an elusive animal is present in a habitat or locality[4].

Snakes are some of the most elusive animals and assessing their abundance has been challenging. The presence of snakes in a habitat or sampling point is more often inferred by signs such as sloughs (molted skin), scats (excreta) or a track that leads to a frequently used hideout such as a burrow or a den than actually sighting one.

Between October 2008 and March 2009, I was involved in a short-term project commissioned by the Wildlife Wing of the Tamil Nadu Forest Department with the mandate of estimating the abundance of the Indian cobra, common krait, Russell's viper and saw-scaled viper in northeastern Tamil Nadu[5]. The project was commissioned in response to a demand by the Irula Snake Catchers' Industrial Cooperative Society (Irula Society) for an annual harvest of 15,000 snakes (including the four species) from Chennai, Kancheepuram and Tiruvallur districts that approximately covered an area of 4,000 sq. km in northeastern Tamil Nadu.

Harvesting the four species of common venomous snakes in northeastern Tamil Nadu began about 40 years ago. The harvested snakes are maintained for around a month in the Irula Society and milked for venom between 4 and 6 times before being released back into the wild. During the early years of this ingenious enterprise, 500–1000 snakes involving the four species were harvested annually. Nevertheless, the demand for snakes has since grown so much that during the year 2008 the annual harvest was around 8,000 snakes.

While it is presumed that the enterprise is sustainable, there has not been any data maintained by either the Irula Society or the Tamil Nadu Forest Department on the recapture of snakes that were caught once, marked and released. Further, there has not been any study to assess the annual recruitment in these four species within the landscape that has been intensely harvested during the past 40 years although it is evident that the landscape is now being intensely used by IT and automobile companies that extensive patches of fallow lands and cultivation have been urbanized.

Against this background, the task of designing a field study that would provide reasonably reliable data on the abundance of the four species of snakes and in just six months was the real challenge. Fellow ecologists brought to my attention the existence of considerable amount of literature on estimation of animal abundances using the occupancy model. I found the writings of Mackenzie[2] most practical and useful. Under the assumption that I have fully understood the model and its application, I went ahead and sampled the snakes.

Five competent snake hunters were engaged during the project and with the exception of one, all were Irulas. The field design allowed two snake hunters to search and find snakes, as they would do normally, and my role was to simply