Table 1. Twin births and adult females/their offspring with polythelia among wild Formosan macaques at Mt. Longevity, Taiwan between 2001 and 2005

Troop name	ID no.	*N*	Date of birth	Sex	Outcome	Other births (year/sex)*	Offspring with supernumerary nipples
B	12	3	16 April 2003	M, F	M died < 3 days	2000 F, 2002 M, 2004 F	Yes (2, 3)
F	10	2	1 August 2005	F, F	1 died < 4 days	2000 F, 2002 M died < 6 months, 2003 F, 2004 M	No
I	12	2	13 April 2002	M, M	1 died < 2 week	2000 F, 2001 F, 2003 M, 2004 M	No
Kc	5	0	12 June and 26 June 2001	M, M	1 died < 6 weeks	2000 M, 2002 F, 2003 M, 2004 F	Yes (2)

N, Number of supernumerary nipples.
*Birth records of 2000 were pooled from unpublished data.

fundamental interest, such as fluctuating asymmetry and primate trend to single births.

It is not easy though to observe polythelia in the often arboreal and furry, non-human primates under field conditions due to visibility problems. Field biologists have to approach their subjects in close quarters to carefully observe the presence of polythelia. Countries like India where monkeys such as the bonnet macaque, rhesus macaque and Hanuman langur co-exist with people in rural and urban areas, may provide better opportunity for such closer scrutiny. This ultimately may result in understanding the population genetics and fitness consequences of both phenomena, as well as the intriguing relationship amongst multiple births, polythelia and the potential correlation of urogenital anomaly.

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Plight of higher education and our helplessness to act

One would like to agree and appreciate the commentary by Lakhotia[1] about the plight of universities in our country in highlighting the prevailing conditions in teaching and research, faculty, facilities, funds, admissions, appointments, administration and also suggestions for possible improvements. A lot has been said in the past about publications and journals too. All this is too well known, particularly to those scientists who matter for shaping the policy of higher education and research. Sometime back, one of the top scientists of the country publicly expressed his anguish over the prevailing poor scientific status of universities in the country, and implying thereby his helplessness to do anything about it. The basic question is: if the physician has diagnosed the illness rightly, why does he not administer the medicine? Unless such things are highlighted, how are they going to be improved?

Lakhotia[1] has rightly suggested restrictions for Master's and Ph D degrees. If one wants to improve the situation, this is perhaps the first thing to be done. The big question is: Can we close down so many PG colleges which have sprung up in remote corners of the country? Will our political system permit this? Another far-reaching suggestions is contractual appointments of teachers. Would we permit an altogether different service condition in isolation from elite services? UGC made this recommendation about three years ago, but so far no university has adopted the scheme.

Lakhotia has not dealt with the factors affecting the standard of education in the universities. It is the government policy of liberalization of education which has literally reduced education to a commodity so that thousands of private professional and basic sciences colleges have been started throughout the country. How can one expect any standard and excellence from such institutions?

Given the existing circumstances, what little can a common scientist do? Thirty years ago when I was appointed as head of the Department of Chemistry of the

University of Rajasthan for three years under the system of rotation, two shifts of M Sc classes were being run with only one set of laboratories in the department. This system was not satisfactory and had its own drawbacks. I reduced the admissions by fifty per cent and managed with one normal shift. There was a lot of hue and cry from the teachers of the department and students in general. Though things returned to their original status of two shifts after my term, I was satisfied that I did what little I could to save higher education from being reduced to mass education.

More than sixty per cent women compared to men do postgraduation and research in science subjects. It is also true that eventually most of them do not take up a career in science. We have to find a way so that higher education for women does not suffer and we also get returns for the funds invested.

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Apomixis revisited

The discussions recently published in *Current Science*, as reviews on apomixis in higher plants, by Kaushal *et al.*[1] and Bhat *et al.*[2], are valuable contributions for generating new ideas in this agriculturally important area. Besides describing the characteristics of the various forms of apomixis, the authors[1,2] have also attempted to identify techniques that can be used to observe the occurrence of apomixis, and features to be present in model systems, as also approaches that should be employed in these to understand the biology of apomixis in molecular terms. The authors have reached the conclusion that, to unravel the enigma of apomixis (formation of seeds having maternal genotype without fertilization), detailed knowledge of the molecular biology of plant reproductive process is a prerequisite for its apomictic manipulation. They have advised that new experimentation on apomixis be directed in *Arabidopsis* and rice plants and it be designed to reveal the regulation of meiosis, endosperm development and parthenogenetic or apomictic embryo development. They have opined that knowledge-based deregulation of the key regulatory step(s) of the above-mentioned plant processes might help engineer apomixis in these systems. The conclusion is unquestionable. Indeed, in the long term, the conventional forward- and reverse-genetics strategies should help in the achievement of these objectives.

The articles evoke the question whether the already available information about plant embryogenesis, especially apomixis type and genetics in the species of occurrence, could be used to select apomictic mutants in plants that have normal or wild-type sexual reproduction. Since the purpose of the articles of Kaushal *et al.*[1] and Bhat *et al.*[2] appears to further the evolution of ideas and experimentation on apomixis, in this letter, the rationale and methodology of a possible approach worth trying to select induced apomictic plant mutants is outlined. Availability of induced apomictic mutants may be critical in functional genomics analysis and agricultural exploitation of apomixis.

A variety of plant species belonging to mono- and dicotyledonous families possess apomictic property. Altogether they demonstrate the known forms of gametophytic and sporophytic types of apomictic reproduction[3–7]. A large majority of apomictic species share several features regarding their reproductive functions. (i) Apomictic reproduction occurs concomitantly with sexual reproduction[4,5]. (ii) They are auto- or allo-polyploids of various degrees[8–10]. (iii) Dominant allele(s) at one or more loci are the determinant genetic factors[11–14]. There are several examples of autonomous apomixes, wherein apomicts develop seeds bearing embryo as well as endosperm without the involvement of the fertilization process[15,16]. There are indications from the recent findings in *Arabidopsis thaliana* that *fis* (fertilization-independent seed) mutants are compromised in genomic methylation to different extents and thereby have pleiotropic effects on gene expression[16–20]. These observations allow the following hypothesis: Apomixis is a method to produce progeny; especially to overcome sexual sterility. A gain-of-function mutation brings about a degree of somatic apomictic fertility, over and above sexual fertility. The gain-of-function mutation occurs upstream in pathway(s) for apomictic embryogenesis. Mutation has pleiotropic effects because it turns on genes that normally remain repressed, including those epigenetically inactivated/silenced via DNA methylation. Apomixis is seen preponderantly in polyploids, among the present-day plants, because apomictic mutations got selected in them for survival in the course of evolution. If apomictic reproduction process had not been superimposed, the concerned polyploids would have become extinct because they suffer from sexual sterility due to problems in meiosis arising from multivalent chromosomal formations instead of bivalents.

The above rationale about the origin of apomictic behaviour dictates the following kind of experimental scheme to recover apomictic mutants among presently non-apomictic, sexually reproducing species. The scheme may be fruitful in some species and not in others, determined by the nature of genetic background on account of the evolutionary history of the species. The plant species to be used in experimentation should be such that it is capable of producing fruits that bear a large number of seeds, as a result of single spontaneous or manual pollination event in its individual flowers. The genotype of the selected species should be such that the plants are able to produce fruits that are largely seedless. It should be possible to produce seeds of such genotypes in large numbers. To isolate the apomictic mutants in such a genetic background, seeds are to be effectively mutagenized with physical or chemical mutagens. Among the resulting M1 population, while bulk of the plants will bear sparsely seeded or seedless fruits, the apomictic mutants will have seed-bearing fruits. The plantlets obtained from densely seed-bearing M1 fruits will be genotyped to identify the products of apomixis. The progeny of