

tions. Late Carl Sagan of Cornell University, USA was convinced of existence of life in our own solar system apart from earth (?). He made all out efforts to impress upon NASA to go for exploration of the outer space and settle the question of other life centres in space. It is quite natural to explore first of all our own solar system and get a final answer. Failures of Mars missions one after another have delayed our expectation for possible signatures of life on Mars. There have been in-depth discussions on the failures of Mars missions especially the one that ran into loss of seven lives of astronauts on 28 January 1986. This major failure delayed *in situ* exploration missions and landing on Mars. The Mars team was aware of inadequacies of the ill-fated mission but failed to persuade NASA officials to call off the flight and went ahead by saying: 'It is time to take off your engineering hat and put on your management hat'. Ignoring the warnings the launch went ahead and the tragic disaster took place. The Mars Global Surveyor (MGS) and Mars Orbiter

Camera (MOC) are basically remote sensing missions and have provided highly interesting results. The recent findings of MGS-MCO and the pictures obtained are of general interest, as it appeared in *Science* on 30 June 2000:

'It began as a whisper on the Web a week ago Monday evening, grew to a noisy torrent of media babble by Wednesday, and on Thursday morning crashed onto the front pages. Moving at the light-speed pace of modern media, a wave of chatter about water and therefore possible life on Mars swept a paper at *Science* into headline news a week before its scheduled publication' (*Science*, 2000, **288**, 2295–2296 and 2000, **288**, 2330–2335).

As discussed by Malin and Edgett (*Science*, 2000, **288**, 2330–2335), the symptoms of life on Mars seem to be ample but the most discouraging fact is the existence of thin atmosphere and low temperature on Mars. Even if life exists, it is a matter of speculation as to

what form of life it could be. If these limited efforts and observations made so far could yield this much of information, then we must have high expectations for existence of life on Mars in making. Let us hope that in the near future, Mars missions become a success and we get much more interesting information about this existing planet as compared to recently received beautiful pictures of mountain ridges, gully landform, channels of varying sizes which clearly depict free flow of water with no one around to check its flow and use it for any purpose. In fact what MGS-MCO pictures depict are only a part of the story whereas it seems that a good deal of exciting news is still to come. Closer looks and *in situ* observations may soon unfold the in-depth story of Mars in course of time.

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Publication lists, citation counts and the impact factor

The editorial on 'The impact of publication list' (*Curr. Sci.*, 2000, **78**, 1177–1178) and its response (*Curr. Sci.*, 2000, **79**, 135–136) have stimulated me to express my views.

The list of publications being the linch pin in assessing the work of the academicians in the research institutes, universities and other places, has become the barometer for their selection and growth. Hence the correct assessment of the list of publications has become the cry of the day. The selections/assessments are always done through the 'peer review' by a team of learned experts. Since the learned experts for selection/assessment have neither the inclination nor the time for an informed and just judgement, the judgements are mostly subjective, prejudiced and accordingly, honest, objective, open, impersonal criteria free from limitations has become mandatory for the correct and just assessment.

Eugene Garfield, the father of 'science watching' has introduced the concept of 'citation counts' and the 'impact factors' in the 1970s. These concepts have been found to be adequately suitable in a digital age, particularly when we are travelling into the information super highway. Garfield's idea is simple. It means simply to look through the reference list in the papers and catalogue the number of times each paper is cited and the addition of these citations refers to the citation counts of the individual paper of the concerned author. Citation count being objective, impersonal and broad based (not confined to any narrow discipline) has become the acid test for the assessment of the quality of publications. Further, in order to assess the quality of a journal objectively, basing on the concept of citation counts, a derived concept like 'Impact factor' has been introduced and is defined as:

(Total number of current citation of articles published in a specific journal in a two years period)/(Total number of articles published in the same journal in the corresponding two years period).

Institute for Science Information (ISI) 'stresses that a journal's impact factor is a meaningful indicator only when considered in the context of similar journals covering a single field of investigation or subject of discipline'. Clearly the 'citation counts' are primary and are not confined to a narrow field or discipline and are much higher for original and seminal work and tend to diminish further and further more the work is extended and trendy. Accordingly, the emphasis on 'impact factor' as well as 'other considerations' rather than the 'citation counts' – the acid test of quality – can result in awarding Padmabhusan to some one having papers with 'citation counts' less than ten for about twenty five years covering the

period of the award. Thus the 'growing emphasis on impact factor' and 'other considerations' rather than the 'citation counts' is abortive and suicidal even if 'it signals a new trend in India'.

Non-emphasis on 'citation counts' in selection and other matters and also the domination of science in India by the persons who have more skills in the

'politics of research' rather than the original research and also do not have the needed courage to stand up to the authority and speak their mind like C. V. Raman, have resulted in research of inferior quality in India. Thus only when quality is preserved by emphasizing the 'citation counts' will our country produce many original scientists

like Raman, and only then will the future of science in India be assured.

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Teaching research students, and scientific career vs engineering

The editorial 'Teaching research students' (*Curr. Sci.*, 2000, **79**, 262) highlights three points in particular, (1) The number of top-quality students available for research specially in physics and chemistry is declining, (2) The research institutes and universities in general have no pre-Ph D training programmes, and (3) Admission to research for a Ph D degree is solely managed by the supervisor. The editorial very rightly points out that Ph D work is a logical extension of M Sc with subsidized student life which provides time for finding a suitable job. One would have appreciated if the editorial had suggested ways and means to improve the credibility of Ph D starting from admission to its evaluation for a degree.

There is no pre-Ph D course for study perhaps in any Institute or University in the country and whatever, wherever student learns, is through informal teaching by the supervisor during the period the student works for his Ph D degree. Although M Phil is not equivalent to pre-Ph D course, in absence of the latter, UGC may consider a suitably modified M Phil course compulsory for taking admission to Ph D. UGC must also ensure that for the teaching of M Phil syllabus there are appropriate facilities of library, laboratory and faculty in the department. It would be academically safer not to permit colleges to run M Phil courses. Normally such facilities are not available in a college. Whether it is running of M Phil or of

supervising research, both can be operated to some degree of success only when there is a group of teachers actively engaged in research.

It has been rightly mentioned in the editorial that of late the number of top-quality students joining the scientific career and research has been decreasing. Students always preferred the engineering and medical careers which ensured them a decent life and earning, and what was available for the scientific career was third/fourth rate stuff. To make things worse, the engineering colleges have multiplied several times. Another avenue for better and bright prospects is finance and management. It is, therefore, the academics and research that suffer. It has already been mentioned earlier (*Curr. Sci.*, 1999, **77**, 1227) that unless through a highly competitive procedure the talent of the country in required number is not picked up right after Intermediate/Twelfth standard with assured jobs after obtaining Ph D, in a cadre, say Indian Scientific Service (ISS) like IAS, future of Science in the country is not bright. Although such talented stuff may not have the research aptitude, the situation would be better than what we have at present. 'Teaching of research students' is a must even for top-quality students.

Another grey aspect of Ph D research today in our country is the admission to Ph D which is more a matter of convenience between the supervisor and the student than any academic criterion.

This can be stopped to a large extent if each student for research is recruited in a funded project through selection committee. The M Phil and funded research together will eliminate/reduce the less meritorious admissions. Thus there will be two streams of research career, one by an integrated programme with an assured scientific career and a job for the top brains, and second for the less fortunate ones doing graduation, PG and research on their own.

Finally one should recognize that scientific research career suffers from one great disadvantage compared to an engineering career. The scientific career would require almost nine years (3 for B Sc + 2 for M Sc + 1 for M Phil + at least 3 for Ph D) before the student will have a settled life, whereas for the engineering career only four years are enough to secure a job and settle. Thus only the determined ones with scientific aptitude would opt for the scientific career, and the latter would not be able to attract the talent in general, unless the proposed Indian Scientific Service (ISS) has super pay-scale, perks and national recognition. This is not unreasonable since the future of the country is shaped by the scientists.

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