A good beginning

Current Science deserves appreciation for the courage and the cudgels it has taken up to improve the standards of teaching science and scientific research in our universities. There is no gainsaying the fact that owing to several articles published in *Current Science* in the last two years or so the subject of deteriorating quality of science, both teaching and research, in our universities is no more a sacred cow. Several conscientious academicians have voiced their opinion that the onus for this unsatisfactory state of affairs, several things apart, lies to a fair degree of measure on the scientific and teaching community also[1,2]. It is heartening to see that in terms of objectivity and critical appraisal of scientific research being conducted in our universities and research institutions, the articles published in *Current Science* score over those which appeared sometime back in *Nature*[3], in which every thing about scientific research in India was goody goody and the other side was totally overlooked. Lack of critical self-appraisal, which, of late, has come to pervade our scientific and educational institutions of higher learning is one of the important causes of our mediocrity in these areas. It is high time that we get ourselves rid of this malady lest it is passed on to our future generation of teachers and scientists. In this regard we need to take a lesson from S. Chandrasekhar, whose recounting of the story of Daedalus and Icarus elegantly brings out how critical self-appraisal is fundamental to all good research and advancement of science[4].

The initiative of the Council of the Indian Academy of Sciences to improve the standards of science education in the country is timely and the agenda enunciated in the 'Academy Paper'[5] is both laudable and challenging. If the articles published in *Current Science* have struck a chord in the hearts of our young researchers and teachers then, probably, a good beginning has already been made.

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RESEARCH NEWS

Does low serum cholesterol increase suicide and aggressive behaviour?

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It is a well-established medical fact that high serum cholesterol is a risk factor for developing ischaemic heart disease and that lowering the high level of serum cholesterol in these patients reduces mortality. Interestingly, follow-up studies showed no overall reduction in the mortality rates. A meta analysis of six primary prevention trials of cholesterol-lowering agents in men (pooled $N = 24,847$) by Muldoon *et al.*[1] revealed that the intervention group experienced reduction of deaths from heart disease compared to controls but the total mortality remained the same. This means that with reduction of serum cholesterol, mortality from other causes increases.

This prompted a detailed examination of the causes of noncardiac mortality. Epidemiological studies have examined the relationship between nonmedical mortality and baseline low serum cholesterol in the general population. The Varmland study in Sweden by Lindberg *et al*[2] and the study of Neaton *et al.*[3], both in 1992, screened more than 350,000 men and showed a higher mortality in men with low serum cholesterol. Most unexpectedly, the higher mortality from noncardiac causes was found to be mainly due to suicides and traffic accidents and aggression as well. A higher risk of suicide and deaths from accidents were reported from a meta analysis that pooled the results of 18 prospective epidemiological studies[4].

More recent findings[5] suggest that men with serum cholesterol levels at or below the 25th percentile were twice as likely to have ever made a serious suicidal attempt compared to men whose serum cholesterol was above the 25th percentile. They have proposed that low serum cholesterol is a potential biological marker of suicidal risk.

Is it possible to explain the increased suicide rates in people with low serum cholesterol? There is an interesting hypothesis to explain this. The explanation invokes the serotonin hypothesis of depression, suicide and impulse control disorders (which includes aggressive behaviour). All these conditions are associated with low serotonin levels in the brain and low serotonin levels in the human brain are associated with poorer suppression of behavioural impulses like suicide and aggressive behaviour[6].

There is evidence that low serum cholesterol is associated with a number of aggressive behaviours. For example, varied psychiatric disorders where aggression is an important symptom, like in male homicidal offenders who are habitually violent under the influence of alcohol[7], and male criminals with anti-social personality disorder who are aggressive[8]. Even from animal experiments there is some evidence that a cholesterol-reducing diet in monkeys makes them more aggressive[9]. A low cholesterol diet in monkeys is also associated with low brain serotonin levels[10]. Both suicide and aggressive behaviour, therefore, are associated with lower serum cholesterol possibly reducing brain serotonin levels[6].

In summary, there is evidence that noncardiac deaths, particularly suicides, occur not only in patients receiving cholesterol-lowering drugs but also in people whose serum cholesterol is naturally low. Interestingly, for some unknown reason, this effect is much more pronounced in men than in women. The question that is yet to be answered is: Is it correct advice to tell people to keep their cholesterol levels low? Cardiologists will invariably say yes, because it reduces mortality from cardiac conditions. It would be wiser to review the answer in the light of recent findings and look at it from all angles rather than just the narrow cardiac viewpoint.

It would be interesting to examine to what extent these patterns are seen in the Indian population. These investigations have recently been undertaken.

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Bose–Einstein condensation in a dilute atomic vapour

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A team of researchers working at the Joint Institute for Laboratory Astrophysics (JILA) in Boulder, Colorado, has just announced[1] having observed three distinct signatures for the occurrence of Bose–Einstein condensation (BEC) in a dilute ultracold vapour of atomic rubidium-87 (^{87}Rb). The most distinctive signal claimed for the onset of the BEC was an abrupt appearance (and gradual growth) at (and below) a threshold temperature of an anisotropic momentum distribution sharply peaked about zero against a diffuse, isotropic thermal background that reflected the lowest-energy *single*-particle state, now being occupied *macroscopically* (i.e. extensively) by the bosonic ^{87}Rb atoms. And that is precisely what the Bose–Einstein condensation is all about – a *macroscopic* (*finite* fraction of the total) number of particles occupying the lowest-energy *single*-particle state, leaving the higher states sparsely populated.

The experiment involved (i) confining a sample of about 2000 ^{87}Rb atoms to a volume about 10 μm across, thus compressing the vapour to a number density of about 2.6×10^{12} cm^{-3}, and (ii) cooling it to an abysmally low temperature of about 170 nk and maintaining the BEC so obtained for a reasonable length of time of about 15 s for diagnostic studies. All this necessitated a synergetic combination of novel experimental techniques for trapping and cooling of atoms. Thus, the magnetic trap used was essentially a quadrupolar magnetic field that dotted with the antiparallel-aligned magnetic moments of ^{87}Rb atoms ($F = 2$, $m_F = 2$) so as to give a confining potential well. This potential well, however, had at its central minimum the magnetic field equal to zero, allowing the atoms to flip their moments freely through unavoidable perturbations and escape. This *leak* was *plugged* in an ingenious manner by superimposing a rotating magnetic field, slow enough for the moments to follow adiabatically but fast enough to yield a time-averaged orbiting potential (TOP) which was parabolic, and with a non-zero averaged magnetic field at the minimum that prevented the spin flip. The TOP was a uniaxial 3D harmonic potential giving an oblate ground state wavefunction. The latter was reflected in the anisotropic momentum (velocity) distribution of the BEC recorded by shadow imaging. As for the cooling, the atomic gas was precooled by the laser Doppler technique, in which the atoms are retarded by a set of counterpropagating laser beams with their frequency tuned slightly below that for an atomic resonant absorption. The Doppler shift then ensures that the moving atom has the sisyphean task of always having to climb up a potential hill and hence get retarded to a near-zero speed. This is then followed by a *forced evaporative cooling* in which the more-than-average energetic atoms are allowed to escape the magnetic trap at the edges, leaving the tardier atoms to thermalize to a lower temperature. The evaporation is ingeniously *forced* by an rf magnetic field that flips the spins of the