It is clear that the common finding of streptomycin and kanamycin-resistant *M. tuberculosis* in TB patients in the late 1980s and early 1990s occurred long before any genetically engineered crops were grown anywhere in the world.

While most strains of bacteria that cause gonorrhoea (*Neisseria gonorrhoea*), an important sexually transmitted disease, are susceptible to streptomycin or kanamycin, resistant strains have been reported[14–16]. Since the DNA in cotton-fibre products that would likely be in contact with the bacteria has either been damaged or removed by washing and processing of the fibre, the probability of transferring resistance from the plant to the bacteria is remote. Further, genes that cause antibiotic resistance to streptomycin and kanamycin are present in many other species of bacteria in the environment. Therefore the bacteria causing either TB or gonorrhoea are much more likely to become resistant through contact with those bacteria.

The information that is available from a large number of important studies, demonstrates that growing *Bt*-cotton in India or anywhere else in the world and using products derived from this crop will be safe and will not have any effect on the incidence of antibiotic resistant-bacteria that cause either TB or gonorrhoea.

In summary, *Bt*-cotton has been grown commercially in the US and Australia since 1996, Mexico and South Africa since 1997, and China and Argentina since 1998. There have been no reports of increased incidence of antibiotic-resistant bacteria that cause either TB or gonorrhoea, which can be attributed to the production of *Bt*-cotton in these countries. Also, several agricultural and environmental benefits have been realized by commercial use of *Bt*-cotton varieties that include reduced chemical insecticide treatments for target pests, highly effective pest control, increased yields and increased population of beneficial organisms in cotton[17,18].

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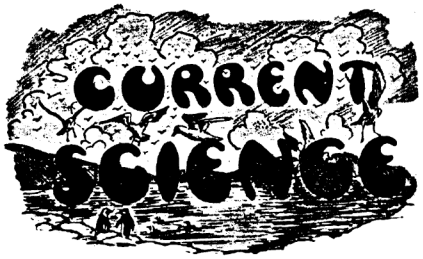
C. S. Prakash is in the Tuskegee University, Milbank Hall, Center for Plant Biotechnology Research, Tuskegee, AL 36088, USA (e-mail: prakash@Tusk.edu).

FROM THE ARCHIVES



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Public benefactions and science

Lord Nuffield's munificent gifts to the University of Oxford are worthy of admiration and imitation. They must have a strong appeal to the more enlightened and wealthy communities in India, and hopes might be entertained that the Indian Universities and other research institutes would likewise benefit by the philanthropic and patriotic instincts of the rich landed proprietors and industrial magnates in this country. The conservative temperament of the Indian mind has not understood the full significance of the somewhat cryptic saying, 'cast thy bread upon the waters,' for generally it fears, that instead of finding it after many days, it may be totally lost. The sage's assurance that it would return in increasing abundance ought to inspire public confidence. No thoughts of personal gain underlie public benefactions, which are made solely with the objects of assisting the work of self-dedicated scientists, whose labours result in the benefit of our own generation and the generations yet unborn. Practically in every instance, material prosperity is absolutely dependent upon the patient researches of those who seek for no personal reward, and whose work at the time was thought by men of affairs to be of no consequence. It must not be forgotten that the foundations of our greatest present-day advances were laid by scientists, and the increasing returns, which men of business reap, have originated in work inspired by no thought of personal gain. Of all the human activities, perhaps the one thing that cannot be overproduced is scientific

research, and we can conceive of no time and no situation when industry cannot utilise it. Nothing can be more clear than the fact that the substitution in economics of the law of increasing returns in the place of its old antonym, demands the continuous and increasing support of scientific research, which is the foundation of progress. The country which hesitates to strengthen and extend research in the domain of pure science voluntarily renounces its claim to independent economic existence, content to seek its prosperity in the foot-paths and by-lanes of international progress.

Generally speaking, India looks at public and private philanthropy from the spiritual standpoint, and she treats mechanical civilisation as synonymous with materialism. Further, the unhappy association of science in developing the technique of modern wars has tended to diminish public faith in the benefits conferred by it on humanity. Even enlightened persons are apt to interpret the achievements of science in terms of material benefits, because they are more tangible, and their more enduring spiritual message escapes attention probably because their reality is less manifest. Our knowledge of Nature has opened out a new outlook on the significance of life, and the old superstitious beliefs and mystical rites have disappeared in proportion to the appreciation of the reasonableness and orderliness of the fundamental laws of nature. In emancipating the human mind from mediaeval mysticism, science has also provided spiritual opportunities all along its progress. Science, while it acquires increasing power over Nature, places all its resources for the service of man. Science is non-moral. It shows the path of increasing human health and comfort. It also provides those who would erect a superstructure of industrial application with the increasing means of augmenting national prosperity. . . .

Scientific research is generally considered as a luxury by government and the public, and not as a fundamental necessity for making life better, cleaner and richer. It postulates the new law of increasing returns, which can be reaped only when its structure is strengthened and extended. Public opinion in India is still slow to recognise that the frontiers of science are unlimited and that industry and the nation owe to its efforts in extending the field for cultivation, continued and unstinted support. Industry was the first to benefit by the application of scientific results, but we have not utilised the new knowledge of a far-reaching and fundamental character in promoting our means to health and our economic and social orders. Scientific discoveries are an investment, and the public have not yet placed this intellectual property on the status of a national asset. If a fraction of the public enthusiasm and private money now expended on activities of a general and doubtful import, could be engaged in support of the Universities and research institutes in India, and if this support is not intermittent and wasteful, this country within a generation may be reasonably expected to achieve sufficient progress to make up for all its arrears. Encouragement of scientific work in India has not yet acquired the status of public obligation of sound management in the minds of her wealthy people, who too often rely on government for financial support. To the building of national greatness, the contribution of government is small, and its foundation and edifice are the work of discriminating philanthropists.

Random selection

Physical theory of learning

'Theoretical description of teaching learning processes: A multidisciplinary approach'
Bordogna Clelia M. and Albano Ezequiel V.
Phys. Rev. Lett., 2001, **87**, 118701

Psychologists and sociologists have been addressing the question of how one learns. Social interactions (for example, classroom interactions) seem to augment the learning process. The underlying processes being rather complex and involving cognition, efforts have been made to understand how one learns subjects which are formally logical and structured like mathematics and physics. Can one model the teaching–learning process mathematically and investigate results of such model calculations?

Bordogna and Albano deal with this question and have proposed a scheme based on a generalized Ising model which is used in the study of magnetism. The interaction described in the Ising model is between nearest neighbour spins and an external magnetic field which influences the behaviour of magnetic spins. Generalized spin models have been used by physicists to model financial markets, sociology, etc.

The authors have defined various concepts like cognitive impact (CI) acting on an individual i due to his teachers CI^{TS}, peers CI^{SS} and sources of information CI^{BS} in terms of persuasiveness P_{ji} of other individuals j, support S_{ij} to each other's views and knowledge σ_I of the individual. Persuasiveness P_{ji} and support S_{ij} are zero or positive definite quantities, whereas knowledge σ_I of the individual as a function of time spans the domain $1 \geq \sigma_I(t) \geq -1$. The Metropolis rate expressed in terms of the CIs and various noise factors due to disorder in the classroom, lack of attention, obscure explanations, etc. are taken into account to arrive at the time evolution of knowledge $\sigma_I(t)$ of the individual in different environments. The results show that 'the emerging model is consistent with well-established empirical results, such as higher achievements reached working in collaborative groups and the influence of the structures of the group on the achievements of the individuals'.