lated by the Office of Agricultural Biological Genetic Engineering Safety Administration (OABGESA) of the Ministry of Agriculture in China. Although China began to grow transgenic plants for commercial use in 1992, the first license for commercialization of GM crops was authorized by the OABGESA in 1997, and not in 1994, after assessing their biosafety[6]. *Bt*-cotton was first commercialized in 1994 by the Cotton Research Institute of CAAS, but it obtained license for commercialization in 1997 (ref. 6). Up to now, more than 8 *Bt*-cotton varieties have obtained licenses for commercialization from the Chinese government[7].

Fourthly, in China, like in USA and Australia, *Bt*-cotton needs insect resistance management schemes, but the authors mention in their paper that China does not need insect resistance management schemes, which is not true. Many field experiments have indicated the developing resistance of bollworm to *Bt*-cotton. Scientists in the Cotton Research Institute of CAAS have observed that resistance of bollworm to Bt toxin increased 6.6–9.8-folds in 1999 (ref. 4). The results have made Chinese scientists pay more attention to insect resistance to *Bt*-cotton.

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G. N. Ramachandran and applied research

G. N. Ramachandran is distinguished for his basic research in physics. His concern for the welfare of the people of this country and his interest in applied research, which could be of benefit to them, are not widely known. The following is a brief account of an applied project initiated by him, with which I was associated.

I met Ramachandran in 1942, when we were both students at the Indian Institute of Science (IISc), Bangalore. Our association continued after I joined the National Chemical Laboratory (NCL), Pune. He wrote to me in 1970, when he was still at Madras University, that he would like to discuss whether we could collaborate on an applied project of national importance. After considering several areas, we decided that utilization of the vast and renewable cellulosic resources of the country to meet our increasing needs for fuel and protein, would be of great potential value. Hydrolysis of cellulose to glucose by concentrated hydrochloric acid was carried out on an industrial scale in Germany, but it was feasible only during wartime, because of high cost and formidable corrosion problems. A biochemical process appeared to be more attractive. We had discussions with senior members of the Planning Commission and the CSIR. Atma Ram, then Director General, CSIR agreed to support the programme and a Silver Jubilee Grant of the CSIR was awarded to Ramachandran, T. N. Ramachandra Rao, CFTRI, Mysore and myself at NCL, for basic and applied research on the utilization of cellulosic materials by enyzmic hydrolysis to glucose or by microbial conversion to single-cell protein for animal feeds. This grant was for three years, the allocation of funds for equipment, chemicals, travel and staff was at the discretion of the project leaders and funds could be carried over from one year to another (features which seem to be worth copying in other grants!).

The beta-glucosidase linkages in cellulose make it difficult to hydrolyse compared to starch, with its alpha-glucosidase links. Basic studies on the structure of different celluloses were planned, but could not be undertaken. Ramachandran left Madras and joined IISc, when the project was begun. He was occupied with setting up a new department and was also away in Chicago for a year and was unable to undertake experimental work. However, his contributions in the form of discussions and advice on different aspects of the project and his continued interest in it, in spite of ill health, were invaluable.

The project on cellulosic materials has been in progress as a long-term programme at NCL, from the mid-1970s till today. After the Silver Jubilee Grant, two UNDP grants were obtained (the second one shortly before my retirement in 1981). Several exo- and endo-cellulases and beta-glucosidases were obtained in pure form and their properties studied. Two high cellulase-producing fungi were obtained and a large number of isoenzymes were also isolated, which acted synergistically in cellulose hydrolysis. This work has been presented in several publications and patents. Research in this area is in progress in several countries and the conversion of cellulose to glucose and ethanol is of potential importance as an alternate energy source.

This project was made possible by the initiative of Ramachandran and reflects his abiding concern for national development.

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