that 'genetic engineering substantially increased the probability of transgene escape, even in a self-pollinating species'. They found that genetically engineered *Arabidopsis thaliana* having resistance to the herbicide chlorsulphuron had much higher chances of fertilizing a wild-type plant than the mutant *A. thaliana* carrying and expressing the same mutant gene $Csr^{1\text{-}1}$ as the transgenic plant.

In this regard, the commentary by Bhatia and Mitra[3] made interesting reading while raising several hitherto poorly discussed but relevant and serious issues concerning the commercial use of transgenic crops. It has been rightly pointed out that gene flow can potentially become a serious concern associated with the field release of transgenic crops. However, lately a very genuine interest has been growing among an ever-increasing scientific community in a special type of transgenics, wherein the transgene is placed not in nucleus but in another DNA-harbouring organelle of the cell, viz. the chloroplasts, in general called plastids. Such transgenics are referred to as transplastomics or those carrying the transgenic plastids. Since chloroplasts are almost always maternally transferred to the next progeny, there is little risk of any transgene flow from transplastomic plants to the neighbouring weedy or wild relatives. Therefore, genes introduced into the chloroplast genomes can move only through seed, whereas the genes introduced into the nuclear genome can move through seed as well as pollen[3].

The other advantages of chloroplast transformation technology in addition to the containment of the transgene, include possibility of expressing multiple genes in operons, high expression levels, possibility of expressing unmodified bacterial genes and human cDNA, and lack of gene silencing and position effects. The technology as such has numerous potent applications in developing plants resistant to biotic and abiotic stresses, and for production of therapeutic proteins and vaccines, which has already been demonstrated in the model plant system of tobacco, and potato and tomato. Technical limitations, however, have hampered its extension to other crops of agricultural importance. Nevertheless, numerous laboratories around the globe including the author's laboratory are engaged in developing transplastomics in rice, maize, wheat, soybean, mustard and cotton. More importantly, as pointed out by Bhatia and Mitra[3], there are many crops, which grow along with their weedy or wild relatives in the same geographical region. For this reason, it becomes important that chloroplast transformation be a method of choice for generating improved transgenics in crops such as rice, sorghum, cucurbits, solanaceous crops, *Vigna* spp., *Cajanus* spp. and *Brassica* spp.

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Indian National Academy of Engineering operationally poised for a new phase

Taking over the gauntlet of the post of President of the Indian National Academy of Engineering (INAE) on 1 January 2003 is Anumolu Ramakrishna, Larsen & Toubro Limited, Chennai. This is significant in the history of this Academy as for the first time the President comes with a background from industry. A. Ramakrishna takes over from distinguished academician Palle Rama Rao, who in 1999 was the Chairman, PG Review Committee that submitted its Report on 'Reshaping Postgraduate Education and Research in Engineering and Technology' to the All India Council for Technical Education (AICTE), New Delhi.

During the Fifth Annual Function of the Academy in December 2002, Ramakrishna, then President-Elect, when asked about his plans for INAE stressed the need for a 'mission approach' with which INAE would formulate action plans. There would be, he said, more interaction with politicians and policy makers invited to INAE meetings, on topics such as rural roads, connectivity between urban and rural areas, urban sanitary systems and telemedicine. This approach could help mend the prevailing disconnect between rural folk and the rest of India with regard to science and technology advancements. When posed with the question about the relevance of engineering education as it exists today with the needs of Indian industry, he replied that fresh entrants to industry had absolutely no idea of the applications of engineering to industrial problems and management. For this, he suggested 'user-oriented projects' and post-graduate training that would comprise the following essential components: practicals (6 months), managerial training specific to industry (6 months), industry projects and submission of project thesis. It is here he believes that Indian industry could fund individual training for skill improvement by supporting stipends. This would ensure that new entrants to industrial climes are better equipped to begin their careers efficiently. Ramakrishna also felt that engineering faculty should be attracted to spend stints in an industry environment that would mould their research and development into a 'more industry-relevant' activity. According to Ramakrishna, Indian industry was playing a key role in providing consultancy, for example to the Public Works Department. This was because private industry in his opinion had better engineering practices, shorter implementation times and providing better turnkey solutions for design and installation of structures. India, he said, needs a 'Corps of Engineering' cadre that would have a physical presence within State Governments to provide correct solutions to engineering problems of all types. He cited the achievements of several private industries whose involvement had led to the construction of the Narmada Bridge, cement plants, rebuilding blast furnaces with higher capacity, installing efficient coal rolling mills and refineries in relatively short time scales than previously executed. These were possible because confidence was reposed in private industry to deliver with a free hand although to begin with the economics of it would appear expensive. The real change, he felt, would be when Government Labour policy would accommodate the possibility of dismissing non-performing employees.

The INAE came into existence in 1987. Late Jai Krishna in his Presidential Address at the Foundation Function had said that the Academy had been established with a mission to be a 'peer' organization composed of the best talent from the entire spectrum of engineering in the country and to provide a forum for futuristic planning for the country's development requiring engineering and technological inputs. This thought was reiterated at the Fifth Annual Function of the Academy presided over by Palle Rama Rao, who in his 2002 Presidential Address felt that it was necessary for the Academy to build its own resource base on the lines of a 'blue-ribbon pattern' by drawing on the support of well-wishers from around the globe as had been successfully done by the IITs. The Academy presently gets about Rs 40 lakhs from the budget allocation of Rs 9.8 crores of the Department of Science & Technology under the head of 'Other Professional Bodies' sharing this head with mainly other science Academies in the country. Rama Rao felt that it was difficult to evaluate engineering. However, engineering made a huge difference to the country's economy, stating that one of the five pillars of the economic policy is engineering education. The challenges were, he said, the 'great gap in graduate engineering education' with small enrolments at the graduate level and even fewer engineering doctorates. The strength and distinguishing characteristic of INAE was, he said, the composition of Fellows, achievers from all sectors such as government and academia and industry, the latter constituting 20% of the total number. To date, this Academy has about four hundred Fellows and twenty-two Foreign Fellows.

On the occasion of the Annual Function, the Life Time Contribution Award – 2002 was presented to Jamshed Jiji Irani, a geologist by training who led Tata Steel until recently and is better known for 'changing Tata Steel from an efficiently operated but ageing steel behemoth of the eighties to an ultra-modern integrated steel plant comparable with the best in the world'. Irani has always believed that as Indians 'we may be limited in our resources, but not in our resourcefulness' making his company the only ISO 14001 certified steel producer in India in 2000 and a global benchmark, said Rama Rao while reading the citation. In his address, Irani laid out two thought-provoking propositions, namely, that we (Indians) should not wait for others to solve our problems since 'why should anyone else be concerned enough to solve it?' The example he cited here was the Tata Steel success of using poor quality coke for steel manufacture through in-house research and development. The second proposition often voiced is that of 'industry–academic interaction'. This, he said, was a story of failure and that he had personally tried but unsuccessfully. He spoke of a recent Scientific Advisory Committee-Cabinet's (SAC-C) approach of bringing both parties together where a common ground could be found for both to have benefits and co-operate at the same level. He hoped for 'success with this approach as we had no choice but to see it work'. He proposed 'four-year postings' of technologists with industry background to spend time in an academic environment and vice-versa.

Anand Swarup Arya, specialist in earthquake engineering, also received the Life Time Contribution Award – 2002 for his 'key role in experimental studies and developing indigenous expertise relating to earthquake disaster prevention and mitigation for variety of structures and his contribution in formulation of the Codes of Practice and Guidelines for earthquake-resistant design and construction of buildings'. Arya felt it necessary to implement retrofitting strategy for existing buildings. He stressed that non-implementation of solutions available were failing society and not the engineering fraternity, reiterating the important role that INAE could play in this regard.

The Hyderabad function also saw the presentation of thirty Young Engineer Awards – 2002 by the Academy which continues to support awardees in helping them get grants for research and development and if necessary, facilitates either technology transfer or technology improvement with industry. In the category of 'Innovative Potential of Students Project Awards – 2002', there were three awards at Doctoral level, six at Master's and nine at Bachelor's level. The three topics that earned awards at the Doctoral level were those concerning (1) use of ion exchange resins in chemical industry for separation processes in non-aqueous medium (2) high efficiency multi-stage bubble column for use in wet scrubbers, waste water treatment, etc. (3) design of a composite leaf spring with lightweight, strength and corrosive resistance and low production costs.

In the formative years of INAE, way back in 1984, it was envisioned that there was an urgent need for a coordinating body at the highest level whom the Government can consult on all matters pertaining to engineering. In 2003, this very aspect of 'being consulted' or the lack of it has to be introspected and a solution found if INAE and engineers are to have any 'formal clout' in shaping aspects of engineering, engineering education or policy.

Nirupa Sen