Amulya Reddy on the comparative costs of electricity generation and conservation. He provided a new and comprehensive approach for comparing different energy generation technologies and energy conservation. He demonstrated that the cost of nuclear power is higher than that of coal-based thermal power plant if reasonable interest rates are assumed. Hydro-electric power was shown to be always cheaper than nuclear power. Decentralized power generation such as biogas, producer gas, mini hydro and cogeneration into bagasse was shown to be cheaper than nuclear power. Energy conservation was demonstrated to be less expensive than all the above methods. He argued that in capital-starved developing countries there should be a greater emphasis on energy conservation. He highlighted the principle of least-cost planning in which the various options for bridging the demand–supply gap are taken up in the order of increasing cost. He cautioned, however, that the results presented by him were sensitive to the cost data that has been assumed. He observed that the ranking of the costs of different technological options is essential for a rational sequencing of various options in the least-cost electricity planning.

The seminar concluded with a discussion on the financial incentives offered by various agencies for renewable energy sources. This seminar was unique since it was for the first time that the field data collected on the performance of various renewable energy technologies in India were discussed in detail. This demonstrates that renewable energy technology has reached a take-off stage in India.

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RESEARCH NEWS

Recombinant gene therapy in the treatment of cardiovascular disease

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What distinguishes medical practice in the present century from that of earlier centuries is the impact of technology. Among the technological advances being made, recent excitement among medical men is caused by the rapid advances in somatic gene therapy research.

It has been demonstrated that genes can be inserted by retroviral-mediated gene transfer into a variety of mammalian cell types like the blood-forming cells, liver cells, neural cells, and endothelial cells. The objective of these gene transfer studies is to find cure for genetically-based deficiency diseases. It is also possible to enhance the function of otherwise normal cells by gene [illegible]. Application of this principle [illegible]ve the clinical efficiency of an [illegible]ble biomedical device forms the [illegible]of a recent article by Dichek [illegible]

[illegible] a major cause [illegible]scular disease. [illegible]

plasty). Recurrent occlusions are reported after these procedures and to maintain the arteries patent, absorbable and nonabsorbable metallic stents have been in use. Many laboratories are involved in perfecting the use of these stents. An important clinical problem in these devices is thrombosis in the early period and re-occlusion due to cell proliferation in the late period. The risk of early thrombosis can be reduced if the stents are seeded with autologous endothelial cells before placing the stent *in vivo*. A distinct advantage would be gained if one could engineer the cells used for seeding, to express an increased anticoagulant or thrombolytic activity. This is precisely what has been accomplished by Dichek *et al.*

Dichek *et al.* have demonstrated that the gene encoding tissue type plasminogen activator (tPA is a naturally occurring anticoagulant in the body) could be introduced into endothelial cells by retroviral expression vectors. They have also successfully seeded these cells onto metallic stents *in vitro* and shown that the genetically modified endothelial cells continue to express tPA while still attached to the device. The amount of tPA produced by these cells is significantly greater than that normally produced by human endothelial cells *in vitro*.

One may ask whether these *in vitro* results guarantee clinical efficacy. To answer this question, *in vivo* studies are required. Nevertheless, two other recent reports favour an optimistic view. In animal experiments, Nabel *et al.*[2] demonstrated that endothelial cells genetically modified *in vitro* express an indicator gene for atleast four weeks after implantation on denuded arteries. In another experiment, when dacron grafts seeded with genetically modified endothelial cells were implanted in arteries of animals, Wilson *et al.*[3] observed that, even after five weeks, the genetically engineered endothelial cells continued to express the introduced gene.

These three reports together illustrate the potential for recombinant gene therapy in the treatment of cardiovascular diseases.

1. Dichek, D. A. *et al.*, *Circulation*, 1989, **80**, 1347.
2. Nabel, E. G., Plantz, G., Stanley, J. C., Nabel., G. J., *Clin. Res.*, 1989, **37**, 521A, (abstract).
3. Wilson, J. M., Birinyi, L. K., Salomon., R. N., *Clin. Res.*, 1989, **37**, 593A, (abstract).

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