In this issue

Offshoots of basic research

At a symposium on 'The essential role of fundamental scientific research' held last December (see *Curr. Sci.*, 1990, **59**, 64), N. Sathyamurthy showed how molecular reaction dynamics, an area that appears to be of purely fundamental interest, has become extremely useful in high-technology areas. In the article (**page 725**) based on the talk, Sathyamurthy traces the growth of the subject, taking us up to laser-induced-fluorescence studies of combustion processes in automobile engines. He also bemoans the fact that, although high investments are not required, India unfortunately has not vigorously pursued either basic research in the subject or many of its applications.

What is fascinating about molecular reaction dynamics is its phenomenal growth and the ingenious techniques it has spawned in recent years. One of the great names in physical chemistry, Michael Polanyi—the name associated with the discovery of dislocations in crystals—, started it all in the late twenties by performing a simple experiment to determine the rate constant for the reaction of sodium and chlorine to form sodium chloride. To explain the surprising result of the rate constant being an order of magnitude greater than that predicted by theory, Polanyi proposed a 'harpoon' mechanism, in which the sodium chloride is formed in a 'stretched' configuration, i.e. the new molecule would be vibrationally 'hot'. This is really the infrared chemiluminescence that John Polanyi—the son—was to discover nearly thirty years later. Then followed the perceptive suggestion, in a paper in 1960 entitled 'Proposal for an infrared maser dependent on vibrational excitation', that a chemical reaction can induce 'partial population inversion', i.e., transformation of a fraction of the molecules to an excited state. Vibrational lasing was achieved by C. K. N. Patel in 1964, and in 1966 Pimentel and his group made a vibrational laser based on a chemical reaction. In both cases the major contribution to lasing came from partial population inversion.

Chemists then moved 'from bulbs to beams' when the crossed molecular beam method was discovered. It became common practice when Lee and Herschbach incorporated universal detectors in the system and reactions could be studied in single-collision encounters. This was followed by control of unimolecular reactions so that the reactions were directed to specific products with nonstatistical rates, a subject that is now becoming one of the most fruitful fields of investigation.

Nuclear safety—unclear?

The carcinogenic potential of ionizing radiation has caused much public concern to be directed at the occupational hazards to nuclear power plant workers, although the human radiation environment includes other sources of radiation than nuclear power plants, including natural radiation of terrestrial and cosmic origin. Several studies have been carried out world-wide of cancer risks for employees of nuclear power plants. Statistical methods have been devised that allow comparison of cancer-related mortality in a population occupationally exposed to radiation and that in a matched, non-exposed population. K. S. V. Nambi *et al.* report (**page 733**) results of their analysis of cancer mortality in the atomic energy department's workers in Bombay and Tarapur. While Nambi *et al.* find that their 'radiation-worker' groups do not constitute adequate databases for statistically meaningful conclusions to be made for those groups, they do find that age-specific cancer death rates for the radiation workers and their families together—constituting an adequate database—match those of the Bombay city general population. The authors even suggest that, since cancer-related mortality in the general population tends to be under-registered, estimated cancer risks for the atomic energy community are likely to be lower compared to the true risk for the general population.

Still, the last word has not been said about the potential hazards of occupational radiation exposure. A recent study in Britain has created a flutter (see News item, **page 721**) by linking fathers' radiation exposure to leukaemia in their children. Results of other studies in the US that might help understand the British results are eagerly awaited.

Solving the 'protean' problem

Molecular biology has seen phenomenal growth in recent years. One area of research that the rapid advances in molecular biology have shot into prominence is that of protein engineering. As the term implies, the aim of protein engineering is to be able to introduce specific alterations in proteins to make them function in desired ways or in specific circumstances. It is obvious that biotechnology, which is the use of living organisms or enzymes of organisms in the production of a variety of useful substances, will benefit from advances in protein engineering.

To make the right alterations in a protein molecule one must know the basic rules of how the sequence of amino acids of a protein translates into the three-dimensional structure of the protein, which is crucial for the way the protein works. Some of these rules are known, but it is clear that we need to know much more. E. Subramanian discusses (**page 728**) the problem—the 'protein folding problem'—and shows how exploratory protein engineering and protein-structure determination by crystallography can be used complementarily. In another article (**page 723**) M. Yahiya Khan also discusses the protein folding problem.