In this issue

Gene therapy

Curing diseases or playing God? Luddites often wrongly frame the question in this manner. Genetic manipulation of organisms, using recombinant DNA methods, is now commonplace. Rapid advances in technology and in our understanding of the mechanisms underlying many diseases allow us to realistically consider methods which alter human DNA to treat illnesses. Should we permit such approaches to medical treatment? Is it safe? What are the ethical implications? Are we playing with Nature when we alter an organism's DNA? Will we create a monster we cannot handle? There is only one answer to all these rather complicated questions: The application of recombinant DNA techniques to medicine, farming, industry, etc. does indeed raise important ethical, social and legal issues. The extent to which answers are known, the implications and the issues all vary from case to case and even with the social context. General answers are not only not possible, particular answers will change rapidly with time. In this situation, the only solution is for biologists to be in constant open communication with their societies so that an ongoing discussion with doctors, lawyers, social leaders, politicians and the lay public is always maintained. Decisions about what is possible and desirable should therefore be based on informed consensus. The credibility and openness of the scientific community is essential if medical science is to benefit from the immense possibilities becoming available.

The situation in many societies, including ours, is unfortunately quite the opposite. Post-World War II euphoria about science as the vehicle for eradication of poverty has given way to suspicion of technology. We are often asked to choose between economic development and the rape of the environment as if one must live in tribal splendour, at one with Mother Earth, or face the wrath of the Gods for daring to alter Nature. As a society, we must accept informed debate as a method for reaching agreement and as scientists we must place technical facts in an accessible form and appreciate concerns of social and cultural origins without being dismisive of them.

Let us take specific examples. Duchenne's muscular dystrophy is a sex-linked disease found in India and in the rest of the world. The gene responsible for the disease has been identified and studied in great detail. It is possible to rather easily diagnose if a developing foetus is male and carries the mutant gene. The human who develops with this defect will surely die early in his youth and will suffer greatly. If it were possible to inject his muscle cells with targeted DNA encoding the normal gene product, so that he is 'cured' and leads a relatively normal life, is it ethical? After all, we give thalassemics blood transfusions, can we not inject into the developing foetus genes which allow them to make normal blood, but do not affect them in any other way? Many biologists will give a qualified yes to these questions, their views depending on the exact method proposed. Many religious and social leaders may object, on the ground that one should not interfere with a developing foetus.

A critical requirement for informed debate on these questions is the availability of facts to discuss potential risks and possibilities. Facts alone are not enough to convince our societies about specific scientific agendas, but facts are essential. And facts on the possibilities can be available only by experiments on model organisms. Gene replacement is possible and has been done effectively in bacteria and yeast and is possible in animals such as mouse. Foreign genes have been introduced in a variety of organisms ranging from bacteria, plants and animals. These studies have allowed a rational analysis of specific possibilities of gene therapy in human. However, much needs to be learnt about how DNA-based therapy can be performed in human. What are the vehicles of delivery of the DNA? How will the DNA be targeted? How will it express in the required amount in the correct tissue and developmental stage? Rangarajan and Padmanaban (**page 360**) address these questions by reviewing rodent models for gene therapy and comparing them to what is possible in human. They present an analysis of their experimental approaches and possibilities. Comments on their report and similar reports from people studying other aspects of medical applications of modern biology should allow discussions to begin on an important issue.

K. VijayRaghavan

Soaps and history

Every child (and adult) who has blown soap bubbles will bear testimony to the marvellous properties of surfactants (a name derived from the term *surf*ace *act*ive *agents*). From soaps and detergents to emulsifiers and foaming agents, surface active molecules find myriad applications, that permeate almost every aspect of daily life. In biology, the wonderfully fashioned architecture of cell and organelle membranes relies on the lipid bilayer; a superb example of self-organization driven by hydrophobic effects. The part 'oil-like' character of soaps and lipids is crucial for their surface activity. Research on 'oil in water' systems began early with Aristotle reportedly speaking on the subject of 'spreading oil on troubled water'. Centuries had to pass before Benjamin Franklin calmed the waters in Clapham ponds by spreading a layer of oil (in what apparently is the first recorded preparation of a Langmuir film; Franklin, B., *Philos. Trans. Roy. Soc.*, 1774, **64**, 445). Towards the end of the 19th century, Agnes Pockels prepared the first monolayer at the air–water interface (*Nature*, 1891, **43**, 437), in an era where the amateur scientist still held sway.

Surfactants are systems with a split personality; a kind of molecular Dr Jekyll and Mr Hyde, with their behaviour being dramatically modulated by the environment. The amphilic nature of these molecules (part polar, part apolar) dictates that they form aggregates; a thermodynamically driven clustering, which results in the burial of apolar segments leaving the polar moieties on the surface. There is great variety in the nature of aggregates formed, with 'spherical micelles' being a feature associated with common detergents. Micellar structures were first suggested for surfactants in water by J. W. McBain (*J. Chem. Soc.*, 1914, **105**, 957); a proposal which was received with minimal enthusiasm. McBain, interestingly enough, went on to become the first Director of the National Chemical Laboratory, Pune, in the early 1950s. Today, the field of micelles is moving rapidly, with entire journals devoted to the study of surface active molecules. Curiously, among the large list of authors who have contributed to the literature of surfactants we must also count the erstwhile British Prime Minister, Margaret Thatcher (then Margaret Roberts), who began as a student of science. The field of micelles has moved on greatly as summarized in a review by S. P. Moulik (**page 368**).

P. Balaram