DESIGNER DRUGS TO DESIGNER BABIES : IS THE SOCIETY PREPARED ?

SEVERAL years back, an American billionaire terminally ill with cancer made news by setting aside a few million dollars for a cryopreservation company, for preserving his body after death at liquid nitrogen temperature. He hoped that in the future when cancer cure would be available, he would be 'resurrected' from death and live again cured of cancer. Had he lived a few years more upto June 2000 when almost complete human genome sequencing was announced, he probably had to pay less amount of money for the same, as the expectations for cure of cancer and for that matter, all diseases including genetic and late onset age-related diseases are much higher. Additionally, he would probably have wished to be 'cloned' to live for ever.

Application of chemistry to explain life processes had its beginning in the 18th century when a galaxy of eminent chemists characterized several organic compounds from biological sources and finally in the nineteenth century, the synthesis of urea led to the death of "vitalistic theory" giving way to a burst of activity in organic synthesis. Metabolic aspects of chemistry started as a result of attention focussed on medical problems, as a branch named Physiological Chemistry, a name when gave way to Biological Chemistry and finally to Biochemistry. With the advent of twentieth century, biochemistry burst into full bloom. Metabolic pathways, nutritional problems, enzymology, bioenergetics and components of living cells were studied in the fist half of that century. The next half of the last century brought forth the golden age of molecular biology through our understanding of gene function, hereditary mechanisms, cell division and differentiation etc., culminating in the development of genetic engineering and biotechnology. One can now isolate genes (pieces of DNA), their control elements, recombine them in test tube, put them in any host organism and multiply (clone) and permanently change the genetic make up of the living being (plant, animal or microbe). Using these techniques, man can make any foreign gene work to order in any organism. Thus, we can now express firefly light gene or human antibody in plants, make human insulin in bacteria, human blood protein in cows milk, or human hemoglobin in pig blood.

Instead of small organic molecules, large informational macromolecules (RNA, DNA, proteins and their laboratory-made smaller versions) are coming up as drugs of the twentyfirst century. Hope of curing genetic diseases by gene therapy is nearing reality. Computer modelling of molecular structures (molecular drug design) and robotics for multiple operations for synthesising large number of organic molecules with permutation and combination of a finite number of starting reactants have led to the new combinatorial chemistry – the medicinal chemistry of the 21st century. Now that the complete sequence of 3 billion nucleotide pairs of human genome is known, it is estimated that the number of genes that make us what we are with all the joys and sorrows is somewhere between 30,000 to 40,000. The pace of activity going on around the world now on knowing the functions of individual genes (functional genomics) predicts the camplete knowledge of this by, say five years. Knowing the functioning of genes in health and disease, there will be gene-based drug development (pharmacogenomics). As the sequence of a gene having same function differs slightly from individual to individual, the genome sequencing will correlate an individual's genetic make up with his or her susceptibility to a disease, response to a drug treatment and possible side effects in each individual. Eventually, there will be ethnic group or race-specific drugs and finally 'designer drugs' for each individual. Age-related late onset diseases like Parkinson's and Aljheimer's diseases will be controlled so that people can live full life extending to more that hundred years. Molecular diagnostic tools will enable doctors to diagnose diseases correctly for proper treatment. They will also be able to predict diseases even before birth of a baby by prenatal diagnosis. A health utopia indeed.

Marriage between embryology and molecular cell biology culminated in the cloning of the sheep "Dolly", thus bringing biology at the crossroads of human destiny. The advancement in assisted reproductive technology (ART) can help infertile couple to have children. Surrogate mothers now not only lend their uterus, but also egg cytoplasm to a woman whose eggs do not mature to fully competent state. Even cows can now be 'cytoplasmic surrogate' mothers for human babies. In the same way, male rat has been a human baby's surrogate father by lending its testis to mature the sperm of the baby's infertile father. The 'Microsort' technique can now separate male producing Y-sperms from female

producing X-sperms to predetermine the sex of a child one wants. Microinjection of a desirable gene into preimplantation embryo or selection for the absence of any defective gene can now give birth to 'designer babies'. Such cases have already been reported in news media, although Vatican and bioethicists have denounced such technology. Very recently, debate is going on whether human cloning for medical purpose and research on embryonic stem cells (these cells can be grown to make any desired organ/tissue like heart, liver, bone marrow, bone etc.) for manufacturing transplant material should be allowed. Already a research proposal for human cloning by the Italian Scientist Severino Antinori is being considered by the US National Academy of Sciences. Antinori and the Nobel Prize winning former Harvard physicist Seed declared that they will clone human any way. If all countries ban this, they will hire ships and go to international waters in the ocean for this. Society is now in a state of shock, scientists confused.

In science and technology, what can be done will be done sooner or later. But the social, ethical, political, legal, economic, demographical and ecological consequences of such rapid technological progress is difficult to ascertain at present. Each of these aspects will need elaborate discussions on benefits and risks. It is time that scientists should now also think beyond the lab and ponder over the question – how far and where we should go ? Granted that there will be social benefits. But, who will be benefitted ? Does the social benefit much outweigh the risks ? Can the risks be foreseen and prevented ? If we clone and design human, he will be biological man, but will he be 'human' man ? Shall we still remain human ? Can we prevent misuse of and discrimination by the genomic data. A genetic finding that Indians (the whole cross section of people of India irrespective of racial origin, food habits, life styles etc ?) are more prone to heart attacks may indirectly prevent a talented Indian to go to the top positions in US corporates even if he is twice as good as an American (What is American ?). Is there any guarantee against such happenings ? And finally, can biotechnology be controlled ? If so, who will control ? And will the advancement narrow the gaps between country and country (G-8 and G-80), race and race, man and man and man and woman and 'gene-rich' and 'gene poor' ? The answers to many such questions are not with the scientists and technologists, but are to be sough by the public at large through awareness and concern, informed opinion and debate, experience and history and above all, judgement and wisdom. ❐

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