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Crystal gazing into future of life sciences

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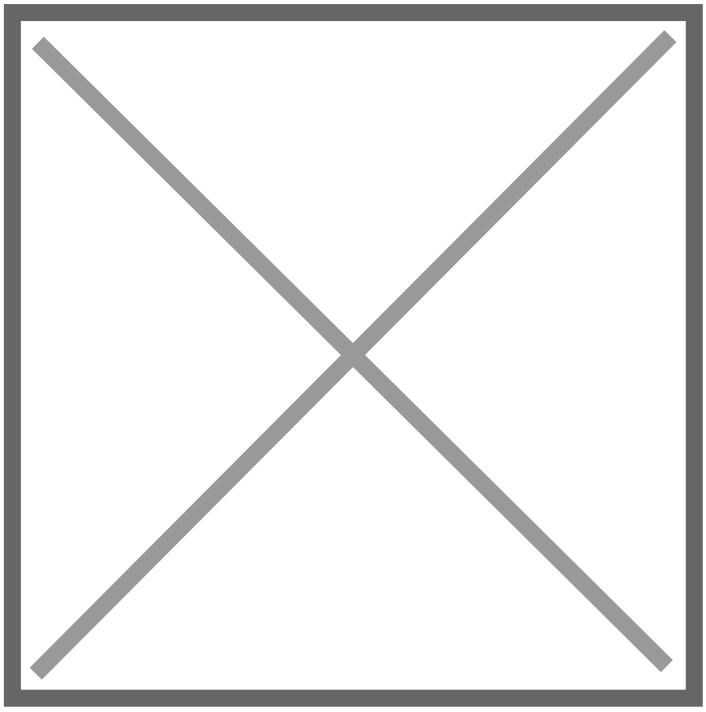

Crystal gazing into future of life sciences

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Can human life be prolonged? Is biomedical genetics miracle or mirage? Is human cloning ethical? Are fears about safety of genetically modified food justified? Is freedom of biomedical research jeopardized?

These are some of the questions that leading scientists, Nobel laureates, business leaders, policy makers, religious thinkers and social scientists addressed at the first World Conference on "The Future of Science" held in Venice from September 21-23, 2005. For the first time, experts from different fields shared a platform to talk about some of the most difficult issues facing scientific research today.

In the recent years, hopes of personalized medicine and 'life on a chip' have been raised with the decoding of human genome and progress made in various branches of genomics.

The real future of biomedical advances is unpredictable. Unless scientists believe that they know fundamental facts of life, they can only use extrapolation to gauge the extent to which science will impact public health in future. Clearly two streams of thoughts have emerged, pointed out Kenneth M Weiss, professor of biological anthropology and genetics, Penn State University. Some scientists believe that genetic research will identify all the relevant physiological pathways to disease, which will be the targets of molecular intervention.

On the other hand, the less enthusiastic lot feels that new molecular discoveries are actually revealing more complexities in disease causation. "There may be as much mirage as miracle in the current drive to map complex diseases. This turns prediction into predicament. We already know the evolutionary reasons and have data to support this view," said Prof Weiss.

Espousing a middle path, he pointed out that behavioral and lifestyle interventions could have greater impact on public health, in much cost-effective manner, than genetic interventions. But to do this would mean diverting investment from technical research to non-technical areas of education, prevention, and behavior modification. And this is a political choice. However, genetic diseases will need to be tackled using current research approaches and they are likely to have interventions such as gene-based therapies.

"Some believe that in areas ranging from behavior, to medicine, to agriculture, DNA will make this possible. But is this real or wishful thinking by scientists' self-interest? Are utopian predictions more likely than that, like the age of sail, the age of science will fade away, yielding to more immediate imperatives?" asked Weiss. "Our biomedical future may be a race between big science that depends on supporting socioeconomic structures, and the tiny, nimbly adaptable infectious microorganisms that will be the ultimate winners in the battle of life."

Dr Teruhiko Wakayama, scientist at the Laboratory for Genomic Reprogramming, Kobe Center for Developmental Biology, RIKEN Kobe, said though somatic cell cloning has been demonstrated in several mammalian species including sheep, cows, cats and mice, some problems exist. Cloned animals consistently display a variety of developmental abnormalities, such as placental anomalies, obesity and premature mortality of unknown cause, besides abnormal gene expression and retention of somatic cell features. Some of these are attributed to insufficiencies in the reprogramming of the donor nuclei.

Despite all these problems, Wakayama said, success in generating cloned offspring has opened new areas of investigation and provides an insight into complex processes like genomic reprogramming, imprinting, and embryonic development. Speaking on 'prolongation of human life span', Dr Leonard Guarente, MIT Cambridge, propounded a simple idea: eat less to live longer. In lab experiments, he said, a moderate to severe restriction of food consumption has been shown to extend the lifespan of rodents by as much as 50 percent! Not only this, it can protect animals from many diseases of aging, including cancer, cardiovascular disease, and neurodegenerative disease.

The session on agriculture biotechnology had some interesting presentations. Rice is the most important food for the world's population, particularly developing countries, feeding half the world. So any strategy to achieve food security has to address the question of improving rice yields without increasing land use and dependence on fertilizers and pesticides.

This new strategy must rely on an understanding the biology of rice and its genome, said Xing Wang Deng, professor of plant biology at department of molecular, cellular and developmental biology, Yale University. The sequencing of entire rice genome has thrown up new possibilities. The challenge now is to comprehensively and accurately annotate the rice genome and use the information to improve crop yield and quality. It is now possible to test and verify a variety of strategies to integrate current knowledge on the genome and understand what it encodes, he added.

With established synteny (order of genes occurring on chromosomes) with other cereal crops, discoveries and experience in rice can easily be transferred to other cereals, Prof Deng pointed out. Thus rice constitutes a good model for testing ways modifying traits in cereal plants of agronomic importance.

The current trend of terming genetically modified crops as unsafe for human health and environment came in for severe criticism by Prof Bruce M. Chassy, University of Illinois at Urbana-Champaign. "Agricultural biotechnology is an almost tragic case study stemming from confusion about risks based on science illiteracy. On the darker side, special interests stand to gain much by opposition to biotechnology," he declared.

Prof Chassy said humans have been practicing biotechnology for millennia. Most of fruits and food crops that we eat are a result of a natural process of gene transfers and evolution of species in earlier times, and of conventional breeding in recent times. New tools are only quickening this process. Gene technology has been used to produce transgenic plants resistant to insects and diseases as well as tolerant to specific herbicides. Over the past 10 years, cotton, maize, canola and soybean crops have been planted on 400 million hectares in 17 countries by 8 million farmers. The safety and productivity gains are well documented.

However, he said, there is global concern among consumers about the safety of biotech crops despite stringent governmental and regulatory scrutiny. He said these concerns can be traced directly to virtually 100 percent negative media coverage -much of it fueled by vested interest groups. "Though virtually unanimous in their support of biotechnology, the scientific community has been largely absent from the public discourse. Scientific culture generally discourages scientists from participation in political and social debate."

Stressing on science-based risk assessment of the food systems, Prof Chassy said, "Eating a proper diet, and avoiding over-nutrition, food borne illness and naturally occurring toxicants should be the major food consumption priorities for consumers. Consumers are, on the other hand, fearful of GMOs, pesticide residues, and chemicals added to our foods. This inversion of the risk hierarchy by consumers, the media and political leaders, leads to regulatory and research expenditures on issues that will yield little real improvement in safety and health," he concluded.

The conference organized by three Italian foundations - Umberto Veronesi, Giorgio Cini and Silvio Trochetti Provera Ã¢â?¬â?? adopted Venice Charter that suggested setting up of an inter-disciplinary authority of scientists, philosophers, theologians, policy makers and social scientists to examine science-society linkages more closely.