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“The Bioethics, Regulation, and Future of Genomic Modification”

Chairs:

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Historical background

This is a marvelous time for genetics, due largely to advances in genetic analysis and genetic manipulation. The impact of innovations in high-throughput DNA sequencing and in genome editing have been felt broadly, from work on model organisms, to evolutionary studies, to improvement of food organisms, to medical applications.
Classically, genetic studies relied on the discovery and analysis of spontaneous mutations.
Later methods relied on transposon insertions that could be induced in some organisms; but these procedures, like radiation and chemical mutagenesis, produced changes at random sites in the genome.
The first targeted genomic changes were produced in yeast and in mice in the 1970s and 1980s.
This gene targeting depended on the process of homologous recombination, which was remarkably precise but very inefficient, particularly in mouse cells. Recovery of the desired products required powerful selection and thorough characterization. Because of the low frequency and the absence of culturable embryonic stem cells in mammals other than mice, gene targeting was not readily adaptable to other species.

Current situation

Nowadays, the future of medicine and international healthcare may lie in genomics, the interdisciplinary field of science that has to do with the human genetic code and the very blueprint of who we are. Moreover, advances in genomics has the potential to be one of the most revolutionary and historical developments in our lifetime, and as we grapple with the momentous implications, remarkable potential, and grave ethical questions, we must consider the holistic picture.
We are now moving into an age where genetic modification is becoming a reality, and the implications are both far and wide and everything possible in between - how we approach medicine, how we define health; we see today that already, genetic engineering and genomic principles are making their way into modern medicine and healthcare.
As the recent improvements in genome editing techniques have made the modification of specific gene sequences of living organisms easier, faster and more precise, its practice has started to be adopted by areas concerning animals and plants, and is now starting in humans. These

developments could potentially result in a wide array of medical applications for treating many serious diseases, but on the other hand, they raise ethical concerns such as “designer babies” or embryo editing. Concerns about the social, cultural, legal and ethical implications of such progress have been growing more rapidly since Crispr-cas 9 technique was developed.

UN involvement

Article 1 of UNESCO’s 1997 Universal Declaration on the Human Genome and Human Rights reads: “The human genome underlies the fundamental unity of all members of the human family, as well as the recognition of their inherent dignity and diversity. In a symbolic sense, it is the heritage of humanity.”
Gene therapy could be a watershed in the history of medicine and genome editing is unquestionably one of the most promising undertakings of science for the sake of all humankind,” the UN Educational, Scientific and Cultural Organization (UNESCO) said in a news release on a report by its International Bioethics Committee (IBC).
But the IBC added: “Interventions on the human genome should be admitted only for preventive, diagnostic or therapeutic reasons and without enacting modifications for descendants.” The alternative would “jeopardize the inherent and therefore equal dignity of all human beings and renew eugenics,” it said.

This is not the first time that a UN body has raised such concerns. In 2010, UN chief Ban Ki-moon said that “as we develop technologies that enable us to make life-or-death decisions, we need a shared, value-based approach to what are fundamentally moral questions.”

Countries involved

- China: a team of Chinese scientists has edited the genes of human embryos for the first time ever, confirming long-swirling rumors that such ethically dicey experiments were underway and flouting recent calls to put a stop to them.

- UK: The UK has become the first country to license genetic modification of human embryos

- Japan: Japan has issued draft guidelines that allow the use of gene-editing tools in human embryos. The proposal was released by an expert panel representing the country's health and science ministries on 28 September.

- US: Researchers at Stanford University have reworked CRISPR-Cas9 gene-editing technology to manipulate the genome in three-dimensional space, allowing them to ferry genetic snippets to different locations in a cell's nucleus.

Key Words

Genetic engineering: Also called genetic modification or genetic manipulation, it is the direct manipulation of an organism's genes using biotechnology.

Genome editing: It is a type of genetic engineering in which DNA is inserted, deleted, modified or replaced in the genome of a living organism.

Crispr-cas 9: CRISPR offers a simple, inexpensive, and remarkably effective genome engineering method that enables users to "make specific and efficient modifications to a genome."

Questions to consider

- What can you anticipate happening in the future, and how may the future of medicine and healthcare come to be defined by genetic principles?

-What will be the medical dangers (moral and physical damages) of genomic modification?

-Will genomic modification exacerbate wealth inequality?

-Shall we seek the ideal human?

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