

Word Alive 2022 - UCCF Science Network

Session 3 - Can we edit who we are?

The human genome consists of 23 chromosomes, approximately 20,000 protein-coding genes and 3.2 billion base pairs. The protein-coding genes only account for about 1% of the entire genome. The remaining 99% consists of regulatory components, 'pseudo-genes' that are replicated from generation to generation but appear to have lost any function and repetitive segments with multiple copies of near-identical sequences.

Although the first sequencing of the entire human genome was carried out in 2003, it contained many gaps. The first end-to-end and gap-less sequence was publicly announced on 31 March 2022.

a) Genetic screening

Whole genome sequencing is now available as a clinical tool. 100,000 Genomes Project was completed in 2018 sequencing 100,000 genomes from NHS patients affected by rare disease or cancer.

The NHS is planning to obtain complete genomes of up to 200,000 babies which will be sequenced and analysed for a set of actionable genetic conditions which may affect their health in early years. "This aims to ensure timely diagnosis, access to treatment pathways, and enable better outcomes and quality of life for babies and their families."

The ability to obtain extremely detailed and predictive genetic information both before and after birth is raising a number of complex ethical questions:

- a) Embryo screening in order to select optimal embryos with the maximum genetic potential.
- b) Prenatal screening of the fetus in order to enable abortion of fetuses with 'undesirable' characteristics.
- c) Screening of newborn babies in order to identify those at risk of physical, mental and behavioural illnesses and anomalies both in childhood and later life.

One of the complexities of genetic testing is that if a significant disease-causing mutation is found in my genome, this may have enormous implications for my relatives, including my parents, my siblings and my present or future children. How can we ensure fully informed consent prior to undergoing genetic testing?

"For his birthday, Daddy gave him a time bomb...."

Questions:

1. Would it be ethical to select embryos for 'socially desirable characteristics' such as intelligence, sporting ability or sexual orientation?
2. Is it ethical to allow abortion on the basis of 'socially undesirable' genetic characteristics?
3. Is it ethical to identify genetic abnormalities and variants in children without their informed consent?
4. Should insurance companies, banks and commercial organisations be allowed to use genetic information to target their products?

What biblical and Christian reasons would you give for your answers?

In biblical Christian thinking predictive genetics is not an unalloyed good. The ability to predict the future in detail is often seen as an occult practice, called soothsaying, and it is quite different from biblical prophecy, see for example Deuteronomy 18:10-14. Is it possible that the ability to predict what diseases you may

suffer from in the future and how and when you are likely to die, may be more akin to 'soothsaying' than an aid to godly and faithful living?

b) Genetic editing

It is now possible to achieve highly targeted editing of the human genome using CRISPR technology, for example changing one specific base pair in 3.2 billion.

Somatic cell genetic editing – 'gene therapy'

This aims to change the genetic code within populations of cells within the body for therapeutic purposes. The genetic changes only last for the lifetime of the individual and they are not passed on to the next generation. The altered genes can be delivered in a variety of ways including viral transfection and bone marrow transplantation.

In general somatic cell gene editing carries the same ethical questions as for any new experimental and potentially dangerous treatment – safety, efficacy, informed consent and so on.

There is also the possible of using the technology in order to enhance physiological functioning to supra-normal levels. 'Gene doping' has been used covertly to enhance athletic and sporting abilities.

Germ-line genetic editing

This involves editing the genome of the human embryo. Since the gametes (sperm or eggs) are also affected, any genetic changes may then be passed onto future generations and on indefinitely into the future of the human race. At present germ-line genetic editing is illegal across the world although a small number of cases have occurred, and it seems likely that there are many more unreported cases.

Christian perspectives

Our unique genetic code is a marker of our individuality but we should not fall into the false idea of genetic determinism. This is both scientific rubbish and theological heresy. We are not programmed by our genes. We are human beings who have been given the gift of genuine freedom by our Creator. We are held morally accountable for the choices we make.

Do we regard the human body as a 'Lego-kit' which can be reconstructed and rearranged according to our human desires? Or do we regard the human body as a 'flawed masterpiece', a unique artistic creation which we may restore using advanced technology to reflect the original artist's intentions, but whose fundamental design we must not change. This reflects the difference between 'restorative' interventions and 'enhancing' interventions. In my view the main ethical question behind genetic interventions is not so much the technology but rather what we are trying to achieve.

Questions:

1. Would it be ethical to edit the genome of an embryo with a lethal or severely disabling genetic variant in order to allow them to live a normal healthy life? If not, why not?
2. Would it be ethical to edit the genome of an embryo with Down syndrome to remove the additional chromosome?
3. Would it be ethical to create a genetic clone of yourself? Or of your dead child?
3. Would it be ethical to edit an embryonic or neonatal genome in order to enhance a child's intelligence, life-span or moral behaviour?

What biblical and Christian reasons would you give for your answers?

Further reading

Genetic ethics: Do the ends justify the genes, Edited by John F. Kilner, Rebecca D. Pentz, and Frank E. Young, Eerdmans

Genes, Determinism and God, Denis Alexander, Cambridge University Press

A crack in creation, Jennifer Doudna, - (a helpful explanation of CRISPR technology and its implications from a secular scientific perspective).

More resources at **bethinking.org** and **johnwyatt.com**

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