| VOLUME 28 | NUMBER 1 | JUNE 2019 | ISSN1361-7710 |

Cambridge Papers
Towards a biblical mind

Healing, enhancement and the human future

By Denis R Alexander

This is a crucial moment in the history of science: a new technology offers the potential to rewrite the script of human life.
Carrie Wolinetz and Francis Collins, 2019[1]

Summary
This Paper reviews some recent examples of genetic engineering and brain science that make human technoscientific enhancement a pressing moral question. Healing and different types of enhancement are compared. Two rival world-views are considered, Transhumanism and Christianity – with contrasting visions of life after death – world-views which come to strikingly different conclusions concerning the path that leads to true human enhancement.

Introduction

Recently Jennelle Stephenson from Florida was dramatically healed using genetic engineering from her sickle cell anaemia – a disease that prevents oxygen being delivered properly to the body's tissues.[2] Or was it enhancement? Healing refers to our physical, mental and spiritual restoration to the state in which we found ourselves before becoming ill and/or to the state which is experienced, on average, by the rest of humankind. The term 'enhancement' is a little trickier to define and here we will consider four types:

Transhuman enhancement (Type A) is probably best known from films, sci-fi literature and computer games. It refers to physical or mental enhancements that go well beyond anything found in present humanity as typified, for example, by the epic 2009 American film *Avatar,* set in the mid 22nd century, in which scientist 'avatars' are operated by genetically matched humans. To start bringing sci-fi worlds into our own bodies, more than 3,000 Swedes have chosen to have microchips implanted in their hands which contain personal details, credit card numbers and medical records.[3] A wave of the hand pays for a train ticket or opens a security door – just a small taste of what is yet to come.

Individual enhancement (Type B) refers to the enhancement to the individual over and above their own previous abilities, but yet remaining within the range of abilities presently found within human populations. A disabled athlete may use artificial legs to enhance their running speed, but the speed is not greater than that displayed by the world's best runners.

Ultimately it is different metaphysical world-views that make the biggest difference to the ways in which people think about enhancement.

Prophylactic enhancement (Type C) involves technological processes that prevent disease. At one level these are familiar and well-established: vaccination; daily statins to reduce blood cholesterol to prevent heart disease and strokes. But now new technologies, such as embryo editing discussed below, are raising more difficult questions as to how far we go with Type C.

Christ-centred enhancement (Type D) refers to the Christian's vision for God's work in their lives that makes them more like Christ, enhances their relational health, and prepares them for the age to come. This concept of human enhancement is shaped by the overall biblical framework of creation, fall, salvation and eschatology – the latter referring to the new heaven and the new earth

1 *Nature,* 567:175, 2019.
2 www.nhlbi.nih.gov/news/2019/sickle-cell-patients-recovery-after-gene-therapy-heightens-hopes-cure.
3 www.economist.com/europe/2018/08/02/why-swedes-are-inserting-microchips-into-their-bodies.

An example of Type A enhancement, Neil Harbisson and his cyborg antenna

promised throughout Scripture (Isaiah 65:17; 2 Peter 3:13; Revelation 21:1–27). Type D enhancement may incorporate aspects of Types B and C, but this involves some challenging questions: how much healing should we expect now?; and at what point does the Christian's hope for wholeness in the present evil age become hubris?

Here we focus on two current areas of technoscience, genetic engineering and brain control, that serve to illustrate and highlight the distinctions between healing and these various types of enhancement.

Genetic engineering, healing and enhancement

Until 2012 the problem for modifying the DNA of a cell was in specifying precisely where the alteration would happen. That situation changed dramatically with the discovery of CRISPR-Cas and a series of publications illustrating its multiple uses over the period 2012–15. CRISPR-Cas is a molecular complex which has the ability to change the DNA of any organism, including humans, with a high degree of specificity at any particular position in the molecule in such a way as to potentially alter the properties of that organism. The gen(i)e really is out of the bottle.

In terms of healing, the genetic engineering of humans currently has three main types of application. In the first type, immune cells are genetically modified to make them work more efficiently. The second type is aimed at those 7,000 genetic diseases, often very rare, caused by a single defective gene. It is now possible to replace the defective gene with a functioning gene to cure the disease, Jennelle Stephenson's cure from sickle cell anaemia providing but one of many recent examples. Jennelle's bone marrow cells were removed, CRISPR-Cas was used to correct the mutation[4] and the healed cells were replaced in Jennelle. Apart from the novel technology, such healing is comparable with healing from any other type of disease: it is not enhancement because Jennelle's oxygen delivery has now been restored to average levels. But only the patient is healed, not their progeny, who may still carry the defective gene.

This problem is potentially solved in the third main type of human genetic engineering in which CRISPR-Cas is used to heal very early human embryos of a specific disease-causing genetic mutation. The embryos are generated by in vitro fertilisation (IVF) using the mother's egg and the father's sperm. If healed embryos are implanted in a mother with a successful birth, then all subsequent generations would be healed of that disease.

In November 2018, Dr He Jiankui, from the Southern University of Science and Technology in Shenzhen, China, made the dramatic claim that, for the first time ever, genetic engineering had been used to change the human germ-line.[5] Dr He reported the birth of twins, one of whom lacked the gene encoding CCR5, a protein necessary in many cases for HIV infection to occur. This announcement of work, as yet unpublished, has received widespread criticism.[6] For example, it broke international ethical norms; there are other less risky ways of preventing HIV infection in children; and CCR5 may be required for other functions, as yet unknown.[7] Also, due to technical failure, only one of the twins lacks CCR5. Experimenting with children is wrong. But the He Jiankui experiment, at least in its motivation, provides a clear example of medical enhancement Type A, since its aim, however misconceived, is to change the human genome in such a way that individuals are enhanced in their resistance to HIV infection.

> A new medical technique is developed with the best of motives to cure some medical condition, but this same technique then opens up potential new doors for use in enhancement Type A or for more sinister applications in social control.

Many other attempts are being made to edit early embryos in this way. Clearly the goal, unlike the He Jiankui experiments, which involved no genetic disease, is ultimately to implant the healed embryo in the mother with the aim of giving birth to a child healed of a particular disease running in a family. There are hundreds of genetic mutations that can cause the death of children in their very early years. But as the reaction to the He Jiankui work has highlighted, further research to ensure safety is necessary before the legal embargo on such germ-line editing may eventually be lifted. In fact a moratorium on embryo editing has been proposed to allow time for further ethical reflection and work on the safety concerns,[8] and the WHO plans to oversee future embryo editing.[9] But if ever applied, the technique would lead to a unique form of Type C enhancement, since the aim is to prevent disease.

In the interim many wonder why and whether such embryo editing should be allowed when another form

4 A 'mutation' refers to a change in the genetic letter sequence of DNA.
5 The 'germ-line' refers to the genetic information that is passed from parent to child.
6 D. Cyranoski, 'CRISPR-baby scientist fails to satisfy his critics.' *Nature* 564:13–14, 2018.
7 D. Cyranoski, 'What's next for CRISPR babies?' *Nature* 566:440–442, 2019.
8 E. S. Lander, *et al.*, 'Adopt a moratorium on heritable genome editing.' *Nature* 567:165–168, 2019.
9 Nature Biotechnology 37:338, 2019, 'WHO to oversee genome editing'.

of Type C enhancement is already available, known as Preimplantation Genetic Diagnosis (PGD). Here embryos are screened in IVF clinics for a known mutation that causes disease in a family's history and only the healthy embryos are implanted in the mother. In the vast majority of genetic diseases such embryos will be available, so is it really worth developing such a complex, expensive and potentially risky technology as embryo editing for the benefit of such a tiny number of cases where PGD might not be feasible? Donation of healthy sperm, eggs or embryos also provides well-established means of preventing the birth of children who will suffer a devastating genetic disease. Furthermore, adoption is always an option.

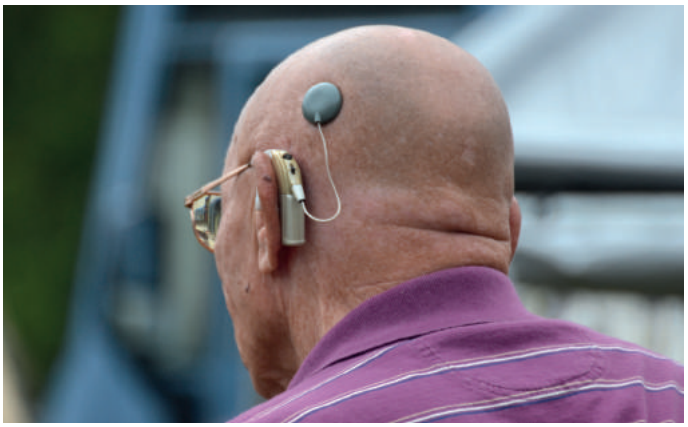
And what about the use of embryo editing for enhancement Type A? A company has been set up in the US to enhance babies genetically on a huge scale.[10] Harvard Professor George Church has identified around 40 genes that could be useful in creating a race of astronauts more able to survive well in space travel.[11] Is this a slippery slope? How much could embryo editing be used to enhance the human genome? To make people more intelligent? To generate better athletes? Stronger soldiers for the army?

Transhumanists share a common commitment to a materialistic, ontologically reductionist, non-relational view of human personhood, a mechanistic view of human life in which the body is a mere device.

Brain research

What about brain control? The image of the cyborg is a familiar one from science fiction movies – organic beings with mechanical parts. But one of the main drivers of developing brain–machine interactions is medical. This well illustrates the way things normally go in technoscience. A new medical technique is developed with the best of motives to cure some medical condition, but this same technique then opens up potential new doors for use in enhancement Type A or for more sinister applications in social control.

One of the earliest and most successful examples of direct machine–brain interaction is the cochlear implant developed in Australia by committed Christian Prof. Graeme Clark in which a multi-channel electrode implant is connected directly to the auditory nerves so that deaf people can now hear.[12] Around 500,000 people around the world have now benefitted from cochlear implants.[13] As of 2017 it became possible to stream sound straight from your iPhone into your brain via a wireless cochlear sound processor.



What about controlling the cyborgian computer interface simply by thinking about what to do? Take, for example, Bill Kochevar who was paralysed in a bicycle accident nine years ago.[14] Using a brain–computer interface, Bill is now able to move his arm to do useful things simply by thinking about it. The built-in computer transmits his thoughts straight from his brain to a so-called functional electrical stimulation system that then moves his paralysed arm.

All these are examples of healing. But let us also notice that very similar cyborgian technologies could readily lend themselves to quite different applications. As claimed by previous Google CEO Eric Schmidt: 'Eventually you'll have an implant where if you just think about a fact, it will tell you the answer.' Now imagine a situation where it were possible to place an electrode in the brain of a persistent paedophile. As soon as paedophilic intentions are detected, these are flashed to a computer in a local police station that immediately sends a suppressing signal that blocks the thought before it can turn to action. At the moment such a scenario appears to belong to science fiction enhancement Type A. Or is it a form of mental healing? Or Type C enhancement? Such thought experiments illustrate the challenges that lie ahead.

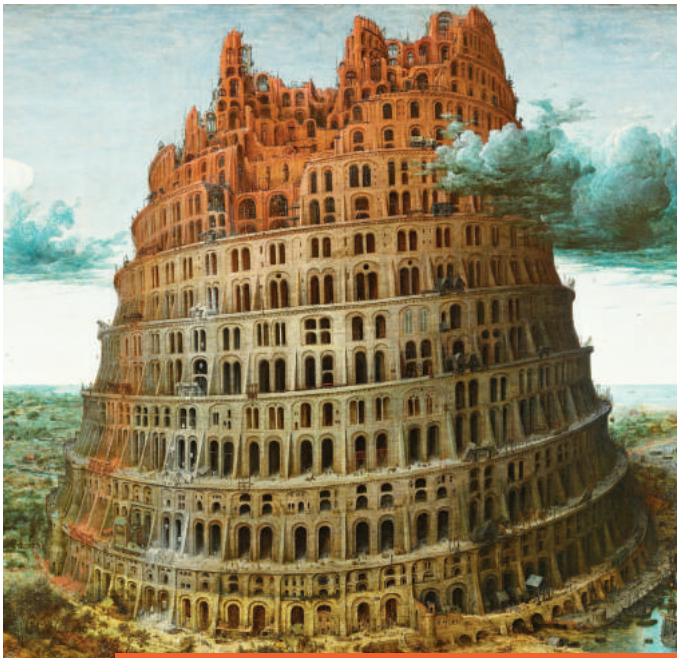
Two rival world-views

Ultimately it is different metaphysical world-views that make the biggest difference to the ways in which people think about enhancement. On healing most are agreed,[15] but on the various types of enhancement there is divergence. In what follows, the Christian vision for enhancement Type D will be contrasted with the strikingly different Transhumanist vision which tends to focus on Type A.

The Transhumanist vision

Transhumanists, as their name suggests, wish to see technoscience used to extend human capabilities well beyond their present limitations. Nick Bostrom from Oxford University says that 'transhumanists view human nature as a work in progress, a half-baked beginning that we can learn to remold in desirable ways.'[16] Giulio Prisco, a transhumanist who used to be a computer scientist in Europe's space

10 A. Regalado, 'The DIY designer baby project funded with Bitcoin.' *MIT Technology Review*, 1 Feb., 2019.
11 J. Pontin, 'The genetics (and ethics) of making humans fit for Mars.' *Wired*, 8 July 2018.
12 M. Worthing, *Graeme Clark – the man who invented the bionic ear*, Allen & Unwin, 2016.
13 Graeme Clarke, Personal Communication.
14 www.bbc.co.uk/news/health-39416974
15 This is not invariably the case. For example, some in the deaf community wish to retain deafness in their progeny in order to retain highly valued forms of social interaction.
16 Nick Bostrom, 'Transhumanist Values', https://nickbostrom.com/ethics/values.html



The story of Babel demonstrates the tensions in human development of technology. *The Tower of Babel,* Pieter Bruegel the Elder, circa 1563–1565

agency, writes that 'the ultimate realization of the dream to achieve indefinite lifespan, with vastly enhanced cognitive abilities, lies in leaving biology behind and moving to a new post-biological, cybernetic phase of our evolution.' When this perfection is achieved, writes Prisco, 'we will build (and/or) become gods.'[17]

Transhumanists share a common commitment to a materialistic, ontologically reductionist, non-relational view of human personhood, a mechanistic view of human life in which the body is a mere device.[18] In the present Machine Age in which we are living, any technical input that increases our happiness is to be valued, but such inputs are assumed to involve physical, mechanical or chemical manipulations.

But the main focus is on the future – transhumanists frequently make eschatological pronouncements full of faith. Ultimately there will be human–brain interfaces that will allow the uploading of the human brain on to supercomputers – the AI Singularity in which the superintelligent machines become autonomous and self-aware.[19] This will involve the extinction of biological humanity in order to abolish death altogether. *Homo sapiens* will be replaced by *Homo cyberneticus* in a do-it-yourself eschaton.

The Christian vision

The salvation inaugurated through the death and resurrection of Christ leads in the New Testament to a great looking forward to the fulfilled kingdom in which Christ's reign over a new heaven and a new earth will be complete. The 'sting of death is sin' (1 Corinthians 15:56) and with that sting wiped out through the cross, those who belong to Christ – 'the man from heaven' (1 Corinthians 15:49) – will share in his life for ever in their radically enhanced resurrection bodies, with moral and physical restoration joined together. In those future bodies in the new earth 'There will be no more death or mourning or crying or pain, for the old order of things has passed away.' (Revelation 21:4)

Healing was central to Christ's mission on earth, demonstrating God's love as a great sign of the coming of the Kingdom – God's reign over all things (Luke 9:11; Matthew 14:14). Jesus authorised his disciples 'to heal every disease and sickness' (Matthew 10:1) and as they healed they were to preach that 'The kingdom of God is near you' (Luke 10:9). As we follow Christ in the ministry of healing in the present age, so we are pointing towards that time when God's rule over our physical bodies is finally complete. It will never be complete in the present age, but it certainly will be in the age to come, the future fulfilled Kingdom.

The two visions compared

The *Transhumanist* vision is to maximise present individual human happiness as interpreted through a purely materialistic lens. So if embryo editing eliminates disease-causing genes from a particular family lineage in a safe way, or if we can make people more intelligent, then of course we should do it. 'Better, faster, stronger' is the Transhumanist slogan.

From a biological perspective there does seem considerable naïveté in the Transhumanist literature concerning the potential of genetic engineering to generate humans with greatly advanced complex human traits. For example, we know from behavioural genetics that around 50 per cent of the differences in biometrically measured forms of intelligence, such as IQ, can be attributed to genetic variation within a given population.[20] But such differences are explained by thousands of genetic variants that contribute to such heritability, each one contributing less than 0.1 per cent to the overall variance in the population. So the human genome is a very complex system, challenging to improve, its complexity being its best defence against meddlers.

Christian enhancement centres on growth in virtues such as kindness, humility, love and generosity – the kind of virtues that help relationships to flourish.

And why would you want to do that anyway? Out of great intelligence can come great evil. And how would it be fair at school if the genetically engineered enhanced pupils did so much better than the 'normals'? All that would happen is greater social inequality and we have enough of that already. Central to all such questions is the Christian understanding

17 G. Prisco, 'Transcendent Engineering', in M. More and N. Vita-More (eds), *The Transhumanist Reader*, London: Wiley, 2013, p.234.
18 M. O'Connell, *To Be a Machine*, London: Granta, 2017.
19 R. Kurzweil, *The Singularity is Near*, London: Duckworth, 2005.
20 J. J. Lee, R. Wedow, A. Okbay, *et al.* 'Gene Discovery and Polygenic Prediction from a Genome-Wide Association Study of Educational Attainment in 1.1 Million Individuals.' *Nature Genetics*, 50:1112–1121, 2018.

of the Fall (Genesis 3:1–24; Romans 1), well illustrated by the history of technology, as it is hard to identify a human technology that has not been used for evil as well as good. Developing technologies with the specific aim of individual enhancement will only expand the human capability to do greater evil. This is always the consequence when humans seek to be their own gods. Since human minds are fallen, how could we trust those who seek to judge what are 'good' qualities to be amplified in humankind?

So for the *Christian* a key question is what do we mean by the 'good' and how can and should that good be enhanced both now and in the age to come? Jesus Christ demonstrated human flesh to be good by becoming sinless flesh in his incarnation (John 1:14). And for the followers of Christ the understanding of the good in the present is heavily influenced by their future life with Christ. Just as Christ's healing ministry on earth acted as a sign to the future Kingdom, so his work in the lives of believers through his Spirit right now provides a communal pilot-plant, pointing forward to the time when transformed resurrected believers enjoy God in community for ever. For the Christian the present aim is to 'reflect the Lord's glory' and thereby to be 'transformed into his likeness with ever-increasing glory, which comes from the Lord, who is the Spirit' (2 Corinthians 3:18). Christian enhancement depends on God's work in the lives of those who submit to his will both now and in the future. The success of such enhancement depends on the extent to which the believer becomes more like Christ.

Therefore Christian enhancement centres on growth in virtues such as kindness, humility, love and generosity – the kind of virtues that help relationships to flourish. And this flourishing takes place in human communities that are diverse, and with limitations and weaknesses that entail that its members have to rely on one another. Christian enhancement is expressed through a myriad different human personalities, passions, abilities and convictions – there is no room for clonal conformity. All this is in striking contrast to the transhumanist vision which relies on machines and genetic modification to achieve the perfect future for the individual, with little interest in relational community.

Nevertheless, the Transhumanist philosopher Mark Walker, who has theological interests, thinks that we can improve morality and virtues via genetic engineering. Prof. Walker writes that 'The implications ….of the genetic virtue program are clear: if we can locate the genes associated with agreeableness and increase their frequency, then we may increase the virtue of caring in a population and reduce the vice of uncaring'.[21] But once again there seems to be a yawning gap here between Transhumanist aspiration and scientific reality. Hundreds of genetic variants contribute to the variation in a population of a complex trait like agreeableness. And in any case, would we really want to engineer super-agreeable people who don't stand up to injustice? The likely outcome would be 'passives', super-boring people.

The point about Christian virtues is that they develop through the actions of God the Holy Spirit working in people's lives to produce the fruit of the Spirit. And establishing good habits is what leads to good virtues. So it is a category mistake to look for the genetic causes of virtues, because the whole point of a virtue is that it develops as a process that involves human effort, for the Christian coupled to the work of the Spirit in bringing about a transformation of life. It is persons who are virtuous and there are no short-cuts to virtue.

Rival eschatologies

Ultimately the rival eschatologies of the Transhumanist and Christian faiths send their followers in very different directions. For the Transhumanist, the immortal human future lies in a disembodied digital existence with our failing biology left behind. As Simon Young asserts: 'the belief in the Fall of Man will be replaced by the belief in his inevitable transcendence – through Superbiology'.[22] But when you look to see what Superbiology means in Transhumanism, it always seems to end up in pure digital mind without a body in sight, a truly tedious existence. And in any case, an eternal future for fallen humanity would just 'give corruption an everlasting license', to use the potent phrase of theologian Ted Peters. So what we believe about the future really does make a difference to the present. In contrast to Transhumanism, with its do-it-yourself eschaton and its rejection of a future bodily life, in the Christian vision the transformed body remains central for all eternity and its salvation and healing is a wonderful gift of God. And in the Christian vision it is not only humanity who are to be redeemed, but also the whole created order.

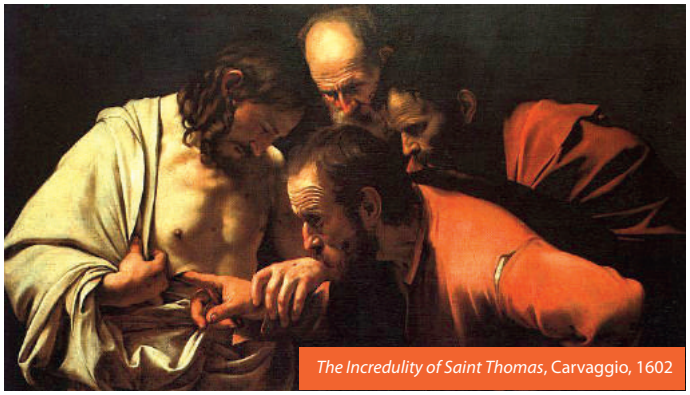
> Christians await expectantly a new heavens and a new earth with resurrected persons enjoying completely fulfilled lives with God and each other, not as a result of their technoscientific striving, but as a result of God's grace.

This leaves the Christian with a practical challenge: how much of the future Kingdom should we expect to be realised now in our physical bodies during our life on earth? The passion for healing – a direct mandate from Jesus himself[23]– remains central to Christian practice, with huge Christian contributions to medicine continuing around the world. But how far should we go? Might genetically healing an early embryo in a form of Type C enhancement, thereby preventing some devastating disease in that lineage for ever, also act as a pointer to the coming of the Kingdom?

The promotion of physical health and the prevention of disease remain central to medical practice. At the same time, Christians are well aware that God can use suffering to draw them closer to God. Paul's 'thorn in the flesh' sounds

21 M. Walker, 'Genetic Engineering, Virtue-First Enhancement, and Deification in Non-Irenaean Theodicy.' *Theology and Science*, 16:265, 2018.
22 S. Young, *Designer Evolution : A Transhumanist Manifesto*, Prometheus, 2005.
23 A mandate that includes all forms of medical healing, not just the miraculous.
24 J. N. Gray, *The Soul of the Marionette: A Short Inquiry into Human Freedom*, Penguin, 2016.

like a medical problem (2 Corinthians 12:7), but despite pleading with God three times for it to go away, it did not, leading to a difficult but valuable lesson (2 Corinthians 12:9). The redemptive power of suffering is a central message of Christian enhancement. Those who are 'in Christ' should not forget that the marks of his passion are still visible in his resurrection body (John 20:27).



The Incredulity of Saint Thomas, Carvaggio, 1602

Furthermore, over-ambitious aspirations for healing and enhancement can readily lead to hubris, with the proud brought down from their aspirations to be gods (Isaiah 2:17–18) and arrogant people called futile (Jeremiah 48:29–30). The contemporary secular writer John Gray comments that 'No one understands the human heart at all who does not recognise how vast is its capacity for illusions, even when these are contrary to its interests, or how often it loves the very thing that is obviously harmful to it.'[24]

So Christians find themselves at the difficult juncture between the present evil age and the age to come, where the waters are rough and often treacherous as two strong currents flow in opposite directions. But being made in the image of God involves 'subduing the earth' (Genesis 1:28) and that might surely, in principle at least, include the prevention of lethal genetic diseases by the restoration of mutated DNA to its normal sequence. The proposed moratorium on embryo editing followed by human implantation seems eminently sensible for the immediate future, but in the longer term further research will no doubt eventually lead to the safe genetic healing of human embryos that would otherwise, if implanted, die slow and painful deaths postnatally. Opposed to such embryo editing is the question already raised: why not use PGD? Or adoption? And will the same technology then be misused for unhelpful forms of Type A technoscientific enhancement? This discussion is not an easy one.

Conclusion

Following in Christ's footsteps clearly entails that healing should be central to Christian mission. The focus on healing, rather than on Type A enhancements should, it is suggested, remain central to state legislation governing the use of new technologies. As theologian Ted Peters expresses the point: 'God calls each of us individually and the human race as a whole toward a divinely appointed end or goal, namely, our true humanity in participation with a redeemed and healed creation.'[25] But, unlike healing, Christians have no mandate to pursue Type A enhancement by technoscientific means. Instead they await expectantly a new heavens and a new earth with resurrected persons enjoying completely fulfilled lives with God and each other, not as a result of their technoscientific striving, but as a result of God's grace. For the Christian, this is the enhancement that really counts and all others fade in comparison, but at the same time they should not hold back from the prevention of human suffering while on planet Earth, as God gives them opportunity.

Denis R Alexander is Emeritus Director of The Faraday Institute for Science and Religion. He was previously Chairman of the Molecular Immunology Programme and Head of the Laboratory of Lymphocyte Signalling and Development at The Babraham Institute, Cambridge.

25 T. Peters, 'Imago Dei, DNA, and the Transhuman Way.' *Theology and Science*, 16:360, 2018.

Photo Credits: Page 2, Neil Harbisson, CC BY 2.0; page 3, Tony Alter, via Flickr, CC BY 2.0

About *Cambridge Papers*

All available issues of *Cambridge Papers* dating back to 1992 can be downloaded from www.jubilee-centre.org/category/cambridge-papers. We encourage debate and, if you would like to respond to this or any other Paper, we invite you to visit the website and post your comments there.

If you would like to receive *Cambridge Papers* and regular news from the Jubilee Centre, and you are not already on our mailing list, please join via our website **www.jubilee-centre.org** or send an e-mail to **info@jubilee-centre.org**
Alternatively, please send your name and address to:
The Jubilee Centre, St Andrews House, 59 St Andrews Street, Cambridge CB2 3BZ Tel: 01223 566319

As part of our commitment to the environment and our efforts to reduce production and postage costs, we encourage readers to access *Cambridge Papers* electronically. Whether you receive our papers by email or in hard copy, there are costs involved in publication and distribution, and we invite readers to help meet these by making a donation by standing order, cheque or credit card. If you are a UK taxpayer, signing a Gift Aid declaration (available from the Jubilee Centre) will increase the value of your donations.

Cambridge Papers is a non-profit making quarterly publication which aims to contribute to debate on a wide range of issues from a Christian perspective. The editorial group is an informal association of Christians sharing common convictions and concerns. The contribution of each member of the group, and each author, is as an individual only and not representative of any church or organisation.

Next issue: Does the West have Christian values?

Jubilee Centre
BIBLICAL THINKING FOR PUBLIC LIFE