Human genome editing report strikes the right balance between risks and benefits

February 16 2017, by Merlin Crossley

Credit: AI-generated image (disclaimer)

If you recognise the words "CRISPR-mediated gene editing", then you'll know that our ability to alter DNA has recently become much more efficient, faster and cheaper.

This has inevitably led to serious discussions about gene therapy, which

is the direct modification of someone's DNA to rectify a genetic disorder, such as sickle cell anaemia or haemophilia. And you may also have heard of deliberate genetic enhancement, to realise a healthy person's dreams of improving their genome.

Both of these issues have now been tackled in a comprehensive report on gene editing released today by the US National Academy of Science and National Academy of Medicine.

The message is fairly simple: relax, we've seen this all before, little if any harm has eventuated, and society is well placed to move forward together on this.

A definite maybe

Of all human technologies, recombinant DNA has arguably been one of the safest. There have been multiple benefits in both medicine and agriculture. And the legitimate concerns that arose when viruses were first mixed with bacterial genes, when cloning was first introduced, and when stem cells were developed, have not come to pass.

I cannot list all the benefits here, but if you have received the Hepatitis B vaccine or Australian Ian Fraser's Gardasil vaccine, which protects against cervical cancer viruses, you have been protected from disease thanks to recombinant DNA technology.

However, you probably haven't received somatic gene therapy, which is gene alteration directed at fixing one cell type, such as defective blood or liver cells. This is because this therapy only touches a tiny number of people, probably fewer than 1,000 worldwide, and again the benefits have outweighed the risks.

But there is one new message in the report that will grab the headlines.

That is the view on human germline gene therapy, which entails modifications that would be passed on to children and then to their children. This kind of gene therapy has been considered highly controversial. But this time, instead of a simple *no thanks* there's a *definite maybe*, provided the therapy is targeted at a severe disease as a last resort.

There will be alarm in some circles at the very mention of germline gene therapy, although perhaps not from the very few people who might be contemplating such treatment for the sake of their future children.

The authors of the report, who are among the mostly highly respected experts in the world, are well aware that many people will not be comfortable with the thought of germline gene therapy. They stress the need for extensive consultation, the meeting of strict criteria, and close regulation.

But in weighing up safety and efficacy, social and individual benefit, they clearly don't want to see a reflex ban put in place that may limit options if this technology can be used to make the life of some individuals better.

On one hand, they are right. This technology is not a threat to the fabric of society. Nor, I'd say, is this a genie that could not be put back in the bottle; gene editing could be reversed.

Nor, like the Sorcerer's Apprentice's broomsticks, will it multiply and spread when we try to restrain it. This is not like letting slip a virus, cane toads, oozing radioactive waste or carbon emissions into the atmosphere.

Seeking germline gene therapy in order to have a disease-free child would be a choice made at a personal level and those not wishing to participate should never feel compelled to do so.

Except, of course, the children who would not have a say in it. But also for them the risks might well outweigh the benefits. And, one way or another, parents already make life-determining choices for their children and sometimes for their children's children.

Even those seeking germline therapy for the sake of their children would mostly have alternatives, such as preimplantation diagnosis, which itself also has ethical considerations. There are no easy answers here.

So I can understand the report's conclusion, although I also believe there are risks, which I'll mention below.

Hard to abuse

There are other aspects of the report worth mentioning. It confirms that we already do properly regulate laboratory-based gene modifications, and we have learned so much from previous somatic gene therapy efforts that we are well placed to push on safely with both research and somatic treatments. I agree with this.

It also says that actual genetic enhancements should be avoided. There is evidence that society is uncomfortable with the idea of individuals, who are not suffering from disease, improving either themselves through somatic therapy or their bloodlines through germline genetic enhancement.

Some people might want more copies of the p53 tumour suppressing gene or to lose their CCR5 gene, which helps HIV invade cells, in order to give their children possible protection from cancer or HIV respectively, but I'd have to say it isn't worth the risk.

I would add that, ethical reservations aside, the sheer complexity of our genomes, and the rather involved and lengthy process of human

reproduction, means that I have no concerns that even the craziest world leader could ever generate an army of super-mutants. Such an ambition would be defeated by not knowing which genes to alter, not to mention the requirement to assemble tens of thousands of surrogate mothers, then wait 20 years for the army to mature.

Yes, it is possible that someone somewhere will attempt germline gene enhancement as a stunt. That would be wrong and dangerous, and a risk for the child. But it would not threaten society any more deeply than many other obscene and regrettable individual crimes that sadly occur every day.

Germline gene therapy is illegal in many countries, and although there is a risk that unfortunate "medical tourism" may occur at some stage, I don't expect this to be a greater problem than the already widespread snake-oil selling that is a feature of many economies.

No emergency

So am I comfortable with this report and confident that it covers the ethical issues? I think it is superbly written. It is accurate, up to date, balanced, thoughtful, and covers experiments, somatic therapy, germline therapy, genetic enhancement, societal responses, and the need for public consultation and careful regulation. There is no emergency here.

My main concern is that raising the prospect of germline gene therapy will trigger discussions that will divert us from more pressing issues.

I do worry that introducing this apex concept as a possibility may increase the number of people who fixate on what gene therapy could deliver and thus may be lured into medical tourism, both desperate patients and also foolish investors, and all the while charlatans will profit from peddling promise.

I worry that raising hopes too high too quickly will ultimately cause a backlash against more moderate science.

I also worry that even conventional funding bodies will succumb to understandable pressures to fund translational research prematurely and this will actually waste large amounts of valuable public money.

And I worry about a hysterical reaction that could divide society along political lines with people lining up for or against germline gene therapy based on their political positions or personal beliefs rather than a sober examination of the facts, risks and contexts.

Finally, I worry that the focus on human modification will distract us from other issues, such as the use of CRISPR-mediated gene drives that could be used to eradicate rapidly reproducing organisms such as mosquitoes, and could thus be used for both great good or great harm.

But I don't feel the burden of worry too much because I know that, as a scientist, I can and should share the weight of my concerns with society.

This article was originally published on The Conversation. Read the original article.

Provided by The Conversation

Citation: Human genome editing report strikes the right balance between risks and benefits (2017, February 16) retrieved 4 May 2024 from https://medicalxpress.com/news/2017-02-human-genome-benefits.html