The Science Show

Should we be worried about CRISPR gene editing?

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IMAGE: DNA REPLICATION (GETTY IMAGES)

CRISPR gene editing technology has become a reality in the last few years. It is being used by hundreds of universities and hospitals. It is now quicker, cheaper and easier to edit genomes than ever before. Many people are excited. Others are concerned. So is concern warranted? Microbiologist Merlin Crossley looks at the pros and cons of CRISPR.

Transcript

Robyn Williams: And this is The Science Show on RN, where again in nature we read this week about an experiment in China using CRISPR on human embryos. So can this powerful method of gene editing make miracles? Here's an assessment from Professor Merlin Crossley from the University of New South Wales.

Merlin Crossley: Our ability to modify DNA has been significantly boosted by a new technology known as CRISPR gene editing. Changing genomes is quicker, easier and cheaper than ever before. Some people are excited; others are concerned. In many cases imaginations are moving much faster than reality. On the one hand this could lead to over-promising, and on the other it could cause panic.

It has been reported that the mega celebrity Jennifer Lopez is producing a new bio-terror drama entitled CRISPR, which will explore possible horror scenarios in this brave new world.

I'm a molecular biologist. Here's my take on CRISPR at this early stage. Firstly, I'm delighted to see a scientific breakthrough that arose from pure curiosity-driven science, hitting the mainstream and doing it so quickly. The ability to efficiently modify DNA using CRISPR became a laboratory reality only in the last three years, but already hundreds of university and hospital labs are using it and people across the world are talking about it.

And yes, in theory you could use it in your shed at home, illegally. But in reality the equipment and chemicals are still very expensive, and there is an art to it. Like building a plane, the problem isn't that you'll crash, the problem is that DNA is so complicated that you will probably never take off at all. But the reason why CRISPR will affect laboratory science and research but not take over the outside world is because there are very real limits to what you can do with it. Those limits aren't a reflection on the technology — CRISPR is great. They arise from the way we are built and the way we grow.

CRISPR can be used to modify DNA, the blueprint of living things. But mostly this isn't useful. Put simply, imagine you left a cake in the oven and it burnt, CRISPR could help you go back and underline the cooking instructions in the recipe but it's not going to help you fix that cake.

Similarly, for many human diseases the problem will be baked in and CRISPR won't be able to help. It could help if it were possible to modify the genes in the developing

embryo but that remains a highly controversial topic and we still don't know if we could do it safely in humans.

Even if some countries decided to modify human embryos, it would take a long time to test the efficacy and safety and it would be so expensive that I can't imagine this treatment taking precedent over other available treatments or slipping by undetected and unregulated.

Spreading is the main issue here. Most things we can make with CRISPR won't spread. Already many countries have used existing recombinant DNA technology to modify crops and animals. These organisms have been regulated and have not taken over the world. CRISPR is just an easier, cheaper, more efficient and precise way of making modifications.

CRISPR is said to be easy. Couldn't we just spray people with CRISPR to make them taller or stronger or smarter? Again we'd have to do this very early in development—preferably at the single cell embryo stage—but more interestingly it would still be hard because our cells are actually very good at blocking entry by foreign DNA.

Not everyone talks about this aspect, but it is hard to get DNA into cells. It can be done by highly evolved organisms like viruses. Viruses are cleverly evolved bits of DNA that seek to get into our cells and hijack them to replicate. Biological viruses really are like computer viruses or worms that aim to take over our genetic code. But we have evolved to combat genetic modification by viruses.

We are constructed in a way that makes us much better at resisting viruses than computers are. Firstly, we have as few portals as possible, though a few viruses do get in through our mouths and noses. Most importantly, unlike a computer we are made of many little cells, rather than being one big machine. If any of our cells is struck by a virus, the cell self-destructs and sends a signal that alerts our immune system to mobilise against the invader. In addition, we have an extraordinary range of 'anti-viral' strategies that we use to protect ourselves from invading DNA.

So yes, CRISPR is a way of modifying DNA, but it still requires every trick in the book to get the machinery into cells efficiently. This is one of the reasons why human gene therapy and gene correction, something that is possible in theory, has turned out to be so very hard to achieve in practice. Only a few individuals, perhaps 10 or so children with the immune condition known as 'bubble boy' disorder, have ever been treated

successfully by gene therapy, and we need to provide lots and lots of DNA in order to eventually get enough of the gene in to correct the condition. It will be the same with CRISPR. Possible, but very hard.

But some viruses do get in, and we can get DNA in via CRISPR. Couldn't a mad scientist make a super-virus or a super toxin using CRISPR, posing enormous threat? I guess so, but why bother? There are plenty of deadly agents already out there in nature. I doubt CRISPR could do better.

What about using CRISPR for personal enhancement? Again it would mostly be too late for yourself, embryos out there would be better advised to wait and then apply themselves to piano practice, tennis, or maths if they want to excel in these things, and to go to an orthodontist rather than to a gene therapist if they want straighter teeth.

One of the most important points here is that our genome is so complicated, it contains so many genes and so many interacting networks of genes, that we don't even know which genes to change to make people smarter or more beautiful or nicer. And remember, CRISPR can only change one gene at a time. I consider it fairly unlikely that CRISPR will be used for making designer babies in the foreseeable future.

So should we relax? Yes, but not completely. People should be interested, should keep discussing the issues, and should keep a careful watch on this. CRISPR is a super power. It can be used in medicine and in agriculture. It will be used for good. But if unregulated, there could be mistakes and individual lives could be harmed. We should always remember those wise words: with great power comes great responsibility.

Robyn Williams: The very responsible Professor Merlin Crossley, Deputy Vice-Chancellor of Education at the University of New South Wales. He also has splendid teeth, just Google him.

Guests

http://www.abc.net.au/radionational/programs/scienceshow/should-we-be-worried-about-crispr-gene-editing/8363948#transcript