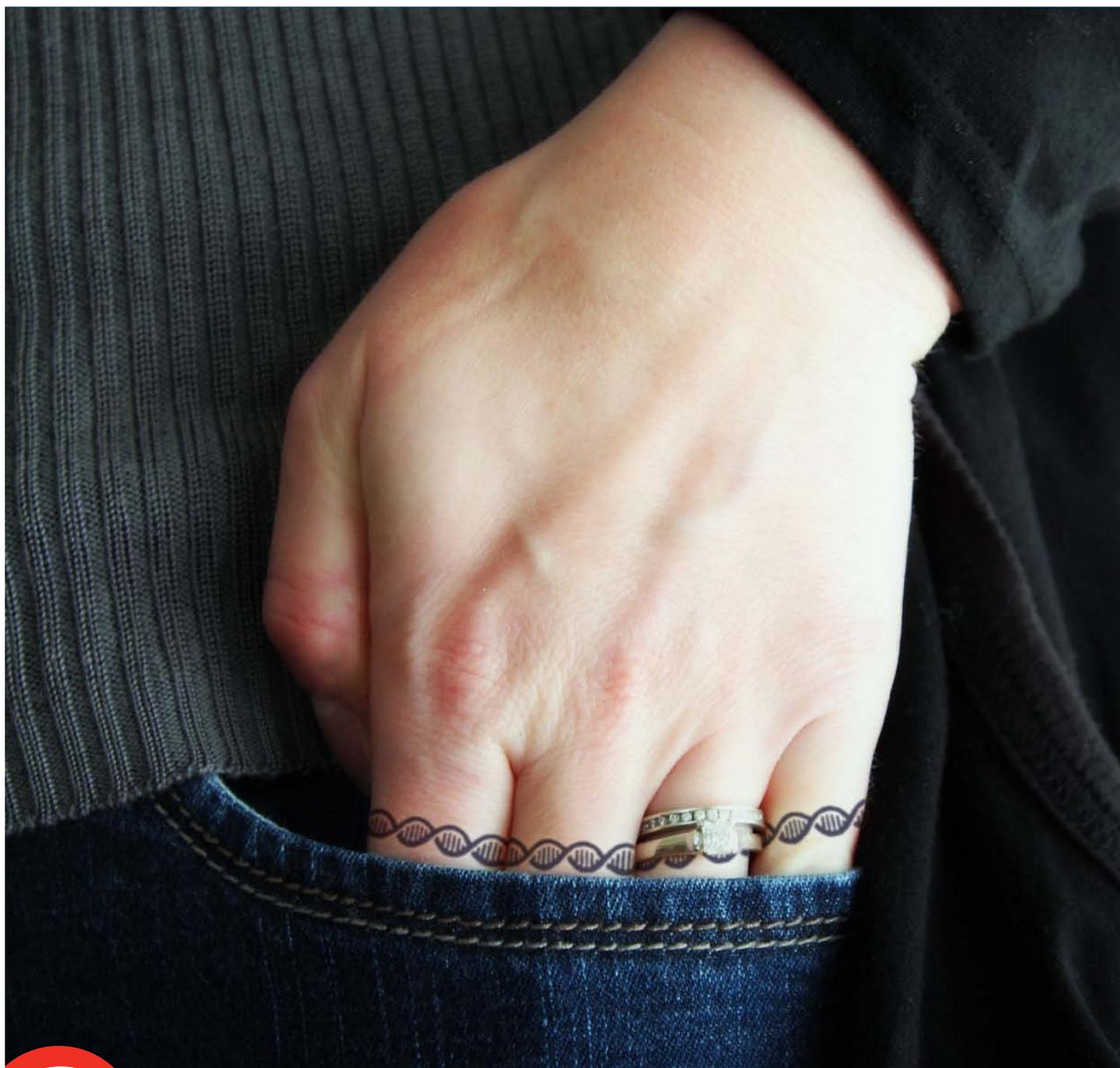


#TECHNOLOGY

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# YOUR GENOME IN YOUR POCKET

THE DNA DILEMMA THAT FACES US ALL



ROSS HARPER

## YOUR GENOME IN YOUR POCKET

In 1989, the Human Genome Project set itself the target of sequencing the human genome – mapping out all of the DNA code of a human. This ambitious plan stimulated fierce ethical debate, which raged well into the 1990s, and was neatly captured in the harrowing box office hit, *Gattaca*.

Boy, did that film affect me. Upon watching with twisted lips, wide eyes and an elevated heart rate, I, like many others waited for the credits with a sense of dread and despair for the future.

But the reality at the time was that sequencing a human genome was just too expensive (over \$10,000 per person) and impractical to be used en masse. Without any tangible impact on day-to-day life, the hype died down and the disciples of pop media occupied themselves with other impending stories of doom, leaving the science of DNA sequencing to plod along quietly in the background. But for how much longer is DNA sequencing to remain niche rather than mainstream?

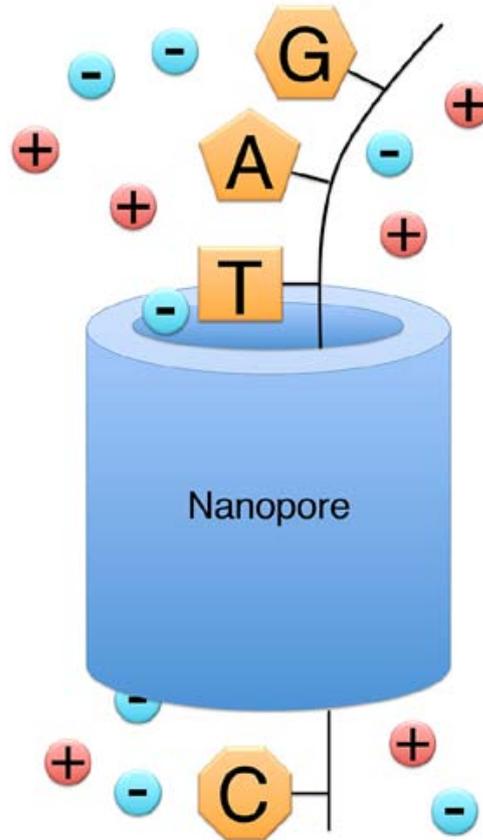
Researchers at Oxford Nanopore Technologies (ONT) have made huge advances that could completely change the scale on which it is practical to carry out genome sequencing. In 2012, the company announced that it had perfected a handheld device that plugs straight into your laptop and can sequence the entire genome of a human for less than \$1,000. What's more, we can expect this machine to be available for anyone to use, perhaps as early as this year. Is it time to dust off the pitchforks, light the torches, and re-enter the debate?

### Power in the palm of your hand

Like most good ideas, the principle behind ONT's new device is pretty simple. It uses nanopores – tiny holes formed by proteins that are small enough to let a minute single strand of DNA pass through. Each strand of DNA is a chain of building blocks (called 'bases'), which act like a computer code. And every strand of DNA is made of just four of these bases: A, T, C, and G.

Now here comes the clever bit. Under the right conditions, it's possible to measure an electrical current passing through a nanopore – but the electricity varies depending on the particular DNA base passing through the nanopore at the time. So the electrical current measured when

an 'A' passes through the nanopore is different from the one measured when a 'T' (or 'C' or 'G') passes through. By measuring the varying current as a strand of DNA passes through, we can infer the exact sequence.

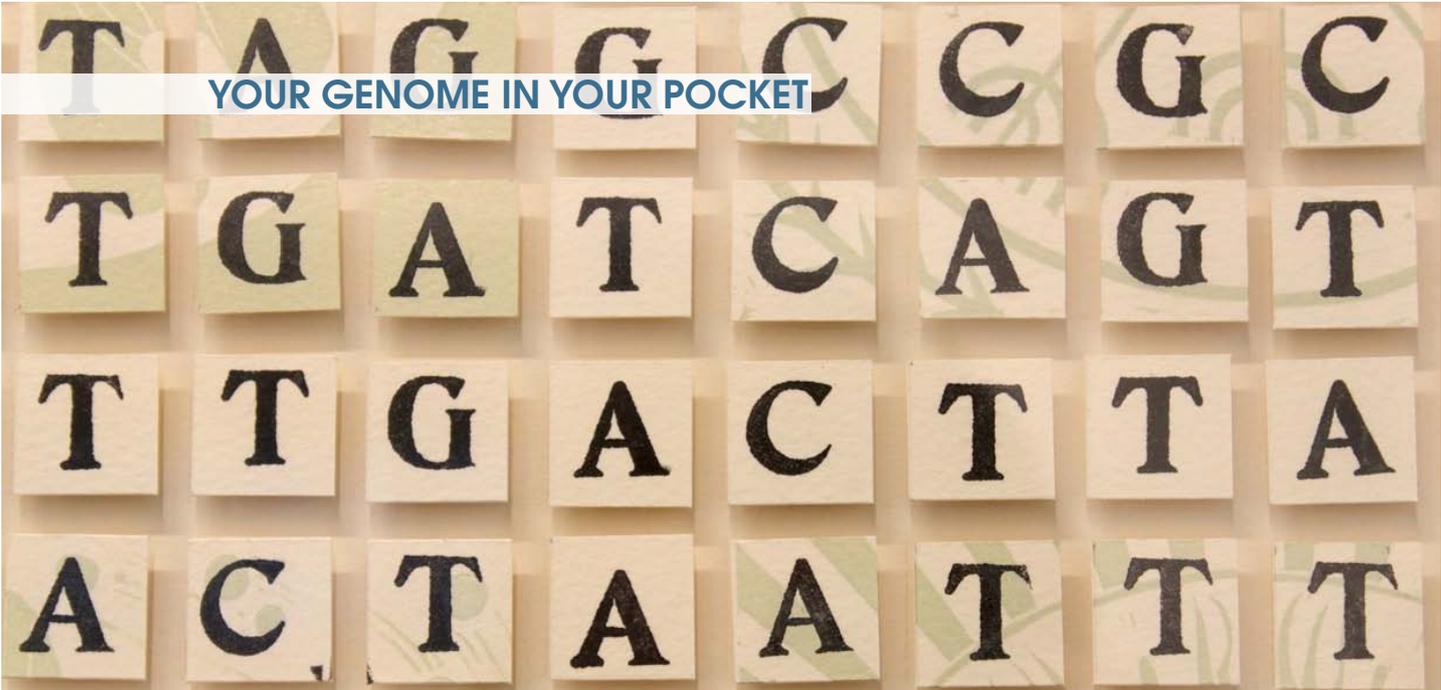


### Why you want to know

There's no doubt that the mass sequencing and analysis of individual human genomes could have a hugely positive impact on various aspects of human life. If we knew more about the genes people carried, we might find it easier to pinpoint disease-causing genetic mutations – leading to improved treatments for illnesses like cancer, muscular dystrophy and heart disease. Personal genome sequencing could even help doctors tailor their treatment to the individual – true personalised medicine.

So why isn't everyone convinced? It's because there are ethical issues that many can't ignore.

With social media and the Internet becoming more and more pervasive parts of our lives, privacy is under threat like never before. Our genes make us who we are – so your genome is arguably the most personal part of you.



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But after our genome has been sequenced, to whom does the information belong? Could this information be abused by politicians, identity thieves, or God forbid, advertisers? I shudder at the prospect of a future where the leaflet through my front door is no longer a discount offer for pizza, but yet another advert for 'Miracle Hair Regrowth Formula' because apparently I'm genetically predisposed to male pattern baldness!

There is also the serious issue of genetic discrimination – addressed so adeptly in *Gattaca*. Imagine being refused life insurance because you're genetically at risk of disease. Imagine being unable to pursue the career you want for similar reasons. And what about more sinister flavours of discrimination? Once we have taken the small step from mapping the human genome to its artificial alteration it becomes hard to avoid echoes of the Third Reich's ghoulish ambition to create a (so-called) master race. It's not to say that such atrocities would likely be committed again – but that we have just cause to fear the creation of a world where our value is based on our genetic readings.

### It's time we made tough decisions

So the risks are certainly great. The challenge we face is to weigh them up – and the important thing right now is the discussion. We can't stand in the way of progress, but as we proceed we need to ask serious questions about whether every scientific breakthrough is worth making. Through government legislation and social pressure, the global population has the power and choice to guide science.

So what sort of science should we be pursuing? What risks are worth taking? Where medicine says 'yes' but history warns 'no', what is the right way for science to jump?

By establishing a dialogue and making our position clear now, we improve our chances of being happier in the future. The truth is that DNA sequencing techniques will continue to be developed and become cheaper. If not here, then somewhere in the world, regardless of what the majority opinion is. Perhaps, then, we should be putting our efforts into controlling how this research is used rather than questioning whether or not it is done.

At any rate, I would very much like to avoid ending up as an extra in the real-life sequel, *Gattaca Part 2: When Did We Let This Happen?* Boy, did that film affect me.



**Ross Harper** recently graduated from Cambridge University having studied Biological Natural Sciences. He spent the last year running his somewhat unconventional advertising business, **BuyMyFace.com**, and is now trying his hand at app development with his new company, **Wriggle Ltd**. Ross is living proof that you can take the boy out of the lab, but you can't take the lab out of the boy - no matter what crazy scheme he's currently working on, he makes sure to devote a bit of time to keeping with the latest in science news. Feel free to say 'hi' to Ross on Twitter ([@refharper](https://twitter.com/refharper)).

