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# In Conversation With:
# Professor Matthew Cobb, May 2017

**Policy@Manchester contributor Professor Vikas Shah interviewed The University of Manchester's Professor Matthew Cobb on science research, the policy environment, and developments in gene editing technology.**

**Interviewee**

**Matthew Cobb**
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**Interviewer**

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**In Conversation**

**Q: To what extent has scientific research been influenced or driven by government policy through the years?**

**[Matthew Cobb]** Government policy drives funding, though that doesn't necessarily mean to say you get what you want…

**[Matthew Cobb, continues]**
Look at Watson and Crick, and their discovery of the double helix structure of DNA, their incredible contribution to science had absolutely no funding whatsoever. It was simply them wanting to do it, being very interested in it, eventually being allowed to. Something as fundamental as understanding our DNA was not directly funded by anybody, in fact, and it was purely curiosity-driven research.

Governments want big wins - a cure for cancer, limitless energy, a whole set of utopian desires, but many of those achievements will not come about from people trying to cure cancer or make limitless energy, they will come as serendipitous discoveries from curious scientists.

In more recent history, look at CRISPR - the gene editing technology. This came about from 25 years of purely curiosity-driven research, by researchers who were interested in bacteria - they weren't looking to understand gene editing.

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If you say 'well I just want to find out about something', you get slapped down, 'this is a fishing expedition'. But you know what, on a fishing expedition, you find fish! And they may be very big, maybe they're very small, but you're going to find fish.

**Q: What will the impact of BREXIT be on scientific research?**

**[Matthew Cobb]** All we 'know' is that 'Brexit means Brexit' and that's as far as we've got. We've been told we've got to keep our cards close to our chest. After all, we don't want to play games but we're playing games. It's all just rhetoric, and we're not getting any closer to actually understanding what life outside the EU means for the UK.

What we do know is that quite understandably the European Research Council and their peers are turning the taps, because we say we're going, so we're going. If we don't retain freedom of movement, this important source of funding will not be available to us. Already, there are lots of stories of people being cut out of proposals because they're in the UK.

Also, the UK has a good body of research administrators who understand the arcane detail of European funding. Post-BREXIT those people are going to be out of a job, and their skills will be dead. And just like we don't have the negotiators to negotiate with Europe, we won't have those people, those science administrators. And those skills are going to disappear. That's something which I've not seen mentioned anywhere, but there's going to be a layer of several hundred people in the UK who are very skilled administrators about dealing with Europe, and I don't know what they're going to do.

Nobody knows what is happening.

**[Matthew Cobb, continues]**
I have already heard of two very brilliant young researchers, a couple who managed to get themselves a job in the UK at one of the most prestigious universities. Neither of them are British, they're both European, and are currently in America because they don't want to come to the UK because of the uncertainty surrounding universities here.

So, UK science is going to take a hit from BREXIT, you might argue that okay, well that's more jobs for British students, okay that's fine. Except those British students and post docs need to go around, move around and not be limited to one country. And they may not be able to do that depending on the terms of the agreement that we come to, it may be more difficult for them.

**Q: What are your views on policy-makers getting involved in science?**

**[Matthew Cobb]** We had a visit from a cabinet secretary… some high-ranking civil servant who gave a talk and was boasting about how the government is absolutely in favour of evidence-based policy.

I challenged him on that on the basis, noting that *really* what they want is policy based evidence. The Badger Cull is a great example. All the scientific evidence demonstrates that a badger cull would be unproductive or at worst most likely counterproductive. It would actually increase the dispersal of the badgers, and furthermore, the evidence of how badgers and cows interact shows that even if they're in the same field, they don't actually interact. Despite all this evidence, the government is going ahead. Research is not being listened to, it's being dismissed.

**Q: What are your views on policy responses to technologies like CRISPR?**

**[Matthew Cobb]** James Clapper, Obama's National Security Chief, described CRISPR as a weapon of mass destruction… so it's officially been recognised as that dangerous by the US government.

Don't get me wrong, CRISPR is powerful, this technique involves using genes from bacteria, allowing you to very precisely edit them. If you know a sequence of a gene in a particular organism, you can then manipulate that. You can change the gene in exactly the way you want. I mean, there are some exceptions. But basically, that is the power that we now have. CRISPR will allow us to cure terrible diseases, certain Leukaemia, HIV, sickle cell disease. A lot of blood-borne diseases are currently the focus of research or the first clinical trials, and this is going to come on stream within the next 4-5 years. This will be a therapeutic technique which is going to become widely available, and it's going to save lives and transform lives. That's fantastic, and I don't think medically that needs regulating, because we have enough procedures in place already to say 'well, is this a safe procedure?' And if it is, then let's go ahead with it. If it's not and it's effective, go ahead with it. If it's neither, then not. So all that, which is an astonishing development, is going to be dealt with by existing medical regulation.

The issue around CRISPR comes with manipulation the human 'germ line'. The work and therapy being talked about at the moment is on particular cell lines which will not be transmitted to the next generation. The area of 'designer babies' requires changing the genes in the embryo or in the egg and sperm. At the moment that activity is not internationally regulated (in the sense of there being any legal framework) but that for example is illegal in the UK, in Canada, in Australia. It's not

**[Matthew Cobb, continues]**
illegal in America. It's not illegal in the United States, but you're not allowed to use any federal funds or any federal equipment, anything that's been funded by federal government to carry out that kind of procedure. These restrictions are not because they're worried about the change to the human germ line, but because various religious groups don't like manipulating embryos. If somebody was rich enough in the States, they could go ahead and do it and nobody would be prosecuted. In the UK that's not the case, you would have the full force of the law against you.

I think it's very clear that someone somewhere in the world in the next decade is going to produce a child whose genes have been altered by CRISPR, probably to avoid them suffering with some genetic disease. With luck, nothing will go wrong and the child will be healthy. At this point, the world will not tilt on its axis, we're not going to have Nazis marching past the Houses of Parliament, there's no slippery slope there. You've got to remember, all this revolves around IVF and anybody who's had IVF or knows anybody who has IVF is appalling. Nobody would do that voluntarily. People aren't going to give up the rather blind but much more fun way of making babies and say 'okay let's do IVF, that's great, we can have a designer baby'. They're only going to do that if they're absolutely desperate.

The other important area is the use of CRISPR for agriculture. At the moment, for example, all our crops are produced by irradiating or mutating them, and then choosing which of those thousands of crops is a bit more resistant to climate or pests. CRISPR is going to enable us to actually target the genes that are involved in say, resistance to desiccation. So we will be able to produce wheat or corn or whatever which will be able to grow in dry conditions. You simply change the genes, and with a bit of jiggery-pokery you end up with a kind of pure DNA with nothing that anybody could be worried about.

However, CRISPR is going to enable the creation of gene drives (which are basically a way of very rapidly changing a natural population). This has mainly been thought of for use with mosquitos. So, people who've seen about this, 'get rid of the mosquito, why not?'. And, technically we could probably do this, we all make mosquitos immune to, unable to carry malaria. So, there are incredibly important humanitarian reasons for wanting to do this research. The problem is that these gene drives are basically bombs. You let them off, they're going to go off very quickly, have immense effect and you can't be certain what's going to happen.

Before any of these things are allowed into the wild, you want to have done ecological studies to try and find out what's going to happen if we get rid of all the mosquitos. Or there could be bizarre effects. So for example, if we stopped the malaria from being able to survive inside the mosquito, just like with an anti-biotic resistance, it's inevitable that some of those malaria parasites are going to survive, it'll be a very small number at first. They will then grow in the population and will end up with, again, mosquitos that can carry malaria. What we might find is that the malaria parasite is now by chance immune to our anti-malaria drugs. So we could completely inadvertently end up creating a 'super' malaria.

The only way of dealing with that would be some kind of international regulation.

The example that's often used by people who are interested in this, is that every day there are millions of people doing something which is incredibly dangerous, and they get away with it

**[Matthew Cobb, continues]**
because there's international regulation. And that's civil aviation. Getting in a big metal tube and flying in the air is inherently a very, very dangerous thing to do. It's highly regulated, but it's not a legal framework, so you can create an airport which doesn't have international civil aviation authority backing, but nobody would go and land at it.

What is particularly striking is there is virtually no interest in CRISPR from any of the regulatory bodies around the world. So in December 2015, there was a big jamboree in Washington about using CRISPR for manipulating the human genome. They agreed it was a bad idea and you shouldn't do it (which to be honest was hardly a surprise) but they didn't consider this idea at all of gene drives. I'm amazed at what could be a fantastic technology but is clearly very problematic is not being discussed at a high policy level, as far as I know, anywhere around the world.

**Q: Is scientific growth outpacing government ability to respond to it?**

**[Matthew Cobb]** CRISPR, for example, is so much easier than the previously existing technologies, which were incredibly expensive, often failed, and required well-equipped laboratories to work in. As of today, there are people selling CRISPR kits over the internet. So there are bio-hackers who are literally using CRISPR to hack e-coli (which is a bacteria which causes all sorts of food poisoning and kills people in certain strains). There are people bio-hacking this all around the world, and anyone with A-Level biology and a couple of hundred quid you can do this.

I know if I was an evil genius rather than putting around some ransomware I'd be making some horrible bug and saying 'I'm going to drop the flask unless you give me a lot of money'. That's not what I'm doing! But, I don't think this is scaremongering.

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