20032 Why finding new vaccines is a high-tech challenge

bbc.com, by Ben Morris, 6 December 2019

"Infectious diseases are evolving much faster than we are, and much faster than our defences are. "I think it's profoundly naive to think we have a handle on them," says Richard Hatchett, the chief executive of the Coalition for Epidemic Preparedness Innovations (CEPI). His organisation was set up after the Ebola epidemic of 2014, when a vaccine was developed, but too late to have any impact on the outbreak. With more than $750m from governments and organisations like the Bill & Melinda Gates Foundation, it is funding promising new vaccine technologies. In particular, CEPI wants vaccines that can be produced quickly. "In most circumstances that we have an epidemic, speed becomes extremely important," Mr Hatchett says.

Traditionally, vaccines are made by taking the original virus or bacteria and disabling it in some way. The idea is to degrade the microbe so that it is no longer a health threat, but can still trigger a response from immune system. The body can then use that immune response if it ever comes into contact with the real infection. That kind of approach has been terrifically successful, saving millions of lives. The trouble is that developing and manufacturing vaccines that way is slow and expensive.

Frederic Garzoni is one of many scientists hoping to change all that. He spent years in France working on proteins, examining and tweaking the building blocks of bodies. But in 2016 he came across something he thinks is very special. A protein structure that self-assembles into a football-like molecule, that can be easily manipulated and be produced in large quantities, and can perhaps be used to vaccinate against a host of diseases.

Mr Garzoni, and others, are manipulating all sorts of microbes, often at the level of DNA, to make particles that spur the immune system into action. His research has been helped by powerful tools, including cryogenic electron microscopy (cryo-EM), a procedure that lowers samples to extremely low temperatures and then bombards them with electrons. The resulting pictures render almost atomic detail, allowing scientists to identify useful properties, that would have been unknown before cryo-EM came along.

At the University of Bristol, those images have been combined with powerful cloud-computing services provided by US tech giant Oracle, which allow detailed pictures to be created more quickly and cheaply than ever before. With that kind of detail, researchers can identify all sorts of useful properties.

397 words