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Life science is taking off in the age of the gene

The 'great stagnation' is a myth; wonders are being accomplished. But silly rules still block progress.

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24 July 2021 • 8:00pm

Back in the early 1950s scientists were baffled by one aspect of life itself. Our cells were full of proteins whose properties depended on their precise shapes, and the key feature of life was the ability to copy itself, but how on earth do you copy three-dimensional shapes? The unexpected answer was that you don't: you copy a one-dimensional, linear sequence in a recipe book called DNA, which automatically determines how each protein folds into its shape.

Surprisingly, until last week, working out how this folding worked was beyond even big computers: tiny shifts in angles could result in wildly different shapes, and forecasting what shape would result from what sequence was as hard as predicting the weather. Now, thanks to the brilliant London AI firm DeepMind (which sold itself to Google a few years back), a learning algorithm has cracked the problem and has predicted hundreds of thousands of shapes from sequences. It did so as an encore after defeating the world champion at the fiendishly complicated game of Go: in neither case was it taught by experts but learned from examples.

Sir Venki Ramakrishnan, who won the Nobel prize for figuring out the structure of the ribosome (the machine that translates DNA into proteins), told me last week that he thinks

the DeepMind breakthrough is huge: “we probably have not yet grasped its impact and all the ways it will change the way we do biology.”

No longer will scientists have to guess and test to find out what their proteins can do: they can find out “in silico” what shape a particular gene sequence will give to a protein. That will

help drug design, vaccine design and the understanding of diseases from Alzheimer’s to Covid. The spike on the virus is a key that fits a lock on our cells. Predicting whether a wild bat virus can unlock human cells will no longer require risky, gain-of-function experiments.

But the breakthrough is also a reminder that life sciences present the big opportunity in the coming decades. If 1900-1950 saw spectacular advances in transport and 1950-2000 saw extraordinary innovations in information, then 2000-2050 might turn out to be the age of the gene. There is a palpable sense of diminishing returns in IT these days. Moore’s Law has run out of room; smart phones no longer need regularly replacing; the internet and social media have matured.

Instead, in the wake of the pandemic we will be obsessed with health. The novel techniques for developing vaccines based on RNA that were so rapidly successful last year will turn their attention to cancer. The microbiome may start to unlock the secrets of allergy. Genomics will grapple with Alzheimer’s and mental health. And ageing itself may gradually turn into a curable ailment. It’s not just medicine: DNA has already transformed genealogy and forensic science. Last month saw a murderer convicted of a crime committed in 1972 thanks to the genealogy-tracing enthusiasm of his relatives.

This week also saw the announcement of an extraordinary result for agriculture. A small manipulation of RNA in young plants led to a 50 per cent yield increase in potatoes and rice in the field (and a trebling of yield in the lab). If it works commercially, this would mean a dramatic reduction in the area of land needed to feed the human race and a surge in spare land: great news for nature.

In short, the life science era is here. Notice that although Deep Mind’s breakthrough was in computing, the application was in bioscience. The good news is that Britain is and always has been unusually strong in biology: from Darwin to the double helix and on to gene sequencing, cloning, test-tube babies and DNA fingerprinting, all invented here.

So don’t believe those who preach a coming “great stagnation”, as innovation dries up. There are golden prospects ahead for those who are bold, as the government’s innovation strategy,

launched this week, rightly makes clear.

But don't take innovation for granted either. It's a myth that technological change is speeding up. Innovation brings prosperity in its wake, but you would never realise that from how little it gets mentioned in parliament or much of the media. The engine of discovery and

application is coughing a little, because of the heavy burden of regulation under which it increasingly labours. Entrepreneurs have to fight ever tougher battles against silly rules, frustrating delays, lobbying by incumbent firms, precautionary extremism masquerading as concern for the environment, and similar obstacles.

Matt Ridley's latest book is How Innovation Works

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