How Artificial Intelligence accelerated the development of the Covid-19 vaccine

April 2021

It was incredible! Within 41 days of identifying, isolating and fully sequencing the Covid-19 virus, pharmaceutical company Moderna had delivered a vaccine candidate. To top this, the company did all of this in January and February 2020 – a full month before lockdowns began in most parts of the world.[1]

It was thanks to a mixture of Artificial Intelligence (AI) algorithms and advanced analytics that this feat was achieved. But why should it not surprise us?

The AI trend in biotech has been decades in the making

The concept of AI has been around for centuries but didn't get sufficient traction until **Alan Turing** had the idea of using computers to stimulate intelligent behaviour and critical thinking. From then, it gradually advanced to formation of increasingly complex algorithms such as **ML** (machine learning), **DL** (deep learning) and computer vision. Despite the period of reduced funding for AI between the 1970s and 2000, collaboration between the pioneers in the field continued and expanded particularly in **AIM** (Artificial Intelligence in Medicine). At that point, AI was already sufficiently advanced to enable physicians to share information about specific diseases, their potential causes and patient information, with various systems such as **CASNET** or **MYCIN** being able to generate the appropriate treatment recommendation. The development of the above-mentioned algorithms made all of this happen.[2]

Then, in 2003, **the first human genome was sequenced**. It was an incredible achievement and took 13 years and USD 3 billion to get there.[3] **Fast-forward to 2021 and this same process now costs less than USD 1,000 to achieve.**

1950
Alan Turing develops the Turing test

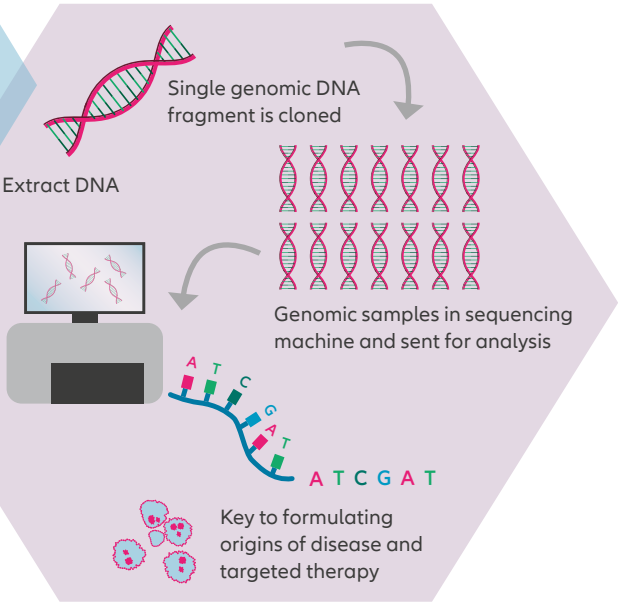
1952
ML introduced

1971
A pilot Research Resource on Computers in Biomedicine launched

1972-1986
Collaborations, resulting in development of AI systems facilitating medical knowledge sharing such as CASNET and MYCIN, take place

2000
DL introduced

2003
First genome sequenced



The pace of technological progress we are seeing in biotech is breathtaking. A side effect of this has been an explosion of data in biotech. It has got to a stage where AI and advanced algorithms are needed to continue this incredible scientific progress. In many ways, this is already happening.

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AI is making what is extraordinary, seem almost ordinary

AI is now being used widely in biotech. According to the Genetic Engineering & Biotechnology News, it is already being used for "drug target identification, drug screening, image screening and predictive modelling. It is also being used to comb through scientific literature and manage huge amounts of critical clinical trial data that is now produced".[4]

Big tech firms are quickly moving in to provide the AI technology needed.

Google has launched its DeepMind project. It has also partnered up with **Sanofi** to set up a new virtual "Innovation Lab" that will focus on data technologies and digital health.[5]

Google partnered up with hospital network **Ascension**, which has given them access to millions of health records in the US.[6]

Access to data is crucial because AI thrives on data – the more data, the better it performs.

Microsoft and **Novartis** have partnered to establish a virtual innovation lab for drug discovery. They plan to use their AI technology in drug research and personalised medicine.[7]

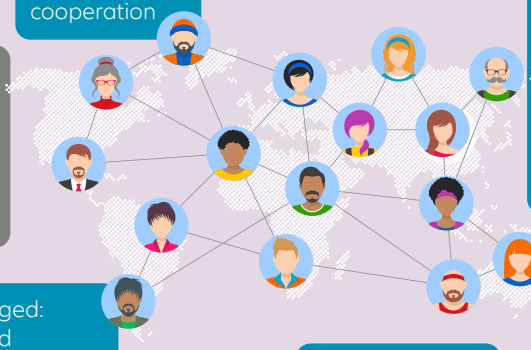
Partnerships between big tech and the pharmacy industry in biotech are just the beginning. They could unlock completely new avenues for how future medicine is researched and developed. Our understanding of diseases, such as cancer, and the treatments developed, could be vastly improved.

IBM AI platform, IBM Watson, has teamed up with **EBSCO**, which feeds in data from peer-reviewed clinical content and scientific literature reviews across several specialties and disease topics.[8]

How were Covid-19 vaccines developed so fast?

Immediate mobilisation of research, resourcing and funding

Global scientific cooperation



Engagement of the new mRNA vaccine type which had been researched for decades and is easier and quicker to produce than older-generation vaccines

Readily available AI solutions engaged:
- genome sequencing that allowed decoding the SARS-CoV-2 viral built
- complex data processing and sharing (ML and DL)

Streamlined clinical research and trials

AI has become an indispensable commodity

AI is needed to help discover new medicines quicker than ever before. It is giving the biotech industry an edge by being able to process data and simulate outcomes at breakneck speed.

Drug development that once took decades to achieve can be dramatically shortened. The billions spent on clinical trials, could be saved through virtual simulations.

What AI does is make better use of patient data. It is able to simulate chemical interactions and predict how patients will react based on their genomics and medical history. It is giving the medical community a real edge in the fight against many diseases that still afflict the human race. It is also not just a technology anymore – it is a commodity – and it is a commodity that science can no longer live without.

AI needs data to thrive

The conditions need to be right for AI to thrive, which is timely because we are now generating a huge amount of data.

According to research produced by IDC, the global data sphere will grow from 33 zettabytes of data in 2018 to 275 zettabytes by 2025. To put this into perspective, it would take 1.8 billion years to download 275 zettabytes with an average high-speed internet connection.[9]

This huge dataset is the reason why AI is doing so well and being embraced by the biotech industry. Patient information, including genetic information and electronic health records on medical histories and allergies, can now be used for new applications in medicine that were impossible before. A great example of this is personalised medicine.

Medicine will become personalised and tailored

The most significant advances in medicine that we will see is likely to be personalised and precision medicine. Here, AI will perform an important role.

If medicine can be personalised to the genetics and health conditions of the patient, the side effects could be dramatically reduced and the treatment would be more effective. This could lead to huge benefits for patients suffering from diseases such as cancer and HIV. Unpredictable and destructive cocktails of drugs would no longer be administered, which would improve the quality of life for the patient and their chances of survival.

Johnson & Johnson and **Pfizer** are already using IBM Watson to analyse patient data and recommend better treatment options.[10]

When it comes to oncology, IBM Watson is able to analyse the meaning and context of both structured and unstructured data in clinical notes and reports that might be important for selecting the right treatment. By combining data from a patient's file with clinical expertise, external research and data, the best treatment for the patient can be selected.[11]

IBM has also launched **Medical Sieve**, a cognitive medical assistant with analytical reasoning capabilities and a range of clinical knowledge. It is being used in clinical decision-making in radiology and cardiology, and can analyse radiology images to spot and detect problems faster and more reliably.[12]

Personalised and precision medicine will need a myriad of disruptive technologies to work on a scale that is cost effective and practical. The boom in data in the information age, coupled with the advances being made in AI, could therefore be a real game changer.

AI is making its presence felt in biotech, in ways that were unimaginable a decade ago. This is arguably just the beginning. The potential therefore should not be under-estimated.

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