Is the AI boom over, or is the best still yet to come in the Life Sciences?

If you talk to an expert on AI, it won't be long until the Gartner hype cycle - a model for assessing the promise, maturity, and adoption of new technologies - comes up in conversation. In fact, by the middle of 2023, Gartner had already placed generative AI at the "peak of inflated expectations". From our vantage point of mid-2024, we set out to judge whether AI remains precariously perched atop that peak in the life sciences - or if it has continued into the gloomily named "trough of disillusionment".

The trough of disillusionment: Is the AI boom over?

It's a commonly cited statistic that up to 90% of clinical drug development fails - and it's a common claim of AI-powered companies that their tech can help to improve this dismal success rate. So, has it?

Dr. Volodimir Olexiouk, Principal Scientist and AI & Advanced Analytics Team Lead at BioLizard, a data analytics consultancy serving biotech and pharma, expresses skepticism: "There are some very strong claims that are being made, but if we look at the

drugs in the pipeline of the top 20 in silico-based drug discovery companies, there is only one drug currently in phase three clinical trials and a lot still in discovery or preclinical phases." He also points out that the large investments spurred by the AI boom may have created self-fulfilling prophecies. "If you take the amount of investments put into AI, and rather put it into more conventional drug discovery approaches, then you would probably also find a new candidate."

Volodimir Olexiouk
Principle Scientist, BioLizard

From the clinical perspective, Dr. Wouter van Amsterdam, Assistant Professor at the University Medical Center Utrecht and an expert in methods and applications of machine learning and causal inference for health care, cautions against falling into the trap of putting too much trust in AI.

He explains: "In many clinical research scenarios, the amount of patient data that is available for analysis is limited and biased. You can only unlock the potential of complex models like AI if you have sheer amounts of data. If you only have hundreds or thousands of patients, then even classical statistical approaches like logistic regression might be under-powered, and you can't expect AI to outperform them. But because of the hype and the boom, sometimes there's a tendency to skip statistics 101 and think, well, this is machine learning so it must be better."

Wouter van Amsterdam
Assistant Professor, UMC Utrecht

In other words, without the right data at hand - both in terms of quantity and whether it's a fit to address your biomedical queries - applying AI is futile. Volodimir agrees, and points out that conversely, where AI has been most successful in the preclinical space is precisely where there is an abundance of experimental data available. "When we look at what kind of molecules have been designed using AI and *in silico* models, the portfolio is much less diverse than with conventional drug discovery approaches. Most of the compounds are targeting kinases, which is a well-studied field. AI thrives when there is a lot of data available."

In the clinic, on the other hand, Wouter contends that we often simply do not have enough - nor the right kind - of data for realistic application of AI. "There's an idea that we'll just open this box of gold that is clinical data, find a lot of insights, and make better decisions. It's too simplistic of a view. And AI isn't even the crucial element missing here - it's causality. If we want to learn from historic data to make better medical decisions in the future,

then we're trying to solve a causal task. But if you haven't performed the right experiment, your historical data will not tell you what to expect when you change a parameter. It doesn't matter if you use AI or a *t*-test, and it doesn't matter if your dataset is 10 patients or 10 million patients - correlation still doesn't equal causation."

The slope of enlightenment: Where is AI poised to have real impact in the life sciences?
After the trough of disillusionment in the Gartner Hype Cycle comes the slope of enlightenment - wherein following a period of failed implementations, a technology begins to deliver on its promise via more targeted applications. In the case of AI, those targeted applications may consist not of the most creative tasks, but rather in algorithms taking on more rote or data-crunching tasks to allow humans to do work that demands uniquely human expertise.

For instance, Wouter envisions a future where AI can be used to help medical doctors connect with their patients better - by taking over secretarial tasks. "Documentation and administration are where I hope AI will have its first big impacts in the clinic. If it were possible that a doctor could just talk with the patient, and not have to have his or her eyes on the computer screen or be writing the whole time, but still have good notes in the end... That is something that AI should be able to accomplish."

Similarly, Volodimir is convinced that AI can best be used as a sort of expert sidekick, by presenting scientists with data-informed options that can enable them to make better decisions earlier in the drug discovery process. "We have the opportunity to use AI to bridge data silos between target identification and compound optimization - to

select early on a compound that fulfills the needs further down the drug discovery funnel, like ADMET characteristics. That can help to make better decisions early, and in the end come up with a better candidate."

In fact, in some ways AI can already be considered to be deeply embedded in R&D processes and clinics alike. "By definition, AI is any technology that mimics human intelligence," Volodimir explains, "And if you take this very broad definition then no step in the drug discovery pipeline is currently executed without some form of AI." When asked if AI has already benefited patients in the clinic, Wouter says, "Yes - in translating between doctors and patients who don't speak the same language. It's AI doing the translation with Google Translate."

The plateau of productivity: Is the best still yet to come in the Life Sciences?
As to whether the AI boom is over or if the best is yet to come, we can stay optimistic about eventually entering the brighter days of Gartner's plateau of productivity - as long as human experts ensure that the input data is sufficient, and output information is rigorously tested and carefully interpreted.

Wouter sees AI as just one of many new technologies that have changed the face of biomedicine. He says, "Maybe it's just a shift. First big data was the hype, then deep learning, and then ChatGPT came around." Volodimir agrees: "The best is still to come by a mile. In my opinion drug discovery as a whole will look completely different in five years - just like it does now compared to five years ago.

Thus, onward - if not upward - we go.