WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.453
Volume 13, Issue 23, 693-705. Review Article ISSN 2277–7105

A REVIEW ON ARTIFICIAL INTELLIGENCE IN PHARMACY

Nakade Sachin Ajinath[1]*, Wakade Ashwini[2] and Megha T. Salve[3]

[1]Shivajirao Pawar College of Pharmacy Pachegaon 413721.

[2]Assistant Professor Department of Pharmaceutics Shivajirao Pawar College of Pharmacy Pachegaon 413721.

[3]Principal Department of Pharmaceutical Chemistry, Shivajirao Pawar College of Pharmacy Pachegaon 413721.

Article Received on
15 October 2024,

Revised on 04 Nov. 2024,
Accepted on 25 Nov. 2024

DOI: 10.20959/wjpr202423-34784

***Corresponding Author**
Nakade Sachin Ajinath
Shivajirao Pawar College of Pharmacy Pachegaon 413721.

ABSTRACT

Artificial intelligence (AI) focuses on creating intelligent models that help us envision knowledge, solve problems, and make decisions. AI is active these days, it plays an important role in various areas of pharmaceutical science, such as drug development and formulation of drug administration. For drug discovery and drug discovery research, such as development, poly-pharmacology, and hospital pharmacy, development of various artificial neural networks (ANNs) such as delivery formulations and Deep Neural networks (DNN) or recurrent neural networks (RNN) are used. Artificial intelligence (AI) focuses on creating intelligent models that help us envision knowledge, solve problems, and make decisions. AI is active these days, it plays an important role in various areas of pharmaceutical science, such as drug development and formulation of drug administration. For drug discovery and drug discovery research, such as development, poly pharmacology, and hospital pharmacy. Development of various artificial neural networks (ANNs) such as delivery formulations and Deep Neural networks (DNN) or recurrent neural networks (RNN) are used.

KEYWORDS: Artificial Intelligence, Drug Discovery, Drug delivery research, Hospital pharmacy.

INTRODUCTION

Artificial Intelligence (AI) is a branch of computer science that deals with problem-solving by the aid of symbolic programming. It has greatly evolved into a science of problem-solving

with huge applications in business, health care, and engineering.[1] Artificial intelligence has results similar to human attentional processes.[2] This process generally involves developing efficient systems that use training data or apply acquired data, demonstrating explicit or approximate fusion, and self-correction / adaptation.[3]

The main purpose of this artificial intelligence in pharmacy is to analyze effective data processing problems and abstractly express solutions to these issues. This kind of computation is called a method and corresponds to a theorem in mathematics. Artificial intelligence is used to analyze machine learning that mimics individual cognitive tasks.

Artificial intelligence technology is used to execute more detailed analysis and provide useful interpretations. Artificial intelligence in the pharmaceutical industry is the use of automated algorithms to perform tasks that traditionally depended on human intelligence. Over the past five years, the use of artificial intelligence in the pharmaceutical and biotech industries has redefined how scientists develop new drugs and fight disease.[1,2,3]

ADVANTAGES 0F ARTIFICIAL INTELLIGENCE (AI)

The benefits of artificial intelligence are incredible. What this area can offer us, is to evolve definitively and move on to the history of artificial robots. Following are the main advantages of Artificial Intelligence (AI).

· Finished task faster than a human,
· Stressful and complex work completed easily,
· Difficult work done in short period,
· Various functions can done at a time,
· Success ratio is high,
· Less errors in task and defects also,
· More efficiency in short time,
· Less space, less size,
· Calculation of long term and complex situations,
· Discover unexplored things. i.e. outer space.[4,5,6]

DISADVANTAGES OF ARTIFICIAL INTELLIGENCE (AI)

Some of the main disadvantages of Artificial Intelligence (AI) in our daily lives are as follows.

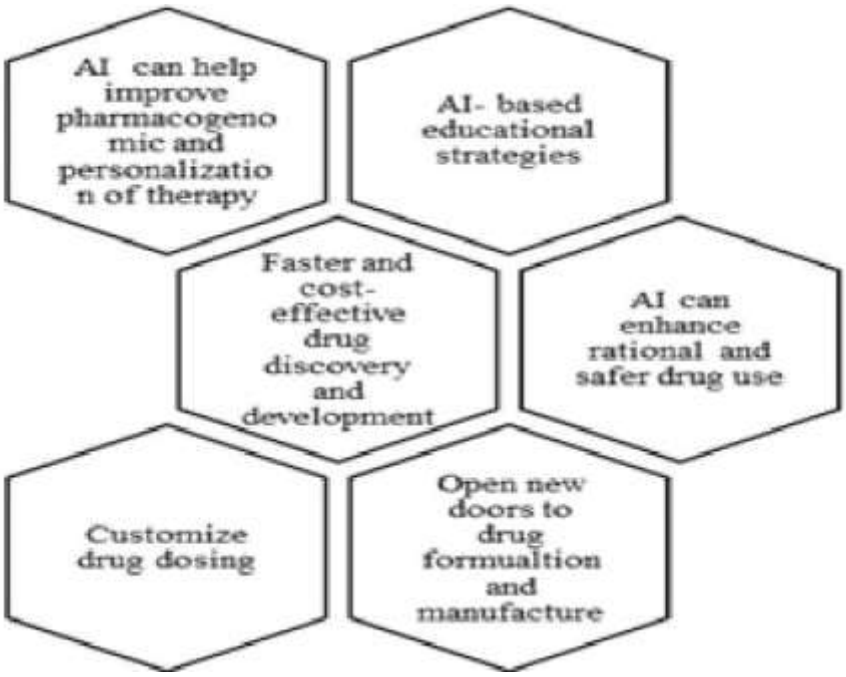
· Programme mismatch sometime done opposite to the command,

· Human jobs affected,
· Unemployment problem increased,
· Creativity is depend upon programmer,
· Lacks the human touch,
· Younger generation becomes lazy,
· Require a lot of time and money, and
· Technological dependency increased

Training complications, AI technology needs to be extensively trained with curated data sets in order to perform as expected. However, due to privacy concerns, it can be difficult to access some of the data necessary to provide AI learning with the breadth and depth of information it needs.

AI will be effective, as well as a plan to show investors it is going to be worth the cost. Everyone working alongside AI technology will need to have an understanding of this technology and how it can assist them with day-to-day tasks.[4,5,6]

Application of AI in Pharmacy



AI applications for targeted genomic therapies and diagnosis AI is used in hospital-based health care systems in a number of ways, including choosing appropriate or accessible administration routes or treatment strategies, as well as structuring dosage forms for specific patients.[7,8]

• Maintaining of medical records

Maintenance of the Medical records of patients is a complicated task. The Collection, storage normalizing, and tracing of data are Made easy by implementing the AI system. Google Deep Mind health project[9] (developed by Google) assists to Excavate the medical records in a short period. Hence, This project is a useful one for better and faster health Care. The Moor fields Eye hospital NHS is assisted by this Project for the improvement of eye treatment.

• Creating treatment plans

AI technology makes it feasible to create efficient treatment plans. An AI system is required to manage the situation when a patient's severe condition develops and choosing an appropriate treatment strategy becomes challenging. The treatment plan that this technology suggests is designed taking into account all of the prior data and reports, clinical competence, etc. Software as a service called IBM Watson for Oncology[10] is a cognitive computing decision assistance system that compares patient data to thousands of historical offers treatment alternatives to assist oncology clinicians in making well-informed decisions, as well as instances and insights gained by working with Memorial Sloan Kettering Cancer Center physicians for hundreds of hours. Nearly 15 million pages of text, including more than 300 medical periodicals, 200 textbooks, and literature selected by Memorial Sloan Kettering, support these therapy alternatives.[10]

• Helping with repetitive work

AI technology also helps with certain repetitive chores, such analyzing radiology, X-ray imaging, ECHO, ECG, and other data for the purpose of identifying and detecting illnesses or problems. Medical Sieve[11], an algorithm developed by IBM, is a "cognitive assistant" with strong reasoning and analytical skills. By merging deep learning with medical data, a medical start-up is required to enhance the patient's condition. Every bodily component has a specific computer program that is used in certain medical problems. Deep learning can be used for nearly every kind of imaging analysis, including CT, ECHO, ECG, X-ray, and more.

• Health support and medication help

AI technology has been acknowledged as being effective in recent years for both medication assistance and health support services. Molly[12], a virtual nurse created by a start-up, is given a friendly face and a charming voice. Its goal is to support patients with their chronic ailments during doctor's appointments and assist them in directing their own treatment. A smartphone webcam app called Ai Cure[13] keeps track of patients and helps them manage

their diseases. Patients taking part in clinical trials and those with serious drug issues can both benefit from this app.

• Medical accuracy

AI has a positive effect on genetic development and genomics. An AI system called Deep Genomics[14] can be used to find mutations and connections to diseases by looking for patterns in genomic data and medical records. This technique tells clinicians about what happens in a cell when genetic variation changes the DNA. Craig Venter, the creator of the human genome project, created an algorithm that uses a patient's DNA to provide information about their physical attributes.[15] "Human Longevity" AI technology can be used to pinpoint the precise location of vascular illnesses and cancer in their early stages.

• Drug development

It takes over ten years and billions of rupees to develop or create pharmaceuticals. An AI tool called "atom wise"[16] that makes use of supercomputers is helpful in determining the treatments from the molecular structure database. It launched an online search for a safe and efficient Ebola virus treatment using currently available medications. Two medications that caused Ebola infections were discovered by the technology. This analysis was finished in just one day as opposed to manual analysis's months or years. Big data was created by a Boston-based biopharma company for patient management. It saves information to determine why certain patients manage to survive illnesses. They determined the distinction between disease-friendly and healthy meteorological conditions using AI technology and biological data from patients. It aids in the development of medications, medical treatments, and applications for problem-solving.

• AI benefits people in the healthcare system

One of the top ten potential technologies in 2016 was the "open AI ecosystem".[17] Data from social awareness algorithms can be gathered and compared for usefulness. A great deal of data is kept in the healthcare system, including treatment records and patient medical histories from infancy to that age. Ecosystems can analyze this vast amount of data and provide recommendations regarding the patient's behaviors and way of life.

• Analysis of the healthcare system: If all of the data is digitized, data retrieval is simple. 97% of bills in the Netherlands are kept in digital format[18], and they include hospital names, doctor names, and treatment information. As a result, these are easily retrievable. A local

business called Zorg Prisma Publiek uses IBM Watson cloud technology to analyze the invoices. If something goes wrong, it identifies it right away and acts appropriately. As a result, it enhances and prevents hospitalization for patients.

FUTURE SCOPE OF ARTIFICIAL INTELLIGENCE

· AI used in science and research.

· AI in cyber security.

· AI in data analysis.

· AI in healthcare etc.

· AI in transport, AI in home.

AI in academia and industry Science has made significant progress with AI. Large amounts of data can be handled by artificial intelligence, which can process information more quickly than human brains. This makes it ideal for studies where the sources have large amounts of data. In this area, AI has already made strides.

1. AI in cyber security

Cybersecurity is another area where AI is useful. The threat of hackers is getting worse as businesses move their data to IT networks and the cloud.

2. AI in data analysis

AI and ML have a significant impact on data analysis. AI algorithms are capable of getting better with each repetition, increasing their accuracy and precision in the process. Data analysts that work with enormous datasets can benefit from AI.

3. AI in transport

For decades, AI has been used in the transportation industry. Since 1912, autopilot has been used by aircraft to navigate them while in the air. A plane's trajectory is controlled by an autopilot system, however this technology is not exclusive to airplanes. Autopilot is also used by ships and spacecraft to assist in maintaining their intended path.[19]

Classification of AI

There are two techniques to categorize AI[19,20]

A) based on caliber

B) based on presence.

Table 1: Classification of AI

Based on the caliber	Weak intelligence Artificial narrow intelligence Artificial general intelligence Artificial super intelligence
Based on presence	Type 1 reactive machine Type 2 limited memory system Type 3 is based on the theory of mind Type 4 self-awareness

AI systems are classified as follows according to their quality.

1. Weak intelligence or Artificial narrow intelligence (ANI).

This system is made and educated to carry out specific tasks, like traffic signals, chess play, driving, and facial recognition.

Examples include social media tagging and Apple SIRI virtual personal assistance.

2. Artificial General Intelligence (AGI) or Strong AI:

Another name for it is Human-Level AI. It can make human intelligence simpler. As a result, it is able to solve problems when presented with new tasks. AGI is capable of everything that humans can do.

3. Artificial Super Intelligence (ASI):

In every discipline from science to the arts, brainpower is more active than intelligent humans in areas like sketching, math, and space. It varies from a computer that is only marginally more intelligent than a human to one that is trillions of times more intelligent.

An AI scientist named Arend Hintze[21] categorized AI technology according to whether it was already in use or not. They are as follows.

Type 1: This type of AI system is called a Reactive machine. E.g. Deep Blue, the IBM chess program which hit the chess Champion, Garry Kasparov, in the 1990s. It can identify checkers On the chessboard and can make predictions; it does not have The memory to use past experiences. It was designed for Narrow purposes use and is not useful in other situations. Another example is Google's Alpha Go.

Type 2: Limited memory systems are the name given to this kind of AI system. For current and upcoming issues, this system can draw on prior experiences. Some of the decision-

making processes in autonomous cars are created exclusively using this technique. Future activities, such changing lanes by car, are documented using the observations that have been logged. The observations are not permanently stored in the memory.

Type 3: The term "theory of mind" refers to this kind of AI system. It implies that every individual has thoughts, goals, and wants that influence the choices they make. This AI doesn't exist.

Type 4: These are referred to as self-aware. The AI systems possess awareness and a sense of self. If the machine is self-aware, it recognizes the situation and applies the concepts found in other people's minds. This AI doesn't exist.

IMPORTANCE OF AI IN PHARMACY

Concept of AI [Artificial Intelligence]

Artificial intelligence is a branch of computer science and this is concerned about how computers behave as humans. Artificial intelligence (AI) is responsible for developing intelligent software and machines.[22] The word Artificial means man-made (Anything, which is made by human beings) and intelligence means the capacity to have different skills or having the capacity to learn different skills and knowledge through which a complex problem can be solved.[23] There are various cognitive functions which are integrated with intelligence such as; planning, language, memory, perception and attention. From the last ten years the field of artificial intelligence has grown.[24] Intelligence is basically available in both humans and artificial intelligence. For solving problems, reasoning and learning humans use their intelligence to solve complex problems. This is basically defined for development of software which is used for solving complex problems using application processes.

According to the U.S. News survey that was carried out on 150 professionals, pharmacists are the 13th best-paid professionals. The average salary of a pharmacist was found to be $120950, and the unemployment rate was found to be 1.6%. The job of a pharmacist, for decades, has been to ensure that the prescriptions that are received by the pharmacy are filled with the right medicine in the right amount and to also ensure that in case of multiple medications, the medicines do not show any adverse drug-drug interactions. However, the scenario has drastically changed over the past 5 years. With the advent of big data and AI, robots are now becoming more trustworthy for doctors, and a large number of institutions are now

employing robots along with human supervision to carry out activities that were previously done by humans.

A large number of compounds that could have the potential to combat a large number of specific diseases are available with pharmaceutical companies. However, the companies have no tools at their disposal for their identification as such. Drug development and production is not an easy task, and it may cost a pharmaceutical company as much as $2.6 billion along with a time frame of as long as 12–14 years for completion. This is where AI becomes a boon for pharmaceutical companies. The major benefit of AI is that it is much more superior to humans in analyzing data and it can analyze large amounts of data that would normally not fit into any of the conventional computers. AI is being mostly used in research areas currently. The processing power of AI is greater than any other tools available at anyone's disposal and in research, especially on gene mutation; it can go through piles of data and pick out the necessary information.[22,23,24]

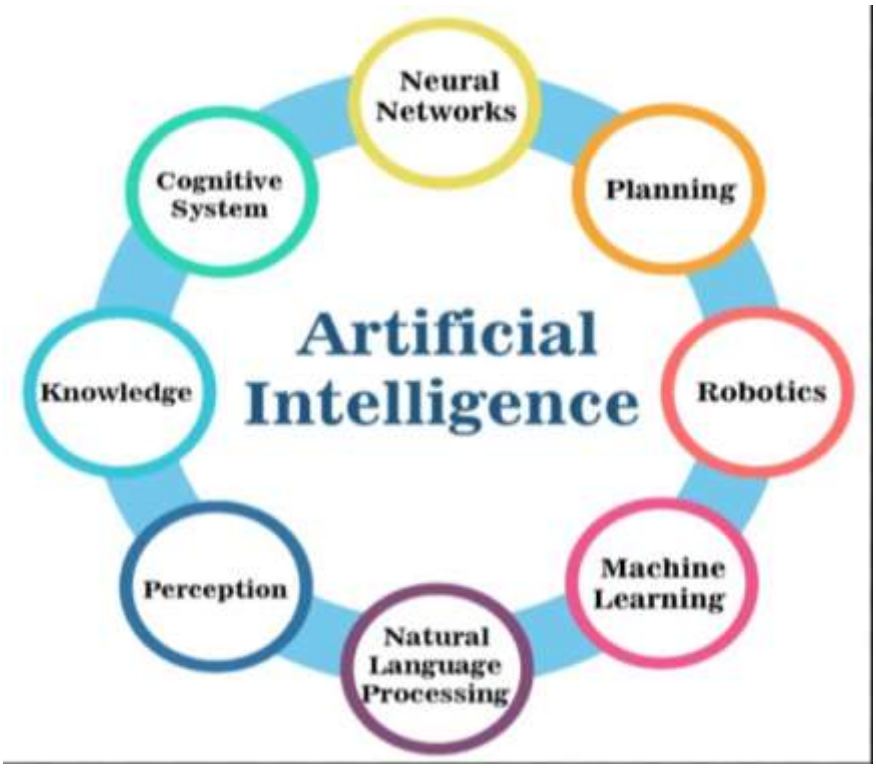


Fig :- Role of Artificial Intelligence.

Benefits of Artificial Intelligence Technology's

1. Accuracy Improvement

Increased accuracy is the outcome of artificial intelligence's assistance in improving precision and minimizing errors. Because they can survive difficult atmospheric settings, resilient metallic robotic beings that can tolerate harsh space conditions are used for space exploration.[25]

2. Challenging Expedition

In addition to finding use in fuel exploration, artificial intelligence also shows its usefulness in the mining sector. By overcoming mistakes made by humans, AI technologies can explore the ocean.[26]

3. Routine Implementations

AI contributes significantly to our daily actions and activities. For example, GPS systems are frequently used on long trips, and the addition of artificial Android devices helps to anticipate user input and correct typos.[27]

4. Artificial intelligence Assistants

These days, advanced companies are using AI technologies, such as "avatars" or digital assistant models, to lessen the need for human labor. Since the "avatar" is emotionless, they are able to make the right decisions. Human emotions and moods impair judgment, however machine intelligence can assist in resolving this problem.[28]

5. Clinical Application

Doctors may generally assess their patients' status and analyze any adverse drug reactions or other health hazards with the help of an AI computer. Trainee surgeons can gain a lot of knowledge by using AI applications, such as various artificial surgery simulators (such those that mimic the heart, gastrointestinal tract, brain, etc.).[29]

6. Enhance Technological Progress Rate

Artificial intelligence (AI) technology is used in almost all of the most advanced technical developments in the world. It may produce a variety of computational modeling programs and aims to produce newer compounds. AI technology is also used in the creation of medicine delivery formulations.[30]

7. Assistant and Relief

AI technology functions as educational tools for teaching and learning, benefiting people of all ages, from young children to the elderly, 24/7.

8. Infinite Possibilities

Machines are emotionless and limitless in their operation. These dispassionate computers are capable of doing a variety of jobs more accurately and efficiently than humans.[31]

REFERENCES

1. Dasta, J. F. (1992). Application of artificial intelligence to pharmacy and medicine. Hospital pharmacy, 27(4): 312-5.
2. Mak KK, Pichika MR. Artificial intelligence in drug development: Present status and future prospects. Drug Discov Today, 2019; 24(3): 773-80.
3. Hassanzadeh P, Atyabi F, Dinarvand R. The significance of artificial intelligence in drug delivery system design. Adv Drug Deliv Rev, 2019; 151: 169-90.
4. Bishop, C. M. (2006), Pattern Recognition and Machine Learning, Springer, ISBN 978-0-387-31073-2.
5. Gots, I. and Saloky, T. (1994), Scientific Research and Pedagogical Aspects of the Doctoral Study at the Faculty of Mechanical Engineering. In Proceedings of AE in ACT'94. International Workshop on Advanced Education and Control Technology. Prague: CTU, Prague, pp. 31-34.
6. Kumar, P. S. G. (2004), Information Technology: Applications. New Delhi: BRPC, pp 401-425.
7. Ganapathy, K., S.S. Abdul, and A.A. Nursetyo, Artificial Intelligence in neurosciences: A clinician's perspective.Neurology India, 2018; 66(4): 934.
8. Manikiran, S. and N. Prasanthi, Artificial Intelligence: Milestones and Role in Pharma and Healthcare Sector.Pharma times, 2019; 51: 9-56.
9. Deep Mind's health team. [cited 2022 13 June]; Available From: https://www.deepmind.com/blog/deepminds-health-Team-joins-google-health.
10. IBM Watson for Oncology.; Available from: bin/ssialias?appname=skmwww&htmlfid=897%2FENUS5725W51&infotype=DD&subtype=SM&mhsrc=ibmsearch_a&mhQ=IBM%20WATSON%20Oncology#:~:text=IBM%20Watson%20for%20Oncology%2C%20software,Center%20physicianS%20and%20other%20analysts.

11. IBM. Medical Sieve. . [cited 2022 13 June]; Available from: https://researcher.watson.ibm.com/researcher/view_group.php?id=4384.
12. MOLLY, THE VIRTUAL NURSE. [cited 2022 13 June]; Available from: http://adigaskell.org/2015/03/20/meet-Molly-the-virtual-nurse/.
13. AiCure. THE RIGHT DOSE FOR THE RIGHT PATIENT. [cited 2022 13 June]; Available from: https://aicure.com/.
14. Deep Genomics. Programming RNA Therapies Any Gene, Any Genetic Condition. [cited 2022 13 June]; Available From: https://www.deepgenomics.com/.
15. Shampo, M.A. and R.A. Kyle, J. Craig Venter—The Human Genome Project. Mayo Clinic proceedings, 2011; 86(4): E26-e27.
16. Atom wise. Artificial Intelligence for Drug Discovery.; Available from: https://www.atomwise.com/.
17. Open AI Ecosystem.; Available from: https://www.scientificamerican.com/article/open-ai-ecosystem-portends-a-personal-assistant-for-everyone/.
18. E invoicing in The Netherlands.; Available from: https://ec.europa.eu/digital-building blocks/wikis/display/DIGITAL/E invoicing+in+The+Netherlands.
19. Russell S, Norvig P. Artificial intelligence: a modern approach (4th edition), 2021; Pearson Series in Artificial Intelligence.
20. Russell S, Norvig P. Artificial intelligence: a modern approach (4th edition), 2021; Pearson Series in Artificial Intelligence.
21. Beck BR, Shin B, Choi Y, Park S, Kang K. Predicting commercially available antiviral drugs that may act on the novel coronavirus (SARS-CoV-2) through a drug-target interaction deep learning model. Comput Struct Biotechnol J., 2020; 18: 784–90.
22. W. Ertel, Introduction to Artificial Intelligence (Undergraduate Topics in Computer Science). 2017.
23. A. Bansla and N. Bansla, "Artificial intelligence," Int. J. Appl. Eng. Res., 2012, doi: 10.4018/ijeei.2018070102
24. F. Jiang et al., "Artificial intelligence in healthcare: Past, present and future," Stroke and Vascular Neurology, 2017,doi:
25. Posner M.I, Rothbart M.K, Research on Attention Networks as A Model for the Integration of Psychological Science, Psychol, 2007; 58: 1–23.
26. Haag M, Maylein L, Leven F.J, Tonshoff B, Haux R, Web-based Training. A new paradigm in computer-assisted instruction in Medicine, Int. J. Med. Inform, 1999; 53: 79–90.

27. Vyas M, Artificial intelligence. The beginning of a new era in Pharmacy profession, Asian J. Pharm, 2018; 12: 72-76.
28. University of California San Fransisco, New UCSF Robotic Pharmacy Aims to Improve Patient safety. Available from: https://www.ucsf.edu/aimsimprove-patient-safety.
29. McHugh R, Rascon J, Meet MEDi, the Robot Taking Pain Out Of Kids Hospital Visits. Available from: http:// www.nbcnews.com/news/us-news/meet-medi-robottaking-pain-out-kids-hospital-visits-n363191.
30. Eye for Pharma. Artificial intelligence- A Brave New World for Pharma. Available from: https://www.social.eyeforpharma.com/clinical/artificial intelligence-brave-new-world-pharma.
31. Silver D, Schrittwieser J, Simonyan K, Mastering the game of Go without human knowledge, 2017; 550(7676): 354-359.