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Artificial intelligence 2.0: Taking organoid intelligence a step ahead

With qubits from a variety of developers now available for hiring on the cloud, quantum computing is making the leap from the lab to the market. IBM Quantum, DWave's Leap service, and Oxford Quantum Circuits' quantum computing hardware are all examples of commercially available implementations of quantum computing. Companies in the quantum computing industry are working hard to make algorithms, which require putting together a sequence of quantum gates, more accessible to the general public. Examples of such companies are Horizon Quantum Computing and Algorithmic. However, quantum computers aren't the only future of computing to think about. Lab-grown neurons, in a research called DishBrain, have been taught to play the popular arcade game Pong, highlighting the possibility that biological hardware may compete with classical bits. Researchers are hopeful that biological systems will play a role in the future of computing, and observers of the sector are weighing the potential of so-called organoid intelligence [1].

Tissues that mimic organs, called organoids, may be generated in a laboratory. These organ substitutes have been employed in laboratories for almost two decades; often produced from stem cells, they have allowed researchers to forego potentially damaging human or animal testing by simulating real-world conditions [2]. Although brain organoids don't seem like miniature human brains, the pen dot-sized cell cultures include neurons with the ability to perform brain-like activities and construct complex networks. Organoids of the brain might be grown from the skin of individuals with neurological diseases, enabling researchers to examine the effects of potential treatments. While AI research has been motivated by how humans think, current technology still falls short of duplicating the brain's capabilities. To bridge this gap, people may employ a Completely Automated Public Turing Test to Tell Computers and people Apart (CAPTCHA) consisting of a picture or string of text to verify they are not automated software. The British mathematician and computer scientist Alan Turing created the Turing test, often called the imitation game, in 1950 to see whether computers can mimic human intelligence. DishBrain was developed by a group of scientists in Melbourne, Australia, lead by Cortical Labs in late 2022. It combines in vitro neural networks with insilico computers to play the video game Manuscript without author details Pong. The scientists used a high-density multielectrode array device to train 800,000 brain cells produced in the lab [3].

Voltage pulses represented game factors such as the ball's direction and distance, while electrical pulses provided feedback when the player missed the ball. Without instantaneous reward channels like dopamine, researchers influenced cellular activity using the free-energy principle. According to this hypothesis, living things like cells actively strive to reduce randomness. By mastering the game, the civilization increased the predictability of its universe. After just 5 min of games, researchers saw signs of learning that were absent in control settings. Organoid research has potential for modelling the cellular processes of cognition and advancing our knowledge of the brain. Scientists have already began conducting experiments to ascertain the influence of drugs and alcohol on the cognitive abilities of brain organoids. Similarly, brain organoids may be cultivated to reflect early stages of brain development by simulating distinct areas and cell layers. They may be put to use investigating the mental effects of neurological conditions. Memory development in organoids of persons with and without Alzheimer's disease may be compared to help find treatments for the condition. Research into the effects of genes, drugs, and the environment on a person's health might be greatly advanced with the use of individualised brain organoids. The use of AI to analyse this data might lead to the discovery of causes and effective therapies for disorders like Parkinson's [4]. Nevertheless, DishBrain's capacity to self-organise activity in response to feedback hints to intelligence and highlights the promise of organoids for studying cognition. A team of researchers from Johns Hopkins University and Cortical Labs met earlier this year to discuss a strategy for pursuing this avenue of inquiry. The group's long-term goal is to develop biocomputers that outperform both silicon computing and artificial intelligence by using organoids from real human brains [5].

Biological learning has three primary benefits. The first is that although computers are more efficient at processing basic information like numbers, human brains are more superior when it comes to handling complicated data and forming judgements based on widely diverse and imprecise sets of information. No technology currently exists that can perform large-scale simulations faster than real time; in 2013, it took the world's fourth-ranked supercomputer, Fujitsu, 40 minutes to mimic 1 second of cerebral activity. The second is that the number of training examples needed for biological learning is far less. When it comes to the strategic board game Go, AlphaGo was the first computer programme to ever defeat a human world champion. Its training data consisted of 1600 games, which is the same as playing 5 h every day for over 175 years, yet it still managed to outperform a human. OI is appealing because of the benefits associated with biological learning. However, we may face substantial ethical and scientific challenges in developing an OI biocomputer. Concerns about ethics often revolve on issues of self-awareness and pain. However, issues of ethics surround OI from the moment a donor's cells are collected all the way through the development, study, and implementation of the technique. Here are a few cases in point. Protecting the donor's rights and dignity at the moment of donation relies heavily on free, prior, and informed permission. Reducing discrimination risks and fostering neurodiversity both require eliminating selection biases. Limits on gene editing usage and standards for ethical culture are required because to the economic interest in organoids. Inclusivity and plurality in knowledge development depend on data sharing and free access to technology throughout the learning and computation phases. There would need to be rules in

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place throughout implementation that take into account input from relevant stakeholders. Many additional issues will need to be tackled as time goes on in order to guarantee the growth of OI in an ethical manner. The first technological step to improving OI's intelligence would be to multiply brain organoids by a factor of 100, from the current 100,000 to 10 million cells. Adding more cells would make the organoid more like a miniature brain in terms of its organisation and synaptic contacts, allowing them to do complicated computations. To do this, we would have to create artificial blood circulation systems. Non-neural cells are known to have a role in learning and memory, thus it would be beneficial to introduce cell variety that includes these cells. The ability to store memories is crucial for developing organoids with complex intelligence. Due to lack of funding for research and other roadblocks, many areas of the technology are still in their infancy.

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Hitesh Chopra
Department of Biosciences, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Chennai, 602105, Tamil Nadu, India

Kavita Munjal
Department of Pharmacy, Amity Institute of Pharmacy, Amity University, Noida, Uttar Pradesh, India

Talha Bin Emran*
Department of Pharmacy, BGC Trust University Bangladesh, Chittagong 4381, Bangladesh
Department of Pharmacy, Faculty of Allied Health Sciences, Daffodil International University, Dhaka 1207, Bangladesh

* Corresponding author. Department of Pharmacy, BGC Trust University Bangladesh, Chittagong 4381, Bangladesh.
E-mail address: talhabmb@bgctub.ac.bd (T.B. Emran).