

We affirm the resolution: In the United States, the benefits of the use of generative artificial intelligence in education outweigh the harms.

Definitions:

Generative AI: MIT in 2023 <https://news.mit.edu/2023/explained-generative-ai-1109> defines: **Generative AI** can be thought of as a machine-learning model that is **trained to create new data**, rather than making a prediction about a specific dataset. A generative AI system is **one that learns to generate more objects** that look like the data it was trained on.

Education: Cambridge <https://dictionary.cambridge.org/us/dictionary/english/education> defines: **the process of teaching or learning, especially in a school or college, or the knowledge that you get from**

C1: innovation

Research at universities is the catalyst for innovation

Bajraktari from the MIT Technology Review in 2024 [Ylli Bajraktari, Tom Mitchell, and Daniela Rus, "Three ways the US could help universities compete with tech companies on AI innovation", 04/19/2024, MIT Technology Review, <https://www.technologyreview.com/2024/04/19/1091488/three-ways-the-us-could-help-universities-compete-with-tech-companies-on-ai-innovation/>, Accessed 03/04/2025]

The ongoing revolution in artificial intelligence has the potential to dramatically improve our lives—from the way we work to what we do to stay healthy. **Yet ensuring that America and other democracies can help shape the trajectory of this technology requires** going beyond the tech development taking place at private companies. **Research at universities drove the AI advances that laid the groundwork for the commercial boom we are experiencing today.**

AI is the newest frontier for this research in over 14 universities

OpenAI 25 [OpenAI, "Introducing NextGenAI: A consortium to advance research and education with AI", 03/04/2025, OpenAI, <https://openai.com/index/introducing-nextgenai/>, Accessed 03/04/2025]

Today, we're launching **NextGenAI**, a first-of-its-kind consortium with 15 leading research institutions dedicated to using AI **to accelerate research breakthroughs and transform education**. AI has the power to drive progress in research and education—but only when people have the right tools to harness it. That's why **OpenAI is committing \$50M** in research grants, compute funding, and API access to support students, educators, and researchers advancing the frontiers of knowledge. Uniting institutions across the U.S. and abroad, NextGenAI aims to catalyze progress at a rate faster than any one institution would alone. This initiative is built not only to fuel the next generation of discoveries, but also to prepare the next generation to shape AI's future.

The Next Generation of AI Leaders NextGenAI's founding partners are **Caltech**, the California State University system, **Duke University, the University of Georgia, Harvard University, Howard University, Massachusetts Institute of Technology, the University of Michigan, the University of Mississippi, The Ohio State**

University, the University of Oxford, Sciences Po, Texas A&M University, as well as Boston Children's Hospital, the Boston Public Library, and OpenAI. Each institution is using AI to tackle high-impact challenges, from revolutionizing healthcare to reimagining education. Here are just a few

examples of their groundbreaking work: Accelerating the next generation of research breakthroughs The Ohio State University is leveraging AI to accelerate the fields of digital health, advanced therapeutics, manufacturing, energy, mobility, and agriculture, while educators are using AI to create advanced learning models. Harvard University and Boston Children's Hospital researchers are using OpenAI tools and NextGenAI funding to reduce the time it takes patients to find the right diagnosis, especially for rare orphan diseases, and improve AI alignment with human values in medical decision-making. Duke University scientists are using AI to pioneer metascience research, identifying the fields of science where AI can have the greatest benefit. "Ohio State is at the forefront of a multidisciplinary approach to the benefits of AI, significantly impacting both research and education. We are excited to join Open AI and this elite research partnership, which will enable us to drive even more groundbreaking discoveries and advancements in medicine, manufacturing, computing, and beyond." —Peter J. Mohler, Executive Vice President for Research, Innovation, and Knowledge, The Ohio State University Empowering the next generation to be AI-fluent Texas A&M is using NextGenAI resources to fuel their Generative AI Literacy Initiative, providing hands-on training to enhance the responsible use of AI in academic settings. MIT students and faculty will be able to use OpenAI's API and compute funding to train and fine-tune their own AI models and develop new applications. Howard will use AI to develop curricula, experiment with new teaching methods, improve university operations, and give students hands-on AI experience to prepare them as future leaders. "We look forward to collaborating with OpenAI, whose support will enable us to empower our students, researchers, and the broader academic community with cutting-edge knowledge and skills in the rapidly evolving field of generative artificial intelligence." —Dr. Robert H. Bishop, Vice Chancellor and Dean of the College of Engineering, Texas A&M University Imagining the future of AI-powered universities and libraries University of Oxford is leveraging AI for a broad research agenda, education, and university operations—its renowned Bodleian Library is digitizing rare texts and using OpenAI's API to transcribe them, making centuries-old knowledge newly searchable by scholars worldwide. University of Mississippi is exploring new ways to integrate AI into their core mission of education, research, and service, and to advance AI-driven solutions that benefit their students, faculty, and the broader community. Boston Public Library, America's first large free municipal public library, is digitizing public domain materials and using AI to make their information more accessible to patrons from all walks of life. "This new collaboration marks an exciting step forward, offering fresh opportunities to enrich our research, expand our AI capabilities, and foster skill development. By working together, we can learn from one another, advancing the frontiers of artificial intelligence, understanding its impact on education and unlocking its vast potential for the benefit of our university community and beyond." —Anne Trefethen, Pro-Vice-Chancellor, Digital, University of Oxford Strengthening the Connection Between Academia & Industry NextGenAI reinforces the vital partnership between academia and industry, ensuring that AI's benefits extend to laboratories, libraries, hospitals, and classrooms worldwide. "The field of AI wouldn't be where it is today without decades of work in the academic community. Continued collaboration is essential to build AI that benefits everyone. NextGenAI will accelerate research progress and catalyze a new generation of institutions equipped to harness the transformative power of AI." —Brad Lightcap, Chief Operating Officer, OpenAI This initiative expands OpenAI's commitment to education, following the launch of ChatGPT Edu in May 2024, which enabled university-wide access to ChatGPT. NextGenAI complements this effort by providing institutions OpenAI's APIs and funding to drive critical innovation. NextGenAI is designed to support the scientist searching for a cure, the scholar uncovering new insights, and the student mastering AI for the world ahead. As we learn from this initiative, we'll explore opportunities to expand its reach and impact. We look forward to sharing updates as our partners drive progress—one breakthrough at a time.

It's specific to genAI

Amazon in 2024 [Amazon in 2024, "Amazon invests \$110 million to support AI research at universities using Trainium chips", 11/12/2024, US About Amazon, <https://www.aboutamazon.com/news/aws/amazon-trainium-investment-university-ai-research>, Accessed 03/04/2025]

Amazon is announcing a \$110 million investment for university-led research in generative AI. The program, known as Build on Trainium, will provide compute hours that allow researchers the opportunity to build new AI architectures, machine learning (ML) libraries, and performance optimizations for large-scale distributed AWS Trainium UltraClusters (collections of of AI accelerators that work together on complex computational tasks). AWS Trainium is the ML chip that AWS built for the purposes of deep learning training and inference. AI advances created through the Build on Trainium initiative will be open-sourced, so researchers and developers can continue to advance their innovations. 4 ways AWS is engineering infrastructure to power generative AI From networking innovations to changes in data center design, AWS continues to optimize its infrastructure to support generative AI at scale. The program caters to a wide range of AI research,

from algorithmic advancements to increase AI accelerator performance, all the way up to large distributed systems research. As part of Build on Trainium, AWS created a Trainium research ItraCluster with up to 40,000 Trainium chips, which are optimally designed for the unique workloads and computational structures of AI. As part of Build on Trainium, AWS and leading AI

student education. In addition, Amazon will conduct multiple rounds of Amazon Research Awards calls for proposals, with selected proposals receiving AWS Trainium credits, and access to the large Trainium UltraClusters for their research. A boost to computing power Developing frontier **AI models and applications requires a** lot of computing power, and many universities have had to slow down AI research due to budgetary constraints. A researcher might invent a new model architecture or a new performance optimization technique, but they may not be able to afford the high-performance computing resources required for a large-scale experiment. The Catalyst research group at Carnegie Mellon University (CMU) in Pittsburgh, Pennsylvania, is one of the research institutions participating in Build on Trainium. There, a large group of faculty and students are conducting research on ML systems, including developing new compiler optimizations for AI. “AWS’s Build on Trainium initiative enables our faculty and students large-scale access to modern accelerators, like AWS Trainium, with an open programming model. It allows us to greatly expand our research on tensor program compilation, ML parallelization, and language model serving and tuning,” said Todd C. Mowry, a professor of computer science at CMU. Funding to support AI experts of the future Since launching the AWS Inferentia chips in 2019, AWS has been a pioneer in building and scaling AI chips in the cloud. By opening those capabilities to academics, Build on Trainium will not only help broaden the pool of ideas, but also support the training of future AI experts. What you need to know about the AWS AI chips powering Amazon’s partnership with Anthropic Anthropic will use our powerful, purpose-built AI chips to accelerate generative AI for our customers. “Trainium is beyond programmable—not only can you run a program, you get low-level access to tune features of the hardware itself,” said Christopher Fletcher, an associate professor of computer science research at the University of California at Berkeley, and a participant in Build on Trainium. “The knobs of flexibility built into the architecture at every step make it a dream platform from a research perspective.” These advancements are possible, in part, thanks to a new programming interface for AWS Trainium and Inferentia called the Neuron Kernel Interface (NKI). This interface gives direct access to the chip’s instruction-set and allows researchers to build optimized compute kernels (core computational units) for new model operations, performance optimizations, and science innovations. “AWS is really enabling unexpected innovation” said Fletcher. “I walk across the lab and every project needs compute cluster resources for something different. The Build on Trainium resources will be immensely useful—from day-to-day work, to the deep research we do in the lab.” Additional resources for grant recipients As part of the Build on Trainium program, researchers will be able to connect with others within the field to bring ideas to life. Grant recipients have access to AWS’s extended technical education and enablement programs for Trainium. This is done in partnership with the growing Neuron Data Science community, a virtual organization led by Amazon’s chip developer Annapurna, which bridges the AWS Technical Field Community (TFC), specialist teams, startups, AWS’s Generative AI Innovation Center, and more. Your guide to free and low-cost AWS courses that can help you use generative AI More than 100 AWS trainings on AI/ML are available to everyone, with all levels of experience. AI advancements are moving quickly because developers anywhere in the world are able to access and deploy the software. **Researchers involved in Build on Trainium will publish papers on their work and will be asked to bring the code into the public sphere** via open-source machine learning software libraries. This collaborative research will become the foundation for the next round of advancements in AI.

This helps **agriculture.**

GenAI developed by universities allows farmers to adapt to climate challenges.

Saldana from Texas A&M in 2025 Gabe Saldana, “Generative AI for decision-making in agricultural and natural resources production, management”, 02/07/2025, Phys, https://phys.org/news/2025-02-generative-ai-decision-agricultural-natural.html#google_vignette, Accessed 03/04/2025

An innovative resource designed to streamline and improve decision-making in agricultural and natural resources production and management is now available to a wide range of users—including policymakers, land and water managers, farmers, researchers and extension agents across the nation. **The Soil and Water Assessment**

Tool released was Virtual Extension Assistant, or SWAT VEXA, in late 2024 by Texas A&M AgriLife

Research and IBM. It is **a free**, interactive, **generative** artificial intelligence, **AI**, **assistant** that **provides custom, user-friendly insights**. By **addressing critical areas such as soil erosion, pollution control and disaster risk mitigation among many other scenarios**, SWAT VEXA empowers users **to**

make informed decisions across a host of scenarios. Decades of research and development Outputs from SWAT VEXA are based on big data sets of the Soil and Water Assessment Tool, SWAT. **This advanced computer modeling system was developed over more than four decades by scientists at the Texas A&M AgriLife Blackland Research Center at Temple along with the U.S. Department of Agriculture’s Agricultural Research Service, USDA-ARS.** Over the years, SWAT has become the international and U.S. standard for agriculture and natural resources decision-making at all geographical scales. “VEXA accelerates research, enhances reproducibility and empowers users to design innovative solutions for complex agricultural and hydrological challenges,” said Raghavan Srinivasan, Ph.D., AgriLife Research distinguished professor and director of the Blackland Research Center at Temple. “With its ability to democratize

knowledge and fast-track decision-making, VEXA is set to drive significant advancements in SWAT model research, ultimately promoting ecosystem sustainability and effective resource management worldwide," Srinivasan said. Merging AI with proven technology The SWAT system was integrated with AI as part of a continuing collaboration between AgriLife Research and IBM through the technology company's IBM Sustainability Accelerator. SWAT VEXA also incorporates IBM's Deep Search AI, watsonx.ai and Granite model. Researchers say **the tool can advance agricultural and natural resource productivity and sustainability by enabling faster decision-making** for users worldwide. "Today, smallholder farmers need more than traditional advice," said Justina Nixon-Saintil, vice president and chief impact officer at IBM. "They need scientifically precise, data-driven insights. Solutions such as SWAT VEXA democratize access to critical environmental insights, enabling faster, more informed decision-making for communities facing agricultural challenges."

Driving global impact In addition to advancing agricultural and resource productivity, SWAT VEXA is expected to amplify the global impact of the IBM Sustainability Accelerator. To date, this program has **supported approximately 65,300 direct beneficiaries through efforts in sustainable agriculture initiatives.** By offering accessible, AI-powered insights, SWAT VEXA enables users to make data-informed decisions, ultimately promoting sustainability and resilience in agricultural systems worldwide.

U.S. agricultural innovation is how we feed the future.

Fain '23 [Irving; February 10; B.A. from Brown University, former analyst at Citi, founder and CEO of Bowery; Fortune, "A new agricultural revolution has started. Congress must invest now to secure the future of U.S. food,"

At a certain point, **we have to wonder how much more the global food system can take. Historic flooding in Pakistan. Droughts across the American West. Russia's invasion of Ukraine. The global food system and the supply chains** that have long allowed us to move food from where it is grown to where it **is needed have rarely been stretched so thin,** or so far. The consequences can be seen in the cost and availability of food in most parts of the world, including in the United States. Americans' growing demand for fresh produce will only accelerate our reliance on an increasingly fragile food system. However, the story of this decade doesn't have to be one of scarcity and strain. A different future is within reach: one of abundance, affordability, and sustainability. The U.S. has a historic opportunity to **shorten supply chains, safeguard long-term food security, and decrease the environmental costs of agriculture. Innovation can make this possible—but only if America invests in new farming technologies.** Not only to feed ourselves but to reaffirm our role as the world's greatest exporter of both food and innovation. Unless you're in the industry, you might not know that agriculture is undergoing a quiet technological revolution. **Drones, sensors, and satellite imaging systems help farms manage crops more effectively with more information and knowledge than ever before. Amid labor shortages, farmers are looking to robotics and automation to fill the gap. Artificial intelligence is now used to monitor soil, control pests, and improve overall yield.** These and other advances are enabling the industry to rethink its most basic assumptions: how we grow, what we grow, and how we transport what we grow. For example, recent breakthroughs in artificial intelligence, computer vision, and sensor and control systems have allowed our company, Bowery, to grow fresh, local, pesticide-free in large-scale, smart indoor environments with crops stacked from floor to ceiling. This approach, powered by renewable energy, uses significantly less land and water. **It's a sustainable model that works irrespective of changing climate conditions or severe weather events. Vertical farms can be built just about anywhere.** But by putting them near the markets we serve, we can radically shorten the supply chain—decreasing disruptions and the environmental costs of long-haul shipping, and increasing the resilience of the food system overall. Many Americans have probably eaten vertically farmed products without realizing how differently they're grown. But vertical farming is only part of the broader transformation that the world must undertake. **With the global population projected to reach nearly 10 billion by 2050, and with the climate crisis worsening, we need to produce more food, more sustainably. This will require collective effort—and collective investment.** Much like crops on a farm, a business requires the right inputs to grow. Great ideas, upfront capital, and a commitment at the state and local levels enable businesses to thrive. But for a cutting-edge industry to flourish and have a national and even global impact, the federal government has a key role to play as an accelerator of innovation.

Think of solar energy in the 1990s or electric vehicles in the early 2000s. The promise was evident. But these innovations could not have become the transformative, ubiquitous technologies they are today absent national investments in research and development, infrastructure, workforce training, and manufacturing—and without appropriate tax incentives.

Agriculture is poised to become the next great success story of sustainable innovation—as foreign governments increasingly recognize. For example, the Netherlands—the world's second-largest agricultural exporter—has invested in new growing technology and cell-based meat production. Small, land-poor states like Singapore and the UAE, as well as massive countries such as Russia and China, are working to build food systems that can withstand the changing climate and reduce their reliance on tumultuous trade relationships. The U.S. must do the same. The global challenges of climate change and food insecurity will accelerate the development of new farming technologies

everywhere humans live and eat. **America has an opportunity to lead this revolution and to spread the benefits around the world.** As a matter of foreign policy and economic policy, the new Congress must act.

Key to prevent poverty

Caldwell 08: 5-1-2008, "Food Price Crisis 101," Center for American Progress,

<https://www.americanprogress.org/article/food-price-crisis-101/>, accessed: 3-13-2022

The timing could not be worse for many of the world's hot spots and the United States' long-term national security. Rising prices and low stockpiles have fueled civil strife and political instability in urban areas of vitally strategic countries such as Egypt, Indonesia, Afghanistan, Somalia, Haiti, Pakistan, and India. At the precise moment when the United States has a narrow window of opportunity to contribute toward progress on the security, political, and economic fronts in key countries such as Pakistan and Afghanistan, the streets have erupted in food riots. Dramatic **increases in food prices disproportionately affect the poor** both in the United States and abroad. The purchasing power of families, food banks, and aid agencies erodes as prices rise, and they cannot keep pace with rising costs. Food banks and soup kitchens in the United States are reporting dwindling stocks and a 20 percent increase in visitors since April of last year. And **in developing countries**, where **60 to 80 percent of** a family's **income is spent on food, every 20 percent increase in food prices will push 100 million** more people **into the ranks of the poorest of the poor living on less than one dollar a day**

Food inflation in the United States is at its highest levels in 17 years. Enrollment in the nation's food stamp and nutrition programs has grown by 1.3 million to its highest levels ever. The U.S. Department of Agriculture estimates that the price of household food purchases will rise by 4 to 5 percent this year. Poor Americans spent almost 6 percent more of their income on food in 2006 than households with incomes above \$70,000. Congress must use the Farm Bill and other legislation to provide additional funding to increase the budgets of the food stamp and nutrition programs so that they can serve more Americans in need.

Subpoint B: Medical

Generative AI improves medical education **Reddy 24**

Reddy, S. Generative AI in healthcare: an implementation science informed translational path on application, integration and governance. Implementation Sci 19, 27 (2024). <https://doi.org/10.1186/s13012-024-01357-9> [Sandeep Reddy: an Artificial Intelligence (AI) in healthcare researcher based at the Deakin School of Medicine besides being the founder/chairman of Healea] In the context of medical education and training, this technology can be used to generate a wide variety of virtual patient cases. These cases can be based on a diverse range of medical conditions, patient demographics and clinical scenarios, providing a comprehensive learning platform for medical students and healthcare professionals [51, 52]. One of the primary benefits of using **generative AI in medical education is the ability to create a safe and controlled learning** environment. Medical students can interact with these virtual patients, make diagnoses and propose treatment plans **without any risk to real patients**. This allows students to make mistakes and learn from them in a low stake setting. Generative AI can **also** create patient cases that are rare or complex, **giving students** the opportunity to gain **experience and knowledge** in areas they might not encounter frequently in their clinical practice. This can be particularly beneficial in preparing students for unexpected situations and enhancing their problem-solving skills. Furthermore, the use of AI in medical education can provide a more personalized learning experience. The AI can adapt to the learning pace and style of each individual, presenting cases that are more relevant to their learning needs. For example, if a student is struggling with a particular medical condition, the AI can generate more cases related to that condition for additional practice. In addition to creating virtual patient cases, generative AI can also be used to simulate conversations between healthcare professionals and patients [51, 52]. This can help students improve their communication skills and learn how to deliver difficult news in a sensitive and empathetic manner. Moreover, the integration of AI in medical education can **provide valuable data for educators**. **The AI can track the performance of students, identify areas of improvement and provide feedback, helping educators to refine their teaching strategies and curricula.**

IMPACT: Lives saved

Pearl 24

Pearl, Robert. "Medical Education Needs Radical Reform: AI, Alone, Isn't the Answer." Forbes, 15 July 2024, www.forbes.com/sites/robertpearl/2024/07/15/medical-education-needs-radical-reform-ai-alone-isnt-the-answer/. Accessed 21 Feb. 2025. [Robert Pearl, M.D.: healthcare leader, author, educator, podcaster and Forbes contributor; for 18 years, he led The Permanente Medical Group (Kaiser Permanente); clinical professor of plastic surgery at the Stanford University School of Medicine and on the faculty at the Stanford Graduate School of Business; Pearl is board certified in plastic and reconstructive surgery] Today, chronic diseases like diabetes and hypertension afflict 6 in 10 Americans, and are responsible for 1.7 million American deaths each year from heart attacks, strokes, cancer and other complications. These deaths are directly tied to a lack of prevention and effective disease management. Today, hypertension is the leading cause of stroke and is adequately controlled only 55% of the time. Diabetes, the leading cause of kidney failure and major

contributor to cardiovascular disease, is controlled even less often. We know that control rates of 90% or more are possible with best practices, but not with today's approach. According to the CDC, 30% to 50% of the life-threatening complications from chronic disease could be avoided with effective management.

Teaching medical students how to use generative AI for continuous—not episodic—monitoring **would radically improve the health of patients and our nation as a whole. Today's doctors have access to wearable monitors capable of measuring blood pressure and blood sugar. When linked with GenAI, these tools can reliably analyze patient health data and provide medical advice based on the expectations set by a clinician. With this combination, patients don't have to guess whether they need a physician's medical attention.** They know. And that expertise allows physicians to intervene sooner when there's a problem while

reducing unnecessary office visits when chronic diseases are well-controlled. Based on CDC data, successfully **training the next generation of doctors to effectively monitor and manage chronic illnesses will save** an estimated 510,000 to 850,000 lives each year with **an annual reduction in healthcare spending of \$163 billion to \$272 billion**

AI is currently being taught and used in the medical field as well with major results

C2: Alpha fold

One example in education is gen ai AlphaFold.

Koul '24 AlphaFold 3 - A Generative AI Model to predict 3D structure of biomolecules. Dr. Nimrita Koul Dr. Nimrita Koul · 6 min read · Jun 14, 2024

AlphaFold-3 (AF3) **is** the latest **generative AI** model in the series of AlphaFold models. It provides an accurate atomic-level view of the structure of biomolecular systems. AlphaFold3 can accurately predict not only the 3D structure of almost all the proteins, but also the interactions among DNA, RNA, and other small molecule ligands within our cells. It can also predict the structural impact of post-translational modifications and ions on these molecular systems.

Alpha Fold is key to research in education universities

Sharma et al. '24 @article{veo2024, title={Veo}, author={Abhishek Sharma and Adams Yu and Ali Razavi and Andeep Toor and Andrew Pierson and Ankush Gupta and Austin Waters and Aaron van den Oord and Daniel Tanis and Dumitru Erhan and Eric Lau and Eleni Shaw and Gabe Barth-Maroon and Greg Shaw and Han Zhang and Henna Nandwani and Hernan Moraldo and Hyunjik Kim and Irina Blok and Jakob Bauer and Jeff Donahue and Junyoung Chung and Kory Mathewson and Kurtis David and Lasse Espeholt and Marc van Zee and Matt McGill and Medhini Narasimhan and Miaosen Wang and Mikolaj Bińkowski and Mohammad Babaeizadeh and Mohammad Taghi Saffar and Nando de Freitas and Nick Pezzotti and Pieter-Jan Kindermans and Poorva Rane and Rachel Hornung and Robert Riachi and Ruben Villegas and Rui Qian and Sander Dieleman and Serena Zhang and Serkan Cabi and Shixin Luo and Shlomi Fruchter and Signe Norly and Srivatsan Srinivasan and Tobias Pfaff and Tom Hume and Vikas Verma and Weizhe Hua and William Zhu and Xincheng Yan and Xinyu Wang and Yelin Kim and Yuqing Du and Yutian Chen}, url={https://deepmind.google/technologies/veo/}, year={2024} }

AlphaFold's impact

So far, **AlphaFold has predicted over 200 million protein structures** – nearly all catalogued proteins known to science.

The AlphaFold Protein Structure Database makes this data freely available. So far, it has over **two million users in 190 countries.**

That means it has already potentially **saved millions of dollars and hundreds of millions of years in research time.**

Meanwhile, AlphaFold Server predicts how proteins will interact with a broad spectrum of biomolecules, accelerating new research.

AlphaFold has already made a significant impact. We hope it will eventually help to transform our understanding of the biological world.

Alpha fold accelerates drug discovery and specific compound CDK 20 is cure to liver cancer.

Feng '23 From the journal: Chemical Science AlphaFold accelerates artificial intelligence powered drug discovery: efficient discovery of a novel CDK20 small molecule inhibitor†
Check for updates Feng Ren,a Xiao Ding,a Min Zheng,a Mikhail Korzinkin,b Xin Cai,a Wei Zhu,a Alexey Mantsyzov,b Alex Aliper,b Vladimir Aladinskiy,b Zhongying Cao,a Shanshan Kong,a Xi Long,b Bonnie Hei Man Liu,b Yingtao Liu,a Vladimir Naumov,b Anastasia Shneyderman, ORCID logo b Ivan V. Ozerov,b Ju Wang,a Frank W. Pun,b Daniil A. Polykovskiy,b Chong Sun,c Michael Levitt,d Alán Aspuru-Guzik*c and Alex Zhavoronkov ORCID logo *ab Article type Edge Article Submitted 14 Oct 2022 Accepted 05 Jan 2023 First published 10 Jan 2023
<https://pubs.rsc.org/en/content/articlelanding/2023/sc/d2sc05709c>

The application of artificial intelligence (AI) has been considered a revolutionary change in drug discovery and development. In 2020, the **AlphaFold computer program predicted protein structures for the whole human genome**, which has been considered a remarkable breakthrough in both AI applications and structural biology. Despite the

varying confidence levels, these predicted structures could still significantly contribute to structure-based drug design of novel targets, especially the ones with no or limited structural information. In this work, we successfully applied AlphaFold to our end-to-end AI-powered drug discovery engines, including a biocomputational platform PandaOmics and a generative chemistry platform Chemistry42. A novel hit molecule against a novel target without an experimental structure was identified, starting from target selection towards hit identification, in a cost- and time-efficient manner. PandaOmics provided the protein of interest for the treatment of hepatocellular carcinoma (HCC) and Chemistry42 generated the molecules based on the structure predicted by AlphaFold, and the selected molecules were synthesized and tested in biological assays. Through this approach, we identified a small molecule hit compound for cyclin-dependent kinase 20 (CDK20) with a binding constant K_d value of $9.2 \pm 0.5 \mu\text{M}$ ($n = 3$) within 30 days from target selection and after only synthesizing 7 compounds. Based on the available data, a second round of AI-powered compound generation was conducted and through this, a more potent hit molecule, ISM042-2-048, was discovered with an average K_d value of $566.7 \pm 256.2 \text{ nM}$ ($n = 3$). Compound ISM042-2-048 also showed good CDK20 inhibitory activity with an IC_{50} value of $33.4 \pm 22.6 \text{ nM}$ ($n = 3$). In addition, ISM042-2-048 demonstrated selective anti-proliferation activity in an HCC cell line with CDK20 overexpression, Huh7, with an IC_{50} of $208.7 \pm 3.3 \text{ nM}$, compared to a counter screen cell line HEK293 ($\text{IC}_{50} = 1706.7 \pm 670.0 \text{ nM}$). This work is the first demonstration of applying AlphaFold to the hit identification process in drug discovery.

CDK20 saves 30k people in the United States alone

ACS '25 Key Statistics About Liver Cancer American cancer society <https://www.cancer.org/cancer/types/liver-cancer/about/what-is-key-statistics.html>

The American Cancer Society's estimates for primary liver cancer and intrahepatic bile duct cancer in the United States for 2025 are:

- About 42,240 new cases (28,220 in men and 14,020 in women) will be diagnosed
- About 30,090 people (19,250 men and 10,840 women) will die of these cancers

Specifically cardio vascular disease (One example of 200 million). AlphaFold-predicted structures have been used to identify and visualize critical binding regions of PCSK9, such as the 370-385 region, which is crucial for its interaction with LDL receptors

D'Mello et. al '24 Engineering Plastic-Degrading Enzymes and PCSK9 Binders with Protein AI Tools A protein engineering toolkit for molecular design // Engineering enzymes to break down plastic with ProtGPT2, OmegaFold, TemStaPro // Designing drugs with RFDiffusion, ProteinMPNN, ColabFold TAHIR D'MELLO, BRONTÉ KOLAR, ANDKENNY WORKMAN OCT 18, 2024 <https://blog.latch.bio/p/engineering-plastic-degrading-enzymes>

Most recent advancements in deep learning based protein structure prediction tools have traditionally relied on evolutionary information from multiple sequence alignments (MSAs) to accurately predict structures. However, for enzymes designed to function outside of their native organisms—such as those aimed at degrading plastics in environmental or industrial settings—MSAs may not always be available or reliable due to a lack of evolutionary data and context.

OmegaFold addresses this challenge by accurately predicting high-resolution protein structures using only a single primary sequence, without the need for MSAs. It combines a protein language model, which makes predictions from single sequences, with a geometry-inspired transformer model trained on known protein structures.

This approach allows OmegaFold to achieve similar prediction accuracy to AlphaFold2 and outperform RoseTTAFold, particularly in cases where evolutionary information is limited or noisy. [6]

For this flow, a Latch Workflow for OmegaFold was used to predict the 3D structures of the 1,000 enzyme sequences generated from the fine-tuned ProtGPT2 model.

This process converted the sequences into PDB files, providing initial structural models for further analysis.

Directory of generated PDB files on Latch Data

While this method is a valuable step in evaluating the potential of these enzymes, it is important to recognize the limitations: the accuracy of these structural predictions, particularly for entirely novel sequences, may not always be guaranteed. Therefore, further experimental prediction, validation and refinement are necessary.

To explore the potential of the generated enzyme sequences, we then used a range of computational tools to predict key properties and stability of protein sequences.

4. Thermostability Prediction with TemStaPro

We used a Latch Workflow for TemStaPro in bulk to predict the thermal stability of the generated enzyme sequences, estimating their stability across a range of temperature thresholds (40°C to 80°C).

The tool generated detailed TSV files with binary and raw predictions for each enzyme, providing insights into which enzymes may remain stable under conditions relevant to industrial and environmental applications.

TSV containing thermal stability predictions for generated enzymes on Latch Data

Predictions were made for mean thermal stability across the entire sequence, as well as per-residue predictions to pinpoint specific areas of instability within each enzyme. [7]

In future iterations of this process, these insights can guide sequence modifications to improve thermostability, either through rational design or further fine-tuning of ProtGPT2.

5. Aggregation Propensity with Aggrescan3D

To evaluate the aggregation tendencies of the 3D structures generated by OmegaFold, Aggrescan3D was used in bulk on all the PDB files through a Latch Workflow. [8]

Aggregation scores for protein 103 - red represents regions with high aggregation propensities while blue represents regions with low aggregation (high solubility) propensity

This tool identifies aggregation propensity by analyzing residue-level interactions and looking at the geometry of the protein surface. This is often overlooked by methods that just look at the sequence alone. The output provided an A3D score for each residue. As a quick summary measure for aggregation propensity of each generated enzyme, we used the median of the protein's residue A3D scores.

This information can highlight potential aggregation issues, guiding further structural optimization.

6. Electrostatic Potential and Hydrophobicity with PEP-Patch

Understanding the electrostatic and hydrophobic properties of enzymes is crucial for predicting their interactions with substrates and behavior in different environments.

PEP-Patch on Latch generates outputs to visualize and quantify these properties on the surface of the predicted enzyme structures. These insights help identify and prioritize surface features that are most likely to support efficient substrate interaction. [9]

Patches of electrostatic potential mapped out on protein 103 - red represents patches with a negative charge and blue represents regions with a positive charge

Patches representing hydrophobicity mapped out for protein 103 - red represents hydrophobic patches while blue represents hydrophilic patches

Future modifications can focus on enhancing these properties to increase the likelihood of effective plastic degradation in various environments.

7. Organize and Filter Results

To bring all the findings together, we used a Latch Pod to compile the results into a table in Latch Registry.

The table includes each generated sequence, dynamic links to structure files, and key predicted properties and files for thermostability values, aggregation scores, electrostatic and hydrophobic characteristics.

By organizing the data this way, we created a clear, centralized resource that makes it easier to analyze and select the most promising enzyme candidates for further refinement.

To narrow down the enzyme candidates, we applied filters to the table, focusing on those that were thermally stable at 40°C, had an aggregation propensity between -0.5 and 0.2—indicating an optimal balance of aggregation and stability—and were longer than 400 amino acids.

This filtering process helped to efficiently identify the most promising enzymes for further refinement and experimental testing, ensuring that only the best candidates move forward in the development cycle.

Designing De-Novo Binders for PCSK9

In this second flow, we turn to drug development and use our toolkit to build a protein binder. Our mock target is PCSK9, a protein involved in cardiovascular disease and of active interest in several modern drug programs. PCSK9 binds to LDL

receptors (LDL-R) on liver cells, causing their degradation and reduces their ability to remove LDL cholesterol from the bloodstream. A PCSK9 binder prevents this interaction, allowing more LDL receptors to be recycled to the cell surface and potentially lowering blood cholesterol levels. [1]

Flow Anatomy

To arrive at **candidate binders**, we will start with **scaffold** design and end up generating **100 potential binder structures** in the following steps:

1. **Use Pymol to identify the region of PCSK9 we want to bind**
2. **Diffuse 10 scaffolds near binding hotspots on PCSK9 with RFDiffusion**
3. **Use ProteinMPNN to generate 100 sequences for these scaffolds**
4. **Predict 3D protein structure for each sequence using ColabFold and explore the structure of the binders a complex with PCSK9**

1. Identifying the binding region

Let's take a look at PCSK9. We first navigate to the RCSB Protein Data Bank and download a PDB file of [2W2M](#), which stores the structure of a complex of PCSK9 bound to LDL-R. [7]
Opening this up in PyMol (a protein visualization tool) we see two chains representing PCSK9 (Chain A - *dark blue*, Chain P - *light blue*) and one representing LDL-R (Chain E - *gray*).

We will now highlight the binding regions on PCSK9 Chain A where LDL-R binds. Our hypothesis is that if we can design a binder to bind to these hotspot regions, we can prevent the interaction of PCSK9 and LDL-R.

From a literature search, we identified amino acids are critical hotspot residues in the 370-385 region of PCSK9 Chain A. [7]

- Asp374 (red)
- Thr377 (yellow)
- Phe379 (green)

Below, you can see these regions highlighted:

2. Designing a binder scaffold with RFDiffusion

Now that we've identified our target region and hotspots, RFDiffusion can be used to create a structure to scaffold this location. RFDiffusion is a protein design tool that uses diffusion models to generate novel protein structures. Using RFDiffusion, we can use the PCSK9 protein structure as a template and diffuse a structure around our hotspot region. This will serve as the backbone of our binder designs.

Using the 2W2M PDB file above as our input structure file, we can generate potential binder scaffolds on Latch using parameters in the RFDiffusion workflow to specify the regions of PCSK9 that we want to use.

These parameters launched a protein design workflow which created 10 potential binder structures, each up to 100 residues long, that were designed using Chain A (residues 370-395) of PCSK9 as a template. [8]

Let's take a look at one of structures generated by RFDiffusion: **PCSK9_binder_3.pdb**. Two chains were generated: 1) **Chain A**, in purple, is the diffused scaffold and 2) **Chain B**, in blue, is the region from PCSK9 that the scaffold was designed against. Essentially, **Chain A** is the generated binder structure.

Here, we can see how it aligns to the original PCSK9 A Chain, with and without hotspots annotated:

There are plenty of parameters that we didn't explore here from RFDiffusion that allow you to diffuse far more complex scaffolds than this. [9]

3. Sequence generation with ProteinMPNN

Now that we have binder structures, the next step is to generate an amino acid sequence sequence that folds to this backbone structure. ProteinMPNN is a powerful tool that does exactly this - given a backbone structure, it generates protein sequences.

We use the design from the previous section, **PCSK9_binder_3**, for the rest of this analysis. We feed the PDB file generated by RFDiffusion to ProteinMPNN on Latch and generate 100 sequences for the binder chain.

Within moments, we generate FASTA file containing 100 sequences that could plausibly fold to our binder.

ProteinMPNN also provides a series of metrics for each generated sequence. The **score** measures the model's confidence in the amino acids it chose for the designed parts of the protein, where lower is better. A low **global score** indicates that the complete protein sequence is more likely to be stable and functional [10] [11].

4. Predicting binder protein structure with ColabFold

The final step is to predict the structure of these generated sequences in a complex with the PCSK9 A Chain and inspect the interface between them. ColabFold combines the fast homology search of MMseqs2 with AlphaFold2 to predict the structure of protein structures and complexes [12]. It's worth noting that there are multiple structure prediction models with their own strengths. AlphaFold2 has shown to be one of the most accurate models for binder design, especially with its initial guess support [4], and has been used in conjunction with

Impact of PCSK9 research

<https://pmc.ncbi.nlm.nih.gov/articles/PMC10626223/>

Patients with established cardiovascular (CV) disorders continue to have greater mortality risks due to recurrent CV events. The most common cause of death globally is atherosclerotic cardiovascular disease (ASCVD) [1,2]. In 2016, 5.52 million individuals died of cerebrovascular disease, and ischemic heart disease caused mortality in 9.48 million, according to the Global Burden of Illness Study [1]. The primary and secondary prevention of CV disease can both be improved by lipid-lowering medications. Dyslipidemia, particularly high low-density lipoprotein cholesterol (LDL-C), is a significant risk factor for ASCVD [3,4]. Statins have long been considered the first-line treatment for reducing cholesterol and averting future CV problems [5,6]. According to the most recent US and European recommendations, proprotein convertase subtilisin/kexin type 9 (PCSK9) inhibitors combined with ezetimibe and statin drugs are implied in lowered CV risk in these individuals. Because PCSK9 promotes the breakdown of LDL receptors, LDL cannot be cleared from circulation. Thus, by modulating LDL receptor expression on the hepatocytes' surface, modulators that inhibit PCSK9 may decrease LDL and, subsequently, significant CV events [7]. When used with statins, PCSK9 medications have been demonstrated to improve CV outcomes. According to ODYSSEY OUTCOMES research data, adding alirocumab to maximally tolerated statin therapy reduces the risk of CV events. When used with the maximum tolerable dose of statin treatment, evolocumab mitigated the risk of CV events in individuals with ASCVD [8]. Both PCSK9 inhibitors (evolocumab and alirocumab), having received FDA approval in 2015, have been approved for use in people with existing CV disease to reduce the risk of stroke, myocardial infarction, and coronary revascularization [5]. Alirocumab and evolocumab are often safe, according to a prior meta-analysis of 25 randomized, controlled studies. Evolocumab was shown to minimize the frequency of abnormal liver function, but alirocumab was found to increase the frequency of injection-site responses [5]. However, there is a dearth of information on PCSK9 inhibitors' impacts on CV outcomes. We aimed to conduct an updated meta-analysis to demonstrate the effectiveness of approved PCSK9 inhibitors on CV outcomes. Comprehending the efficiency of PCSK-9 inhibitors in lowering CV events such as heart attacks, strokes, and deaths from CV causes was the primary expected outcome.

Subpoint B: Pandemics

Not only did Gen AI help slow the spread of COVID it could prevent the outbreak of new strains

Higgins, Matthew K. "Can We AlphaFold Our Way out of the next Pandemic?" *Journal of Molecular Biology*, June 2021, p. 167093,

<https://doi.org/10.1016/j.jmb.2021.167093>.

With an infectious organism dominating the world stage, the developers of AlphaFold 2 were keen to play their part, accurately predicting novel structures of two proteins from SARS-CoV-2. They highlighted this contribution, writing "we've also seen signs that protein structure prediction could be useful in future pandemic response efforts". Knowledge of the structure of the SARS-CoV coronavirus spike protein allowed design of mutants which stabilise the spike in the pre-fusion conformation.¹ As this is the form of the spike found on virus particles, vaccine immunogens which elicit antibodies that target this conformation are likely to be most effective.¹ As the SARS-CoV-2 virus, which causes COVID-19, is closely related to SARS-CoV2, ^{3, 4} this insight was transferable to the new pandemic strain.² As a result, the Pfizer/BioNTech and Moderna vaccines, amongst others, include spike-stabilising mutations in their effective designs.⁵ This is just one example of a broader field of 'reverse vaccinology', in which rational insight into the structures of pathogen surface proteins, and their complexes with neutralising monoclonal antibodies, guide design of improved vaccine immunogens. The current strengths of AlphaFold 2 appear to be in the prediction of structures of single proteins, both in cases where there is a similar structure to act as a template, and where there is not. As seen in the case of PfRH5, structures of single antigens can be used to guide design of improved vaccine immunogens

This is essential as pandemics killed 16 million lives globally.

UN 21

United Nations. "14.9 Million Excess Deaths Associated with the COVID-19 Pandemic in 2020

and 2021." *United Nations*,

www.un.org/en/desa/149-million-excess-deaths-associated-covid-19-pandemic-2020-and-2021

New estimates from the World Health Organization (WHO) show that the full death toll associated directly or indirectly with the COVID-19 pandemic (described as "excess mortality") between 1 January 2020 and 31 December 2021 was approximately 14.9 million (range 13.3 million to 16.6 million). "These sobering data not only point to the impact of the pandemic but also to the need for all countries to invest in more resilient health systems that can sustain essential health services during crises, including stronger health information systems," said Dr Tedros Adhanom Ghebreyesus, WHO Director-General.

We need these vaccinations not only in the event of another outbreak but to prevent death overall

Carter 21

Carter , Austin, et al. "Modeling the Impact of Vaccination for the Immunization Agenda 2030:

Deaths Averted due to Vaccination against 14 Pathogens in 194 Countries from

2021-2030." *Papers.ssrn.com*, 20 Apr. 2021,

papers.ssrn.com/sol3/papers.cfm?abstract_id=3830781 .

Overall, an estimated **51.0 million** (95% CI: 48.5 – 53.7) **deaths are expected to be averted due to vaccinations administered between the years 2021 and 2030.** With immunization coverage projected to increase over 2021-2030 an average of 5.1 million per year (4.9 – 5.4) deaths will be averted annually, with 4.4 million(3.6- 5.1) deaths be averted for the year 2021, gradually rising to 5.8 million(4.9-6.6) deaths averted in 2030.

Impact: AI used in medical fields are used to make vaccinations. These vaccinations helped stop the spread of covid, and potentially the next one. This shows how our youth needs to learn Gen AI in schools in order to work with it in the workforce.

Overall we can see that AI helps us build crucial infrastructure and prevent millions of deaths annually. The future of our country depends on the capabilities of our youth, we

must teach them what the jobs demand in order for them to be employed. therefore it is clear that the benefits of AI outweigh the harms and I trust you will vote in the affirmative

Rebuttal

Crit: the zhai card they use LITERALLY says “potential” the critical thinking loss is literally hypothetical. Don’t buy the link for critical thinking because their own link card is hypothetical.

1. They fundamentally misunderstand how AI works – it’s a tool like calculators which still requires critical thinking to function.

Gibson 25 (Jen Gibson is an Instructional Coach, Instructional Technology Facilitator, and teacher at Capuchino High School, "From GPS to GPTs: Steering Students Toward AI Literacy", Krause Center for Innovation, <https://krauseinnovationcenter.org/from-gps-to-gpts-steering-students-toward-ai-literacy/>, 1-6-2025, DOA: 2-20-2025) //Bellaire MC

AI is like your GPS. You plug in the destination, and it gives you directions. It’s great at finding the fastest route, avoiding traffic, and even letting you know when there’s an In-N-Out Burger nearby. But here’s the thing: if you don’t know where you’re going in the first place, the GPS is useless. And if the GPS tells you to turn into a lake (it happens!), you’re the one who has to catch the mistake before things go off the rails. That’s **AI. It’s a tool** that helps you get from point A to point B more efficiently. But it doesn’t know why you’re going there, and it won’t tell you if the destination doesn’t make sense. **It needs your critical thinking** and judgment **to steer it in the right direction.** Otherwise, you might end up at “Lake In-N-Out!”

And they say there’s an impact of 43% of college students having no crit think

THIS IS 2016. This shows how their

on socio-economic:

1) Inequality is decreasing

Bloomberg 23: <https://news.slashdot.org/story/23/03/07/1958249/microsoft-google-backed-group-wants-to-boost-ai-education-in-low-income-schools>

The group on Tuesday is announcing a national call for AI education with an expanded list of backers and partner schools at the South by Southwest EDU conference in Austin, Texas. So far, **aiEDU has reached 100,000 students and has relationship with districts representing 1.5 million low-income and underserved kids across the country.** The non-profit was founded in 2019, and Kotran thought it would take a few years before there was widespread demand from educators for these kinds of programs. "We were kind of wearing the T-shirt before the band was cool," he said. Instead the rapid increase in interest in generative AI with the popularity of programs like OpenAI's chatbot and Dall-E, its tool for digital images, has dramatically boosted demand, and the group could use more funding, he said.

AI helps low income com

Vast majority using now

Veera Korhonen, research expert covering US social topics, 10-14-2024, "Global student AI usage for schoolwork 2024," Statista, <https://www.statista.com/statistics/1498309/usage-of-ai-by-students-worldwide/>, accessed 2-19-2025

Share of students using AI for schoolwork worldwide as of July 2024

During **a global survey** of students conducted in mid-**2024**, it was found that a whopping **86 percent** said they were **using artificial intelligence tools in their schoolwork**. Almost **a fourth** of them used it **on a daily basis**.

Intelligent, online resource for higher learning, 10-24-2023, "New Survey Finds Students Are Replacing Human Tutors With ChatGPT," Intelligent, <https://www.intelligent.com/new-survey-finds-students-are-replacing-human-tutors-with-chatgpt/>, accessed 2-19-2025

In May, Intelligent.com surveyed 3,017 high school and college students (ages 16-24) along with 3,234 parents of younger students to learn more about student study habits over this past academic year.

Ten percent of high school and college students aged 16-24 say they studied with both ChatGPT and a tutor this past academic year, while 15% of parents with school-aged children say their kids did the same.

We found, of students who studied this past academic year with a tutor and ChatGPT:

Nearly all have replaced some of their tutoring sessions with ChatGPT

95% say their grades have improved since studying with ChatGPT

9 in 10 prefer studying with ChatGPT over studying with a tutor

Most common subjects students have replaced tutors for are math and science

This shows how people DO have access to education. THsi helps people because low income schools have a lack of

2) Cheating

3) Bias

Existing laws, audits, and frameworks are tackling bias.

Kristine **Gloria 21**, Ph.D. in Cognitive Science from Rensselaer Polytechnic Institute; Director of Artificial Intelligence for the Aspen Digital Program, July 2021, "Power and Progress in Algorithmic Bias," Aspen Institute,
<https://www.aspeninstitute.org/wp-content/uploads/2021/07/Power-Progress-in-Algorithmic-Bias-July-2021.pdf>

As outlined above, **efforts to counter algorithmic bias** can come from the implementers, regulators, policymakers, and civil society. Strategies **include legislation, audits, ethical frameworks, and grassroots activism** and lobbying. For example, **there are now multiple toolkits**, such IBM's AI Fairness 360¹⁹ (AIF360-open source Python toolkit for algorithmic fairness) or Amazon's SageMaker Clarify,²⁰ and/or Microsoft's InterpretML²¹ **that help facilitate evaluations of algorithms, identify bias in datasets, and explain predictions.** **We also see growing interest in additional efforts on explainable AI.** AI system factsheets,²² datasheets for datasets,²³ bias impact statements,²⁴ and many others. Additionally, power and progress in the data context must include a robust approach to data literacy, which is vital to consumers and citizen advocates. As we learned, this lack of knowledge may hinder a group's ability to acknowledge and challenge algorithmic decision-making outcomes.

T: Affirming improves ai. It is racist is because there's not enough racially inclusive datasets to train them on.

Ritter **20** [Stephen Ritter, "Council Post: Biometrics Aren't Inherently Biased — We're Training Them Wrong", 11/04/2020, Forbes,
<https://www.forbes.com/sites/forbestechcouncil/2020/11/04/biometrics-arent-inherently-biased---were-training-them-wrong/>]

The problem with **bias arises when the training data skews toward one specific demographic. This results in** a very specific type of error known as **over-fitting.** When datasets disproportionately exhibit certain characteristics, a machine learning model will inherently focus more heavily on that characteristic. That means **a biometric system isn't biased against any particular race or gender, but instead it is less able to identify the patterns typically found in that face's demographic.** The video player is currently playing an ad. You can skip the ad in 5 sec with a mouse or keyboard. **If limited or disproportionate datasets are the primary cause of biometric technology bias, then the solution seems simple enough: Make sure new algorithms are trained with an equally diverse range of data.** right? Unfortunately, problems with relatively new technologies like biometrics are rarely so simple, especially when people with their own inherent norms and biases are involved.

Things like colleges and universities are KEY for this inclusive.

Let's go back to socioeconomic inequality. AI cost is decreasing.

Dave Andre, 2-10-2025, Dave Andre is an editor at allaboutai who writes about AI and tech. "AI Will Get Cheaper Fast—Altman Says Costs to Drop 10x Annually!", All About AI,
<https://www.allaboutai.com/ai-news/ai-will-get-cheaper-fast-altman-says-costs-to-drop-10x-annually/> // DOA: 3/6/2025

Sam Altman predicts **AI costs will decrease tenfold every year**, far outpacing the historical pace of Moore's Law. Lower costs will fuel widespread AI integration across industries, from tech giants to small businesses. AI cost reductions may lower the price of many goods, while luxury items and scarce resources like land could become more expensive. The \$500 billion Stargate project underscores the U.S.'s commitment to leading global AI development. Chinese AI startup DeepSeek's cost-effective models signal intensifying competition in the AI landscape. In a bold new prediction, Sam Altman, CEO of OpenAI, announced that the cost of using artificial intelligence (AI) will decrease tenfold every year, a rate of decline that could reshape industries, economies, and society. "The **cost to use a given level of AI falls about 10x every 12 months**, and lower prices lead to much more use," Altman wrote in a recent blog post. This statement marks a significant shift from the well-known Moore's Law, which historically stated that the number of transistors on a microchip doubles approximately every 18 months, leading to corresponding computing power increases and cost decreases. Altman claims AI's cost trajectory is not just faster but revolutionary: "Moore's law changed the world at 2x every 18 months; this is unbelievably stronger." The implications of this accelerated cost reduction extend far beyond the tech industry, potentially transforming global economies, labor markets, and access to technology. Real-World Evidence: OpenAI's Own Cost Reductions Altman's claims aren't just speculative—they're grounded in OpenAI's own data. He highlighted the dramatic drop in costs associated with the development and deployment of OpenAI's models: "You can see this in the token cost from **GPT-4** in early 2023 to GPT-4o in mid-2024, where the **price** per token **dropped about 150x** in that time period." This rapid decline in AI costs is largely due to advancements in hardware efficiency, optimized algorithms, and large-scale investments in AI infrastructure. A

s models become more efficient, the cost of delivering AI services to end-users drops significantly. Broader AI Adoption:

The Democratization of Intelligence One of the most profound outcomes of this trend is the potential for widespread AI adoption across industries. Altman envisions a future where

AI is not a luxury reserved for large corporations but a tool accessible to individuals and small businesses globally. "Anyone in 2035 should be able to marshal the intellectual capacity equivalent to everyone in 2025; everyone should have access to unlimited genius to direct however they can imagine." This democratization of AI could revolutionize sectors like healthcare, education, manufacturing, and finance. Imagine small businesses leveraging advanced AI models to optimize operations, students accessing personalized AI tutors, or local governments using AI for efficient public services—all at a fraction of today's costs. Altman also mentioned OpenAI's openness to unconventional ideas to promote global AI accessibility: "We are open to strange-sounding ideas like giving some 'compute budget' to enable everyone on Earth to use a lot of AI, but we can also see a lot of ways

where just relentlessly driving the cost of intelligence as low as possible has the desired effect." This indicates a potential **shift toward more equitable**

access to AI resources, particularly in developing countries. While the cost reduction is poised to unleash new opportunities, Altman also highlighted its complex economic implications: "The price of many goods will eventually fall dramatically (right now, the cost of intelligence and the cost of energy constrain a lot of things), and the price of luxury goods and a few inherently limited resources like land may rise even more dramatically." How Will This Play Out? Decreased Costs for Consumer Goods: AI-driven automation and efficiency could

significantly reduce the cost of manufacturing, logistics, and services, **leading to cheaper products** across industries. Increased Value for Scarce Resources: On the flip side, items with inherent scarcity, like luxury goods, prime real estate, and rare materials, may become more expensive as wealth generated through AI-driven industries increases demand. Job Market Disruptions: As AI becomes more affordable, companies may automate jobs that were previously cost-prohibitive to replace, raising concerns about job displacement in sectors like

customer service, data entry, and even creative industries. New Economic Opportunities: However, **history shows that technological revolutions often**

create new job categories that didn't previously exist. The AI boom could lead to roles focused on AI oversight, ethical governance, model training, and more. The \$500 Billion Stargate Project: The U.S. Bets Big on AI Altman's announcement comes just weeks after the unveiling of Stargate, a \$500 billion AI infrastructure project supported by OpenAI, SoftBank, Oracle, and Emirati investor MGX. The project was announced at the White House, with Altman standing alongside President Donald Trump. "This means we can create AI and AGI in the United States of America," Altman said in an interview on Fox News' Special Report with Bret Baier. Stargate represents one of the largest investments in AI infrastructure to date, highlighting the strategic importance of AI to national economies and global power structures. The project aims to build advanced computing facilities to support the development of artificial general intelligence (AGI)—AI that can perform any intellectual task a human can do. Global Competition: China's DeepSeek Challenges the Status Quo While the U.S. doubles down on AI infrastructure, global competition intensifies. Chinese AI startup DeepSeek recently disrupted the industry with high-performing, cost-effective AI models, raising concerns among investors

about the future demand for expensive AI hardware like Nvidia's chips. Altman acknowledged this growing competition: "It appears that **you can spend arbitrary**

amounts of money and get continuous and predictable gains; the scaling laws that predict this are accurate over many orders of magnitude."

DeepSeek's success highlights the global AI arms race, with countries and companies vying for technological dominance. This race is not just about innovation but also about securing economic and geopolitical power.

- **ChatGPT 3 is free for use, Khanmingo and Gemini are also. We actually prepare students for the workforce, which they concede will use AI more. Enables them to bridge the gap later in life if need be. They say "AI is too expensive" but our MORE recent card from ONE month ago.**

This goes against their college stuff. YOU CAN

2 -- Algorithms are improving – reduces the racism they contextualizes.

Jake **Parker**, 7/23/2022, What Science Really Says About Facial Recognition Accuracy and Bias Concerns, Security Industry Association, <https://www.securityindustry.org/2022/07/23/what-science-really-says-about-facial-recognition-accuracy-and-bias-concerns/>/// DSL

According to data from the most recent evaluation from June 28, each of the top 150 algorithms are over 99% accurate across Black male, white male, Black female and white female demographics. For the top 20 algorithms, accuracy of the highest performing demographic versus the lowest varies only between 99.7% and 99.8%. Unexpectedly, **white male is the lowest performing of the four demographic groups for the top 20 algorithms.** For 17 of these algorithms, accuracy for white female, Black male and Black female are nearly identical at 99.8%, while they are least accurate for the white male demographic at 99.7%. (See data beginning with figure 105 of page 154. For simplicity, accuracy is stated here as the true accept rate (TAR) at a set 0.01% false accept rate (FAR), the scientific measurement of biometric performance on the ability of the software to successfully match photos. Note TAR/FAR is the inverse of false nonmatch rate and false match rate.)