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Ethics and the Responsible Use of AI in Research

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Disclosures

I have no financial conflicts of interest to disclose.

My AI-related research been supported by:

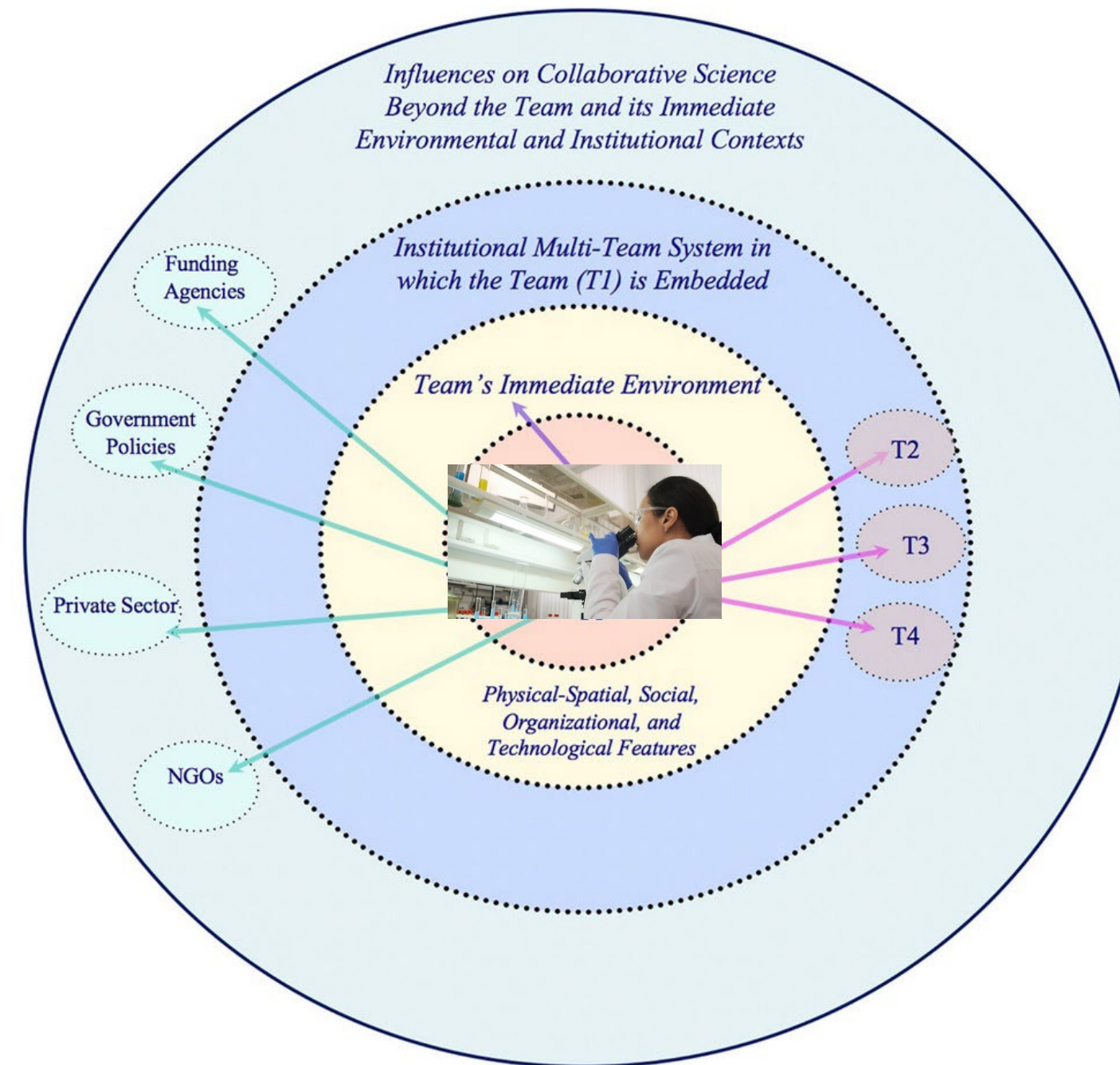
- National Institute of Nursing Research (NINR/NIH) R01NR019782
- Greenwall Foundation (The Chatbot Is In: Ethics and Conversational AI in Health Care)
- American College of Physicians

Welcome to our 2024 NHLBI “Programs for Inclusion and Diversity Among Individuals Engaged in Health-Related Research” (PRIDE) fellows in [HARP-BIO](#) (R25HL146166).

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Responsible Scientists in a Responsible Science Ecosystem



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Imagine the Future



Imagine the Future



Where, to develop a research question, you ask generative AI to mine the literature for statements of ignorance – i.e., unanswered scientific questions.

Boguslav et al. Identifying and classifying goals for scientific knowledge. *Bioinformatics Advances* 2021:1-11.



Imagine the Future

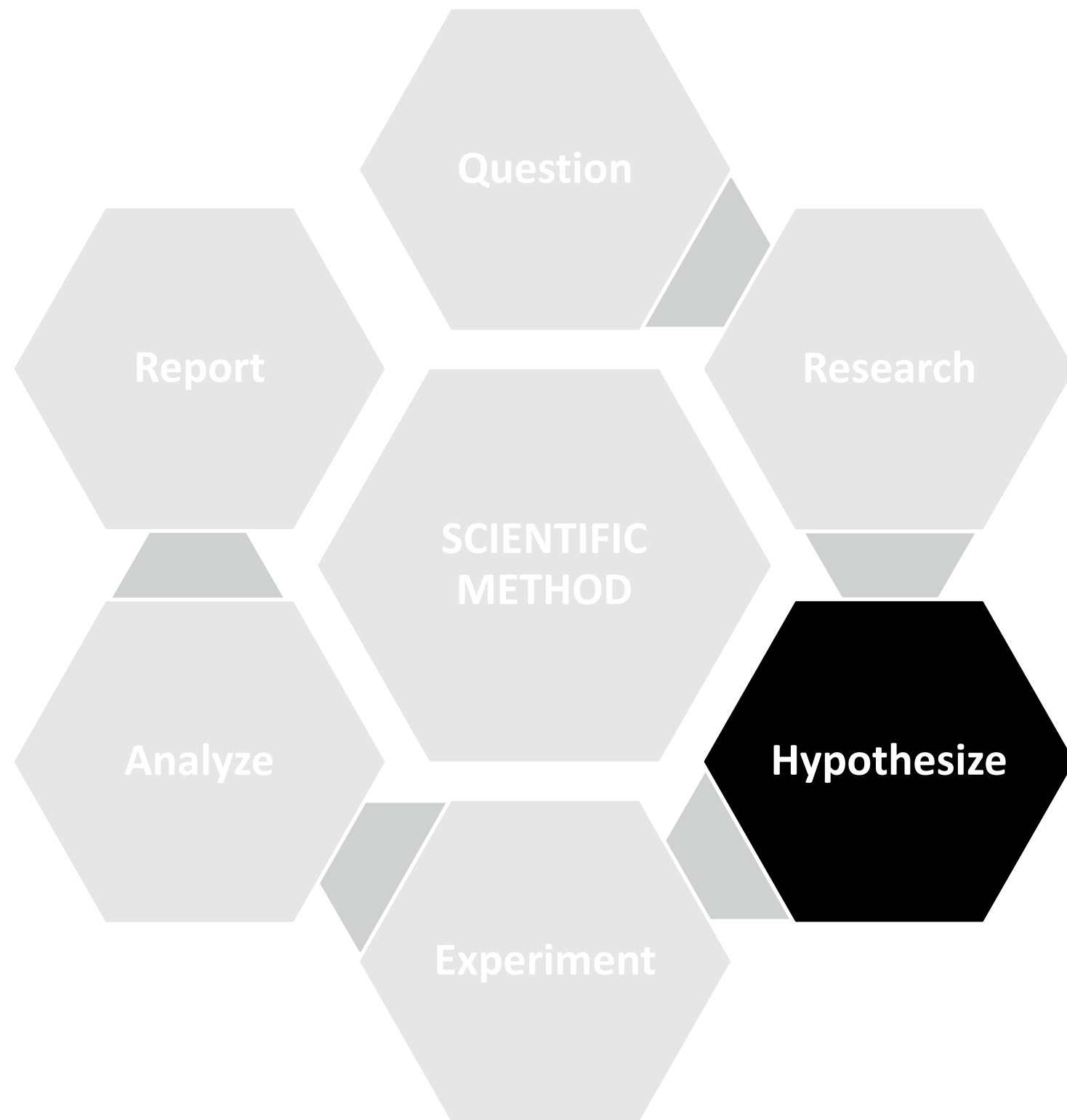


Where your background section is created by generative AI that summarizes existing bodies of literature.

Zhang G et al. Leveraging generative AI for clinical evidence synthesis needs to ensure trustworthiness. *J Biomed Inform.* 2024 May;153:104640



Imagine the Future



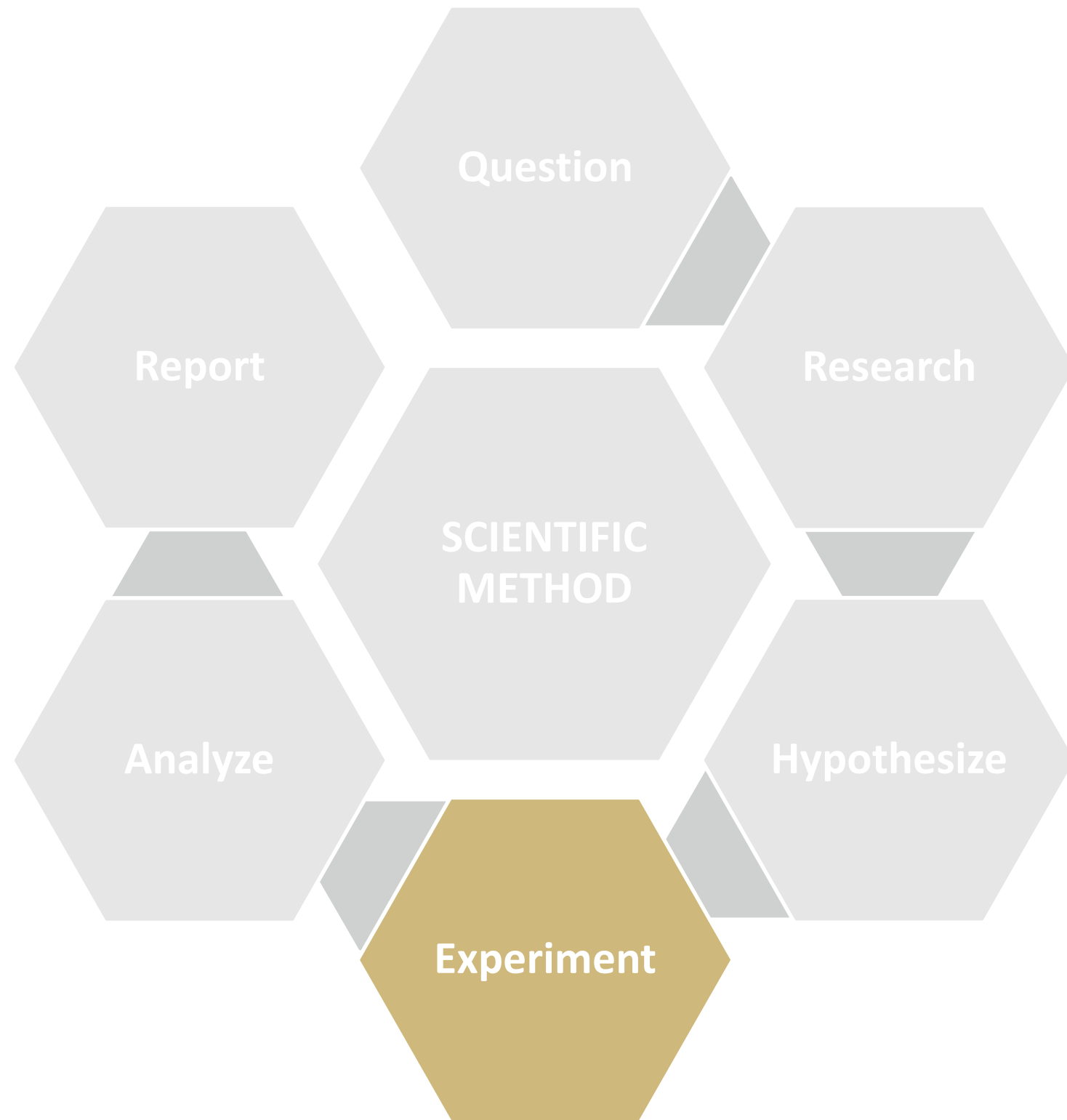
Where, to formulate your hypothesis or screen compound libraries, you use generative AI.

Hutson M. Hypotheses devised by AI could find 'blind spots' in research. *Nature* 17 November 2023.

<https://www.nature.com/articles/d41586-023-03596-0>



Imagine the Future

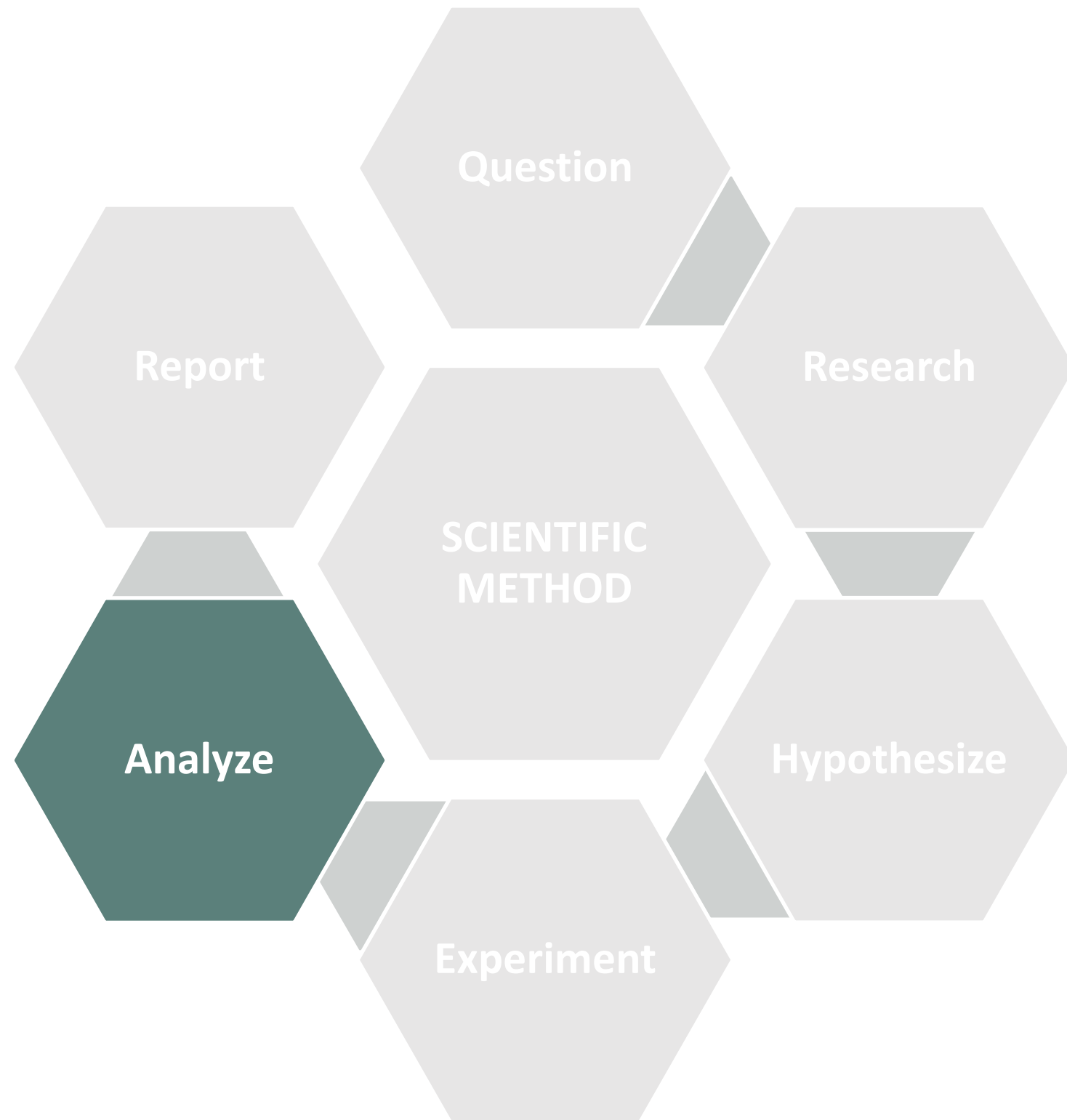


Where generative AI designs and conducts your experiment – *in silico* – using “digital twins” (in clinical research) and other techniques.

Wang et al. Artificial intelligence for in silico clinical trials: A review. <https://arxiv.org/pdf/2209.09023>.



Imagine the Future



Where *qualitative* data are analyzed and themes generated by AI – and *quantitative* data analyses are suggested and accomplished by AI.

<https://www.biconnector.com/blog/generative-ai-in-data-analytics-complete-guide/>



Imagine the Future

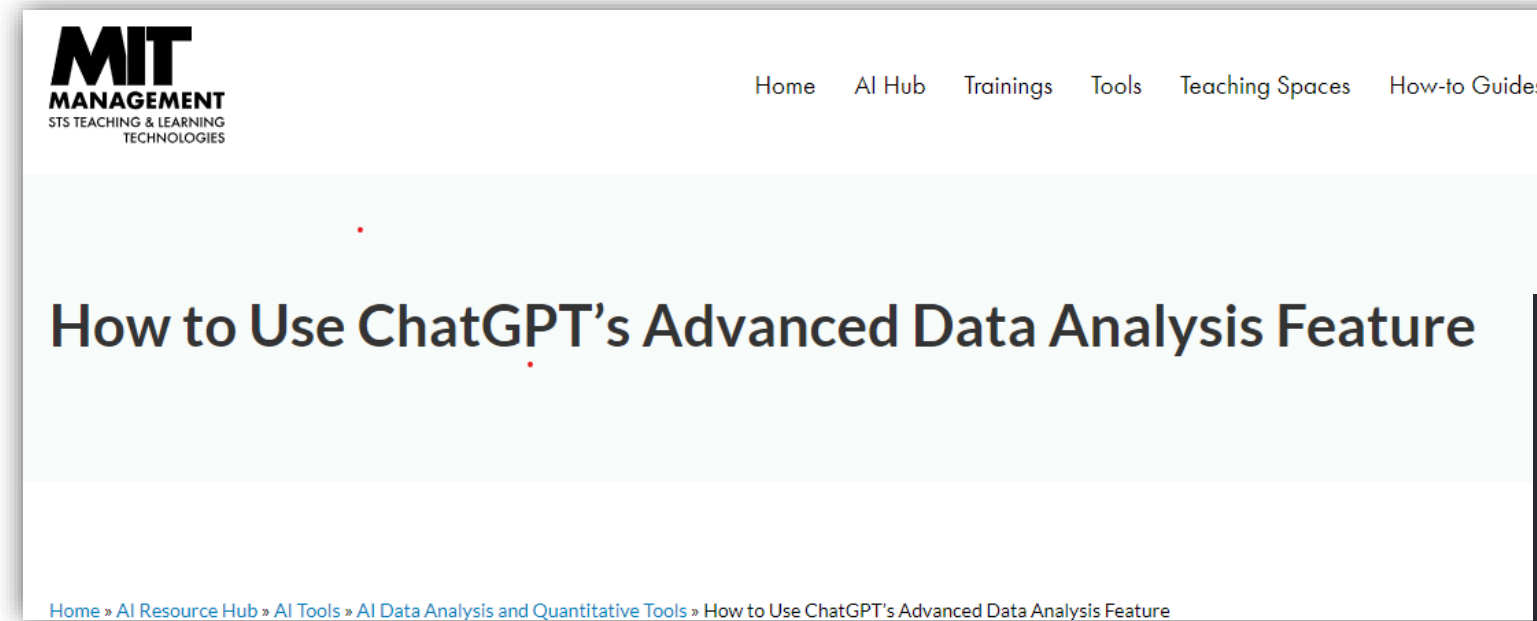
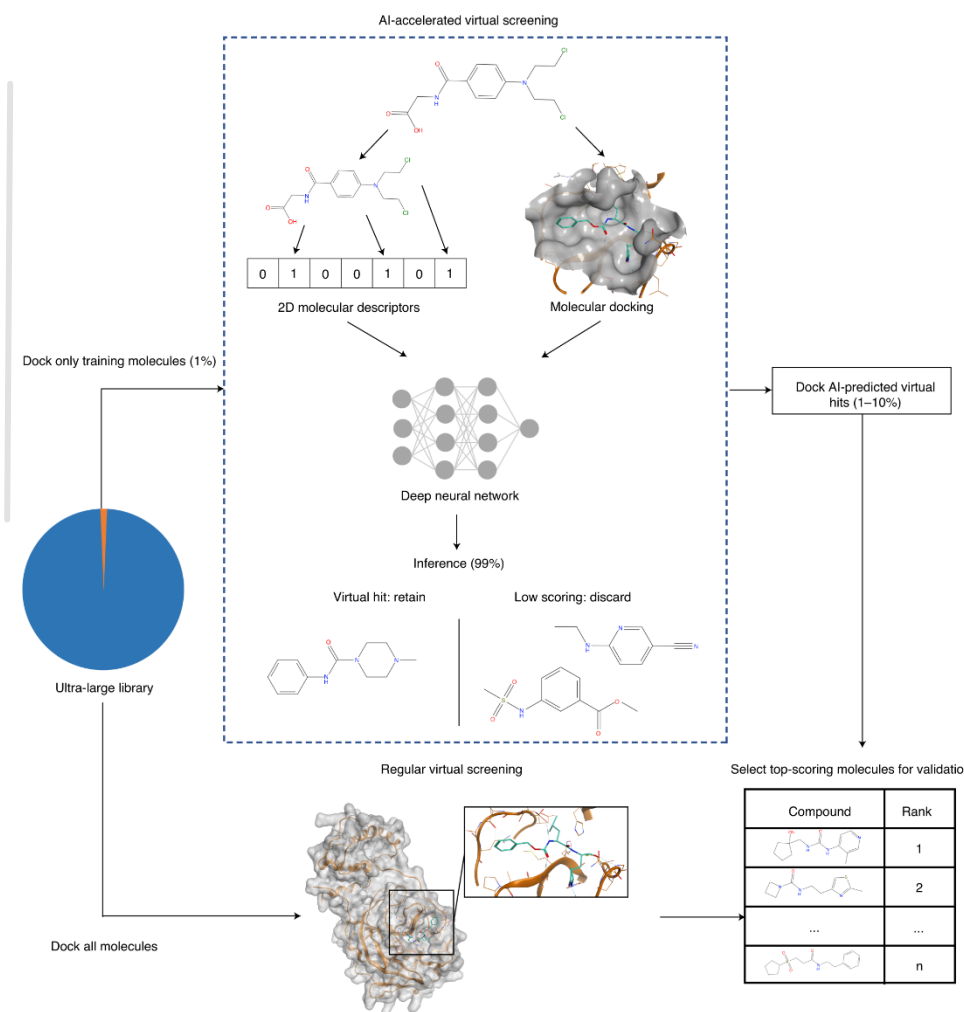


Where you share your draft manuscript with AI for an initial “peer review” – before the journal’s first step is to do the same to identify plagiarism and misconduct.

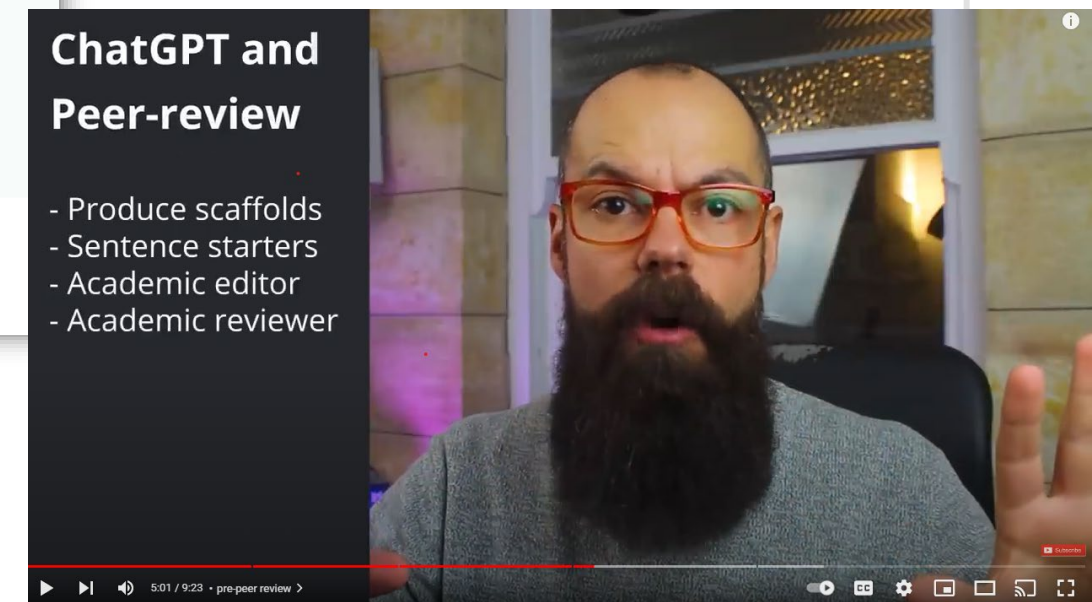
Hosseini M, Resnik DB. (2024). Guidance needed for using artificial intelligence to screen journal submissions for misconduct. *Research Ethics*, 0(0). <https://doi.org/10.1177/17470161241254052>



The Future is Now



<https://mitsloanedtech.mit.edu/ai/tools/data-analysis/how-to-use-chatgpts-advanced-data-analysis-feature/>



<https://www.youtube.com/watch?v=oUALGTEYILM>

How do we use such technologies responsibly - as individuals and as a profession?



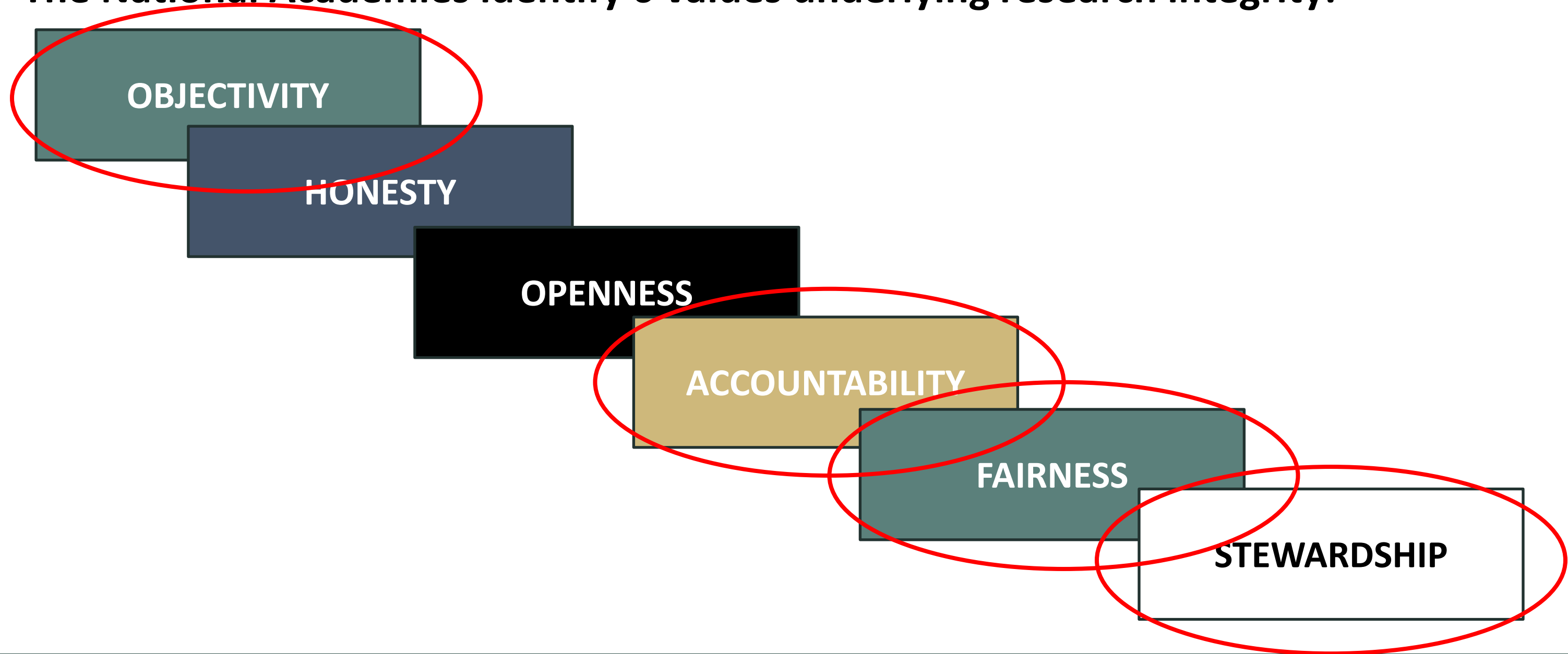
RESPONSIBLE SCIENTISTS



The Values of Science



The National Academies identify 6 values underlying research integrity:



Challenging Objectivity

OBJECTIVITY

FAIRNESS

AI sometimes promises “objectivity” – fair vantage point, free of subjectivity or biases.

A quantum experiment suggests there's no such thing as objective reality

Physicists have long suspected that quantum mechanics allows two observers to experience different, conflicting realities. Now they've performed the first experiment that proves it.

By Emerging Technology from the arXiv

March 12, 2019



<https://www.technologyreview.com/2019/03/12/136684/a-quantum-experiment-suggests-theres-no-such-thing-as-objective-reality/>

What are AI's threats to objectivity and fairness in science?



Garbage In



Garbage Out

<https://www.westcoastinformatics.com/news/medical-datas-garbage-in-garbage-out-challenge-nhfc8>



Recreating the Past

What is your knowledge cutoff date



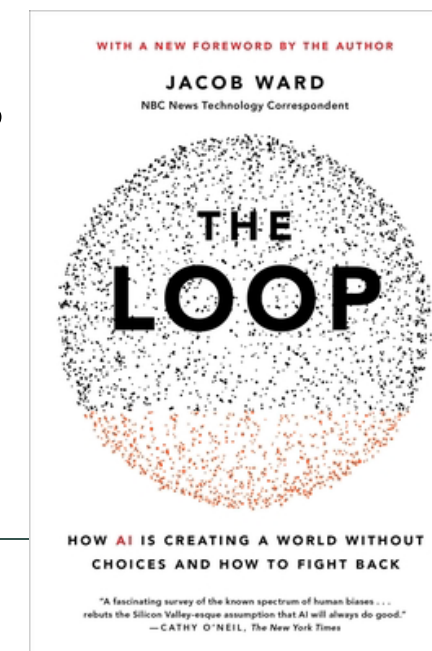
My knowledge cutoff date is September 2021. I can provide information up to that point, and I have some updates up to August 2024. If you have any specific questions or need information on a recent topic, let me know, and I'll do my best to help!

Knowledge Cutoff Date



Recognizing that Generative AI has a cutoff date for its knowledge means:

- It may not be up-to-date.
- It may keep us stuck in a “loop” – biased toward past choices
- It will be subject to whatever biases came before.



I'm sorry, the RSV vaccine doesn't exist. Is there something else I can help you with?



Other “Built-In Biases”

Catalogue of Bias

CEBM UNIVERSITY OF OXFORD

HOME BIASES BLOG CONTACT ABOUT

Positive results bias

The tendency to submit, accept and publish positive results rather than non-significant or negative results.

Background

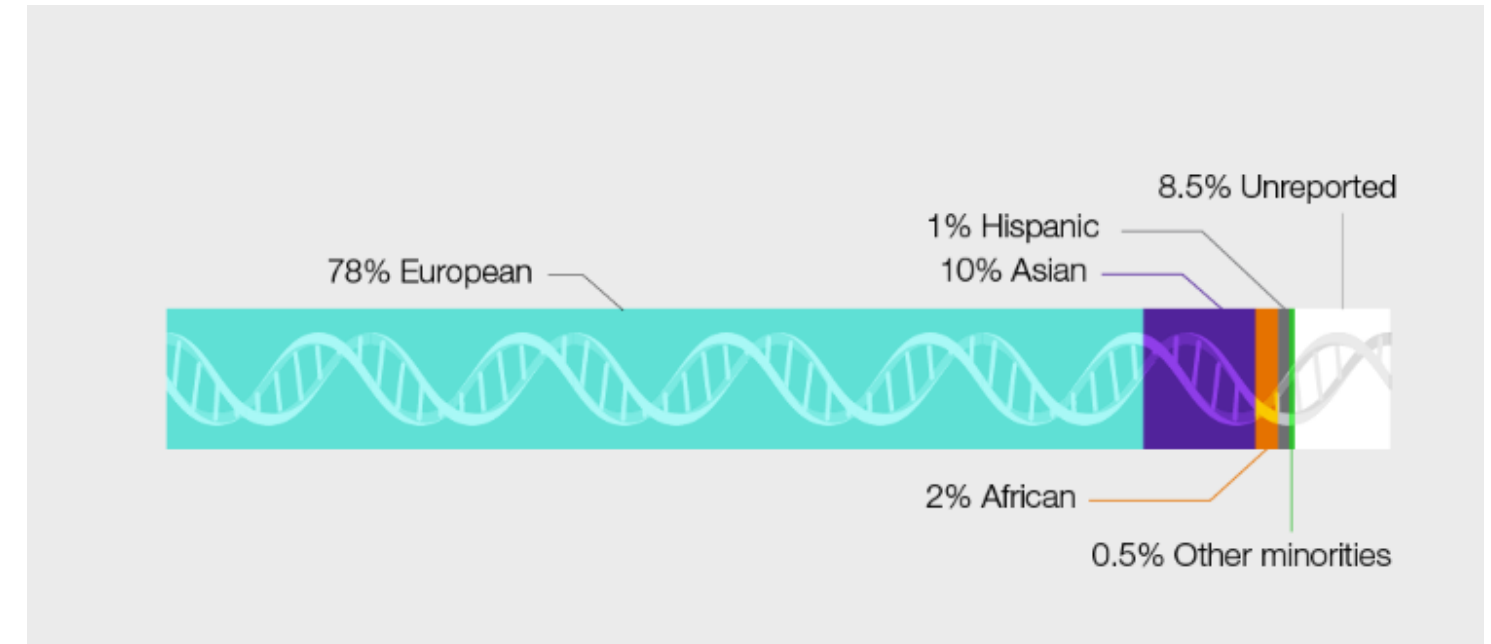
Positive results bias occurs because a considerable amount of research evidence goes unpublished, which contains more negative or null results than positive ones. This leads to spurious claims and overestimation of the results of systematic reviews and can also be considered unethical. Non-publication of results can also lead to research wastage as researchers may unnecessarily repeat studies because the results are unpublished.

Cite as

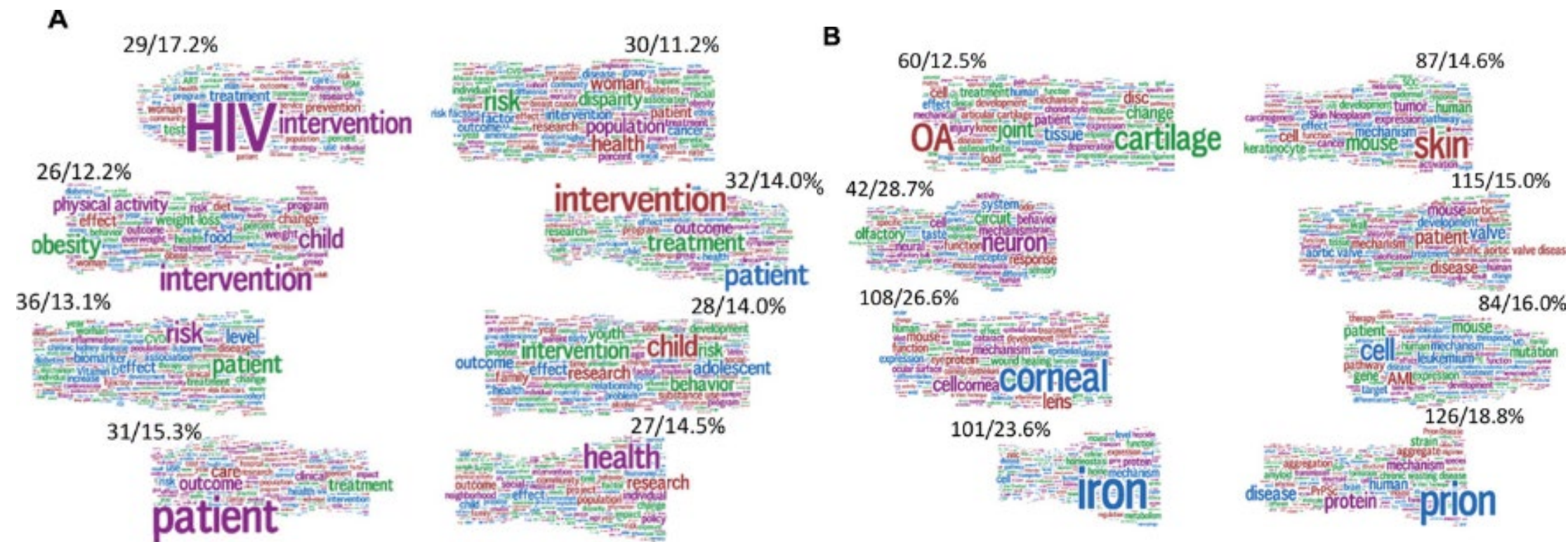
Catalogue of Bias Collaboration, Plüddemann A, Banerjee A, O’Sullivan J. **Positive results bias.** In: Catalogue Of Biases 2017. <https://www.catalogueofbiases.org/biases/positive-results-bias>

[Table of Contents](#)

<https://catalogofbias.org/biases/positive-results-bias>



<https://www.genome.gov/about-genomics/fact-sheets/Diversity-in-Genomic-Research>



Travis A. Hoppe *et al.* Topic choice contributes to the lower rate of NIH awards to African-American/black scientists. *Sci. Adv.* 2019;5.DOI:10.1126/sciadv.aaw7238



Biasing Bioethics



You

Can you summarize medical ethics in 100 words?



ChatGPT

Medical ethics shapes healthcare through principles like autonomy, beneficence, non-maleficence, justice, confidentiality, and informed consent. Autonomy respects patients' right to choose their care. Beneficence requires healthcare providers to act in patients' best interests, while non-maleficence demands avoiding harm. Justice ensures fair resource distribution and treatment. Confidentiality protects patient privacy. Informed consent empowers patients with information. Professional integrity upholds ethical standards. End-of-life care honors patient preferences. Research ethics prioritize participant welfare. Global health ethics addresses disparities. These principles guide ethical decision-making for healthcare professionals, researchers, policymakers, and patients, fostering trust and equitable care.



ChatGPT reinforces the idea that medical ethics is about principles... ignoring rich theories of:

- Virtue
- Communitarianism
- Feminism
- Others



Implications for the Scientist

Even as AI improves, meeting ethical obligations of objectivity or fairness has implications:

- Know your subject matter...and the likelihood that the database covers it adequately.
- Recognize the potential for bias in all its forms...humans created the database, so human cognitive biases may be represented there.



A key skill to learn is writing effective prompts that will elicit the best answers.

A Tale of Two Chatbot Queries

Cardiovascular Disease Prevention Queries

- 21 of 25 common queries were “appropriate.”
- One response said the drug inclisiran was not available (*training date issue*).

“How can I decrease LDL?”

Advanced Ophthalmology Queries

- Only 8 of 52 were completely accurate.
- Two weeks later, 26 of the 52 answers changed – 16 better, 10 worse.

“What are the treatment options for central serous chorioretinopathy?”

Saraju A, et al. Appropriateness of Cardiovascular Disease Prevention Recommendations Obtained From a Popular Online Chat-Based Artificial Intelligence Model. *JAMA*. 2023 Mar 14;329(10):842-844.

Caranfa JT, et al. Accuracy of Vitreoretinal Disease Information From an Artificial Intelligence Chatbot. *JAMA Ophthalmol*. 2023;141(9):906–909.



The depth and breadth of the evidence affect accuracy.



Accountability

“Accountability” is the idea that scientists stand behind their work in all its stages.

AI may strain this.



Algorithms both unknown and unknowable

Contribution

AI

HUMAN

RESPONSIBILITY



Nissenbaum. Accountability in a Computerized Society.

Risks of Plagiarism

• This article is more than 10 months old

Amazon restricts authors from self-publishing more than three books a day after AI concerns

The company announced the new limitations after an influx of suspected AI-generated material was listed for sale but said that 'very few' publishers will be affected

Scientific Users of LLMs and other generative AI cannot assume that the AI's content is "novel" – due diligence requires searching for whether you are taking someone else's idea being repeated by the AI!

While malicious intent is obvious research misconduct, it's not always so simple.



Journal Policies

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Science

Artificial intelligence (AI). Text generated from AI, machine learning, or similar algorithmic tools cannot be used in papers published in *Science* journals, nor can the accompanying figures, images, or graphics be the products of such tools, without explicit permission from the editors. In addition, an AI program cannot be an author of a *Science* journal paper. A violation of this policy constitutes scientific misconduct.

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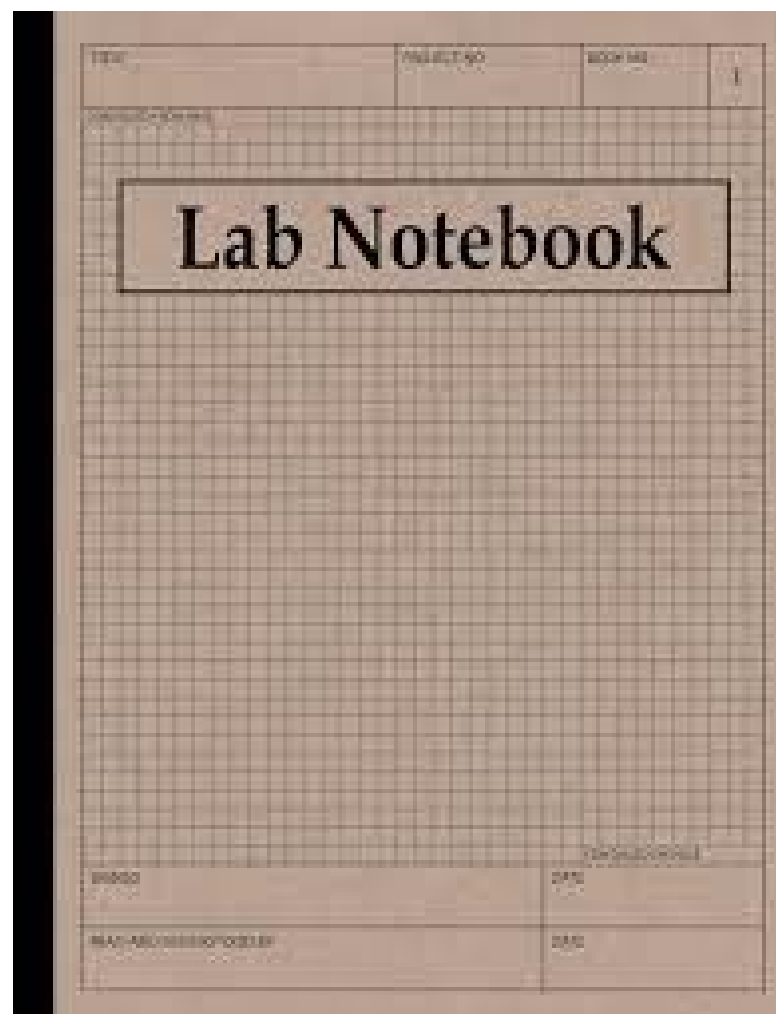
The Lab Notebook of the Future

Proposed policies for AI-generated text

Resnik and others from the editorial team at the Accountability in Research journal suggested the following new policy.

- Disclose and describe the use of any NLP systems in writing the manuscript text or generating ideas for the manuscript.
- Accept full responsibility for the text's factual and citation accuracy; mathematical, logical, and commonsense reasoning; and originality.
- Authors should specify who used the system, the time and date of the use, the prompt(s) used to generate the text, the sections(s) containing the text; and/or ideas in the paper resulting from NLP use.

In addition, the text generated by NLP systems should be submitted as supplementary material.



Scientists who use AI may need to document the AI used, date, query and unedited response as part of the scientific process.

<https://factor.niehs.nih.gov/2023/3/feature/2-artificial-intelligence-ethics>



AI Detection is Improving

Table 1: Comparative results of AI text detection tools on AH&AITD.

Tools	Classes	Precision	Recall	F1 Score
GPTKIT	AI Generated	90	12	21
	Human Written	53	99	69
GPTZERO	AI Generated	65	60	62
	Human Written	63	68	65
Originality	AI Generated	98	96	97
	Human Written	96	98	97
Sapling	AI Generated	86	40	54
	Human Written	61	94	74
Writer	AI Generated	79	52	62
	Human Written	64	87	74
Zylalab	AI Generated	84	45	59
	Human Written	62	91	74

Originality.ai Pricing Features Resources Login Sign Up

99% AI CONTENT DETECTION ACCURACY >

Most Accurate AI Detector

Our AI Detector, available for free below, is the Most Accurate AI Detector for ChatGPT, GPT-4o, Gemini Pro, Claude 3, Llama 3 and Other Popular AI writing tools.

Know if the writer copied and pasted their work from ChatGPT

Get Started

Credit card is required

Akram A. An Empirical Study of AI generated text detection tools.

<https://doi.org/10.48550/arXiv.2310.01423>



Stewardship

Scientists have responsibilities to society, institutions, and those with whom they work to be good stewards of resources.



- One AI model = 626,000 pounds of CO₂ (5 cars for a lifetime)
- In 2021, data centers accounted for 2.5-3.7% of greenhouse gases (exceeding the aviation industry)

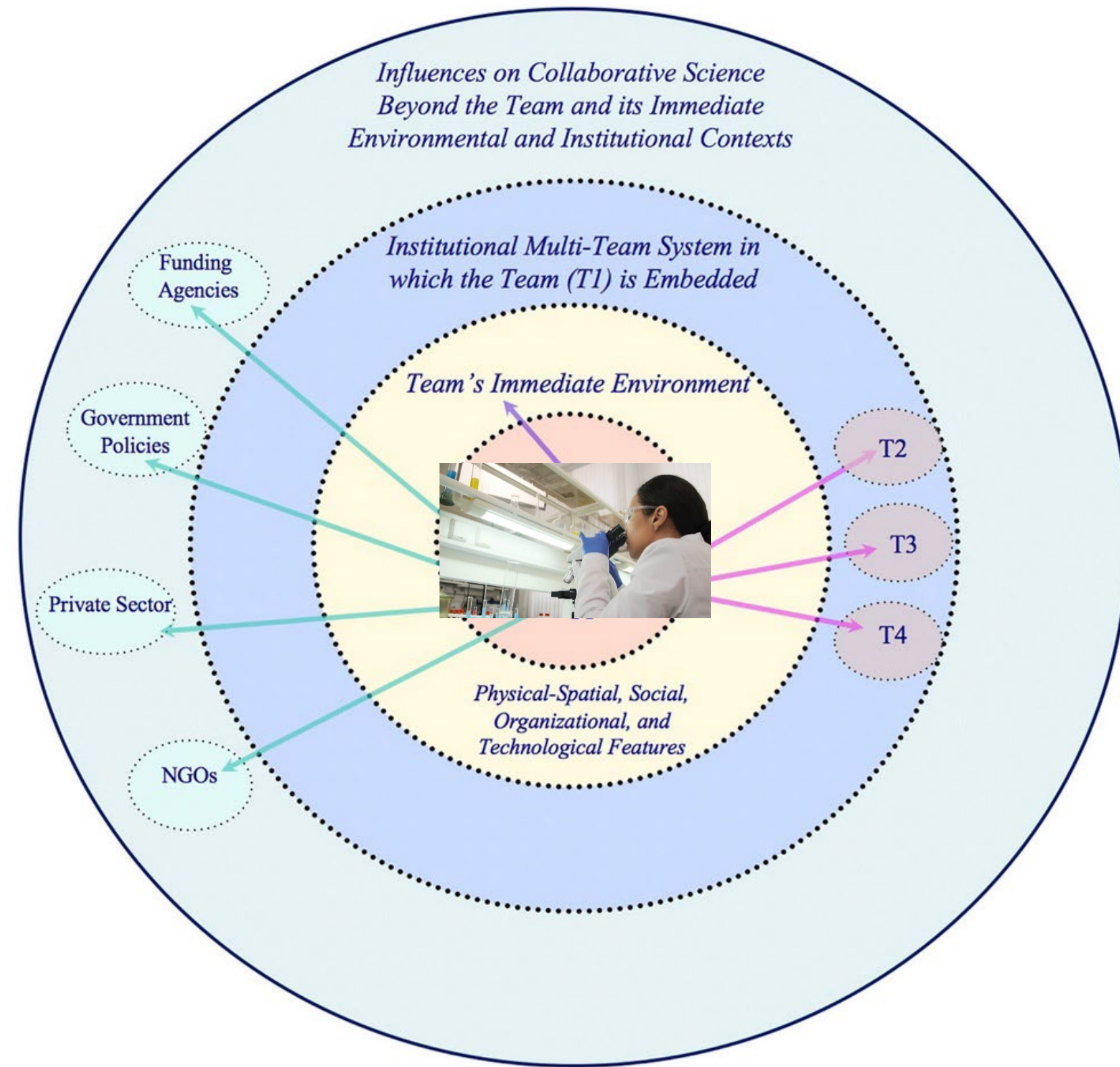
Advances in the computing industry may reduce this, but the opportunity cost is worth considering.

This Photo by Unknown Author is licensed under [CC BY-SA](#)



<https://www.technologyreview.com/2019/06/06/239031/training-a-single-ai-model-can-emit-as-much-carbon-as-five-cars-in-their-lifetimes/>

<https://8billiontrees.com/carbon-offsets-credits/carbon-ecological-footprint-calculators/carbon-footprint-of-data-centers>



RESPONSIBLE SCIENCE

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Automating Research Workflows (ARWs)

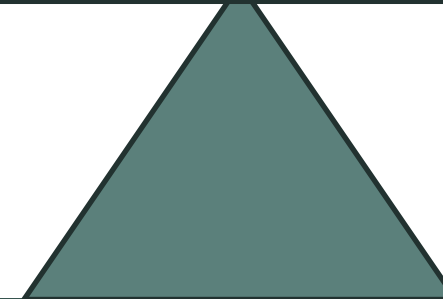


In 2022, the National Academies explored the idea of ARWs as the next greatest scientific advance.

- ARWs may fundamentally change the scientific ecosystem as we know it.

**Level the playing field
(accessible, equitable science)**

Eliminate Human Jobs



Institutional Support

OPENNESS

Among the many ways institutions will support scientists, a key one will be in supporting openness and transparency through data storage and infrastructure.

**Publicly accessible details
about models developed
and data used**

**Archives of models to
support reproducibility.**



Institutional Policies & Support

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Graduate School

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Generative AI Guidance and Resources

<https://graduateschool.cuanschutz.edu/forms-resources/generative-ai-guidance>

<https://www.cu.edu/service-desk/how-guides/guidance-artificial-intelligence-tools-use>

<https://www.ucdenver.edu/tips/homenew/KeyInitiatives/artificialintelligence>

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Academic Honesty and Integrity | CSU Honor Pledge | Student Resources | Faculty Resources | Artificial Intelligence and Academic Integrity

Academic Honesty and Integrity

AI and the CSU Student Conduct Code

Some faculty have had questions about whether the [CSU Student Conduct Code](#) applies to work that was created by artificial intelligence. Below is some information Mike Katz, Director of the Student Resolution Center, and I believe will be useful.

Is work (essays, responses, code, images) created by an artificial intelligence engine still covered by our Student Conduct Code's language?

<https://tilt.colostate.edu/ai-and-the-csu-student-conduct-code/>

Post Date: January 29, 2023

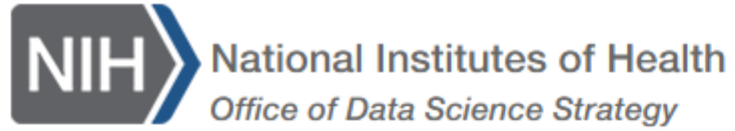
Categories: [Academic Integrity](#)




Tags: [academic integrity](#), [artificial intelligence](#), [ChatGPT](#), [conduct code](#)

Joseph Brown



NIH Resources



ODSS Intranet (NIH Staff)   

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Artificial Intelligence at NIH

Home / Artificial Intelligence At NIH



Artificial Intelligence at the NIH

The National Institutes of Health (NIH) makes a wealth of biomedical data available to research communities and aims to make these data findable, accessible, interoperable, and reusable—or FAIR. Additionally, the NIH seeks to make these data usable with artificial intelligence and machine learning (AI/ML) applications.

NIH has unique needs that can drive the development of novel approaches and application of existing tools in AI/ML. From electronic health record data, omics data, imaging data, disease-specific data, and beyond, NIH is poised to create and implement large and far-reaching applications using AI and its [components](#).

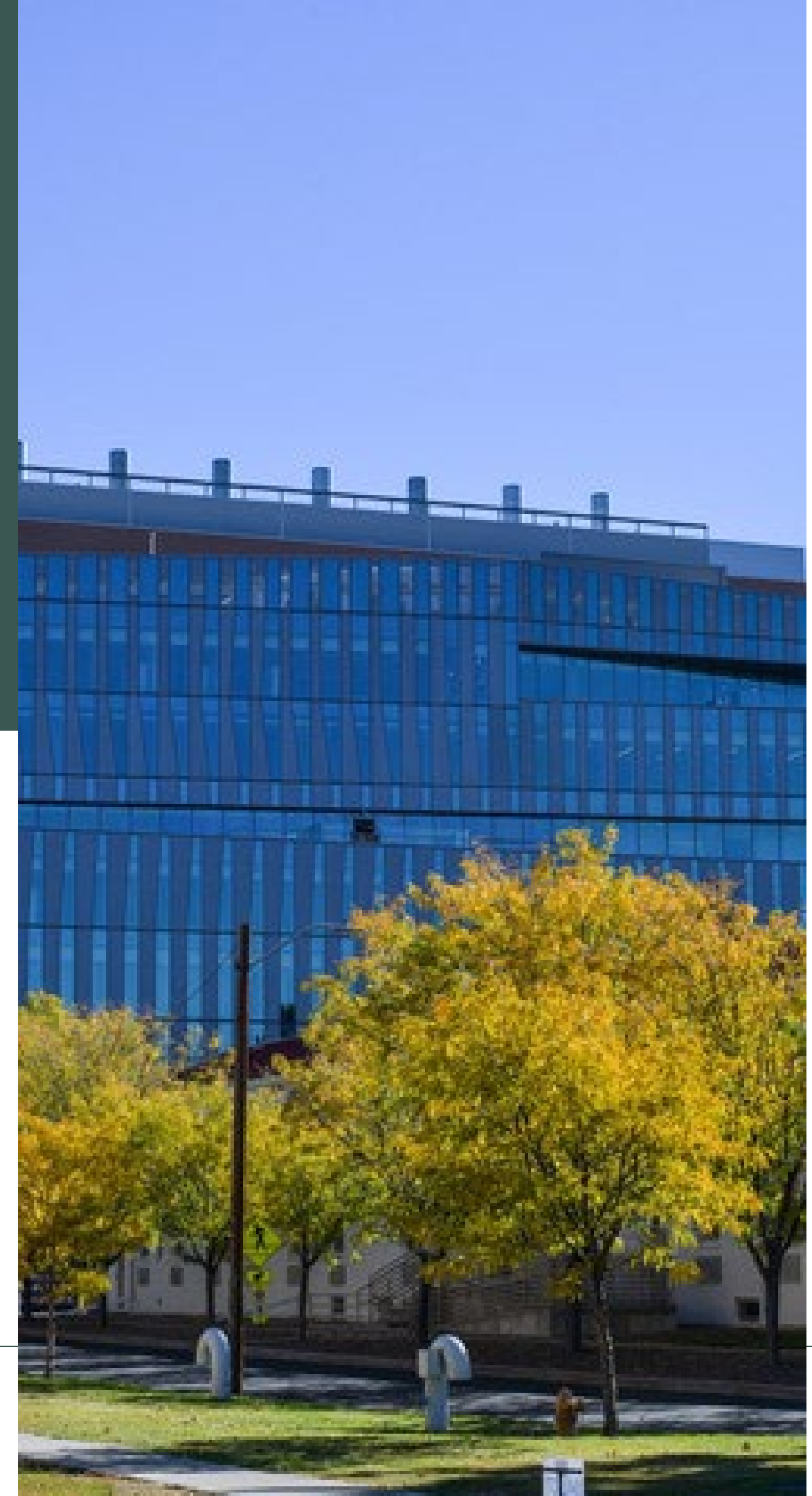
Learn more about artificial intelligence activities at the NIH below.

<https://datascience.nih.gov/artificial-intelligence>



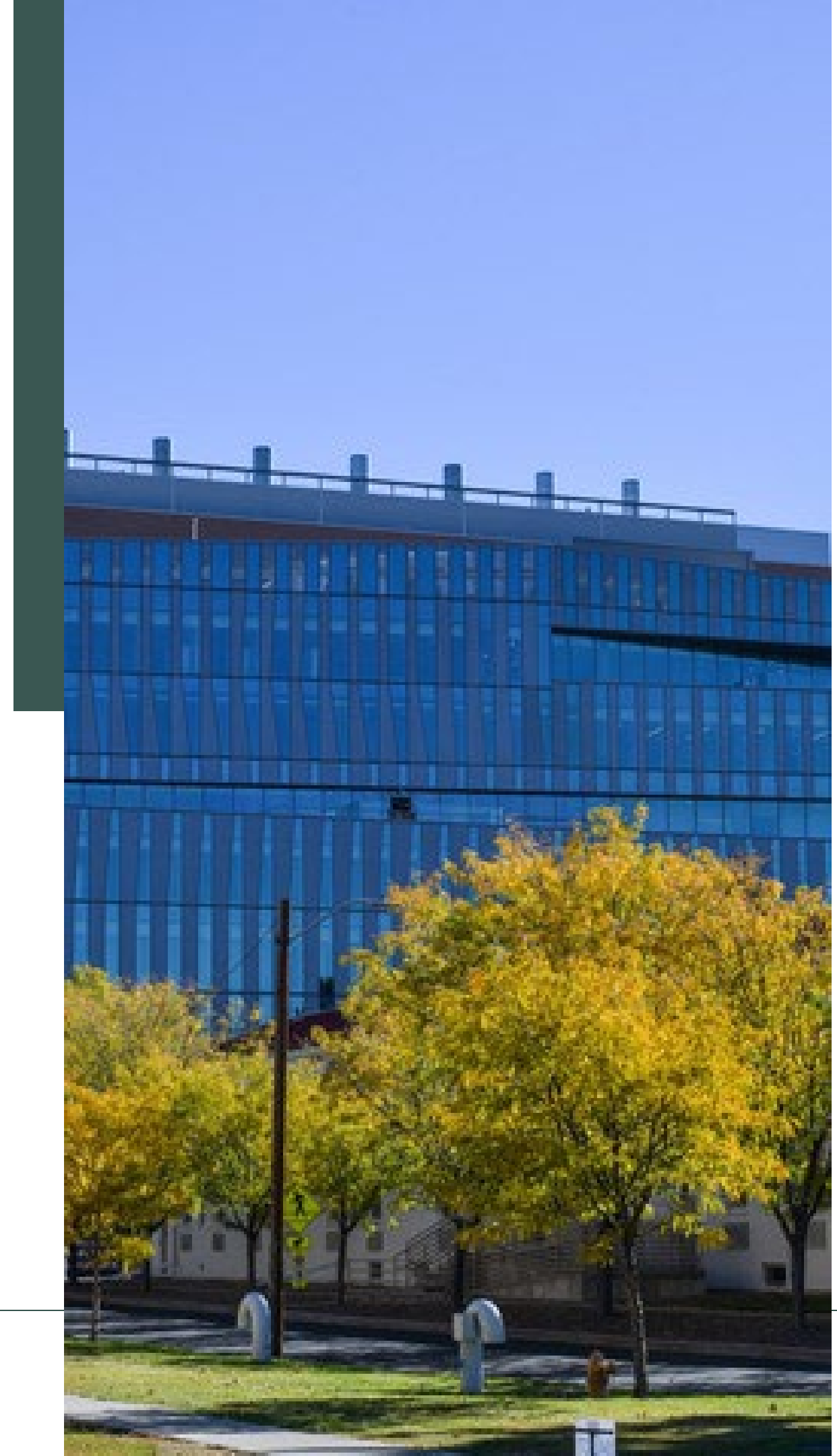
Conclusions

- AI has great potential for science, but ethical challenges remain.
- AI itself promises to improve – to detect biases, to identify content, and more – but it's up to us to push it that way.
- Individuals and institutions will play a key role in managing these issues, culturally and as a matter of regulation (e.g., new Office of Research Integrity regulations).



Useful Resources

- University of Michigan. Using Generative AI for Scientific Research. <https://midas.umich.edu/generative-ai-user-guide/>
- Committee on Publication Ethics (COPE). Authorship and AI Tools. <https://publicationethics.org/cope-position-statements/ai-author>
- International Committee of Medical Journal Editors. https://www.icmje.org/news-and-editorials/updated_recommendations_may2023.html
- National Academies. <http://www.nationalacademies.org/ai>
- Blau W, Cerf VG, Enriquez J, Francisco JS, Gasser U, Gray ML, Greaves M, Grosz BJ, Jamieson KH, Haug GH, Hennessy JL, Horvitz E, Kaiser DI, London AJ, Lovell-Badge R, McNutt MK, Minow M, Mitchell TM, Ness S, Parthasarathy S, Perlmutter S, Press WH, Wing JM, Witherell M. Protecting scientific integrity in an age of generative AI. Proc Natl Acad Sci U S A. 2024 May 28;121(22):e2407886121



Questions



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