GENERATIVE AI IN THE BIOLOGICAL AND BIOMEDICAL SCIENCES

FASEB
Federation of American Societies for Experimental Biology

22 FASEB Member Societies
Representing over 110,000 Scientists

AGE American Aging Association
Research to Increase the Healthy Human Lifespan

AMERICAN ASSOCIATION FOR ANATOMY

American Association of Immunologists™

AFMR American Federation for Medical Research 1940

american physiological society

ASBMB American Society for Biochemistry and Molecular Biology

ASBMR The American Society for Bone and Mineral Research

ASIP American Society for Investigative Pathology

ASPET Transforming Discoveries into Therapies

ASHG American Society of Human Genetics

AMP Association for Molecular Pathology

ABRF Research • Technology Communication • Education

ENDOCRINE SOCIETY

GSA Genetics Society of America

THE HISTOCHEMICAL SOCIETY

TRAUMA SHOCK SHOCK SOCIETY EST. 1978 SEPSIS

DEV BIO SOCIETY FOR DEVELOPMENTAL BIOLOGY

SEBM SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE

SOCIETY for Glycobiology

SfRBM Society for Redox Biology and Medicine

SOCIETY FOR LEUKOCYTE BIOLOGY

SSR Society for the Study of Reproduction

FASEB Engagement

Board of Directors Generative AI Taskforce

CHARGE

Develop recommendations for federal agencies, policy makers, societies, and researchers about the relevance and impact of Generative AI (Gen AI) to biological and biomedical science and scientific societies. Identify opportunities for FASEB and FASEB member societies to use Gen AI to meet our shared missions.

Gen AI Taskforce Objectives

Public document

1

Develop a report with recommendations on the appropriate and responsible use of Gen AI in routine research activities related to the biomedical/ biological research community.

FASEB/member societies only guidance

2

Identify potential FASEB and society applications of Gen AI that can enhance mission, improve staff scope, expand member engagement, and increase efficiency of operations.

Board of Directors Generative AI Taskforce

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Chair
ASIP

Joe Yost,
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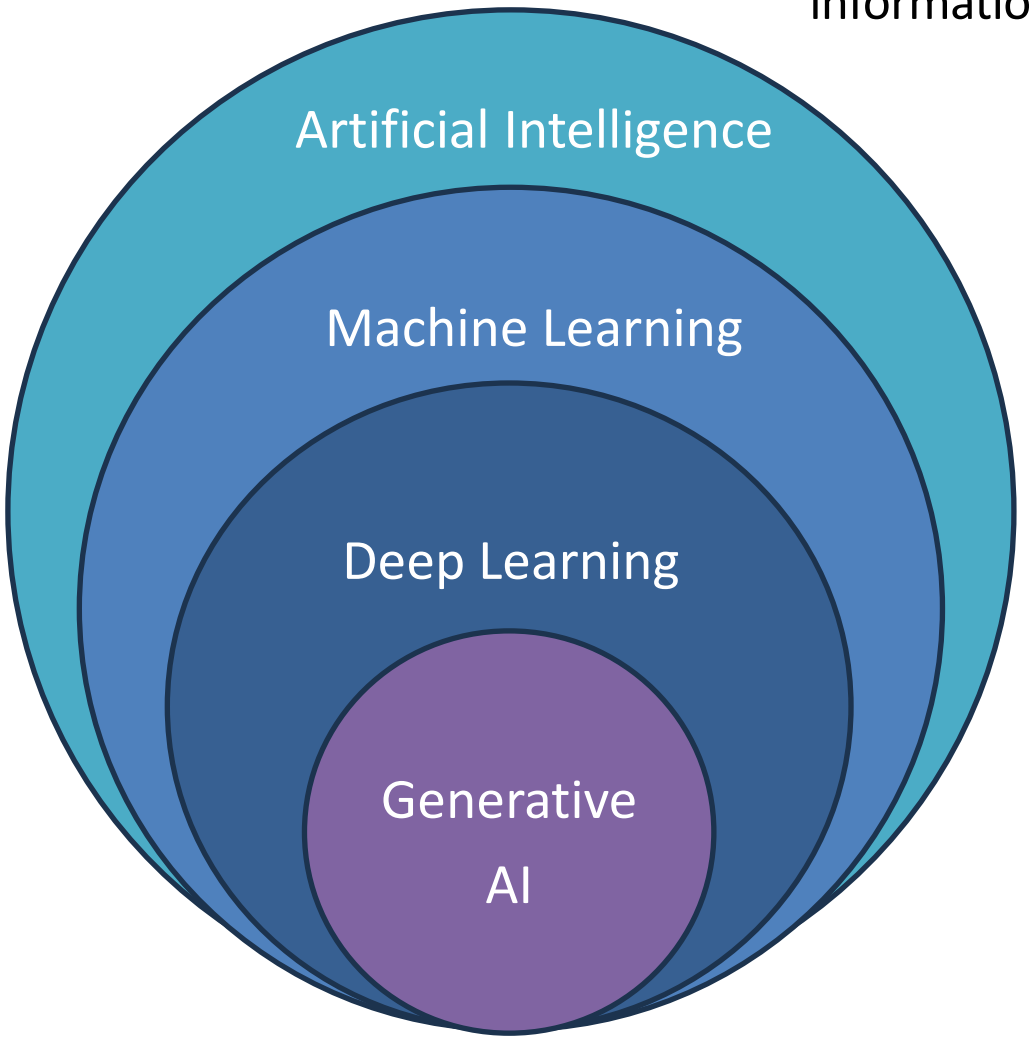
Frank Krause
Executive Director

Definitions

Gen AI is a subset of artificial intelligence (AI) that ***creates novel content, including text, images, sound, and video.*** As a rule, the software, the algorithms ***learn and evolve*** over time through use, responses, and new information being accessed.



Machines learn and perform tasks (predetermined rules)

Systems learn and predict by themselves

Artificial neural networks uses input and output layers to transform data

Learns patterns from massive amounts of data, generates new original content (autonomously)

Applications of Gen AI in the Biological and Biomedical Research Space

Accelerating drug discovery

Predicting protein structures, sequence design

Synthetic biology, gene circuit design

Medical imaging, diagnostics

Genomics

Workflow and system optimization

Potential Future Applications

Accelerating research and development

Precision medicine

Improved agricultural processes

Environmental conservation

Enhanced disease surveillance

Digital twins

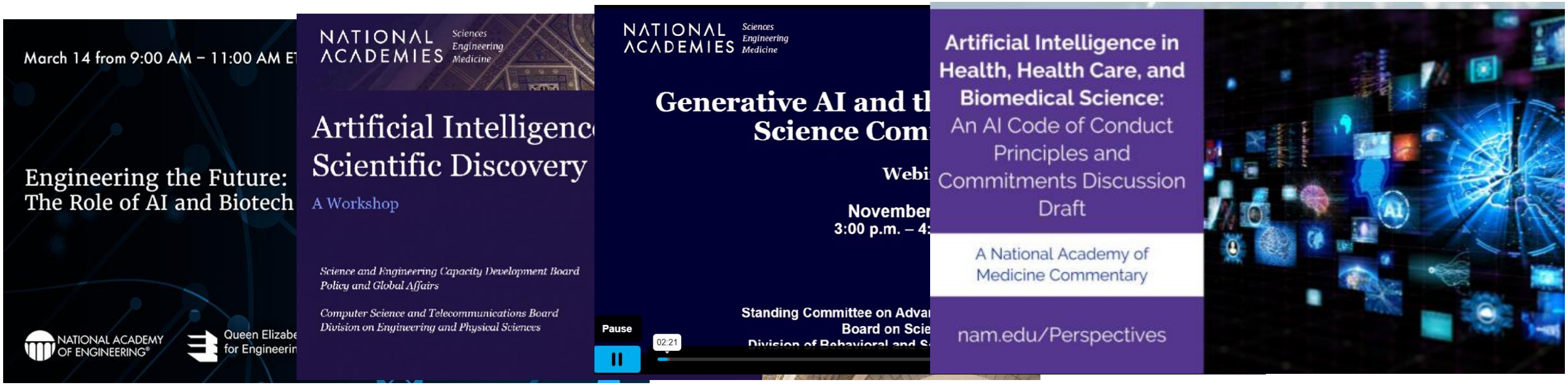
AI and Gen AI Issues And Challenges

- Bias, fairness, and equity
- Ethics, human agency alignment with human values
- Intellectual property rights
- Trust and oversight concerns (human +AI)
- Workforce impact
- Privacy and security Risks
- False information / data quality
- Misuse and malicious applications
- Lack of transparency and explainability

Why Engaging with Gen AI is Important for Biomedical Researchers and Educators

- **<u>Mission</u>**; potential and real applications that accelerate research, expedite healthcare, uncover hidden insights.
- **<u>New sources of funding</u>** - Federal agencies have significant funding tied to AI and Gen AI initiatives.
- **<u>AI/Gen AI is already in broad use globally –</u>**
- Federal agencies are using AI extensively internally
- Corporations, academic and research institutions, and medical fields are rapidly adopting Gen AI/AI
- Younger generation using multiple times a day, integrated throughout various common tools/apps

Background Resources



Generative AI to Become a $1.3 Trillion Market by 2032, Research Finds (Bloomberg, June 2023)

"**Of note is the potential for generative AI to benefit life sciences and education**, with BI's analysis finding that early use cases of ChatGPT suggest that these are two areas that could see rapid growth from their position as a fraction of larger software segments today. The potential for specialized AI-based software assistants may be particularly transformative for search and other means of summarizing information that drive these two market segments."

Generative AI Is Set to Shake Up Education (Morgan Stanley, December 2023)

The Growing Influence of Industry in AI Research (MIT, March 2023)

NVIDIA

IBM

Hippocratic AI
Do No Harm

Insilico Medicine

Google DeepMind

Benevolent AI

Iambic

Recursion

zymergen

See also https://www.eweek.com/artificial-intelligence/generative-ai-startups/
and sort by bio/med/data segments for more start ups

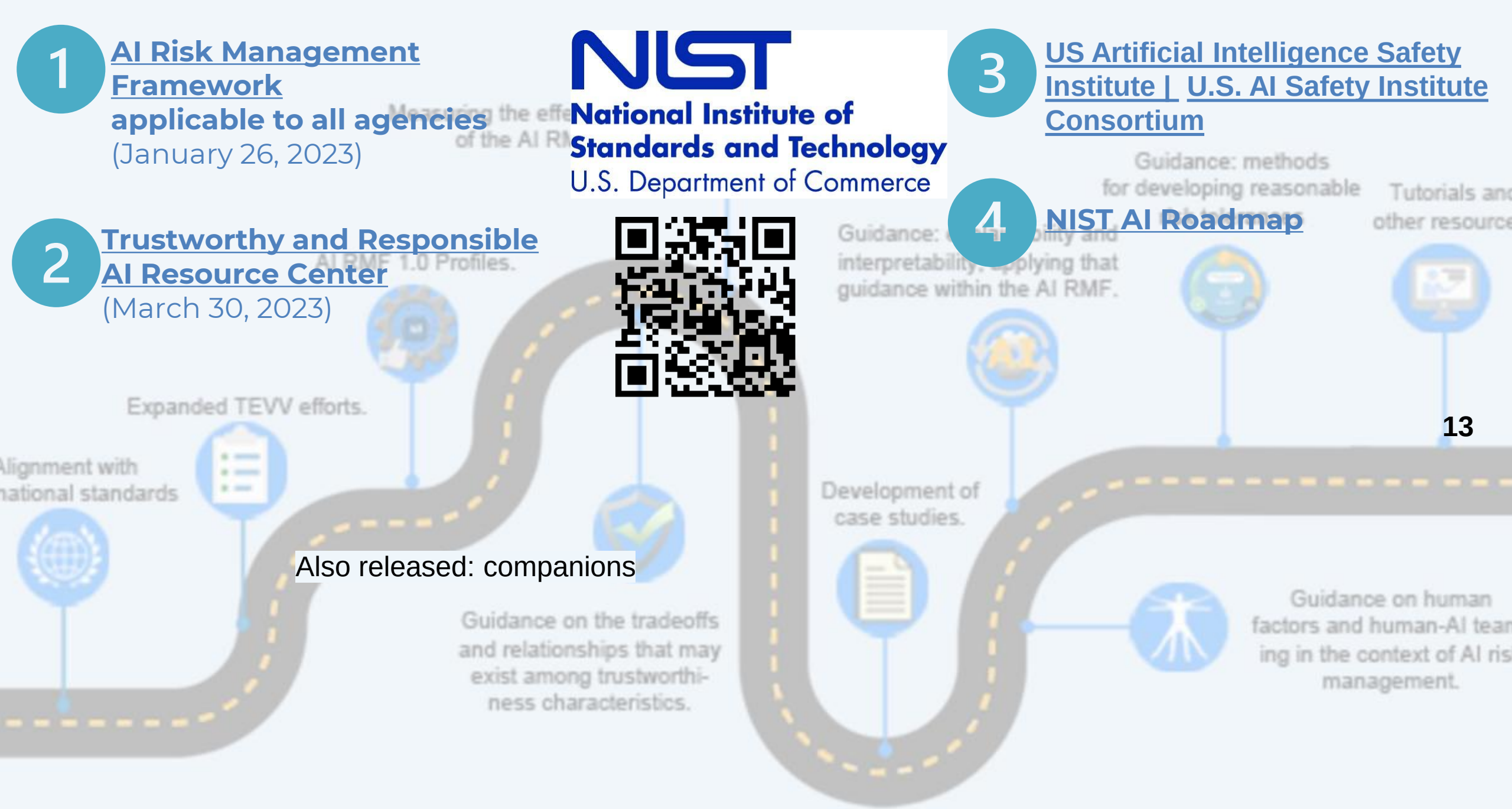
1 **AI Risk Management Framework applicable to all agencies** (January 26, 2023)

2 **Trustworthy and Responsible AI Resource Center** (March 30, 2023)

National Institute of Standards and Technology
U.S. Department of Commerce

3 **US Artificial Intelligence Safety Institute | U.S. AI Safety Institute Consortium**

4 **NIST AI Roadmap**



Also released: companions

>$700M annually to AI

National AI Research Institutes (launched 2020)

✓ 25 AI institutes connecting…

✓ …>500 funded/collaborative institutes

National AI Research Resource Pilot (NAIRR)

✓ Charge – create roadmap for research infrastructure for researchers, educators, students (implementation plan)

Directorate-Level Support

✓ Includes funding in the BIO directorate

NSF Inventory AI Use Cases

ODSS Led Initiatives

Address workforce gap in data governance for AI in biomed; ethics, bias, and transparency; improving the AI-readiness of existing, IC-supported data
outputs: Admin supplemental grants, AI Ethics Lab

Bridge2AI

Address workforce gap in data governance for AI in biomed outputs: grants, new datasets, software, standards, tools, resources, training videos

AI/ML Led Consortium to Advance Health Equity and Researcher Diversity (AIM-AHEAD)

Outputs: new coordinating center announced, at Uni North Texas (admin network, protocols for sharing de-identified, data science training, infrastructure, ECR fellowship program - calls out now)

Advancing Health Research Through Ethical Multimodal AI

Grants for system level biomed challenges using collaborative approaches

Institute and center-funded initiatives

USDHHS Inventory Use Cases

Expect to Release Plan for AI Strategy in the Next Few Months

"We're still in the early stages, still doing some current state assessments, asking questions, doing surveys, launching interviews, but expect at some point in the next few months that USDA will launch an AI strategy." Fredy Diaz,
Deputy Chief Data Officer
USDA | March 19, 2024

USDA FY2024-2026 Data Strategy

- ✓ Upskill USDA to support advanced analytics and AI
- ✓ Standardize principles & best practices for analytics & AI
- ✓ Promote data & AI ethics, responsible use, and transparency

Various Innovation Funds , Grants, Related Activities

- ✓ ARS AI Innovation Fund
- ✓ AFRI Competitive Grants
- ✓ Hackathon

USDA Inventory Use Cases

VA | U.S. Department of Veterans Affairs

National Artificial Intelligence Institute

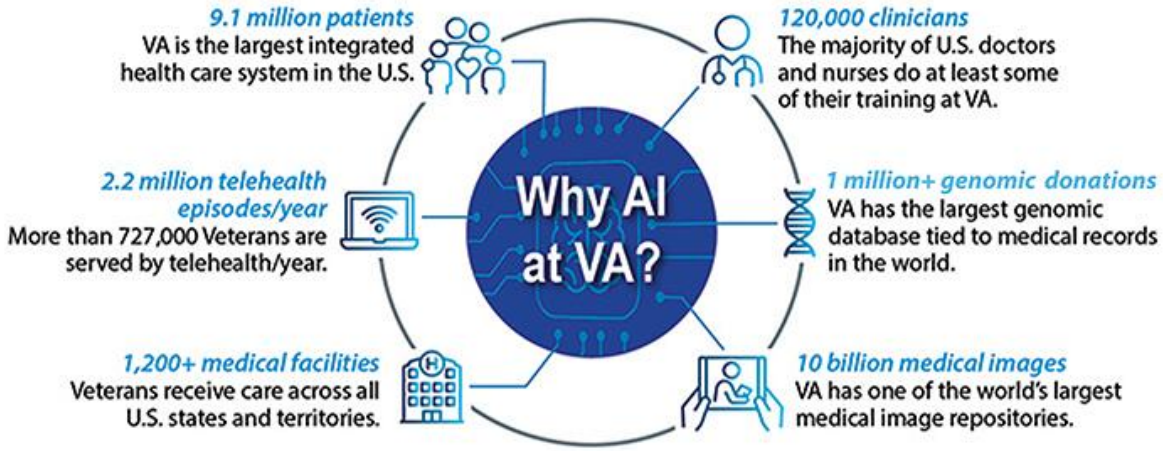
- ✓ Education of medical professionals
- ✓ Improved treatments for Veterans

Various Innovation Funds , Grants, Related Activities

- ✓ Tech Sprints
- ✓ Summit Series

Flagship Pilot Projects

- ✓ COVID-19 120-day mortality model
- ✓ AI-to-Go Tool (research stats models)
- ✓ Digital Command Center
- ✓ Suicidal Ideation Text Screening
- ✓ Smart Wearable Pilot



VA AI Use Case Inventory

U.S. DEPARTMENT OF ENERGY

AI for Science, Energy, and Security Report 2023

Office of Critical and Emerging Technology

December 2023

✓ Workforce
(w/ NSF, establishing pilot program for training 500 new researchers by 2025)

✓ Coordinate across portfolio, support and inform policy making

✓ Develop industry-academia partnerships to accelerate US innovation

Various Innovation Funds , Grants, Related Activities

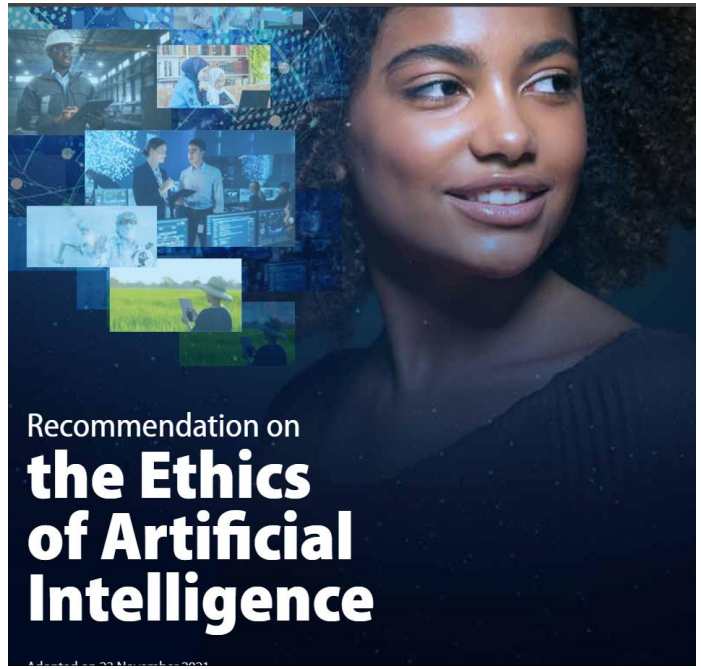
✓ Advancements in Artificial Intelligence for Science

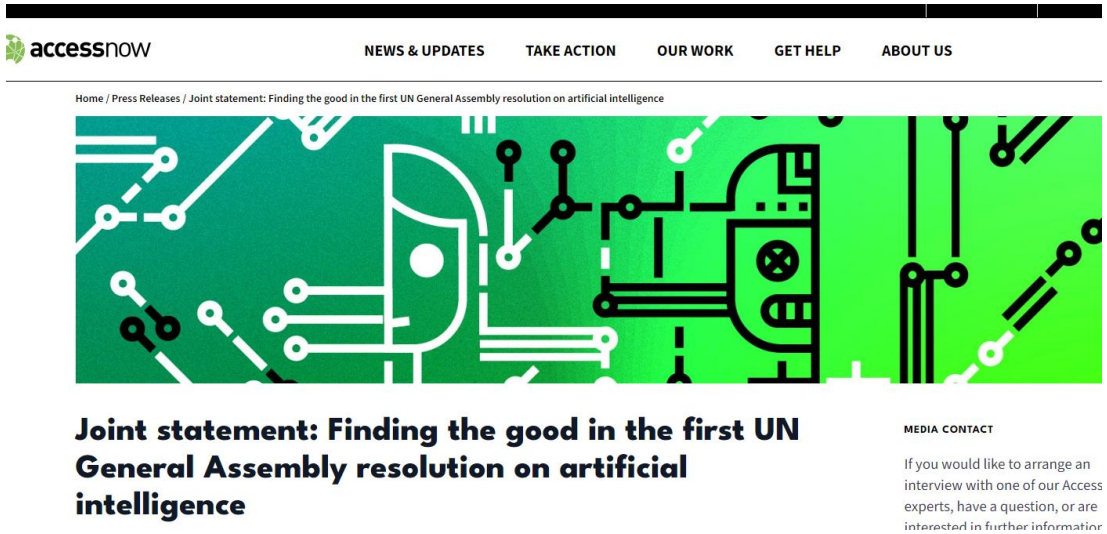
✓ DARPA's AI Forward

US DOE's Inventory Use Cases

- [UN 78/265. Seizing the opportunities of safe, secure and trustworthy artificial intelligence systems for sustainable development]

US-led resolution adopted March 21, 2024





Proportionality and do no harm

Safety and security

Fairness and non-discrimination

Sustainability

Right to privacy and data protection

Human oversight and determination

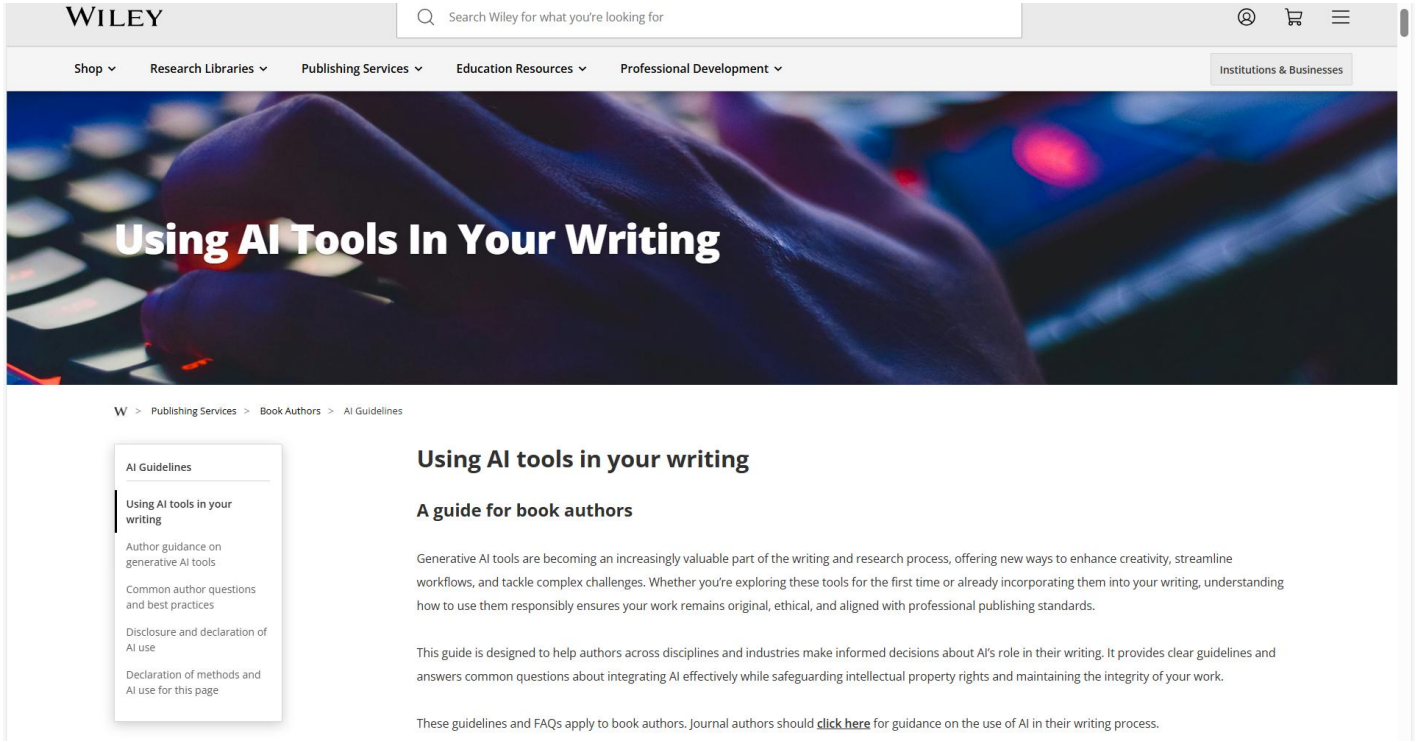
Transparency and explainability

Responsibility and accountability

Awareness and literacy

Multi-stakeholder and adaptive governance and collaboration

Useful Resources for AI in Writing



CANGARU

ChatGPT and Artificial Intelligence Natural LarGe Language Models Accountable Reporting and Use Guidelines

Giovanni Cacciamani, MD,
Assoc Prof Research Urology
Keck School of Medicine, USC

Recommendations for Generative AI in the Biological and Biomedical Sciences

From the Federation of American Societies for Experimental Biology (FASEB)
Issued January 2025

FASEB RECOMMENDATIONS FOR GEN AI IN BIOLOGICAL & BIOMEDICAL SCIENCES

1

THEME 1 | POLICY AND REGULATION

U.S. AI policy lags behind technology. Biological and biomedical stakeholders must help shape regulations that advance science while ensuring integrity and protection.

2

THEME 2 | SCIENTIFIC INTEGRITY AND INTELLECTUAL PROPERTY

AI challenges scientific integrity and IP rights. Detailed understanding of the issues and careful consideration of use is essential.

3

THEME 3 | DATA PRIVACY AND SECURITY

The U.S. should enhance data privacy in AI, especially in biomedical sciences, with shared responsibility and stronger governance.

4

THEME 4 | DIVERSITY, EQUITY, ACCESSIBILITY, AND INCLUSION

Gen AI can aid accessibility or worsen inequities. Oversight and collaboration are vital.

5

THEME 5 | WORKFORCE IMPACT, TRAINING, AND EDUCATION

Gen AI training can support research integrity and propose applications and collaboration of stakeholders in training supports responsible use.

FASEB
Federation of American Societies for Experimental Biology

Top 10 Tips for Getting Started with AI/Gen AI for Biological and Biomedical Researchers

1. Understand relevant policies (institutional, community, journal, funder).
2. Consider what you hope AI can do to help you, start with a pain point of yours in research and id an appropriate tool.
3. Check in with IT before you download the tool and ask for help setting security settings to protect your research.
4. Take 5 minutes to teach the tool about you and your research, tell it what you hope to get out of your interactions.
5. Start experimentation; consider the tool as an intern.
6. Understand the tools that serve you best for various purposes.
7. Learn how to research the underlying data, the software, its limitations and how to counteract limitations.
8. Brush up on ethics, research integrity, respecting intellectual property, data security and privacy.
9. Incorporate AI tools in teaching and mentoring.
10. Focus on improving your research, human health, the mission, and less on saving money/costs.