INTERNATIONAL RESEARCH AND INNOVATION FUNDERS FORUM

AI in Basic Research

Opportunities and Challenges

How AI is reshaping scientific discovery — and what must remain at the heart of science.

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Ha Noi, 5.11.2026

AI is entering a “new generation”

From predictive AI to generative AI and agentic AI



NEXT-GEN AI

Traditional AI

- Predict
- Classify
- Recognize

Auto-grading, handwriting recognition, suggestions

Generative AI

- Generate
- Explain
- Summarize
- Create

Drafting tests, summarizing, generating examples

Agentic AI

- Reason
- Plan
- Use tools
- Execute

Building review plans, calling tools, tracking each student

AI is shifting from answering tools to systems that can reason, act and collaborate.

What makes next-gen AI different

MULTIMODAL

Text, images, audio, video

Reading handwriting, grading diagrams, fixing pronunciation

REASONING

Analysis, reasoning, problem solving

Explaining solutions step by step, pinpointing errors

AGENTIC

Planning, using tools, executing

Building review plans and tracking progress to the goal

PERSONALIZED

Understanding learners, adapting content

Generating exercises for each student's level and gaps

REAL-TIME

Continuous interaction

Instant feedback the moment a student makes a mistake

EMBODIED AI

Robots, IoT, physical environments

Educational robots, sensors, smart labs

AI shifts from Answering to Thinking, Acting and Collaborating.

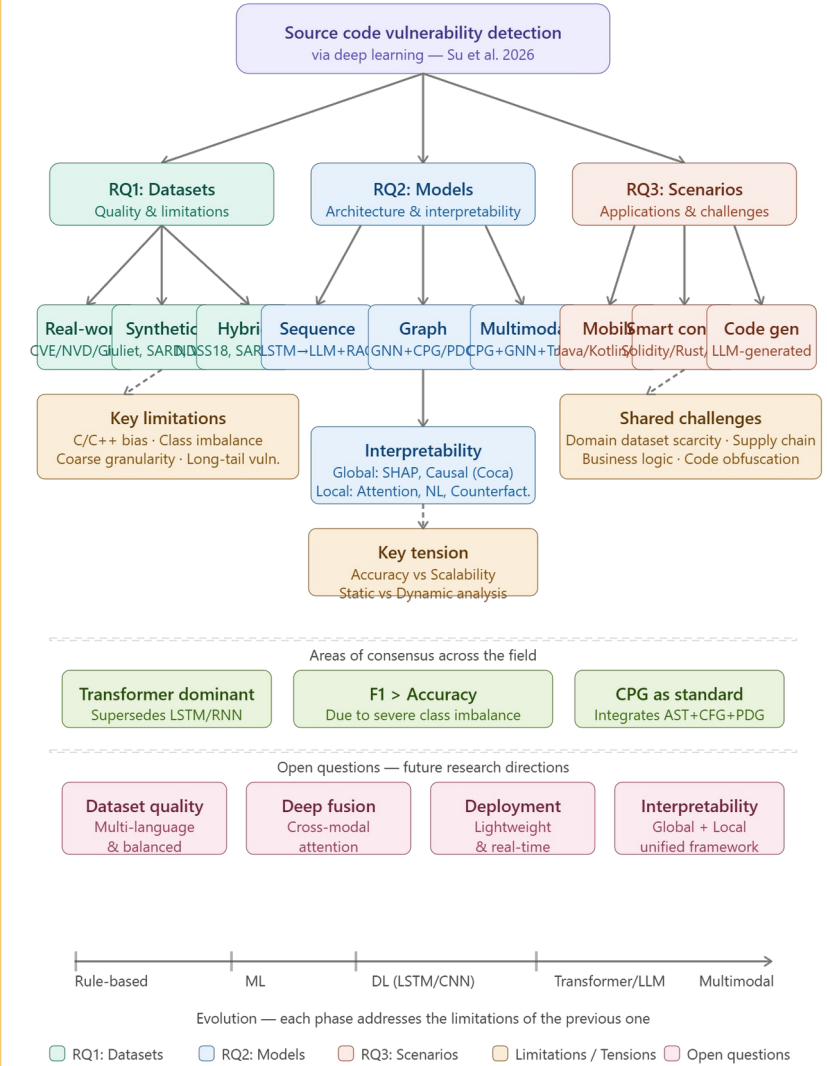
Stanford HAI (2026). AI Index Report 2026. Stanford Human-Centered Artificial Intelligence

An EXAMPLE from CLAUDE



Prompt: "Act as a senior research assistant. Review the document I have just uploaded. Construct a **literature map** that includes:

- The main thematic clusters (content groups) under discussion.
- Specific arguments/theses for each group.
- Key authors/sources.
- Points of consensus and points of contention (debates) among the parties.
- Unanswered questions or research gaps.
- Conclude with a simple diagram to help me grasp the overall landscape of this field."



AI + LEAN: a Case Study

From AI-generated ideas to machine-checked proofs — enabling more reliable fundamental research

VERIFICATION WORKFLOW

1. Mathematical input
Problem, conjecture, theorem or proof sketch

2. AI reasoning
LLM / AI agent formalizes the goal and proposes proof steps

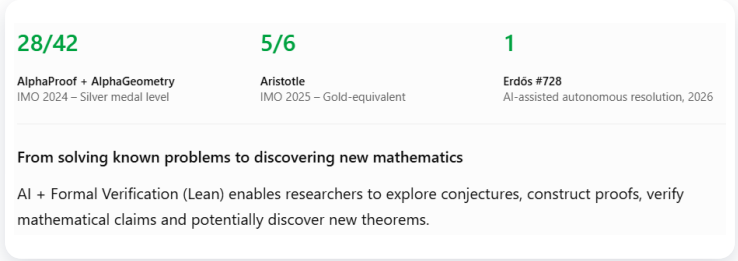
3. Lean 4
Formal proof checked by the Lean kernel

VERIFIED
Proof accepted

NOT VERIFIED
Revise / retry







Note: Google DeepMind and OpenAI also claimed 5/6 problems solved

Key distinction: the AI proposes or searches for a proof; Lean's trusted kernel checks whether the formal proof follows from the stated definitions and assumptions.

DeepMind

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NEWS | 30 November 2020

‘It will change everything’: DeepMind’s AI makes gigantic leap in solving protein structures

Google’s deep-learning program for determining the 3D shapes of proteins stands to transform biology, say scientists.

By Ewen Callaway

An artificial intelligence (AI) network developed by Google AI offshoot DeepMind has made a gargantuan leap in solving one of biology’s grandest challenges — determining a protein’s 3D shape from its amino-acid sequence.

OPENING PERSPECTIVE

A shift in how science discovers

AI is moving from a tool for processing information to a participant in the discovery process.

01

FROM ANALYSIS

Process data, simulate systems, and detect patterns.

02

TO HYPOTHESIS

Suggest relationships, mechanisms, and new research questions.

03

TOWARD DISCOVERY

Connect models, experiments, and evidence in iterative loops.

Can AI help us produce genuinely new and reliable scientific knowledge?

AI is changing the research workflow

Its impact ranges from faster computation to proposing new structures, hypotheses, and laws.

01 Discover hidden patterns

Find structures and regularities in complex scientific data.

02 Generate hypotheses

Propose candidate explanations and relationships for testing.

03 Optimize experiments

Prioritize simulations, measurements, and experimental conditions.

04 Close the discovery loop

Use new evidence to refine models and guide the next experiment.

Key point: AI's contribution differs across disciplines. More speed does not automatically mean more discovery.

Multi-Agent AI for Research

Level	Description	Example Research Agents	Common Tools / Platforms	Characteristics
Level 1	Role-based Simulation in a Single GPT Session	Research Agent, Coding Agent, Reviewer Agent, Experiment Agent	ChatGPT, Claude, prompt engineering	Simple, fast, low cost, agents are simulated within one LLM
Level 2	Multiple Custom GPTs Coordinated by Human Orchestrator	Literature Review GPT, Hypothesis GPT, Data Analysis GPT, Writing GPT	ChatGPT GPT Builder, Claude Projects, shared documents/workspaces	Separate GPTs with different instructions and expertise, manual coordination
Level 3	True Autonomous Multi-Agent System	Planner Agent, Research Agent, Coding Agent, Experiment Agent, Reviewer Agent, Tool Agent	LangChain, LangGraph, Microsoft AutoGen, CrewAI	Independent agents with memory, tools, planning, and autonomous collaboration

Four ways AI can expand the frontier of knowledge

The opportunity is not only to do existing research faster, but also to investigate new questions.

01

Discover new regularities

Surface patterns and candidate laws that merit scientific explanation.

02

Connect disciplines

Bridge mathematics, physics, biology, computing, and social sciences.

03

Use resources better

Reduce search spaces and prioritize promising experiments or simulations.

04

Broaden research capacity

Help more teams access literature, methods, and advanced analytical tools.

AI can lower barriers to research — but scientific progress still depends on expertise, evidence, and context.

Producing an answer is not the same as producing knowledge

Five tensions that matter especially in basic research.

NOVELTY	New discovery — or recombination of known ideas?
EXPLANATION	Accurate prediction — or understanding of mechanism? (black-box nature)
RELIABILITY	Can the result be independently verified and reproduced? (hallucination)
DIVERSITY	Could AI reinforce mainstream ideas and narrow exploration?
RESPONSIBILITY	Who is accountable for data, claims, and scientific integrity? (ethics)

Core risk: generated hypotheses may grow faster than our capacity to validate them.

Producing a … roducing knowledge

Five tensions that matt…

- NOVELTY
- EXPLANATION
- RELIABILITY
- DIVERSITY
- RESPONSIBILITY

Core risk: generated … m.

…m?
…ced?
…oration?
…egrity?

Artificial intelligence tools expand scientists' impact but contract science's focus

Qianyue Hao, Fengli Xu ✉, Yong Li ✉ & James Evans ✉

Nature **649**, 1237–1243 (2026) | Cite this article

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Abstract

Developments in artificial intelligence (AI) have accelerated scientific discovery[1]. Alongside recent AI-oriented Nobel prizes[2,3,4,5,6,7,8,9], these trends establish the role of AI tools in science[10]. This advancement raises questions about the influence of AI tools on scientists and science as a whole, and highlights a potential conflict between individual and collective benefits[11]. To evaluate these questions, we used a pretrained language model to identify AI-augmented research, with an F1-score of 0.875 in validation against expert-labelled data. Using a dataset of 41.3 million research papers across the natural sciences and covering distinct eras of AI, here we show an accelerated adoption of AI tools among scientists and consistent professional advantages associated with AI usage, but a collective narrowing of scientific focus. Scientists who engage in AI-augmented research publish 3.02 times more papers, receive 4.84 times more citations and become research project leaders 1.37 years earlier than those who do not. By contrast, AI adoption shrinks the collective volume of scientific topics studied by 4.63% and decreases scientists' engagement with one another by 22%. By consequence, adoption of AI in science presents what seems to be a paradox: an expansion of individual scientists' impact but a contraction in collective science's reach, as AI-augmented work moves collectively towards areas richest in data. With reduced follow-on engagement, AI tools seem to automate established fields rather than explore new ones, highlighting a tension between personal advancement and collective scientific progress.

The scientist's role shifts — it does not disappear

As AI lowers the cost of generating candidate answers (*although buying tokens still the headache for scientists* ☺), scientific judgment/verification becomes more valuable.

AI CAN HELP

- Search and synthesize literature
- Suggest hypotheses and alternatives
- Simulate and optimize experiments
- Detect patterns and anomalies

SCIENTISTS MUST LEAD

- Choose consequential questions
- Judge novelty and significance
- Design falsifiable tests
- Interpret evidence and own conclusions

When answers become cheaper, asking the right questions — and knowing when to doubt an answer — matters more.

From using AI to creating knowledge with AI

How can Vietnam contribute to global discovery, not only consume its outputs?

INVEST IN FOUNDATIONS	People, theory, high-quality data, and ethical, fair&innovative research environment — not computing alone.
TARGET DEEP PROBLEMS	Develop AI-enabled research in mathematics, physics, biology, materials, and social sciences.
BUILD OPEN SCIENCE	Support reproducibility, shared benchmarks, appropriate data access, and collaboration.
REWARD CONTRIBUTION	Reform evaluation methods; assess novelty, rigor, theory, reusable tools, and long-term knowledge value.

The goal: move from using AI efficiently to creating scientific knowledge with AI.

AI is a means.

Scientific knowledge is the goal.

THREE TAKEAWAYS

1. AI changes how science is done; it does not replace the purpose of science.
2. Trustworthy discovery requires novelty, explanation, validation, and reproducibility.
3. Excellence combines AI with deep expertise, scientific judgment, and better questions.

The advantage belongs to those who combine AI with scientific insight.

DISCUSSION

What counts as excellent discovery in the age of AI?

Three tests for the scientific community.

01

NOVELTY

Is the result genuinely new — and important?

02

EVIDENCE

Can others test, reproduce, and challenge it?

03

UNDERSTANDING

Does it deepen explanation, not only prediction?

AI can accelerate the search. Science must still decide what counts as knowledge.

THANK YOU!

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