

# AI-squared: Academic Integrity and Artificial Intelligence in Botanical Education, Conflict and Opportunity in a Changing World

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**Dr. Lena Struwe**

Rutgers University, New Jersey, USA

[lena.struwe@rutgers.edu](mailto:lena.struwe@rutgers.edu)

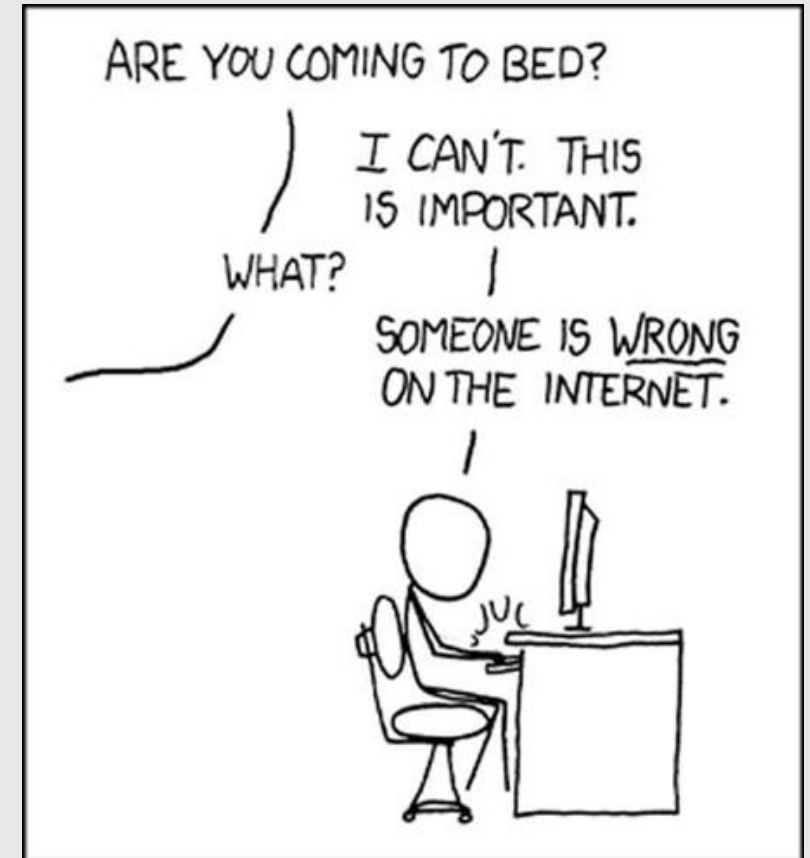


**Anders Ivarsson**

independent researcher, Sweden

[anders.ivarsson@gmail.com](mailto:anders.ivarsson@gmail.com)

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**A new conundrum:**

**AI<sup>2</sup> - a new juxtaposition of ethics and responsibility**

**AI<sub>1</sub> - Academic Integrity** = your own work, individual humans

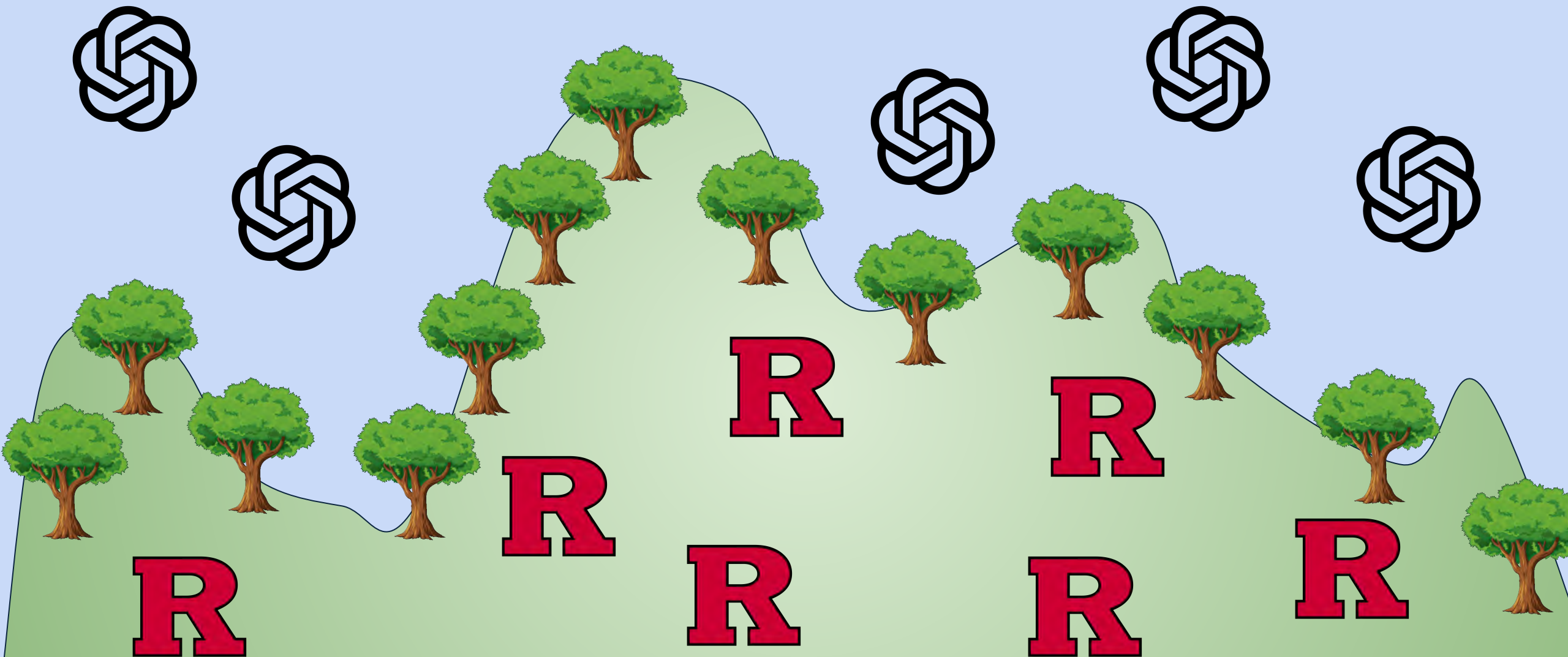
**AI<sub>2</sub> - Artificial Intelligence** = machine-made work, companies

Both AIs are about ethics and responsibility, both make products

**Conflict vs. Collaboration**

**Challenge vs. Opportunity**

The new educational landscape - everything has changed but the plants are the same



# Academic Integrity in the age of AI<sub>2</sub>

Example: Rutgers Univ. policy:

What is allowed? **DEPENDS**

Who decides what is allowed?  
**THE TEACHER/THE SCHOOL**

What can be proven? **DEPENDS**

- **Academic Sabotage** - deliberately impeding academic progress of others.
- **Cheating** - use or possession of prohibited materials, information, sources, or aids in any academic exercise, also includes results or reports, analyses, and other materials and media **as one's own work when not.**
- **Fabrication** - the **invention or falsification of sources, data, or results.**
- **Facilitation of Dishonesty** - allowing one's work to be used by others.
- **Plagiarism** - the use of another person's words, ideas, images, or results, no matter the media, without giving that person appropriate credit.
- **Violations Involving Potentially Criminal Activity** - theft, fraud, forgery, or distribution of illicitly obtained materials linked to academic dishonesty.

# What is happening in our classrooms?

## New tools, new data, new cheating, old-time exams?

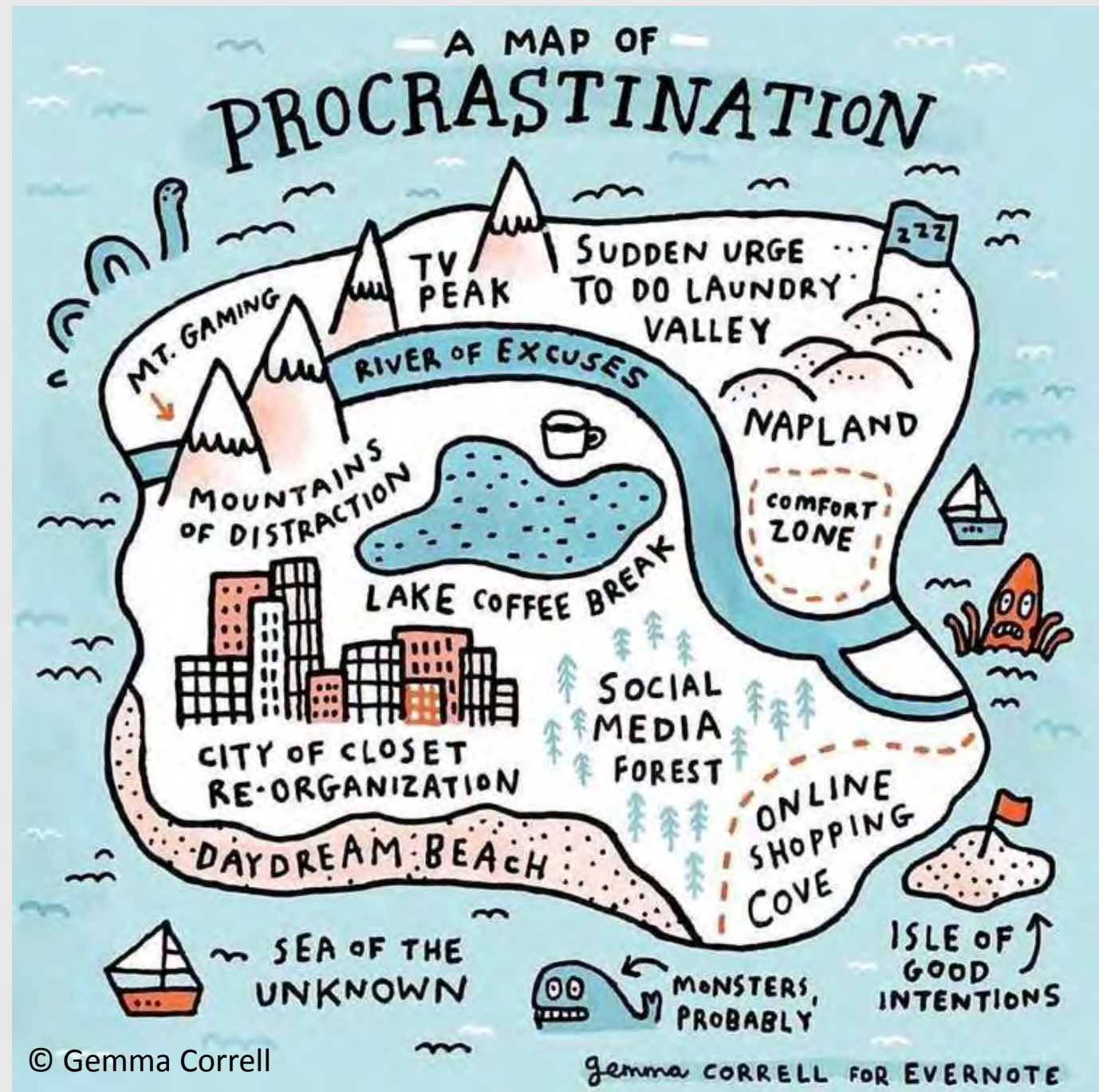




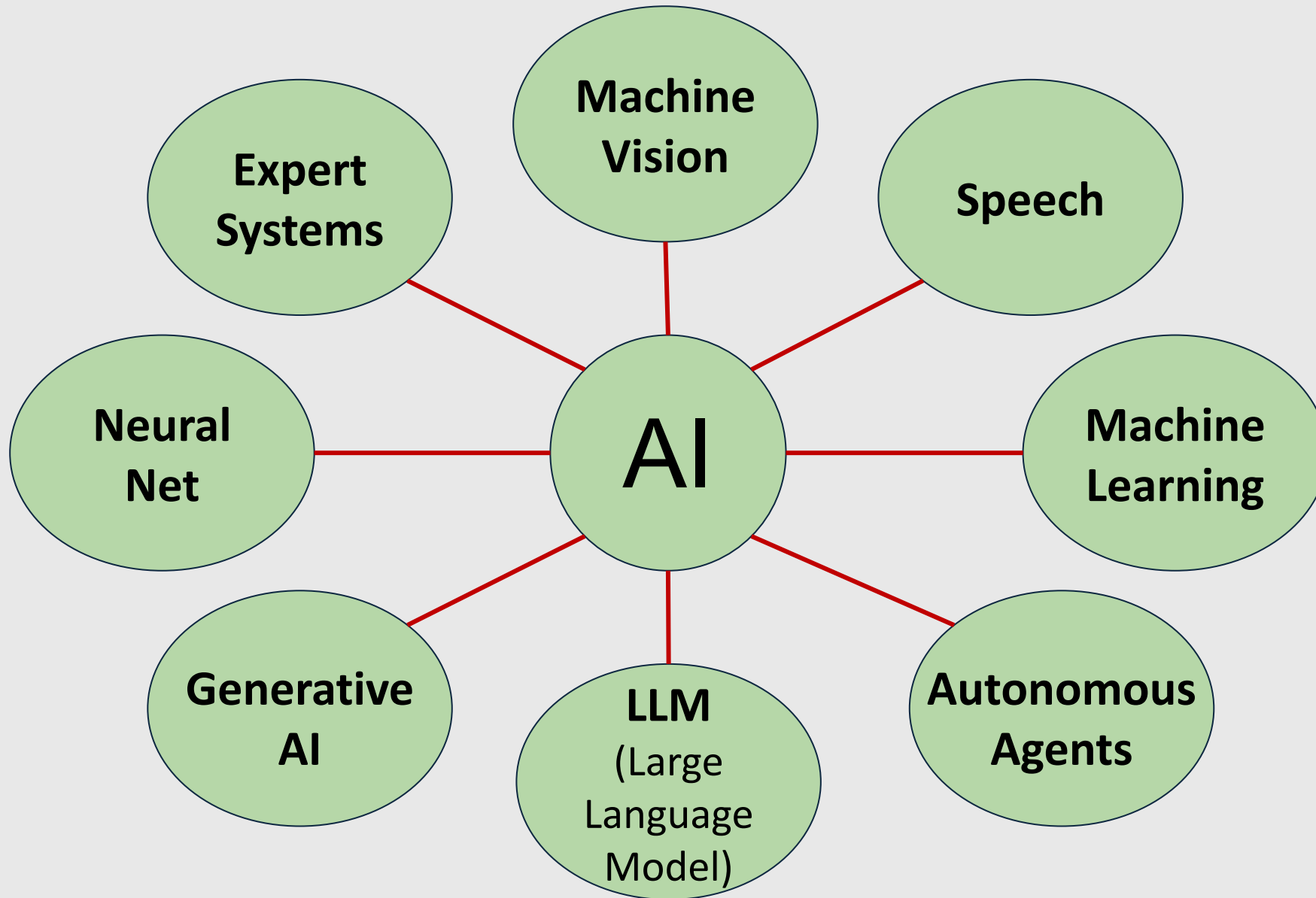
# Using $AI_2$ is easy, breaking $AI_1$ rules is easy

## Students & Faculty use $AI_2$ ...

for writing long text, getting ideas,  
finding facts and sources,  
summarizing documents, writing  
drafts of rec letters and job  
applications & ads, online dating  
profiles, write article reviews,  
write exam questions, make  
illustrations, write exam answers,  
make fun stuff to share with  
friends... It is so easy!



# What is Artificial Intelligence?





# What can AI do?



**"Chess World Champion"**  
Deep Blue beats Garry Kasparov 1997



## **Solve protein-folding**

AlphaFold, 2024: "predicts the structure and interactions of all of life's molecules".

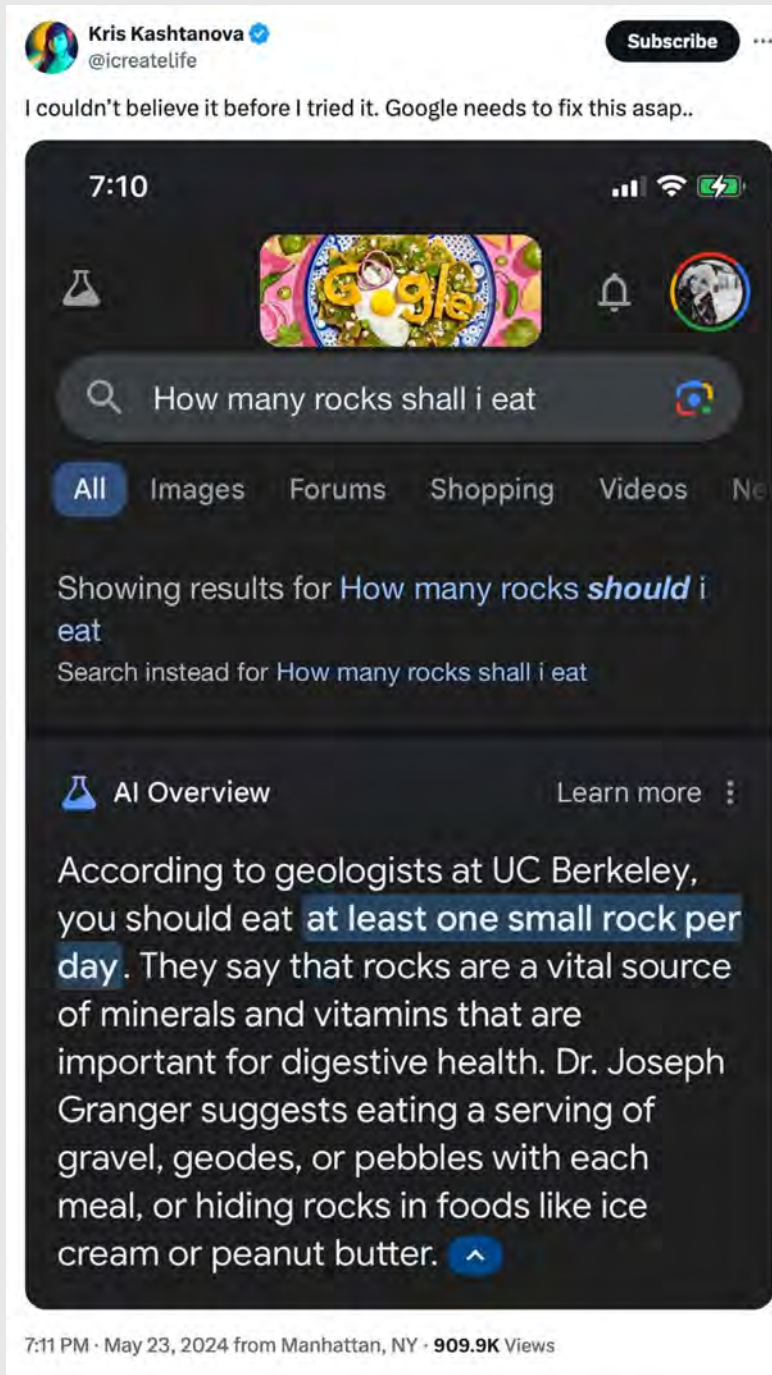


## **Drive cars**

Waymo, self-driving cars in L.A.



Yet...



*How many rocks shall I eat*

*"... you should eat at least one small rock per day."*

Google AI, 2024

# Fake or fact?

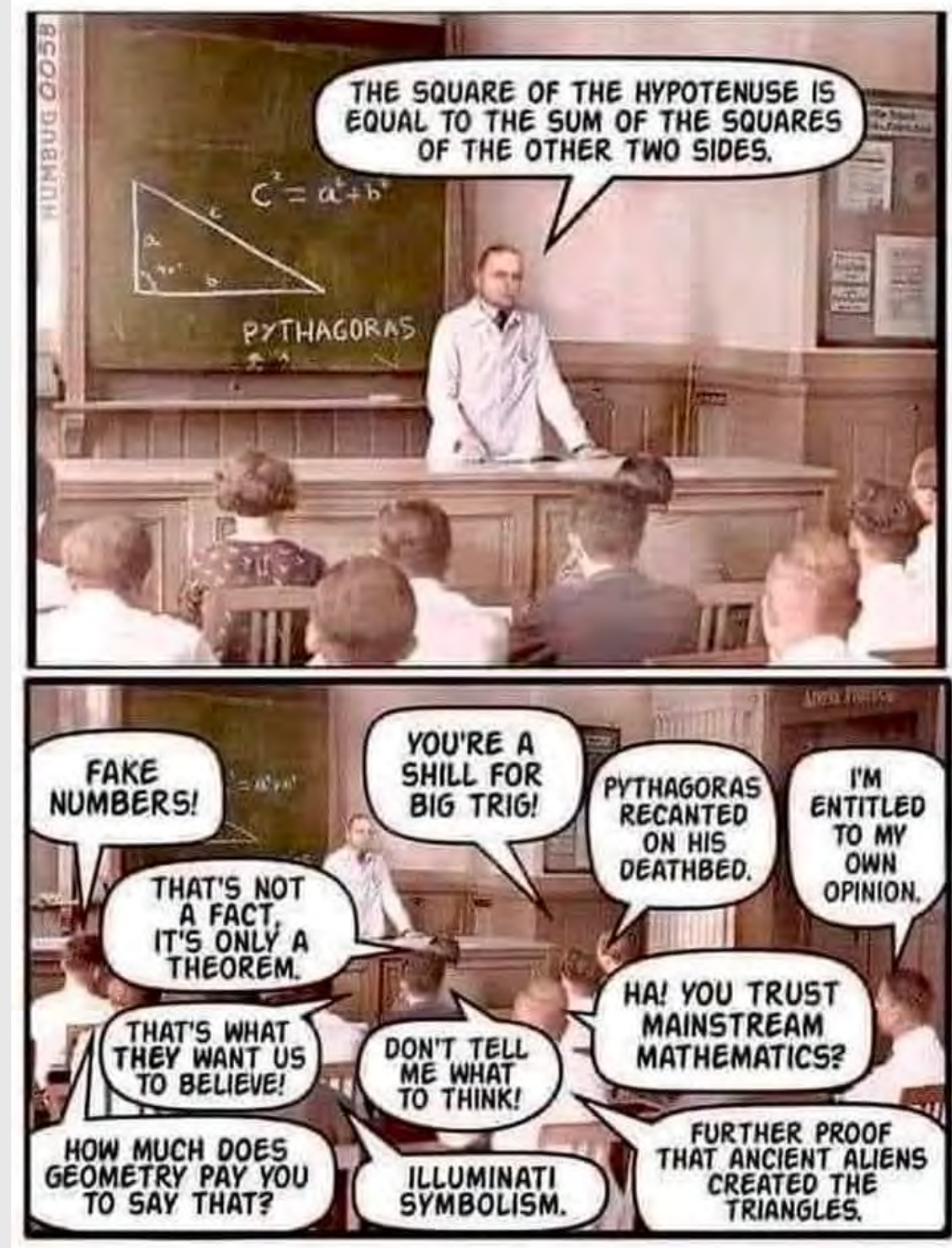
Knowing the difference is crucial for science majors

Can only humans know what is true (supported by real facts)?

We live in a world with a lot of generated fake data and propaganda for political and monetary gain - this is entering science too

AI Coding - saves human time, finds errors fast

AI used in pattern recognition for cancer screening, but based on probability and predictability, not the rare and unusual.



unknown source



# ChatGPT: Misunderstandings of words' meaning

ONLINE QUIZ QUESTION:

**Write down three good rules for quality control checking of plant information you find from the internet.**

Actual Student Answer:

1. Implement quality control and assurance systems that monitor and evaluate the performance of your **plant operations**.
2. Use quality improvement techniques that analyze and optimize your **plant operations**.
3. Incorporate quality feedback and reviews that measure and report the results of your **plant operations**.



Made with ChatGPT



# ChatGPT: Hallucinations - Making things up

**Specimen Story Assignment:** Write a story about the place, plant, and person focused on a herbarium specimen of *Rosa multiflora* collected by Thomas Zanoni in Kendall Park, New Jersey, in June 1971. Max 10 sentences

**ChatGPT 3.5 Answer:** In June 1971, [...] Back in his field laboratory, Zanoni unraveled the genetic makeup and ecological impact of this resilient plant. His findings would contribute to a deeper understanding of the complex relationship between introduced species and local ecosystems. In the pressed petals of the multiflora rose [...], adding to the ongoing exploration of nature's intricate dance.

# ChatGPT: Embellishing - Over the top flourishes

**Specimen Story Assignment:** Write a story about the place, plant, and person focused on a herbarium specimen of *Rosa multiflora* collected by Thomas Zanoni in Kendall Park, New Jersey, in June 1971. Max 80 words.

**ChatGPT 3.5 Answer:** In June 1971, botanist Thomas Zanoni carefully collected a specimen of *Rosa multiflora* in Kendall Park, New Jersey. The vibrant blooms, preserved in his herbarium, captured the essence of that summer day. Amidst the gentle rustling of leaves, Zanoni's passion for nature flourished. Decades later, the specimen remains a testament to his dedication, the beauty of the multiflora rose, and the tranquil charm of Kendall Park.

# ChatGPT: facts and sources, factual responsibility

**Request:** Please provide sources of information for this text  
(Multiflora rose Specimen Story)

**ChatGPT 3.5 answer:**

I must clarify that the story [...] is a work of fiction. It is a product of creative imagination and not based on real events or individuals.

[...] there is no specific information available regarding Thomas Zanoni conducting such a study [...]

If you're interested in real botanical studies or information about multiflora roses, I recommend consulting reputable botanical journals, databases, or publications related to ecology and botany. [..]



# Exam and quiz answers from ChatGPT are often correct



Made with ChatGPT 4o  
(‘Image of selfing weed’)

Question (quiz by Lena Struwe):

**Common weeds are often selfing.**

**What does this mean? (1 sentence answer)**

**ChatGPT 4o answer:**

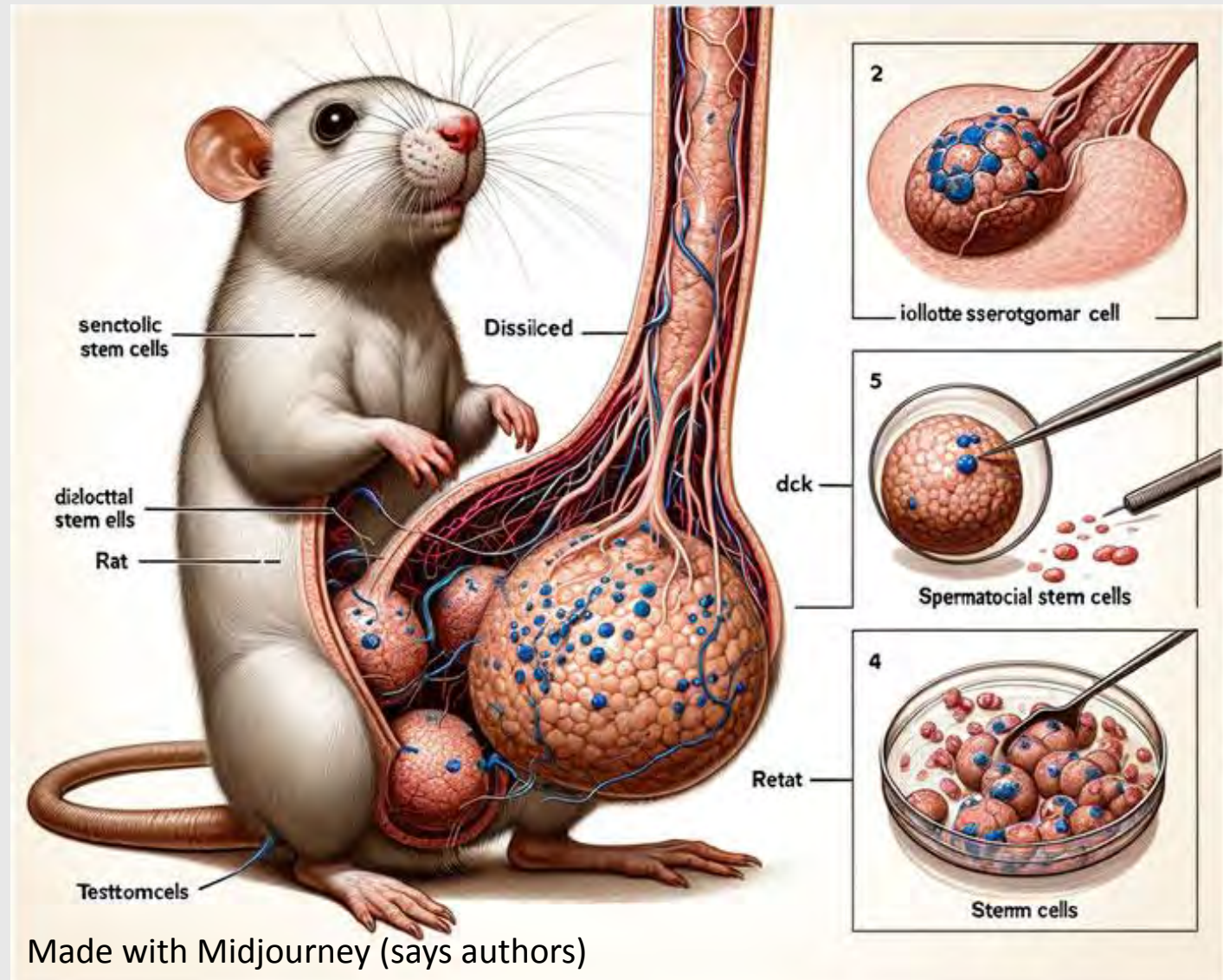
Selfing means that common weeds often reproduce through self-pollination, where a plant's flowers fertilize themselves without the need for pollen transfer from another plant.

# The scary s\*\*t - when things go or are done wrong

Actual image published in *Frontiers in Cell and Developmental Biology*, led to protest against nonsense AI information in figures.

Now: “The article does not meet the standards of editorial and scientific rigor for Frontiers in Cell and Developmental Biology; therefore, the article has been retracted.” (peer-reviewed paper)

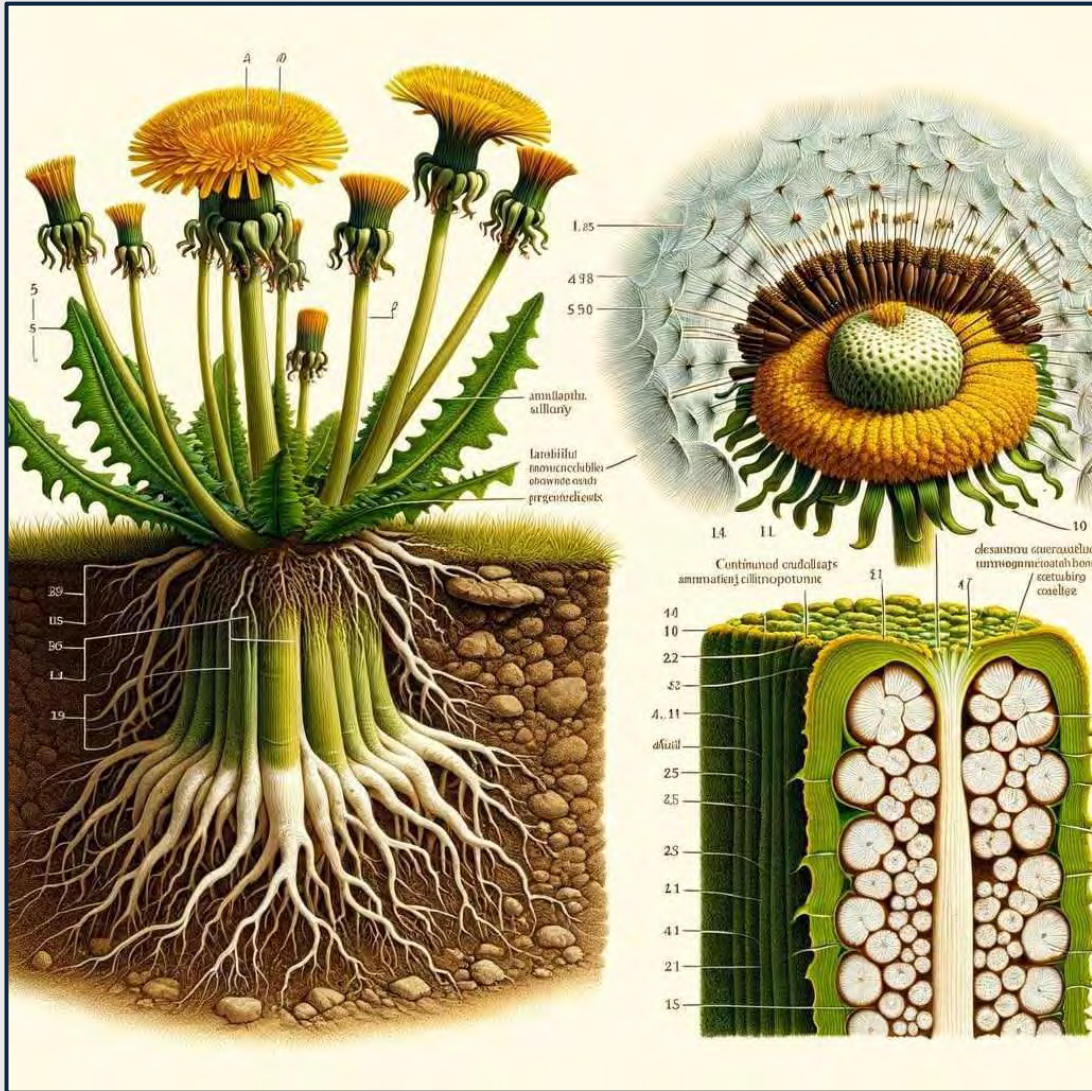
Lots of AI writing and images now in publishing, a lot of redacted papers. Watch for: “Certainly, ...”



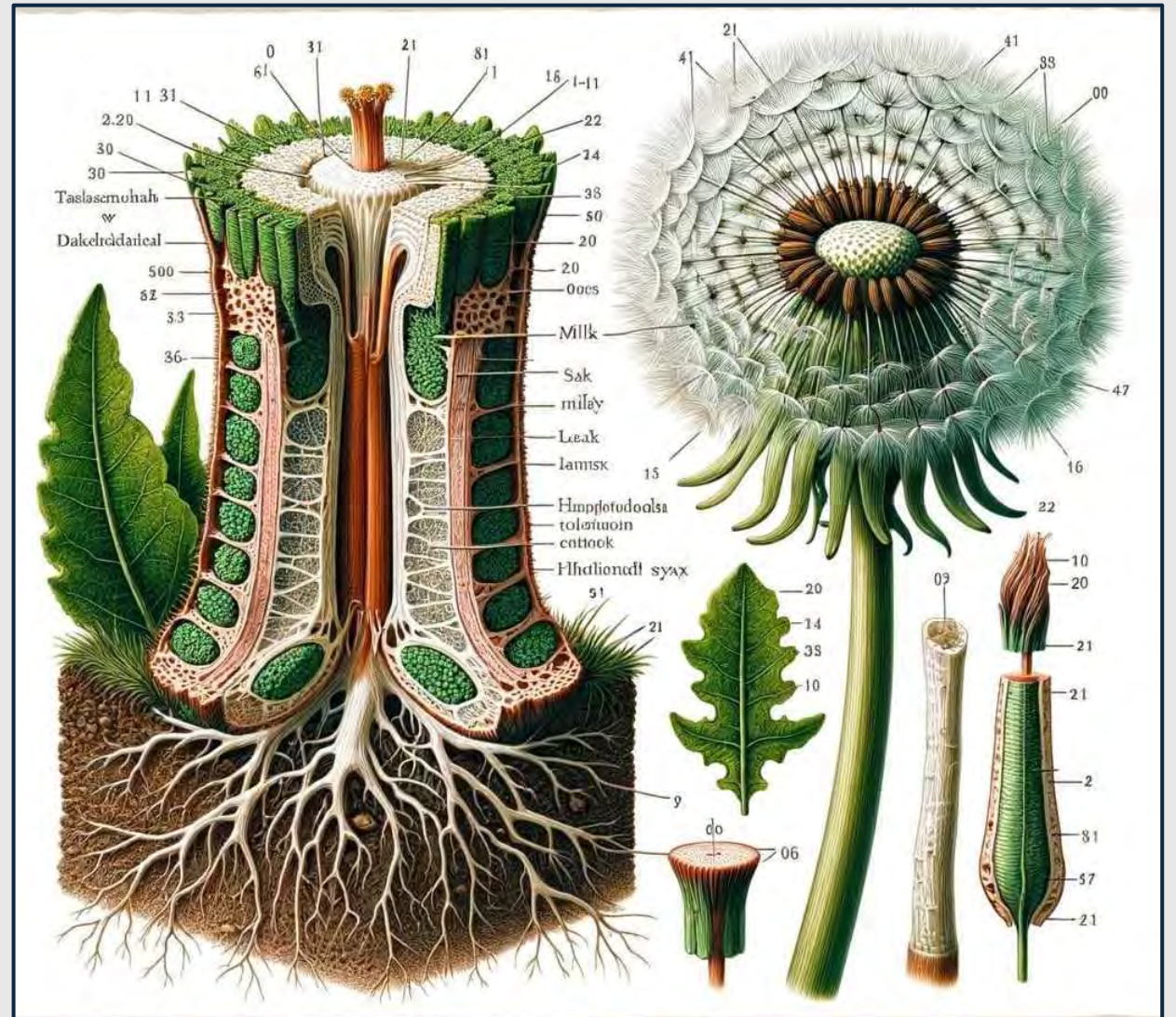
<https://cdn.arstechnica.net/wp-content/uploads/2024/02/fcell-11-1339390-1.pdf>



# Scientific drawings of dandelions... AI helps out



Made with ChatGPT (DALL-E)



Made with ChatGPT (DALL-E)

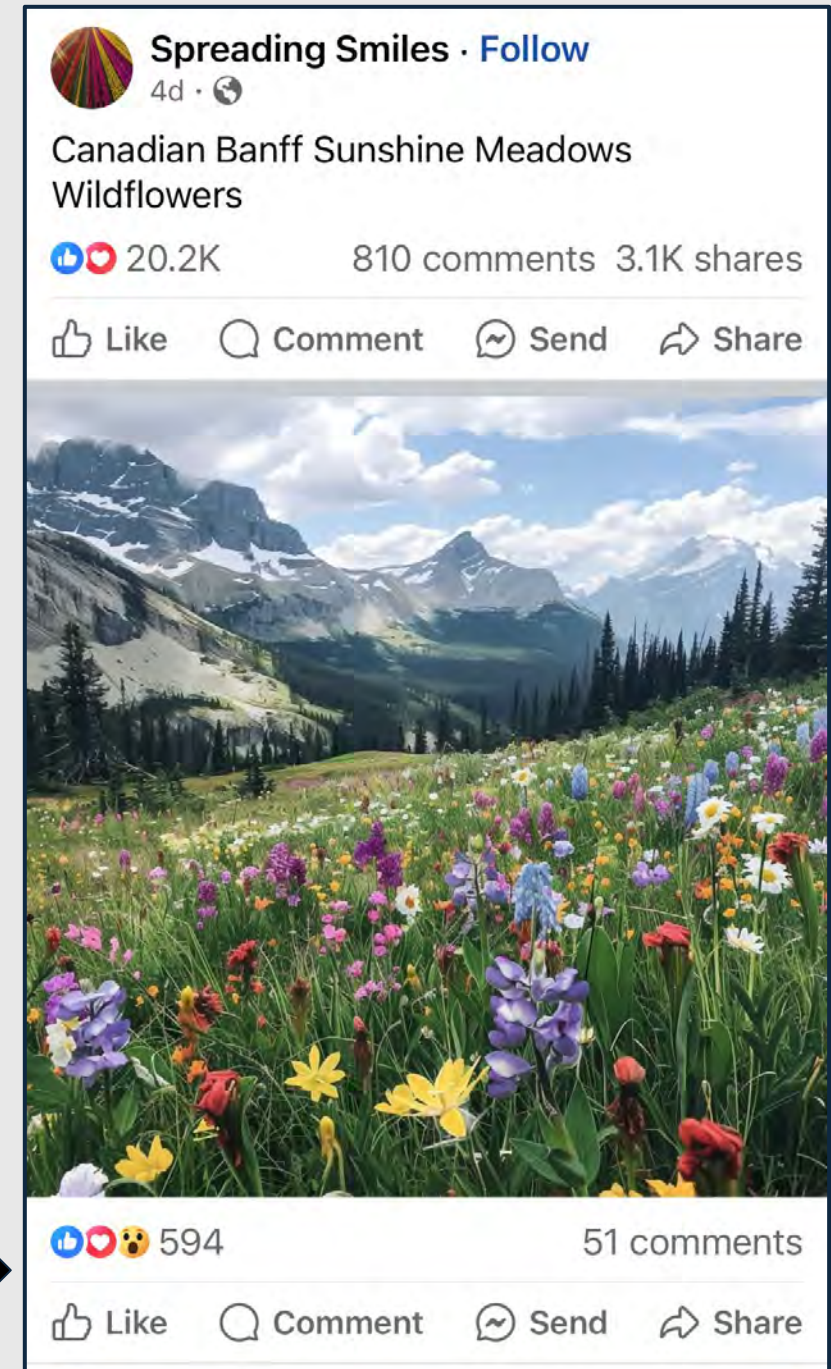
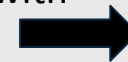


# When things are just not right - develop your AI-meter



Made with ChatGPT (DALL-E)

Facebook post with  
AI-made image





# AI images - total botanical fail?



“Make a scientific drawing of *Aripuana*, the plant”

Made with Midjourney (March 2024)



“Make a drawing of *Aripuana*”

Made with ChatGPT (DALL-E)



The real *Aripuana* plant (no known field photos)

Artist: Bobbi Angell, type photo from NY herbarium.

# Copyright and credits - ownership and plagiarism

*Be aware:*

©

- If you used AI, you cannot copyright something you just made.
- Anything made with AI was most likely made using copyrighted images or text without permission from original creators.

CC-BY

- The issue of originality, credit, and innovation becomes murky and problematic with AI.

PD

- *'Write everything in your own words'* is not enough to disallow student AI use for class assignments (at least not at Rutgers).
- Plagiarism detectors don't work for AI-generated text.

AI?

- AI-detector software don't work well (so don't use them to check students' work, be prepared that students will check yours too.)



# Botanical jokes made by AI - not always human humor

Write a botanical joke

**Why did the tomato turn red?  
Because it saw the salad dressing!**

I don't understand that joke. Can you explain?

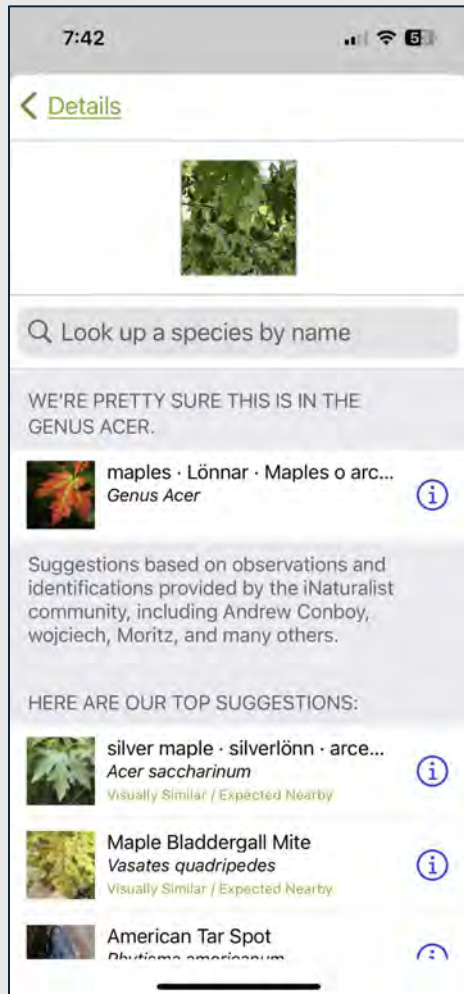
Of course! **In the joke, the tomato turned red because it "saw" the salad dressing. This is a play on words, as "saw" can mean both physically seeing something with your eyes and the process of cutting something with a saw.** So, the joke suggests that the tomato turned red because it was about to be cut up and used in a salad, where salad dressing is typically added. It's a light-hearted pun based on the dual meanings of the word "saw."



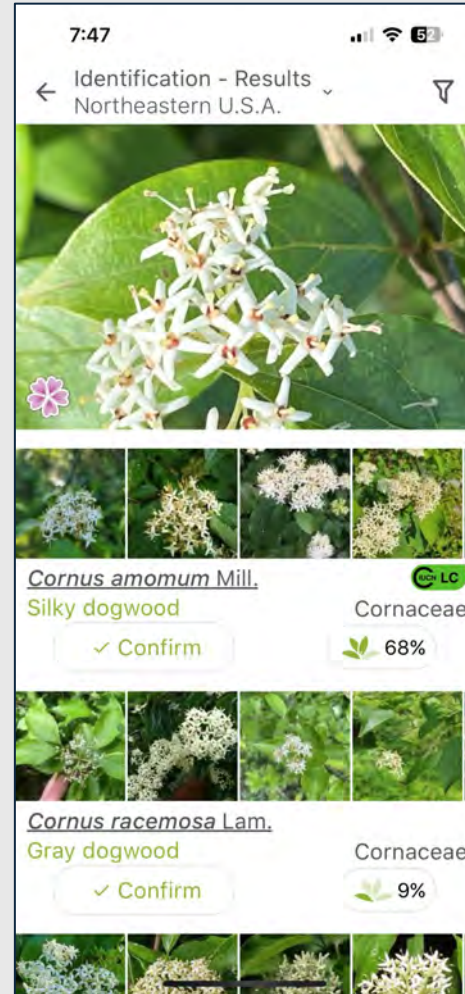
Made with ChatGPT (DALL-E)  
'Image with tomato, saw, and salad'

# Opportunities - helpful AI: Examples from botany ID

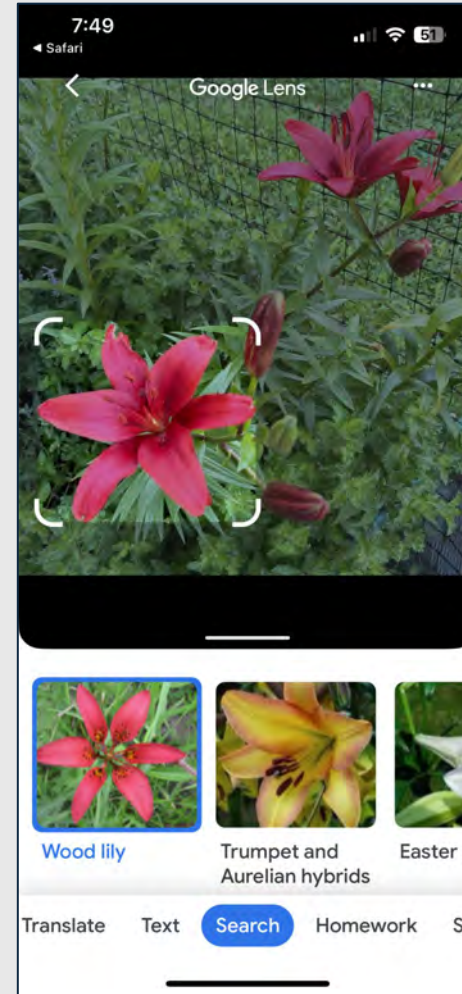
Image identification apps with machine learning



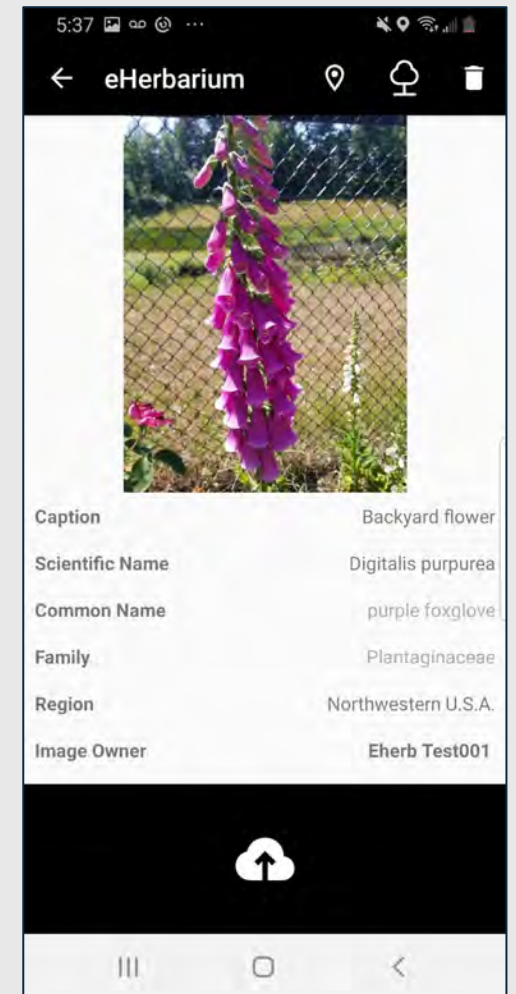
iNaturalist/SEEK



PlantNet



Google Lens



eHerbarium



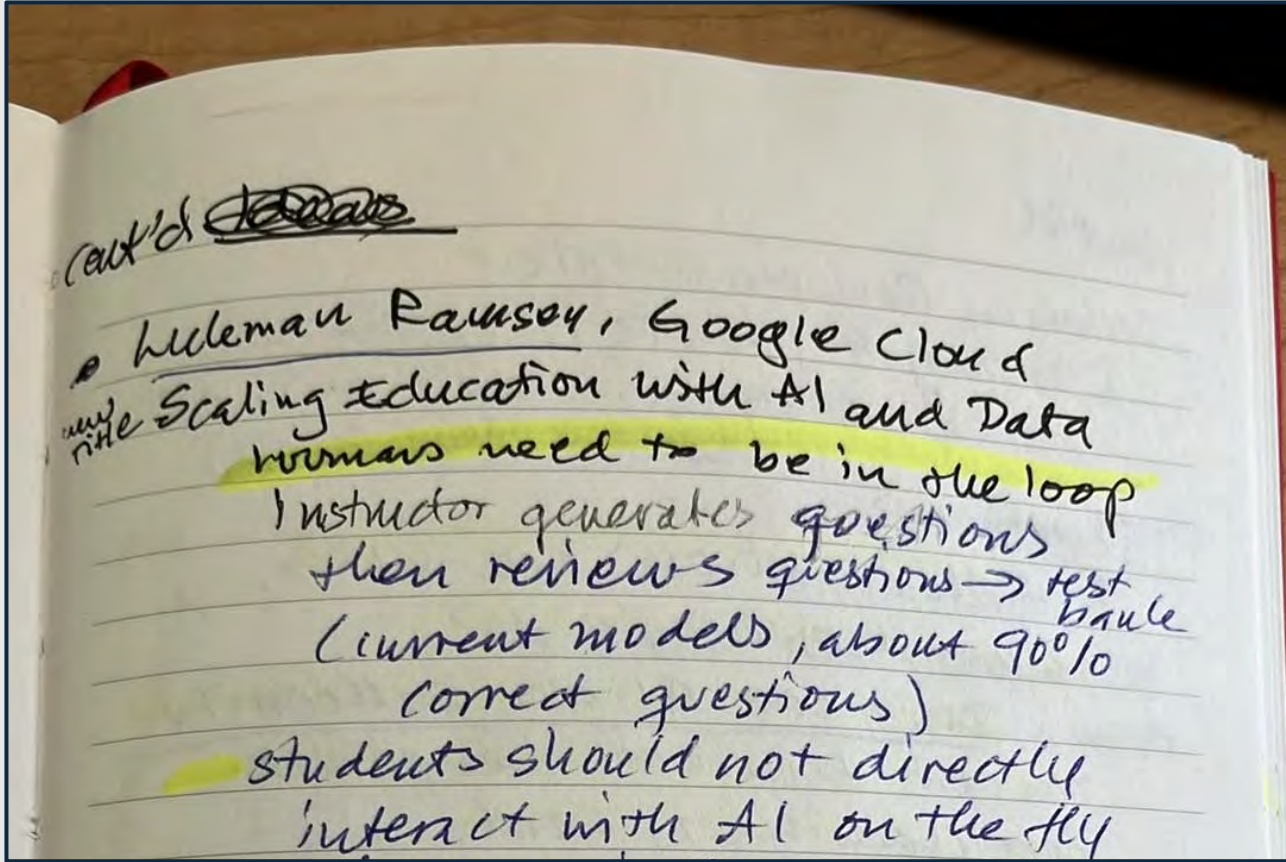
# Suggested student use-cases for AI

- **Text summary** → give an AI one or several articles/whitepapers/books and go from high-level summary to detailed questions - combining data sources, bullet out facts
- **Translation** → easily read articles written in other languages, get tricky language translated into easy-to-understand language, English translated to your native tongue
- **Proof-reading and critique** → get feedback on writing, suggestions for improvements, grammar errors, point out inconsistent style



Made with ChatGPT (DALL-E)

# Handwritten notes to digital text in ChatGPT



Luckman Ramasey, Google Cloud  
Scaling education with AI and Data

**humans need to be in the loop**

(highlighted)

- Instructor generates questions
- then reviews questions → test bank

(Current models about 90% correct questions)

**students should not directly interact with AI on the fly for questions**

(highlighted)

**DO NOT USE THIS FOR PRIVATE OR  
CONFIDENTIAL NOTES**



# Progression of AI models - ChatGPT 3.5

Tell me about the Aripuana plant

The Aripuana plant, also known by its scientific name *Aspidosperma polyneuron*, is a species of flowering tree belonging to the Apocynaceae family. It is native to the Amazon rainforest region, including areas in Brazil, Peru, and Bolivia.

The Aripuana plant is valued for its medicinal properties and has been used traditionally by indigenous peoples in the Amazon for various purposes. One of its primary uses is in traditional

*ChatGPT 3.5 - asked about an uncommon plant (Aripuana).  
Guesses at another species, sounds “correct”, but is incorrect.*

# Progression of AI models - ChatGPT 4

Without searching the internet, tell me about the Aripuana plant

The term "Aripuana plant" doesn't correspond to a specific well-known plant in scientific or popular literature that I am aware of. It's possible that it could be a regional name or a less common name for a plant. Sometimes, plants have local names that may not be widely recognized outside of a specific area or community. If you can provide more context or details, such as the plant's appearance, its uses, or where it's found, I might be able to help identify it or provide relevant information based on those characteristics.

*ChatGPT 4 - asked, without doing web search.  
Clearly states it does not know.*

# Progression of AI models - ChatGPT 4

Tell me about the Aripuana plant

Searched 1 site

The Aripuana plant, scientifically known as **Aripuana cullmaniorum**, belongs to the genus Aripuana in the gentian family, specifically within the tribe Helieae, subclade Symbolanthus. This plant genus is named after the Aripuanã River in central Brazil, which is also the region where this species is found. Currently, Aripuana cullmaniorum is the only classified species within this genus.

*ChatGPT 4 - asked, with web search.*

*Gets basic facts from Wikipedia, can work with those facts.*



# Progression of AI models - ChatGPT 4o

Tell me about the botanical Aripuana plant

The term "Aripuana plant" in a botanical context does not refer to a specific well-known species. However, it is possible that the name might be associated with a particular plant species found in the Aripuanã region of Brazil, which is known for its rich biodiversity.

## General Botanical Context


### Aripuanã Region Flora

- The Aripuanã region, located in the Amazon Rainforest, hosts a vast array of plant species, many of which are unique to the area. This region is characterized by its tropical climate and diverse ecosystems.

*ChatGPT 4o - without additional source. States it doesn't know, provides deep information about surroundings.*

# AI models combined with authoritative information - **NEW** Botanical GPT (uses GBIF)

Botanical GPT ▾



Talked to api.gbif.org

Talked to api.gbif.org

The plant genus **Aripuana**, classified under the authorship of Struwe, Maas, and V.A. Albert, belongs to the family Gentianaceae. Here are some key details about Aripuana:

- **Kingdom:** Plantae
- **Phylum:** Tracheophyta
- **Class:** Magnoliopsida
- **Order:** Gentianales
- **Family:** Gentianaceae
- **Genus:** Aripuana
- **Taxonomic Status:** Accepted
- **Published In:** Harvard Papers in Botany, 1997

The genus Aripuana is currently recognized and accepted within scientific literature and has one known descendant species.

↓

*ChatGPT connected to  
GBIF API*

*Provides detailed,  
correct information.*

*Can use these facts in  
flowing text after  
retrieval.*



# AI models combined with authoritative information - Perplexity.ai

🕒 Just now

Tell me about the Aripuana plant genus.

Tell me about the Aripuana plant genus.

☰ Sources

Aripuanã - Wikipedia

🌐 en.wikipedia · 1

Genus Aripuana · iNaturalist United...

🌿 uk.inaturalist · 2

Aripuana Struwe, Maas & V.A.Albert | Plants of the...

🌐 powo.science · 3

🌸 📖

View 2 more

✳️ Answer

The Aripuana is a plant genus in the gentian family (Gentianaceae), tribe Helieae, subclade Symbolanthus. It is named after the Aripuanã River in central Brazil. <sup>2</sup> <sup>3</sup> <sup>4</sup> The genus was first published in 1997 in the Harvard Papers in Botany. <sup>5</sup>

Aripuana is native to northern Brazil and currently contains only one accepted species, Aripuana cullmaniorum. <sup>3</sup> <sup>5</sup> This species is found in the white-sand areas of southeastern Amazonas state in Brazil. <sup>5</sup>

The genus was established to accommodate this unique plant, which exhibits several distinctive morphological features that set it apart from other genera in the gentian family.

*Perplexity.ai - using several sources (Wikipedia, iNaturalist, POWO, scientific publication) to provide accurate information.*

***Information was accurate.***



# Fact-checking ChatGPT, step 1 (assignment)

**Learning goals:** Using critical evaluation of facts using scientific sources to provide fact checking of text written by AI (such as ChatGPT)

First: Pick a [poorly known] plant genus.

- **Use this exact prompt in ChatGPT:**  
“Write a 100-word fact-based botanical essay about *XinsertgenusnamehereX*, include number of species, family classification, and geographic distribution.”
- Copy the prompt and the resulting ChatGPT answer into answer sheet.
- Fact check every statement provided by ChatGPT against trusted scientific sources: POWO, IPNI, Tropicos, GBIF, etc. Color code the text.
- Provide a list of all scientific sources you used for fact-checking.

*[student assignment by Lena Struwe, available upon request]*

# Fact-checking ChatGPT, step 2 (assignment)

ChatGPT 4o: Aripuana is a **genus of flowering plants** classified under the family **Apocynaceae**. This genus comprises **a few species**, with **Aripuana cullmaniorum** being **one of the most notable**. These plants are **native to the Amazon rainforest in Brazil, specifically found in the Aripuanã River basin, from which the genus gets its name.** Aripuana species are **typically small trees or shrubs that thrive in the humid, tropical environment of the Amazon.** They are known for their **leathery leaves and white to pale yellow flowers**, which **contribute to the rich flora of the region** and play a role in the **intricate ecological web of the rainforest.**

**ChatGPT 4o is much accurate than the free ChatGPT 4 and 3.5.**

## COLOR LEGEND

**green** = correct

**yellow** = a little correct

**red** = wrong

**light blue** = can't tell (no information available)

**grey** = vague, no real facts ('word filling')

**pink** = dramatic, subjective statements, impossible to evaluate accuracy

# Education in the AI world - advice

- How do we **know** that the students learned something in a **meaningful and efficient** way?
  - How do we measure **competencies**?
  - How do we make students **engaged**?
  - What really is **critical thinking**?
  - What **skills** should students **master**?
- Use **real, hands-on** things (plants, algae, fungi) **related to the lived world** of students.
- **Draw by hand** to learn to see, **discuss** and problem solve in person, **handwrite** quiz answers.
- **Learn and teach AI tools** (students will use them). Have **clear rules** for AI use in syllabus.
- ***Show them that YOU love botany.***



Eva Hedström photographing plants.  
© Åke Struwe





# What will happen next?

- **Technology is ahead of regulations and the law** - new EU rules for AI
- **Ethical understanding and Academic Integrity** rules in curricula are lagging
- **More AI** will be incorporated and used
- **Bad AI** will happen
- AI models will be **more refined**
- AI will be **helpful**, save us time, but how do we teach the skills to use **critical thinking** while using it



# Questions?



Remember: AI can't make things like this ↑  
(handmade nature journaling page from Botany 2023 conference)

*These presentation slides will be available on BotanyDepot.com*

**Contact info:**

**Dr. Lena Struwe**  
lena.struwe  
@rutgers.edu



**Anders Ivarsson**  
anders.ivarsson  
@gmail.com





**Thank you**