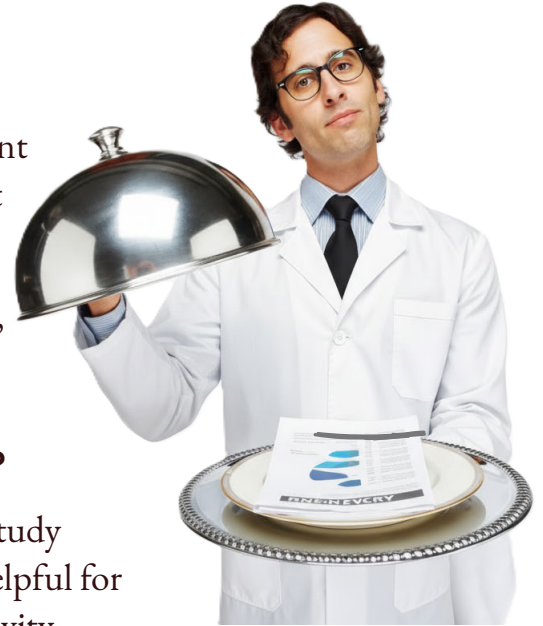


Models and Laboratory Studies

What are laboratory studies and models?

A lab study is a type of research conducted in an environment with controlled conditions. Such studies share an important similarity with scientific models, which are “physical, conceptual, or mathematical” representations used to “explain and predict the behavior of real objects or systems,” often via computer simulations.



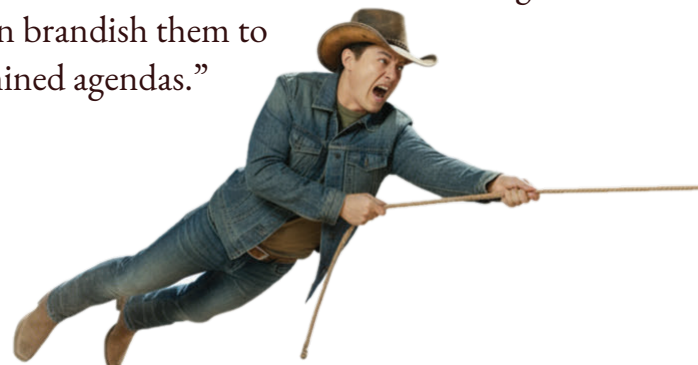
How can lab studies and models be informative?

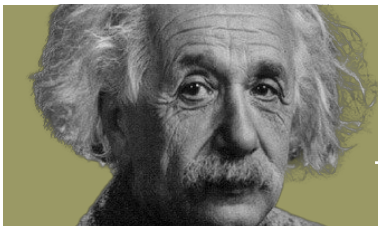
Their controlled conditions allow researchers to isolate and study interactions between different variables. They are also very helpful for discovering or measuring fundamental laws of nature like gravity.

How can lab studies and models mislead?

Reality is often much more complicated than the simplified conditions and parameters used for these studies. In other words, they can’t accurately replicate all of the relevant variables and interactions of complex biological or social systems like human bodies, our planet’s ecosystem, or nations’ economies. As 22 professors and researchers wrote in the scientific journal *Nature*:

- “Mathematical models produce highly uncertain numbers....”
- “Modellers must not be permitted to project more certainty than their models deserve....”
- “Rather than using models to inform their understanding, political rivals often brandish them to support predetermined agendas.”





Models and Laboratory Studies

How can you use lab studies and models to expand your understanding instead of warping it?

- 1) **Realize** that they can be a **great place to start** but a **horrible place to end**.
- 2) **Learn how to spot them** by watching for tell-tale signs like predictions about the future, artificial conditions, or words like “simulation” and “in vitro.”
- 3) Use **lab studies** to measure **basic laws of nature** like those that govern motion and electromagnetism.
- 4) Use **lab studies** to discover “whether something *can* happen, rather than whether it typically *does* happen” in the real world.
- 5) Use models and computer simulations for **engineering and physics** where the applicable laws of nature are **clear-cut and precise**.
- 6) **Be aware** that despite tight controls, lab studies may not be **reproducible**, rendering them largely **useless**.
- 7) **Tread very lightly** when authors aren’t crystal clear about their **assumptions and limitations**.
- 8) **Don’t rely** on lab studies if **observational studies** are available, and don’t rely on observational studies if **RCTs** are available.
- 9) Use lab studies **in combination** with observational studies and RCTs to gain “**deeper insights**” than using them all in “isolation.”



REMEMBER: To research like a genius, you must be aware that scientific models **DON’T** always equal real life.