

Keys for Successful Research

BAE 815

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In college

- Your main job is to **consume** knowledge.
- You study really general things.

In grad school

- You're expected to **produce** knowledge.
- You focus on something very specialized.

Why do universities need research?



Increase university reputation



Attract the best experts



Increase research funding

“Research is the zenith of education”

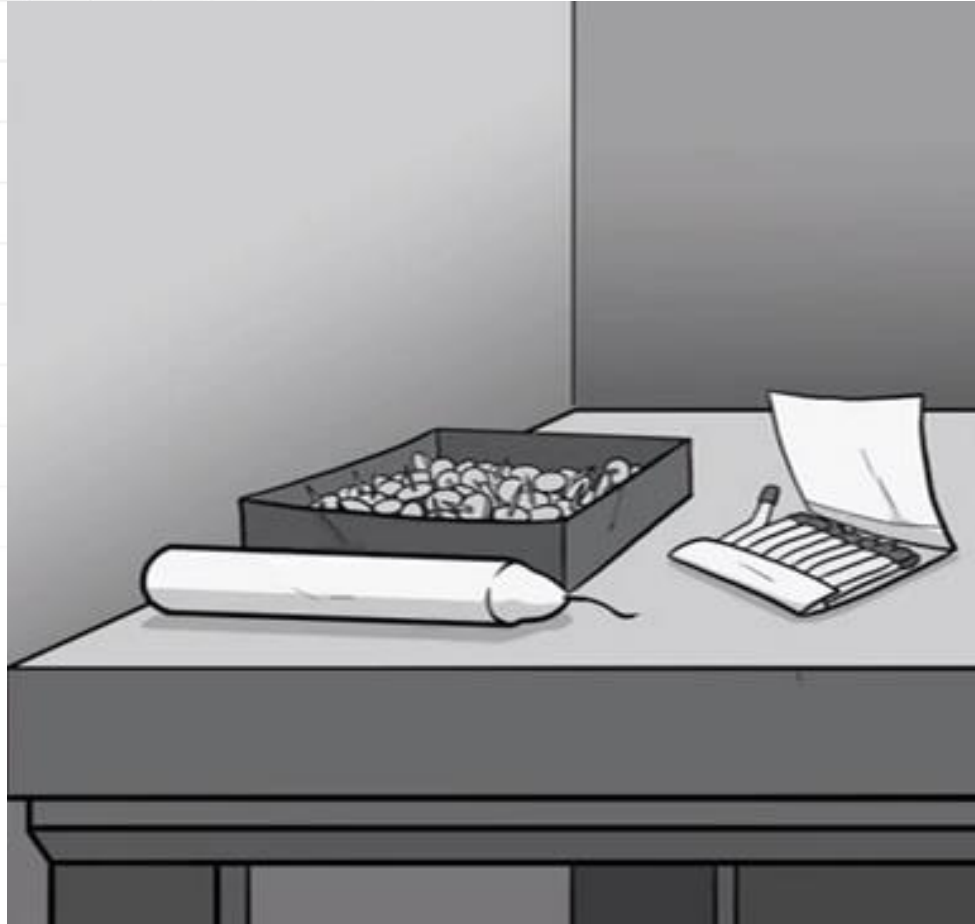


Why do you do research?

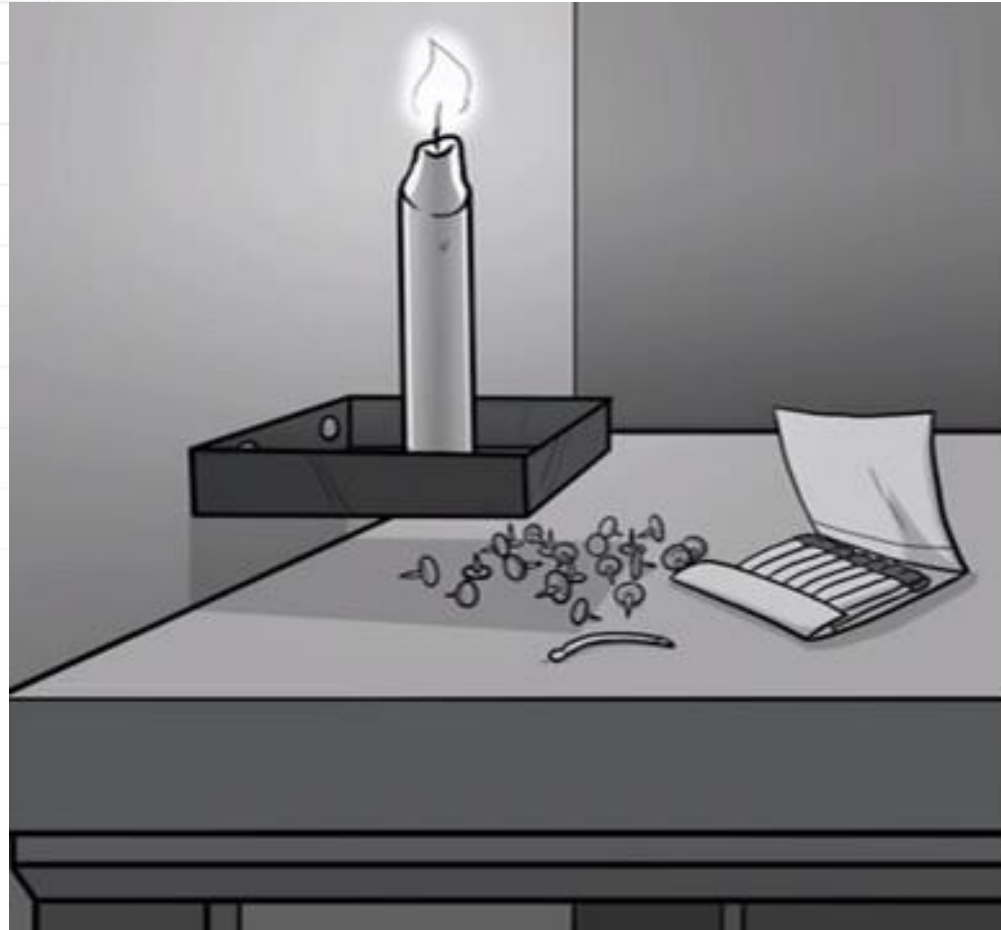
- External drive
 - to get degree, diploma, career ...to become a scientist.
- Internal drive
 - to pursue your interests (curiosity).
 - to make a real contribution to knowledge (sense of achievement and responsibility).
 - to solve a problem.
 - to hone your problem-solving skills and to challenge yourself in new ways.

A worried
mother does
better
research
than the FBI

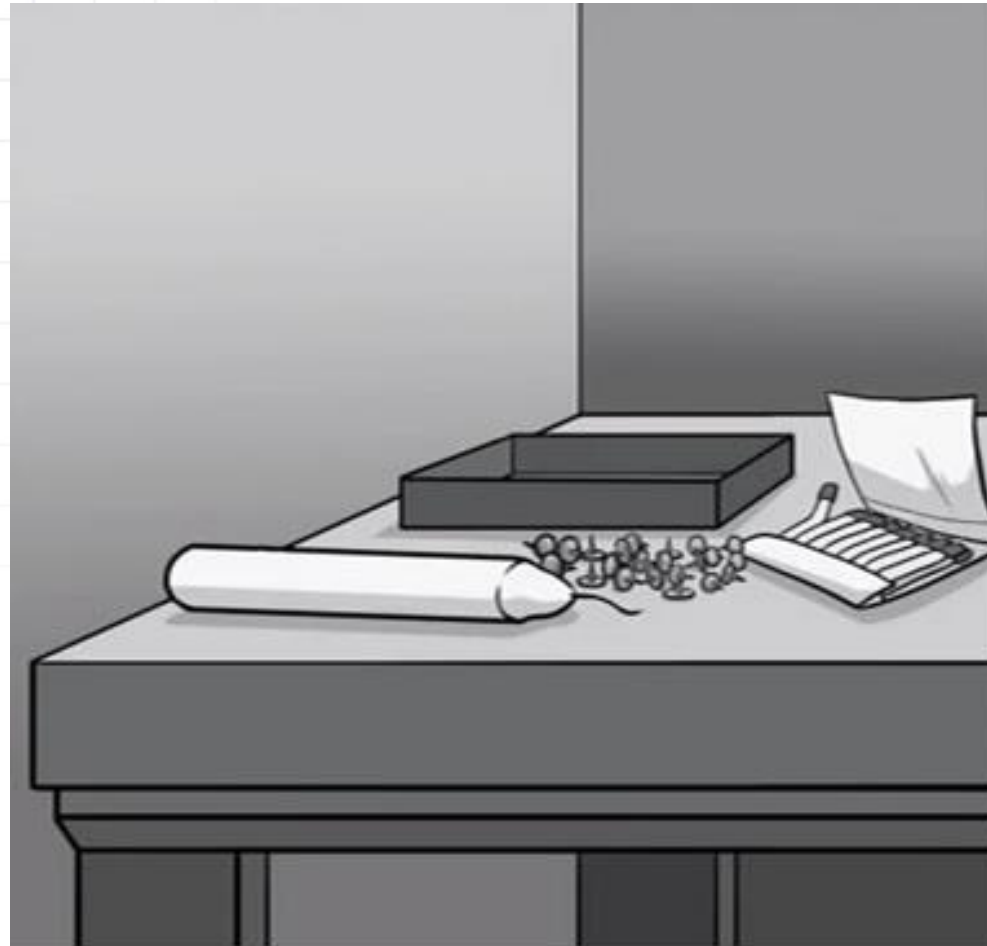
The candle problem



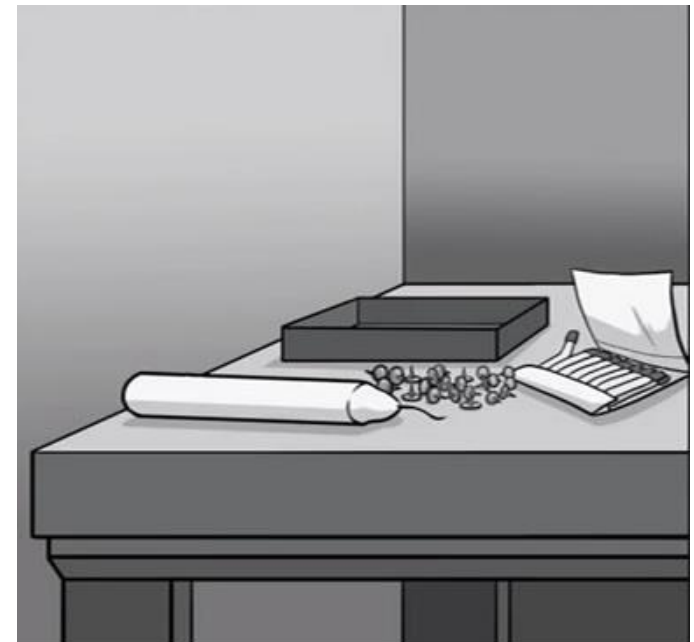
The candle problem



The candle problem for dummies



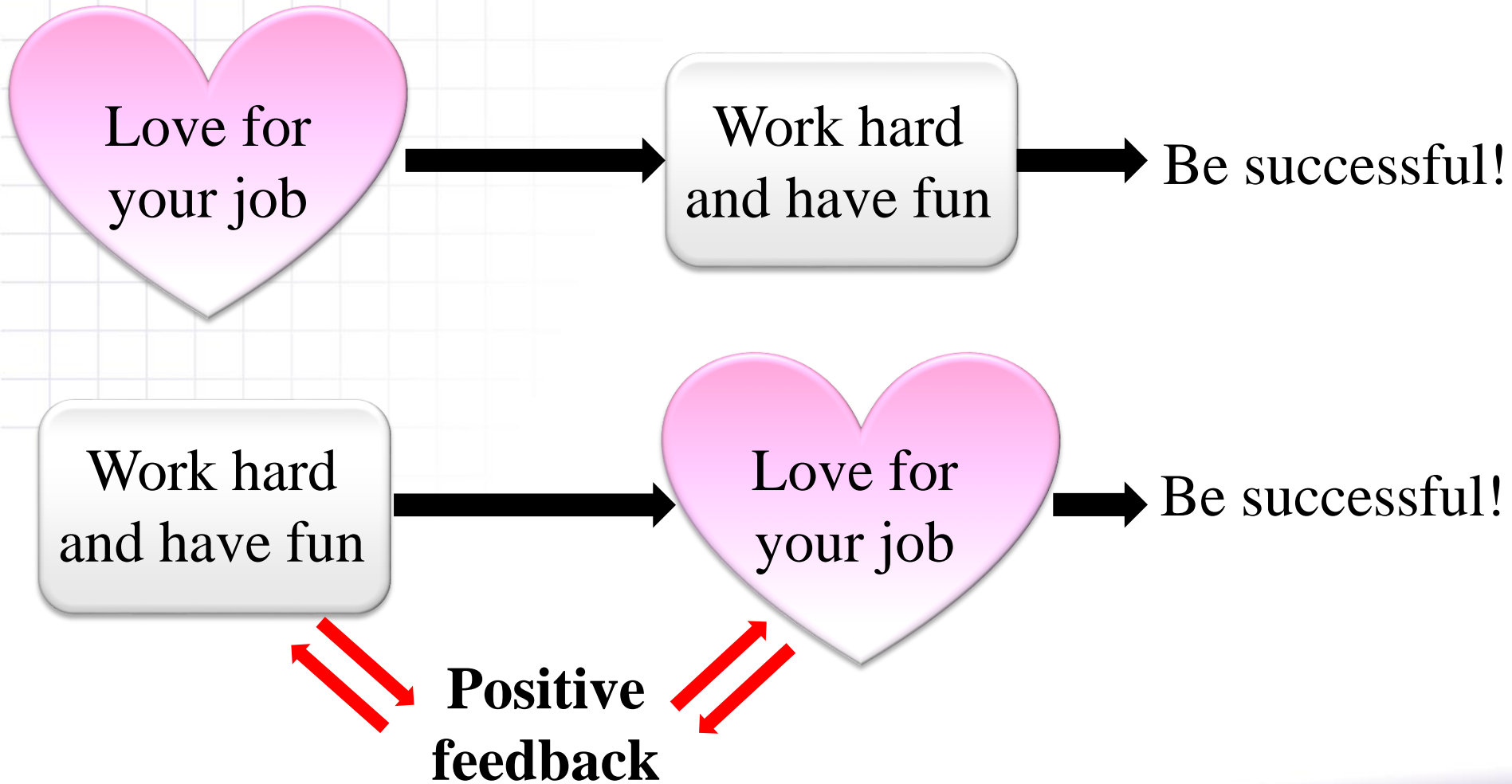
Everybody is dealing with their own version of the candle problem



Conducting research that makes a difference

- Always ask yourself: “what’s the novelty of my research?”
- Do follow
 - Your goals & interests; defining your interests in terms of your audience
- Don’t follow:
 - The money; the latest fad; what will get published; what others want you to do

Create your internal drive

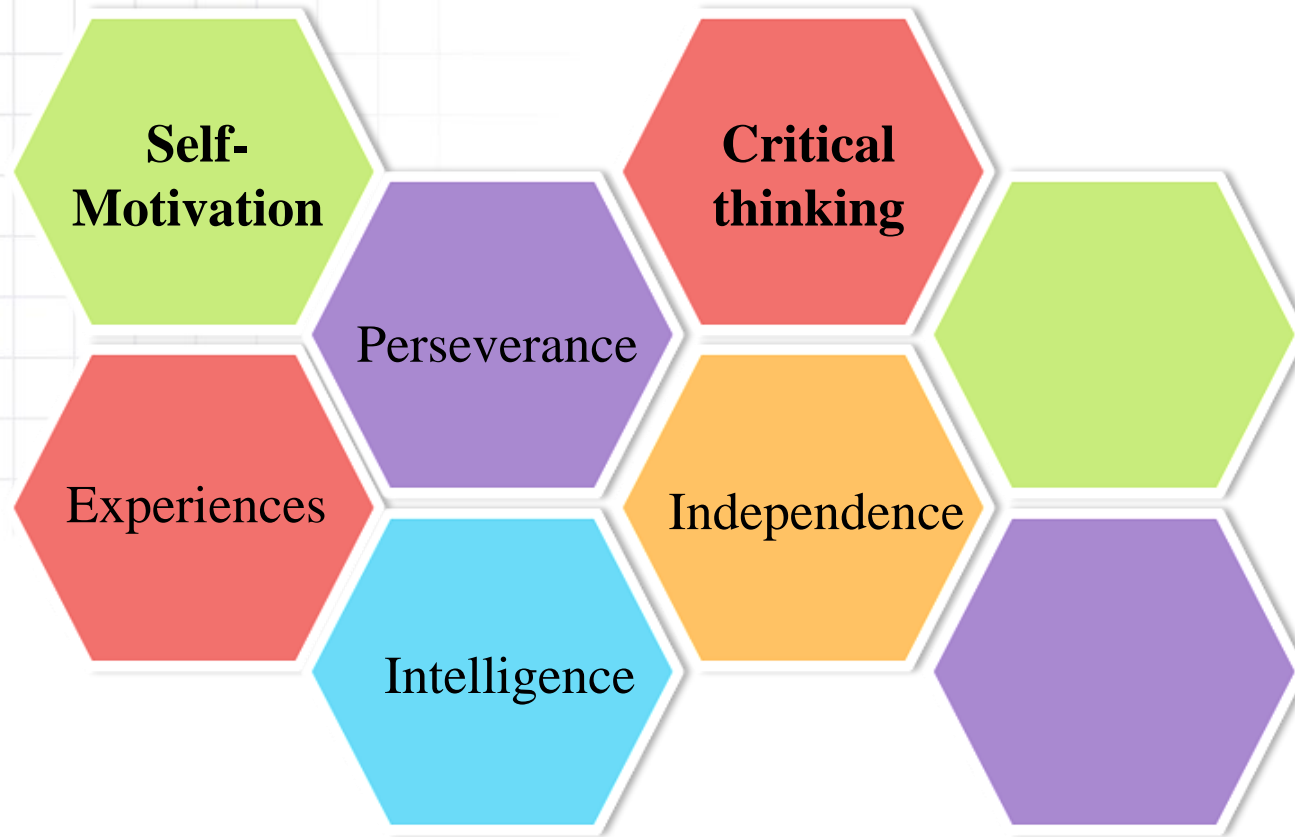


Take ownership of your degree

- No one is responsible for getting your degree but you
 - Faculty set up opportunity, but it's up to you to leverage it



What do you need to be successful in research?

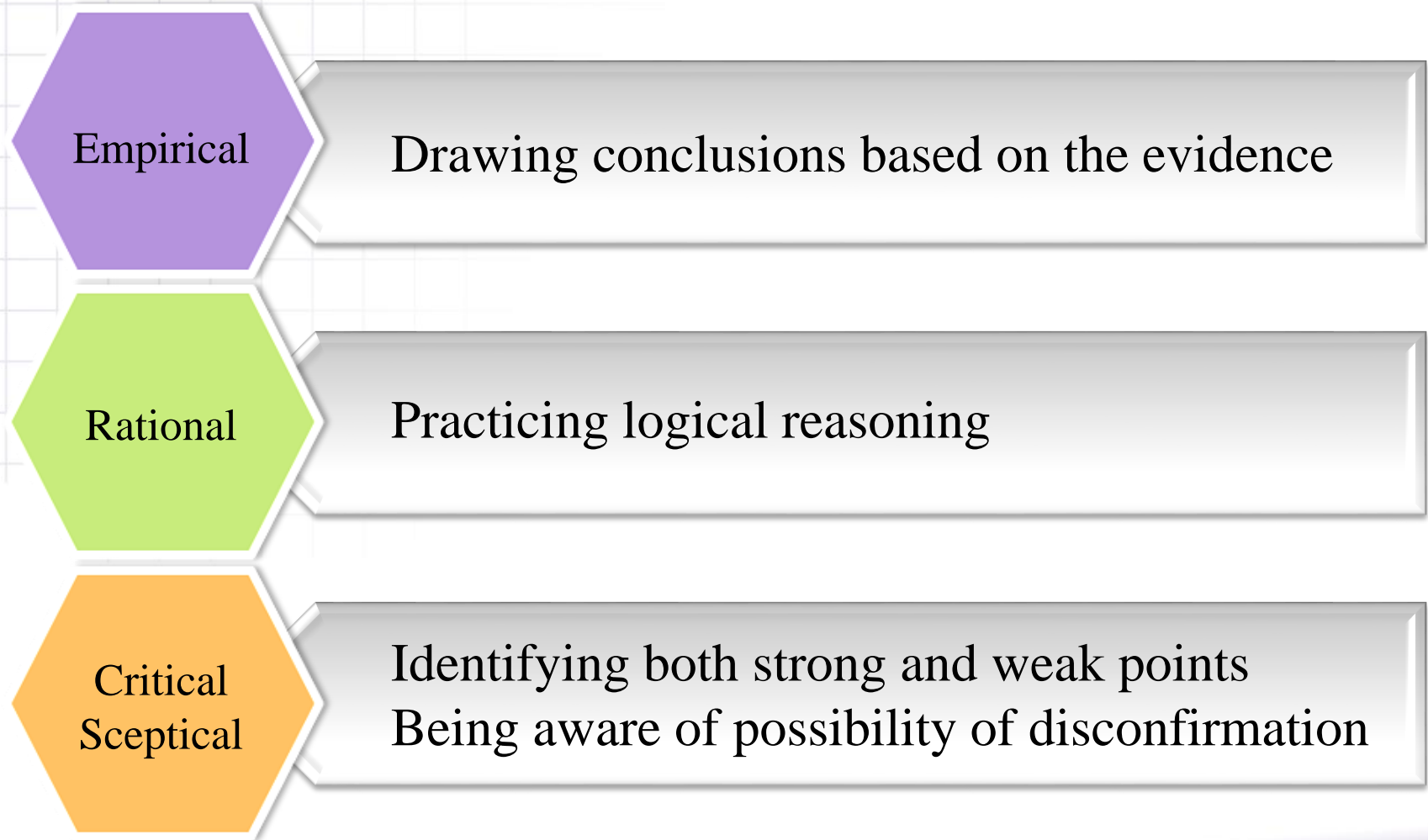


“Scientific research is **systematic, controlled, empirical** and **critical** investigation of hypothetical proposition about the presumed relations among natural phenomena.”

- *F. N. Kerlinger*



Being scientific



Science and falsifiability

“Whenever a theory appears to you as the only possible one, take this as a sign that you have neither understood the theory nor the problem which it was intended to solve.”

Karl Popper

“To know the history of science is to recognize the mortality of any claim to universal truth.”

- *Evelyn Fox Keller*

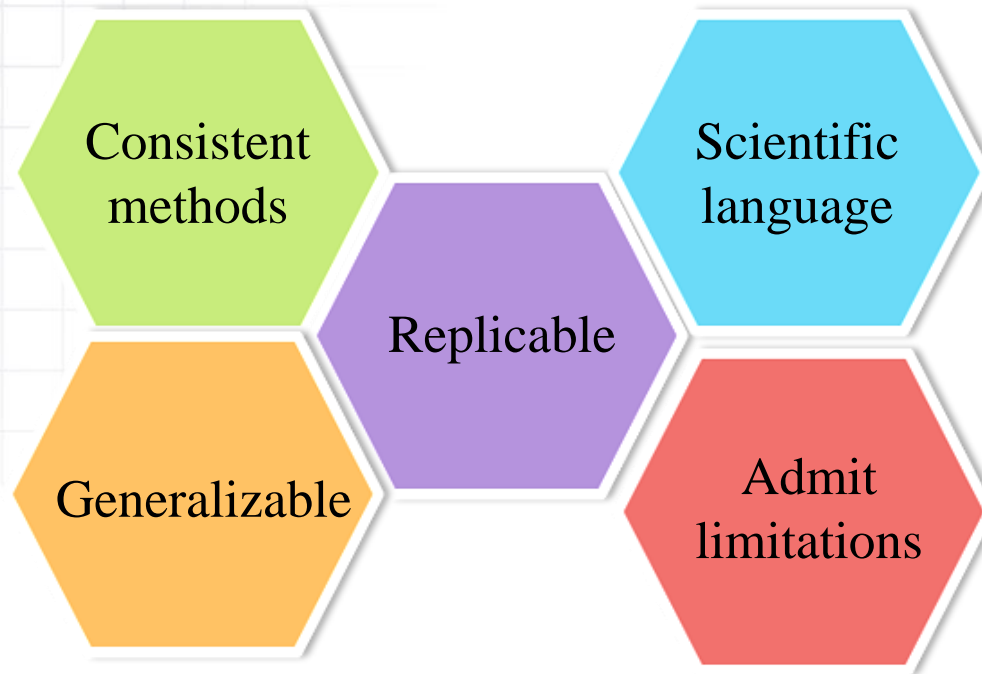
“The aim of science is not to open the door to infinite wisdom, but to set a limit to infinite error.”

- *Bertolt Brecht*

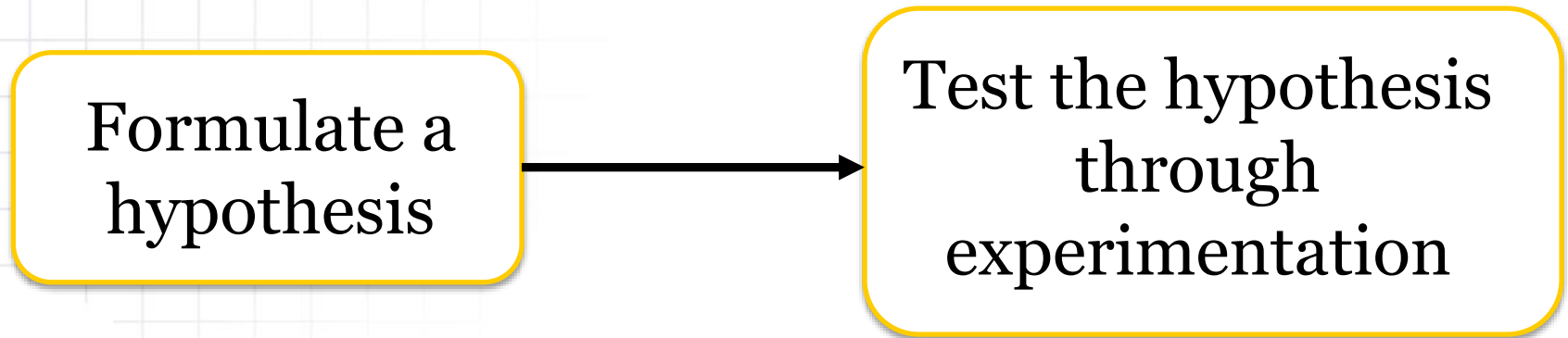
Correlation does NOT necessarily imply causation

- Children who get tutored get worse grades than children who do not get tutored
- The more fire engines sent to a fire, the bigger the damage
- Social drinking and earnings
- Shoe size and reading ability
- Ice cream consumption and rate of drowning
- Energy consumption and economic growth
- Obesity and diabetes

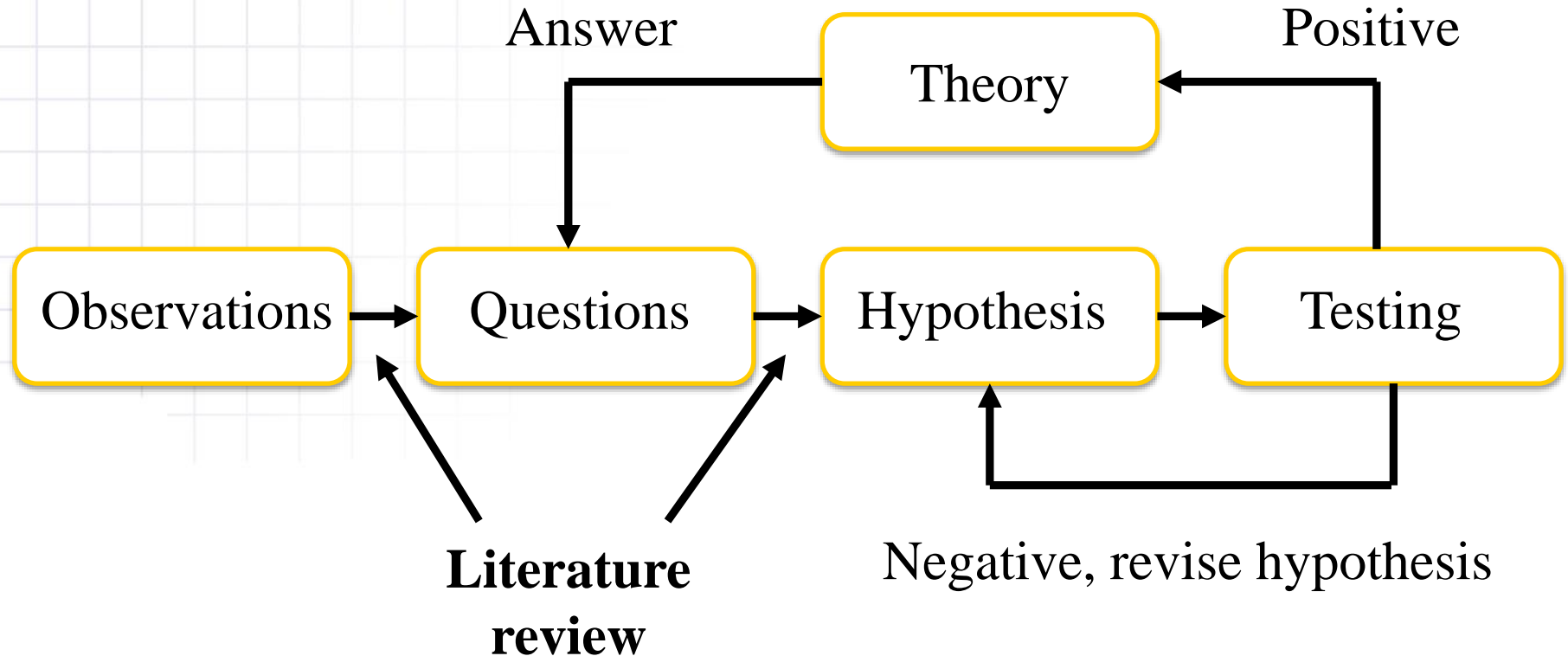
Being systematic



The hypothetico-deductive method



Classical scientific research



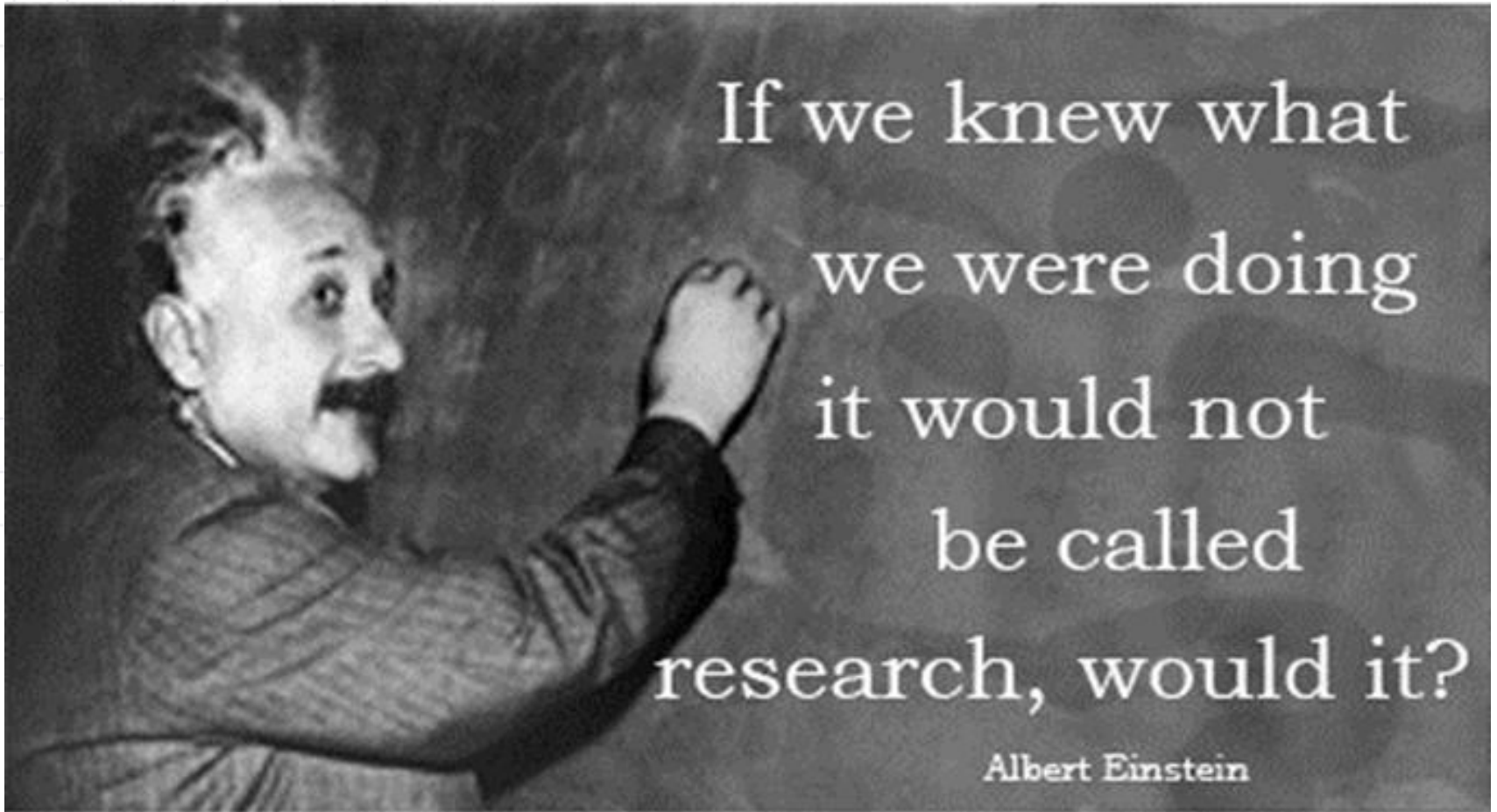
Nature of Research

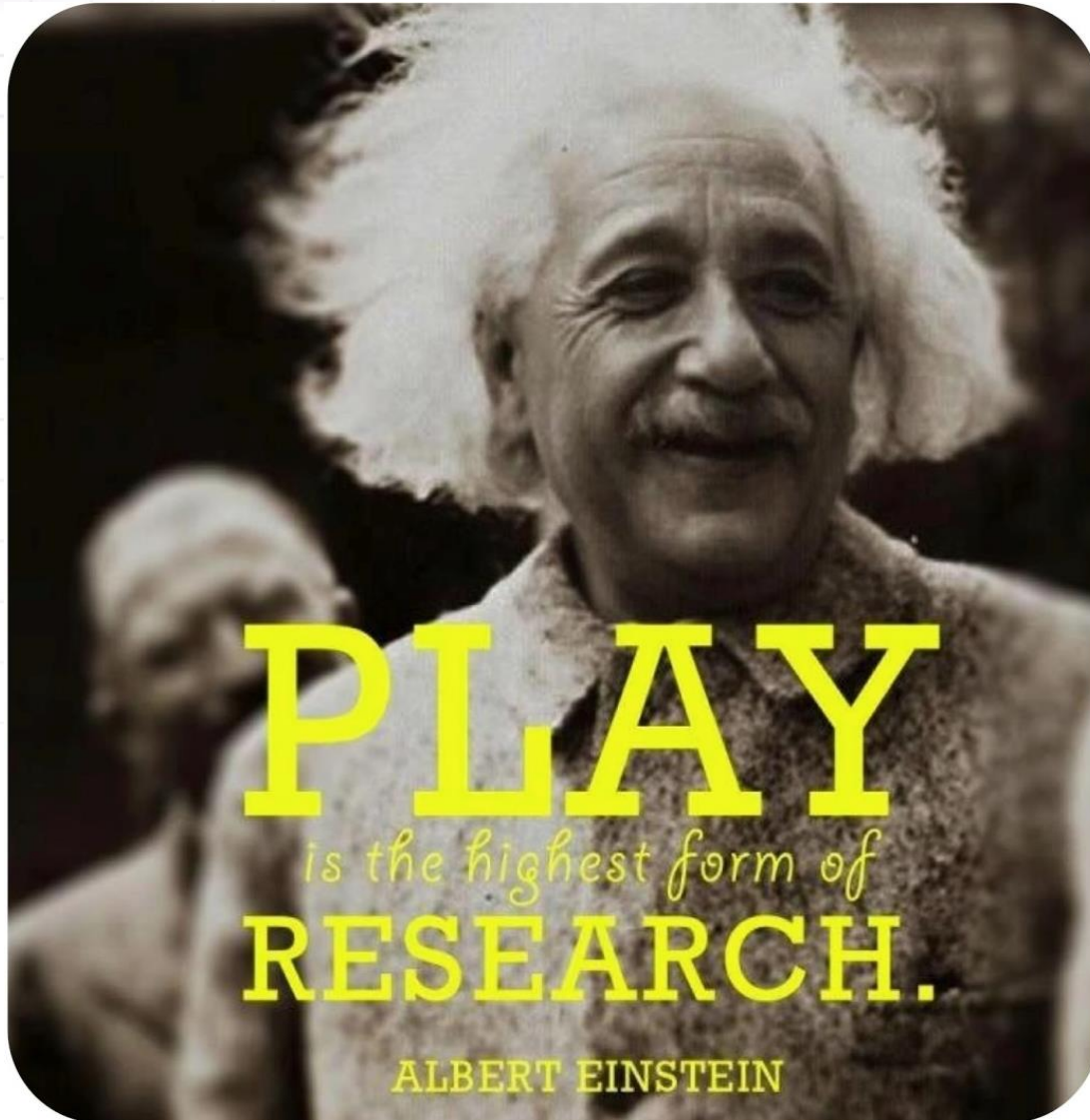
“Research brings you so close to the edge of what is known and unknown.”

- *Dalziel Soto*

“That's the nature of research - you don't know what in hell you're doing.”

- *Harold "Doc" Edgerton*





“The most exciting phrase to hear in science, the one that heralds new discoveries, is not 'Eureka!' (I found it!) but 'That's funny....' ”

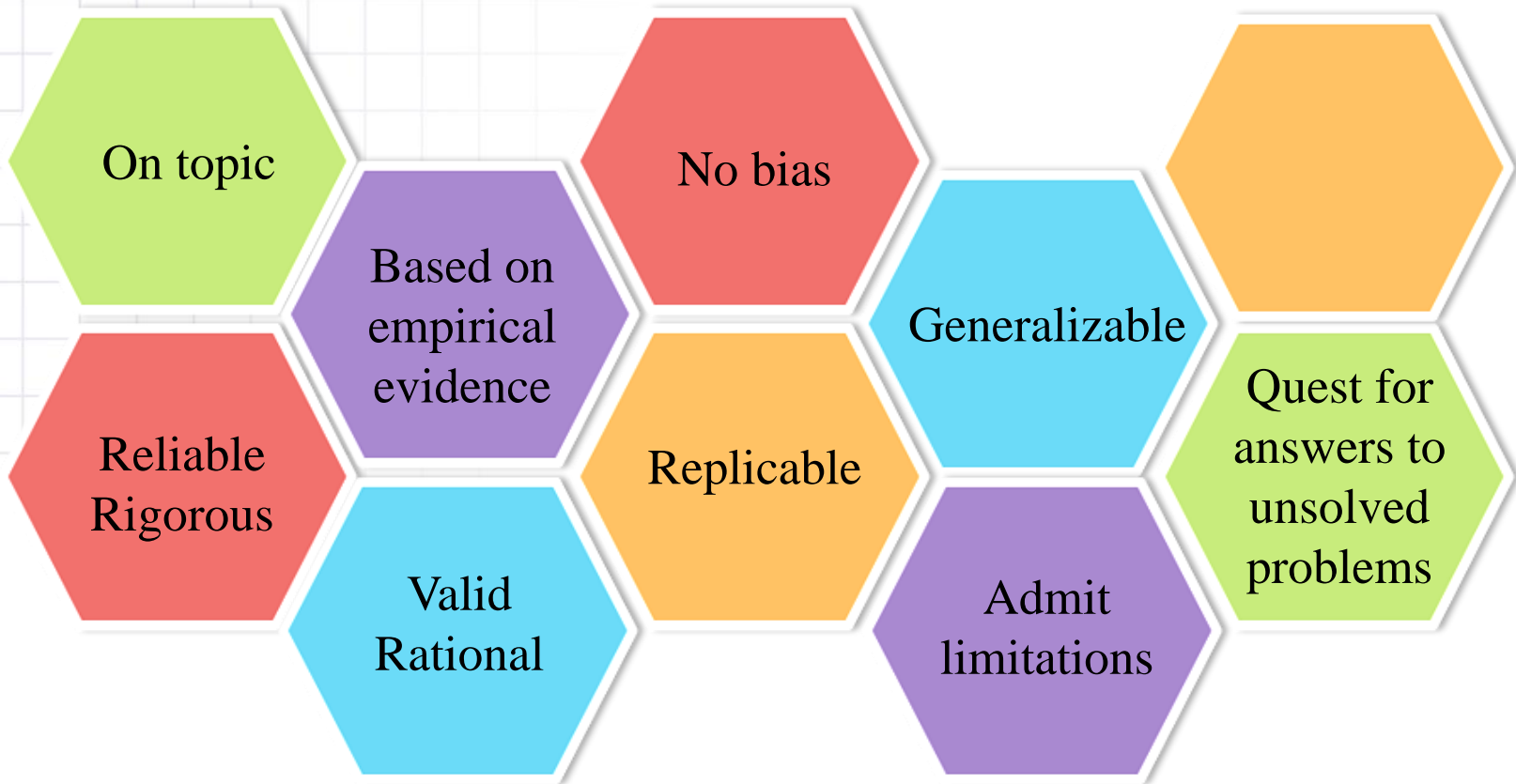
-Isaac Asimov

Play with it until

- You break it
- It breaks you
- You discover something more interesting to play with

From Jeff E. Janes

Good academic research



Take home message

- Find your internal motivation
- Develop critical/scientific thinking