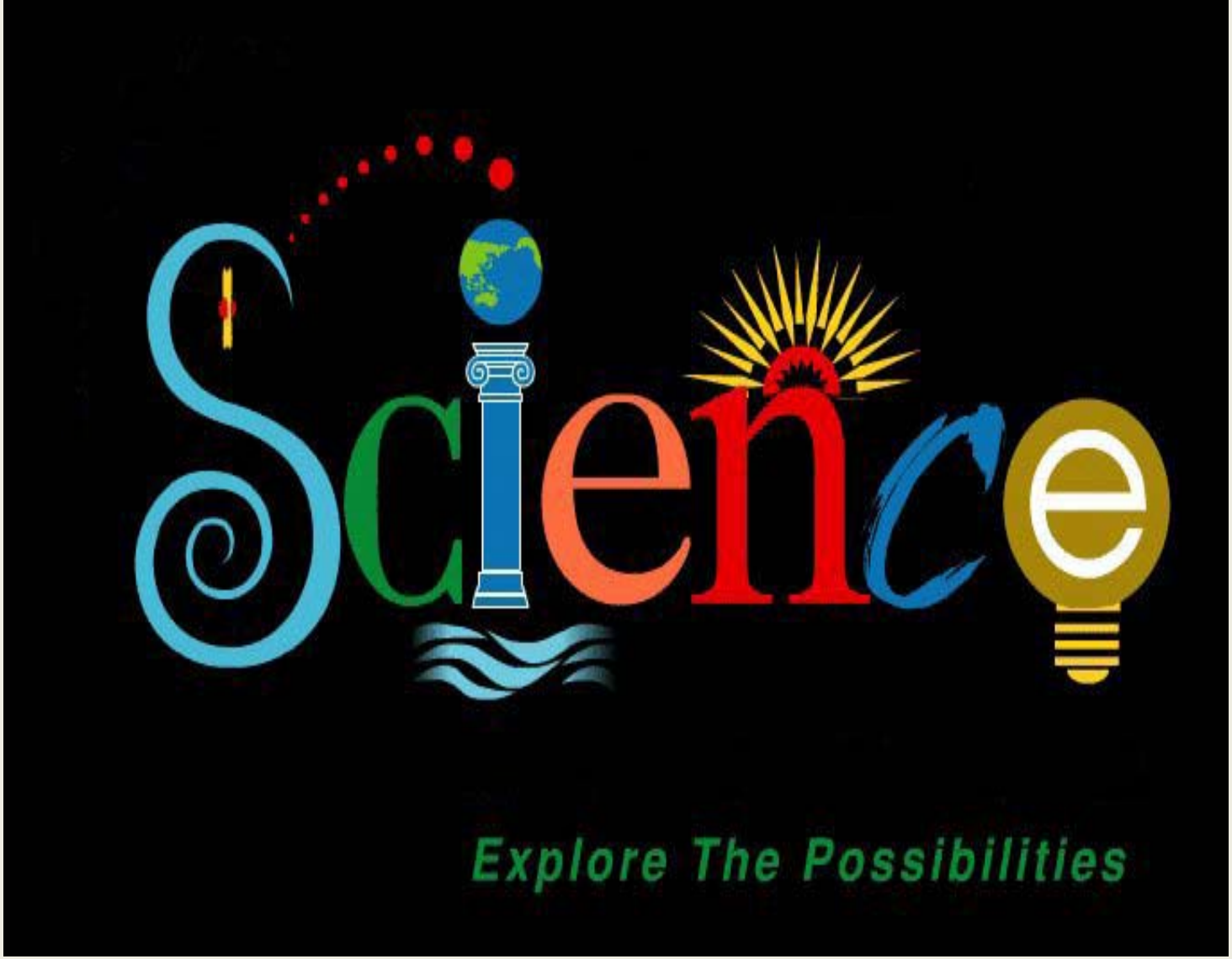


Bob Gemin WPAFB Educational Outreach

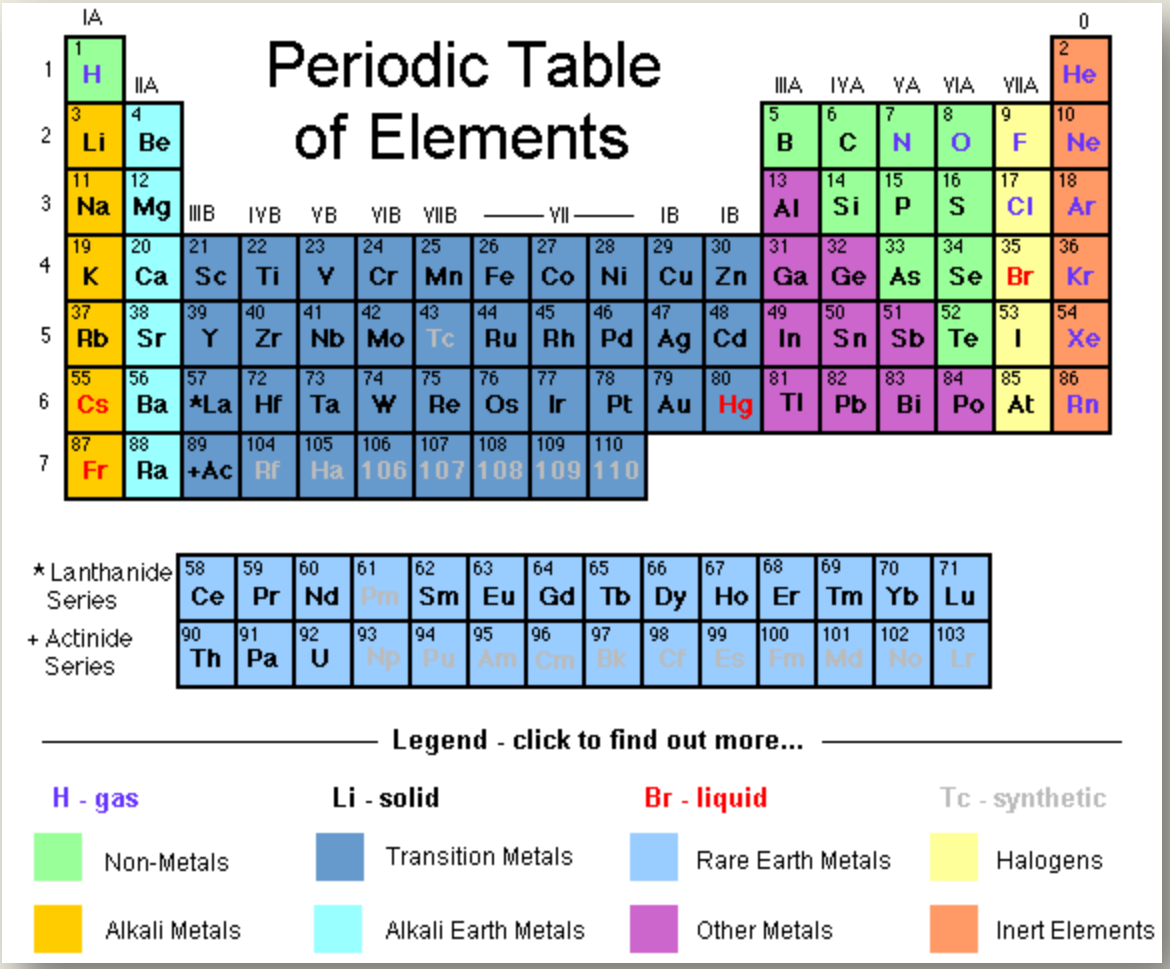
A Puzzle and an Adventure

Have you ever asked yourself,

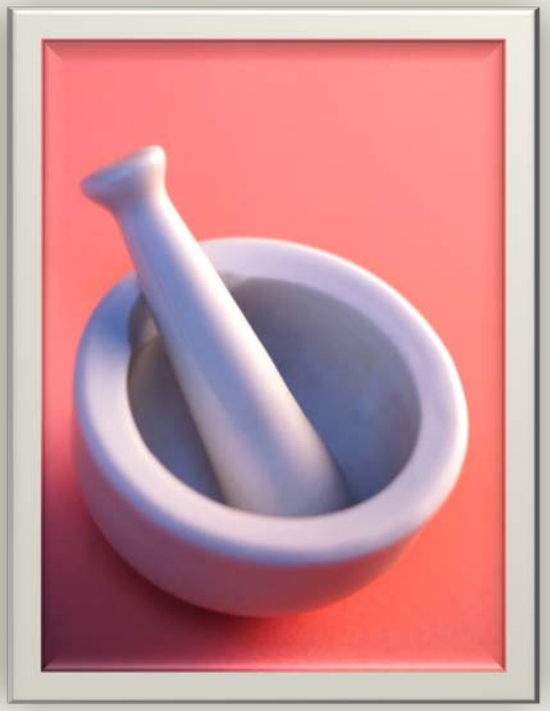
"Why would I want to learn science over any other subject?"

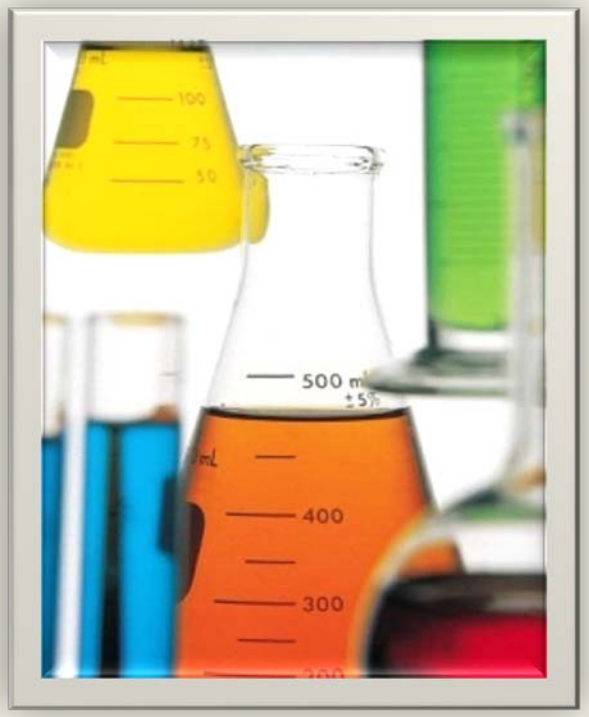
Science is unique in that science facts are not determined by man, it is not a language or history of man, it is not governed by the rules of man.

Science is not subjective since the facts of science would be true without their discovery.

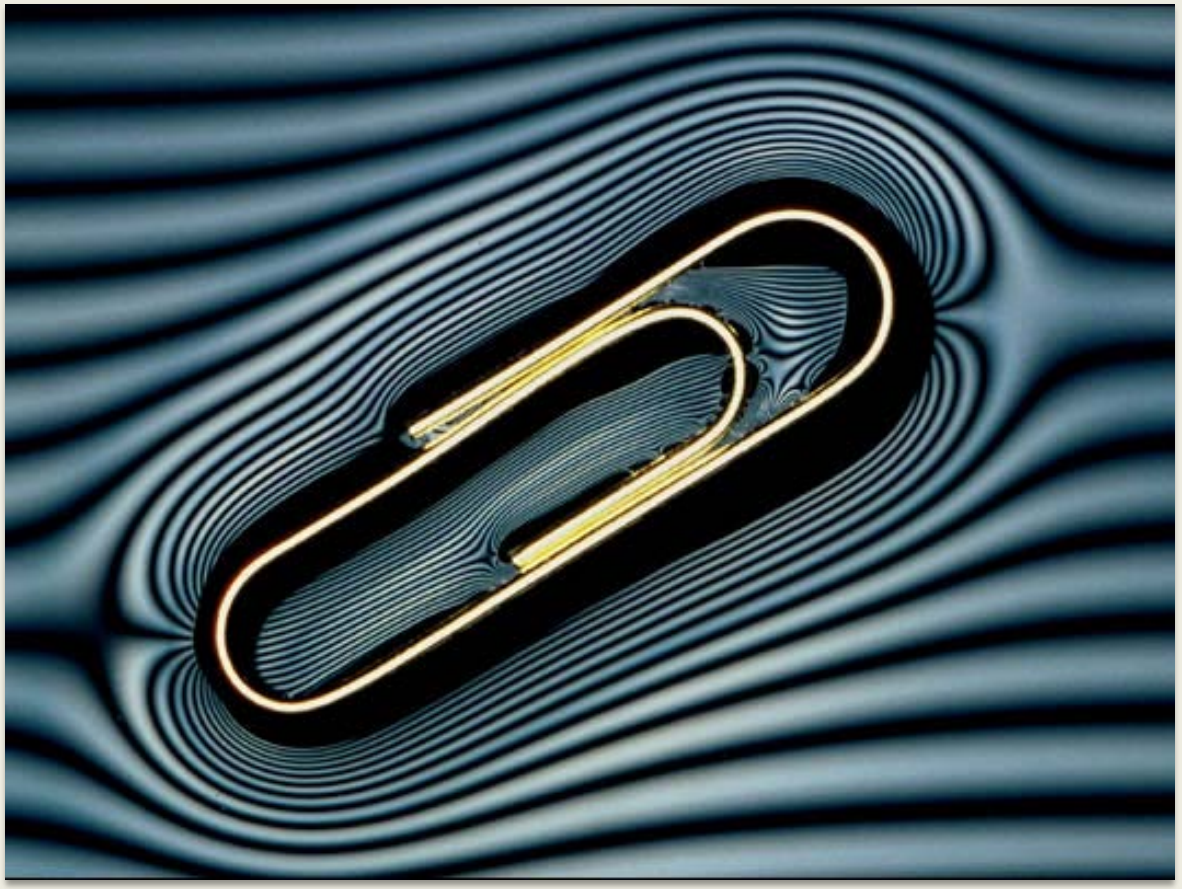


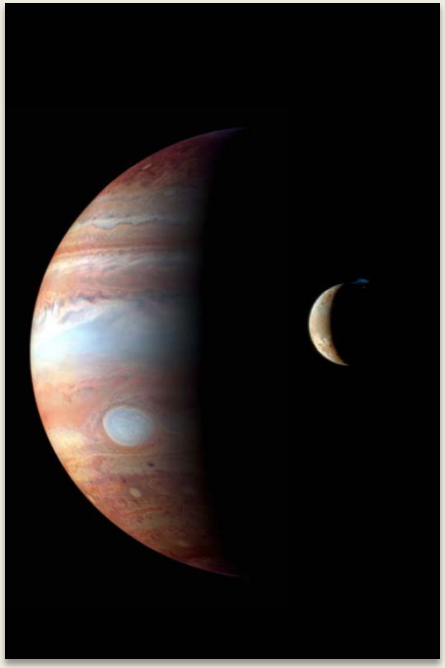
Yet learning science is not the memorization of facts.

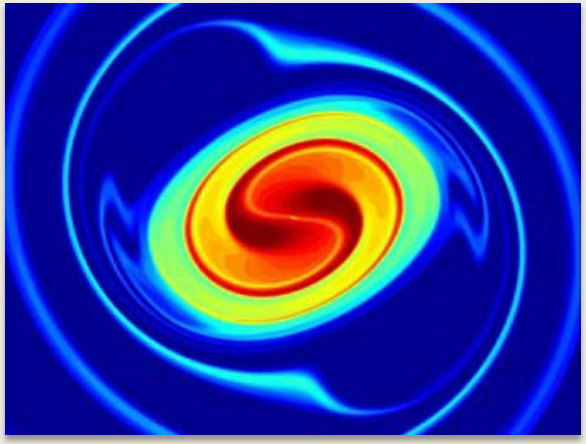


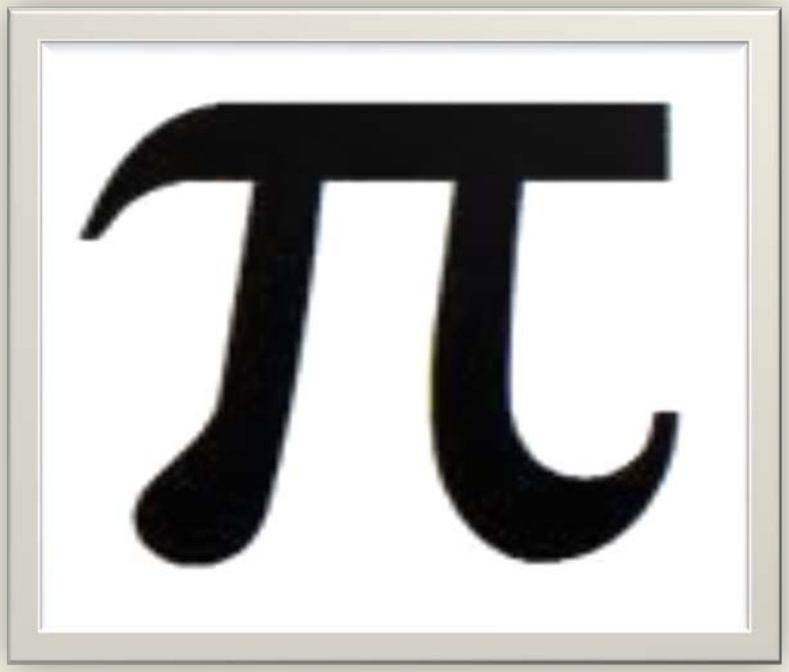


Allow me to explain why I believe science is both an **adventure** and a **puzzle**.

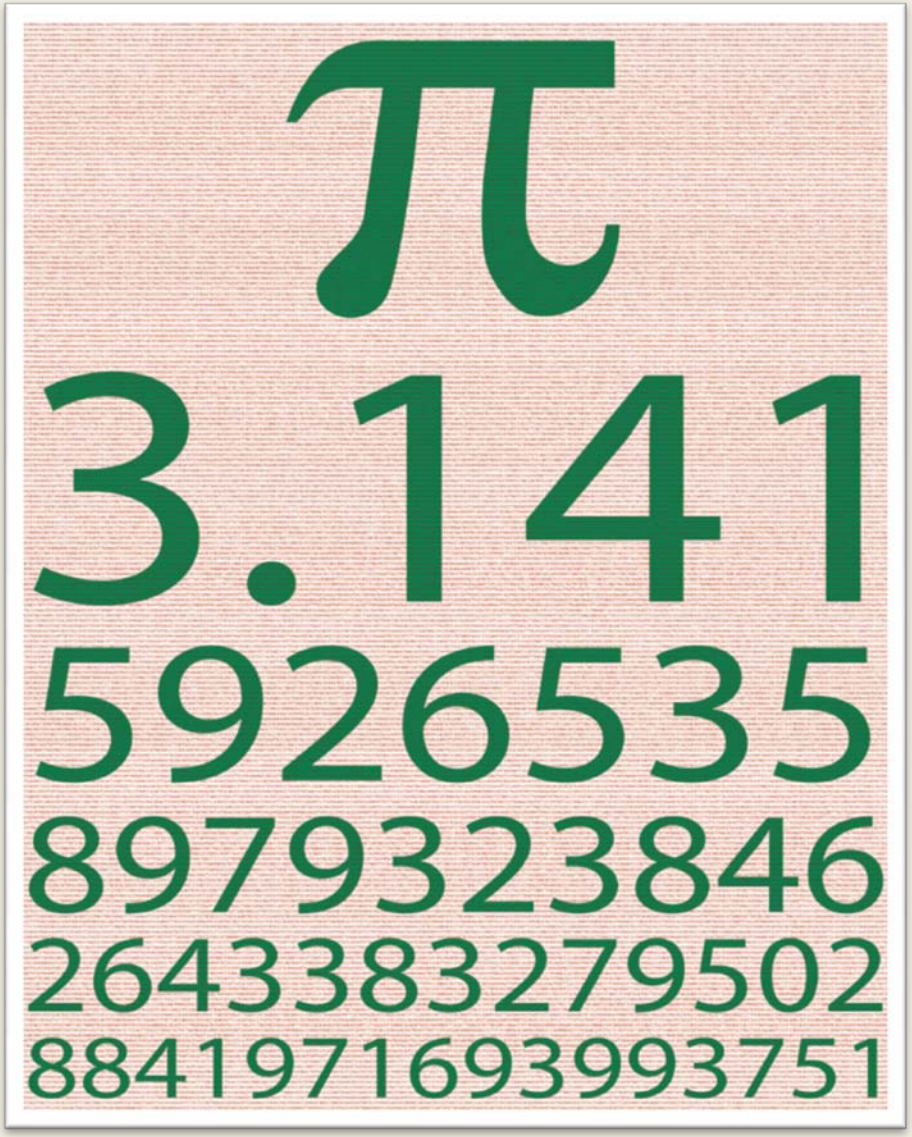


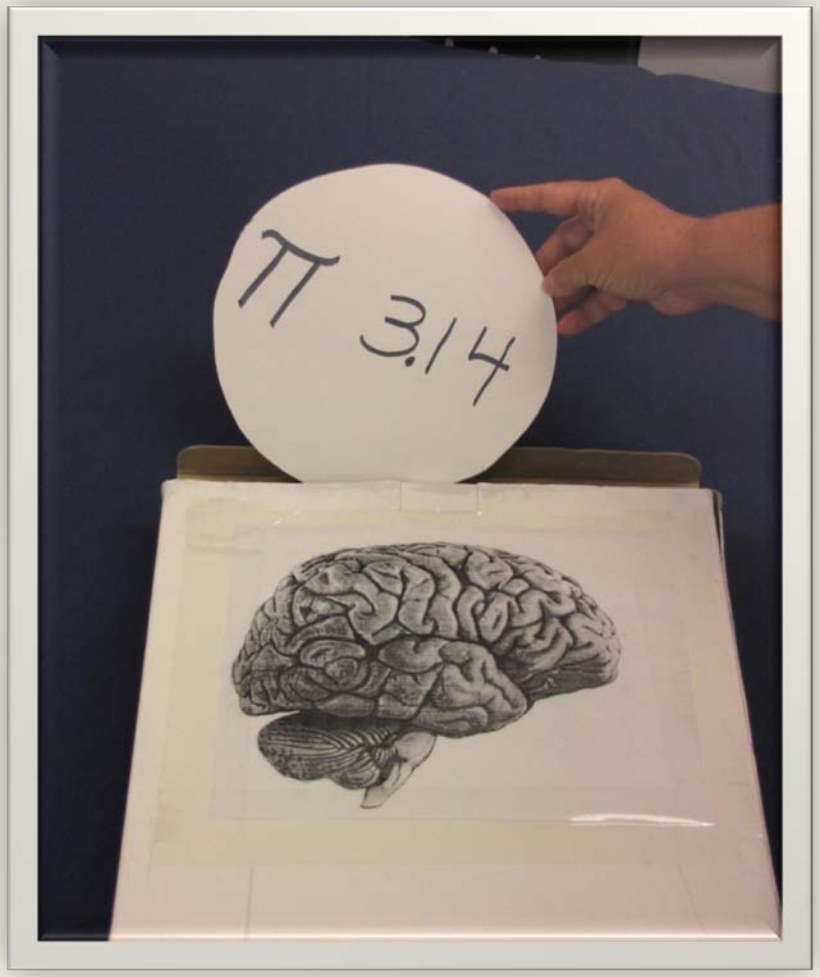




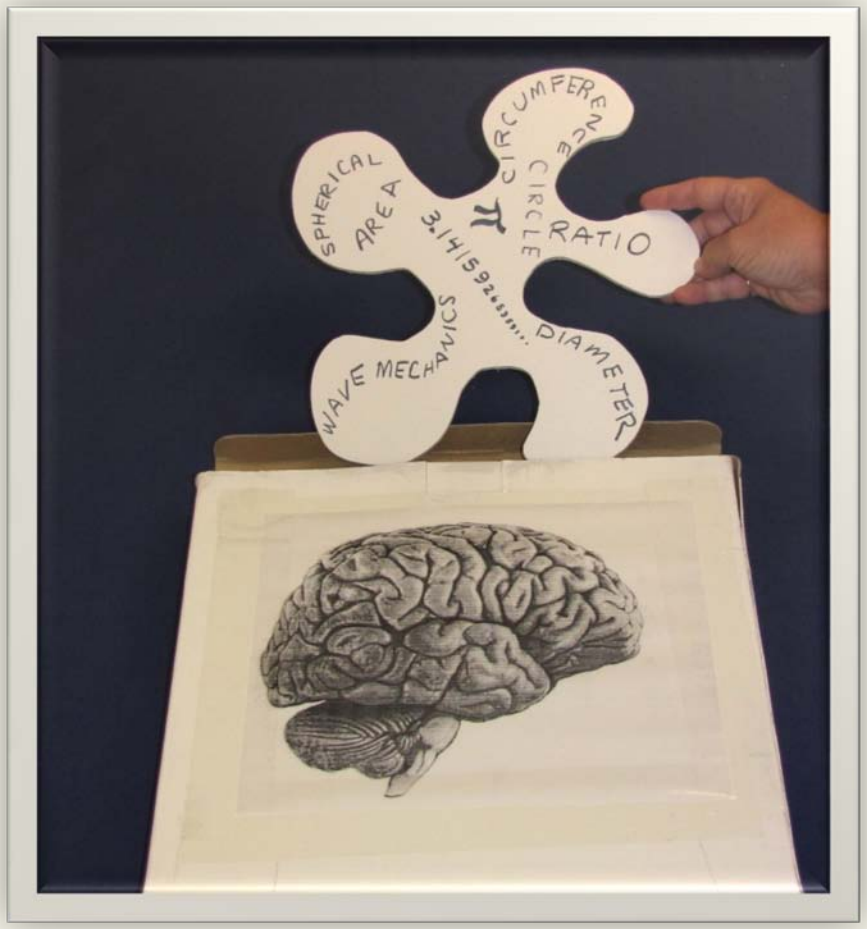


Could someone tell me what is Pi?


π
3.141
5926535
8979323846
2643383279502
884197169399375

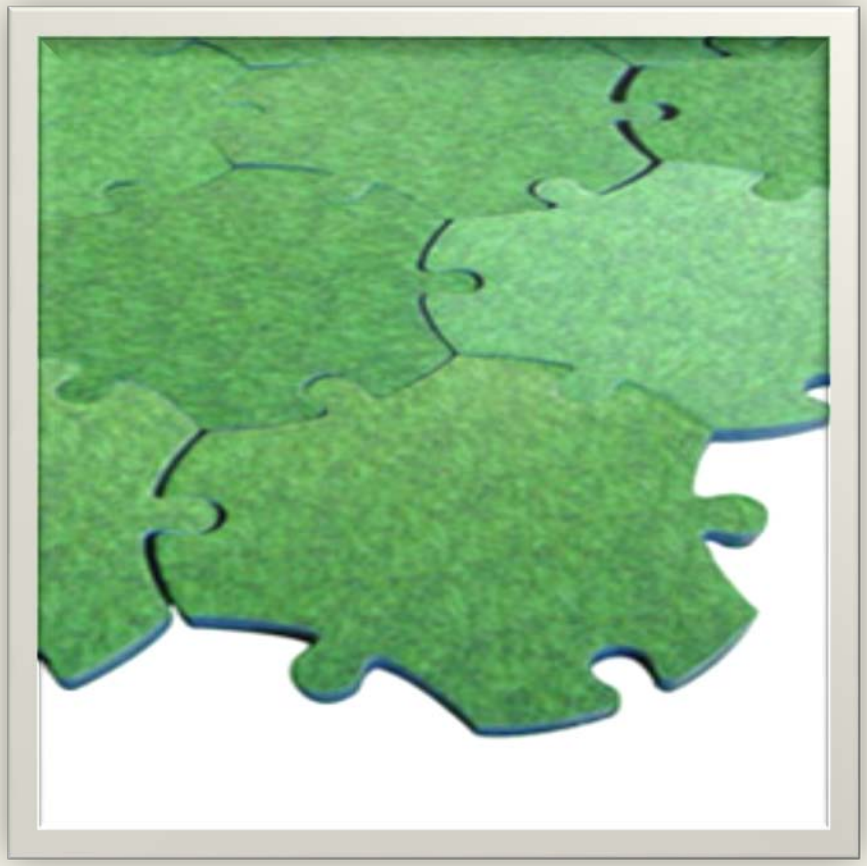


Think of your brain as a Puzzle. The simple memorization of this fact (Pi) doesn't result in a puzzle piece that fits and connects well to other pieces. It's just a "fact".



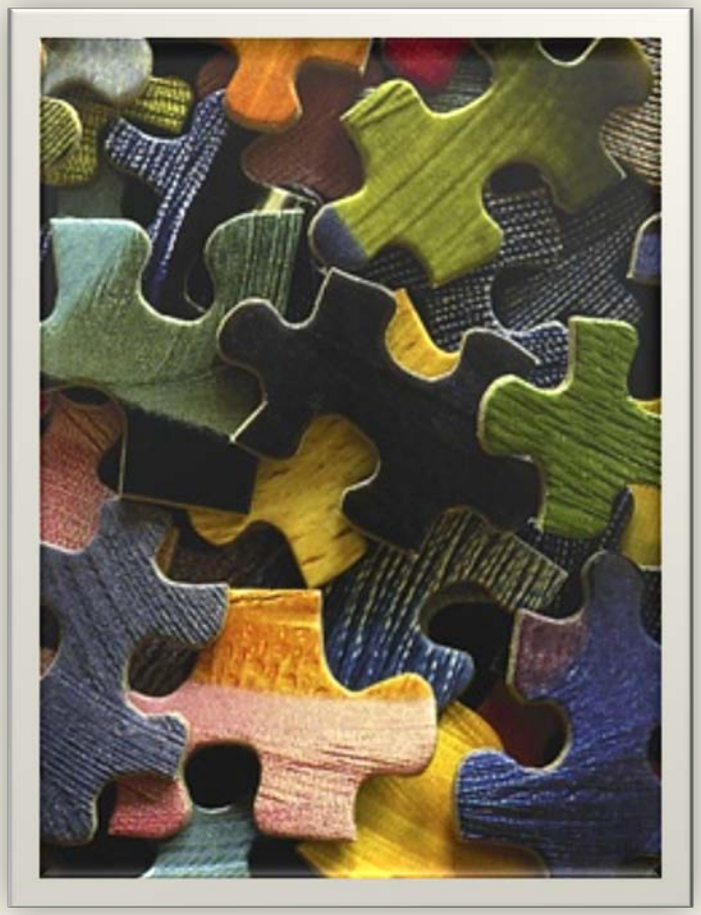
To connect Pi in our memory we need better understanding.

It is the ratio of a circle's circumference to diameter and allows spherical area and wave mechanics calculations.



It is the text or teacher's job to provide good puzzle pieces that can link to other pieces.

It is the student's responsibility to fit the puzzle together by thinking of relationships and solving problems.



If the student is handed too many pieces at one time, some are dropped. The student must start fitting the pieces together or they will just end up with a larger and larger stack of pieces.

If the student only memorizes, like remembering your phone number, the student only has a stack of facts- just a collection of puzzle pieces.

This is not solving the puzzle, it is not learning.

It is only when you connect the puzzle piece within your present knowledge puzzle picture are you capable of critical thinking.

A teacher cannot place a piece within the puzzle picture for the student.

The teacher only helps the student develop that piece – viewing it from different perspectives.

Only the student can place the fact within their knowledge base.

EUREKA!

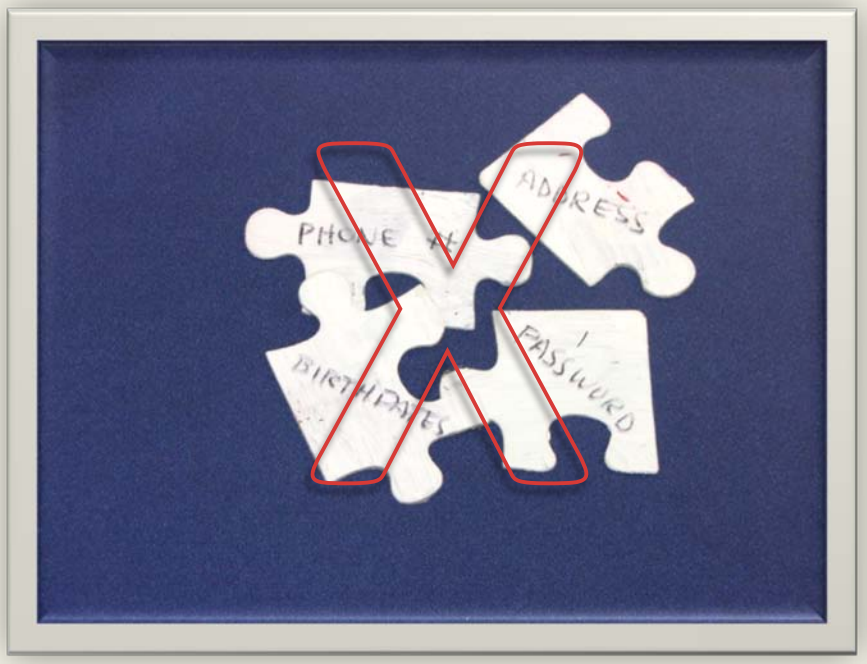
Learning this way is satisfying.

Again, learning science is not memorization and acceptance of faith, it is acceptance by recognizing the connection with what you already know…

…like fitting in a new puzzle piece into each of our personal picture of rules of nature.

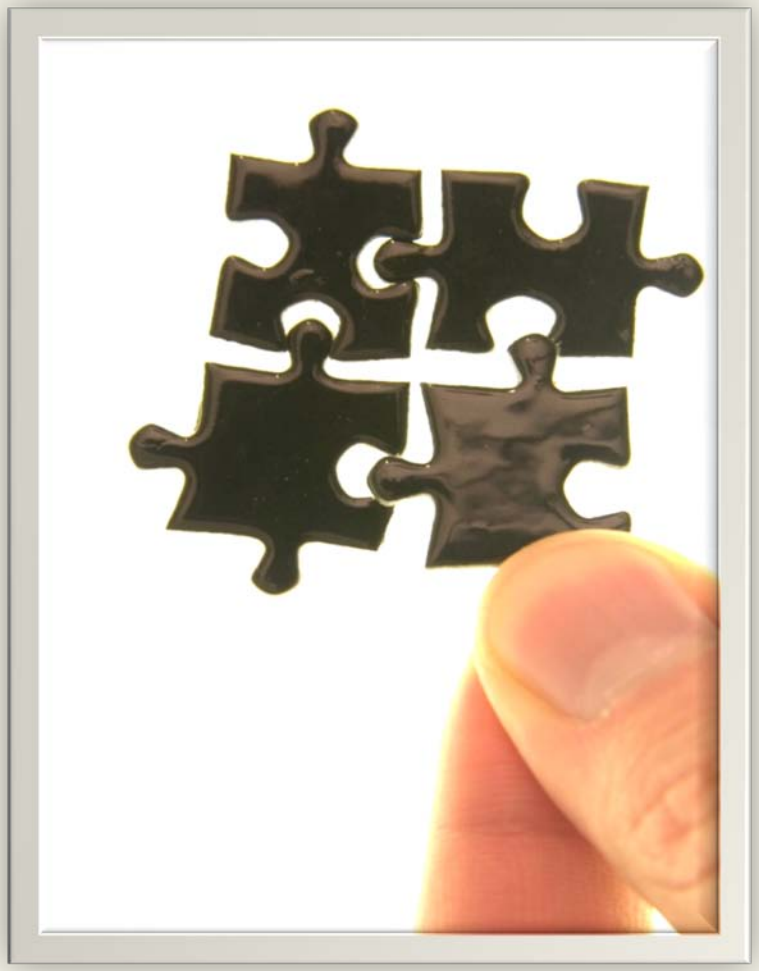
Let us take a look at a symbolic two-dimensional version of a three-dimensional puzzle picture in our brain.

Each of our puzzle pictures look different, but there are features in common. There can be no straight borders or corners of our puzzle…

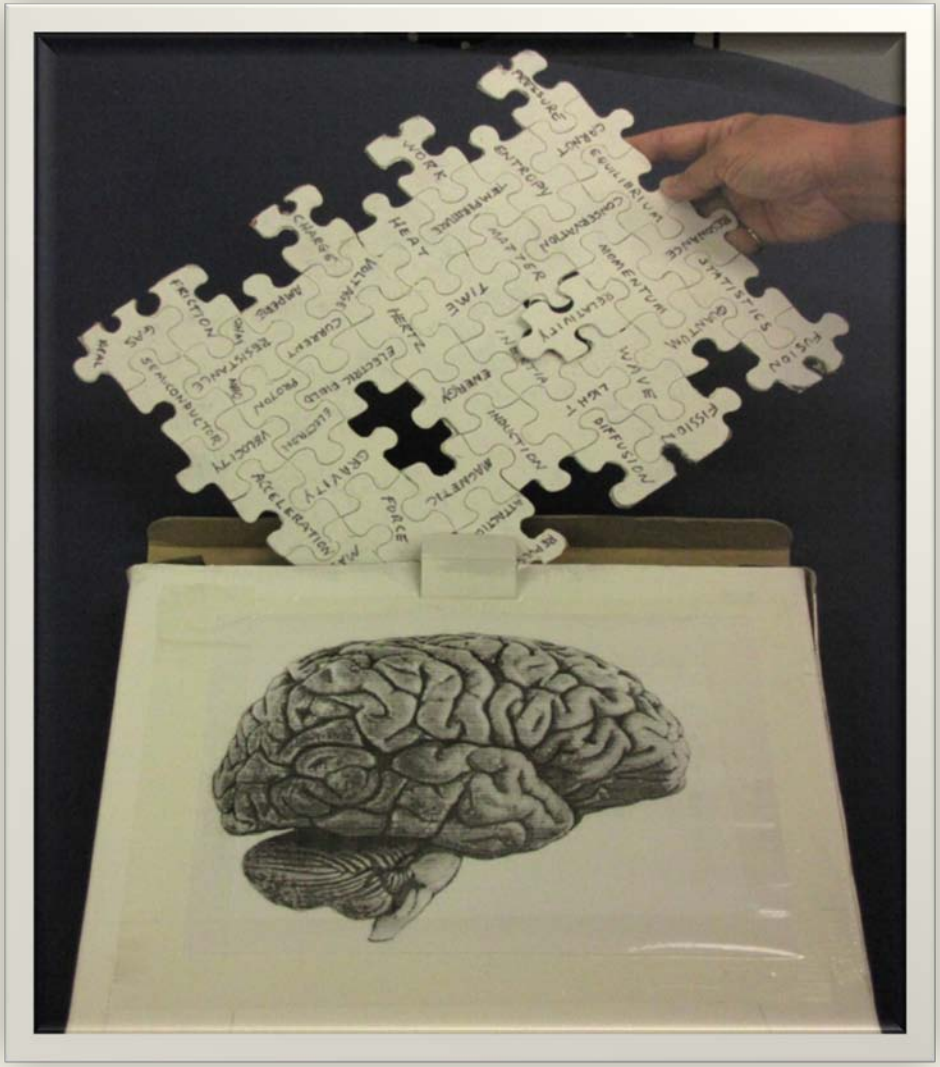


…if there are edges and borders, additional knowledge could not be connected to pieces of pre-existing knowledge.

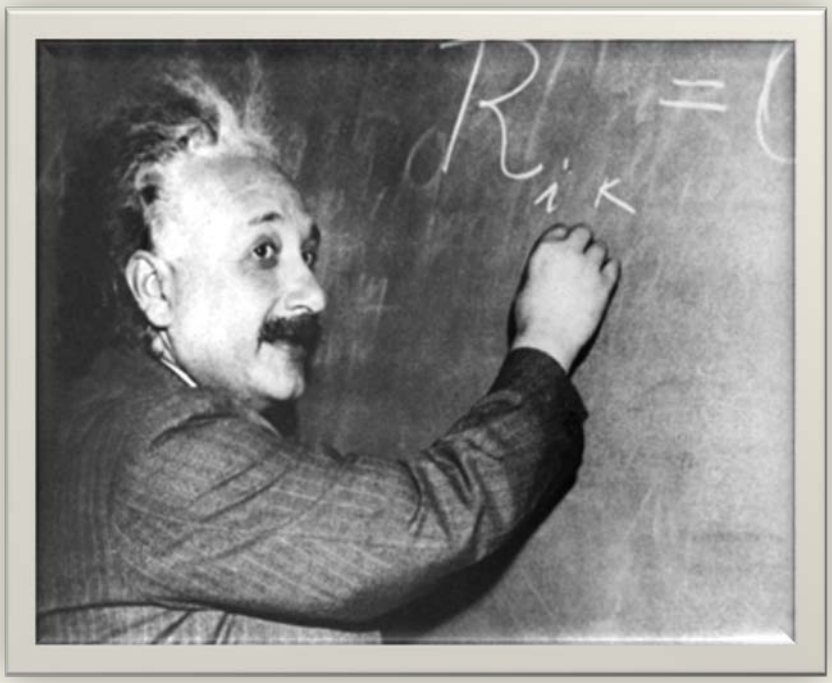
We can never have the complete picture. There will always be more pieces to add and holes in our understanding that challenges us.



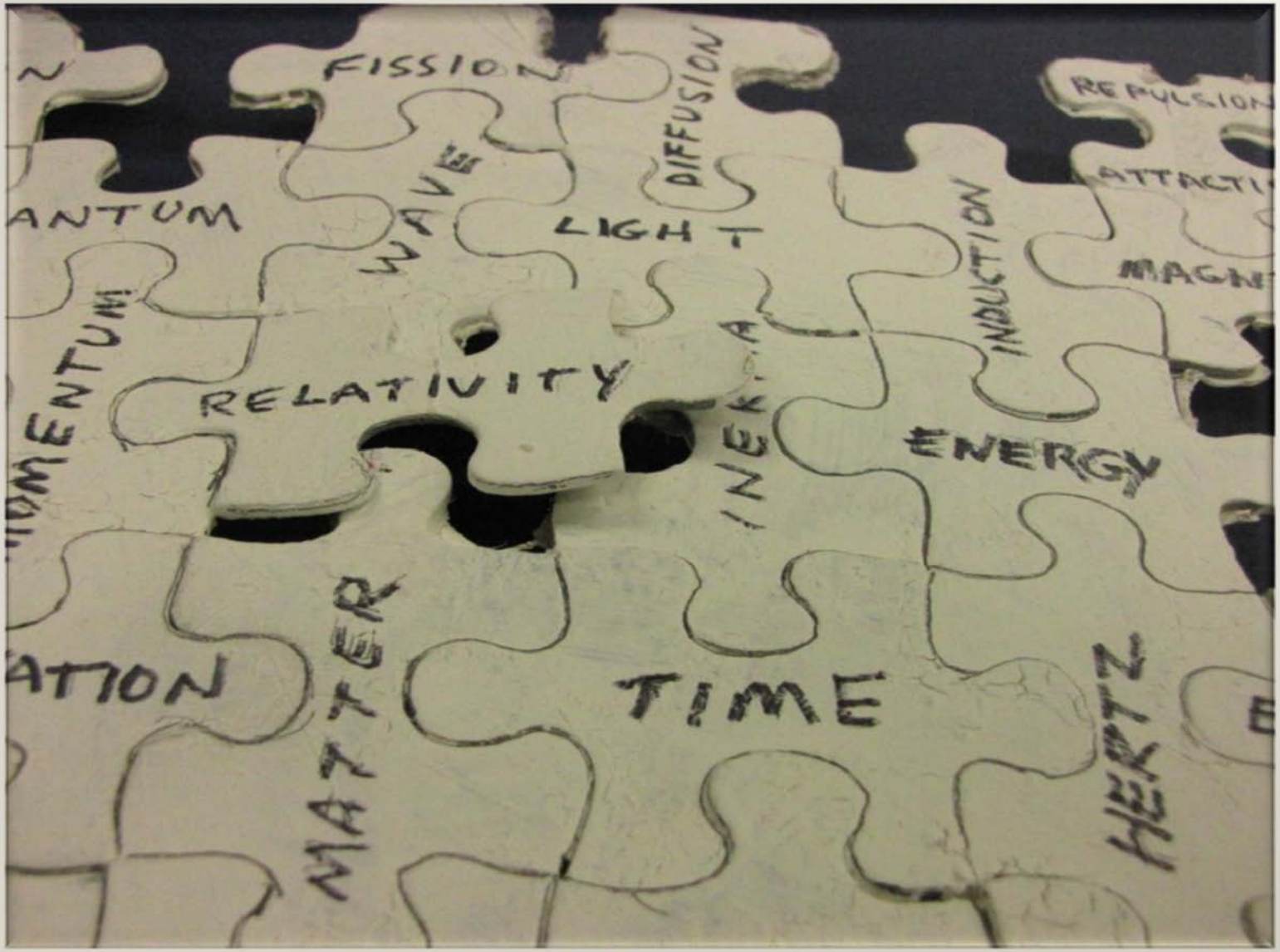
The most difficult part of the science puzzle is the pieces that are misplaced or forced into our picture because of faulty understanding or due to theories subject to later clarification.



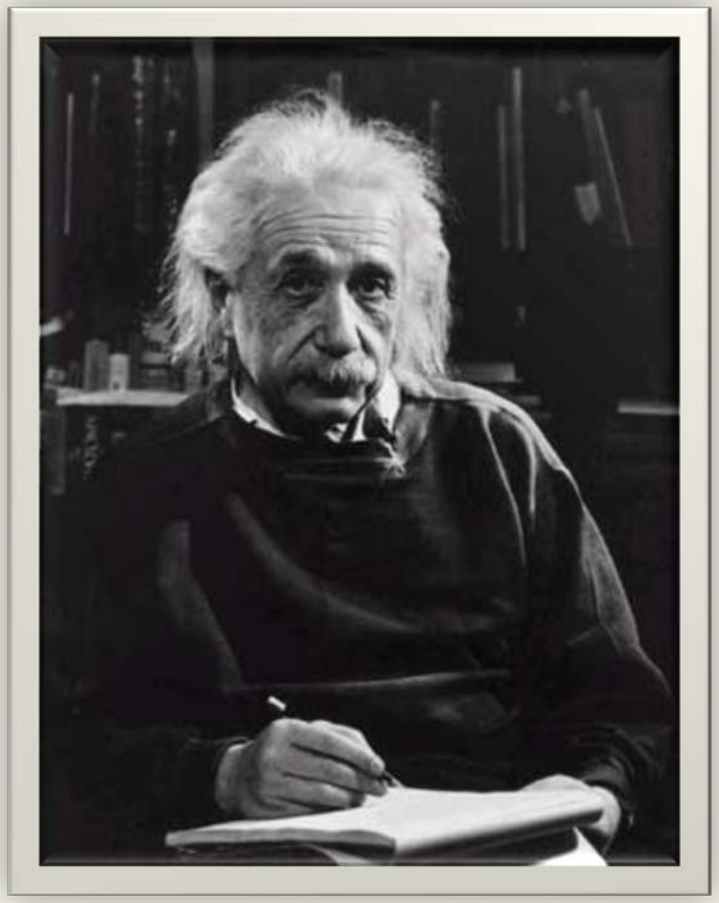
As our knowledge increases and our puzzle is more complete, what were imperfections give insight.



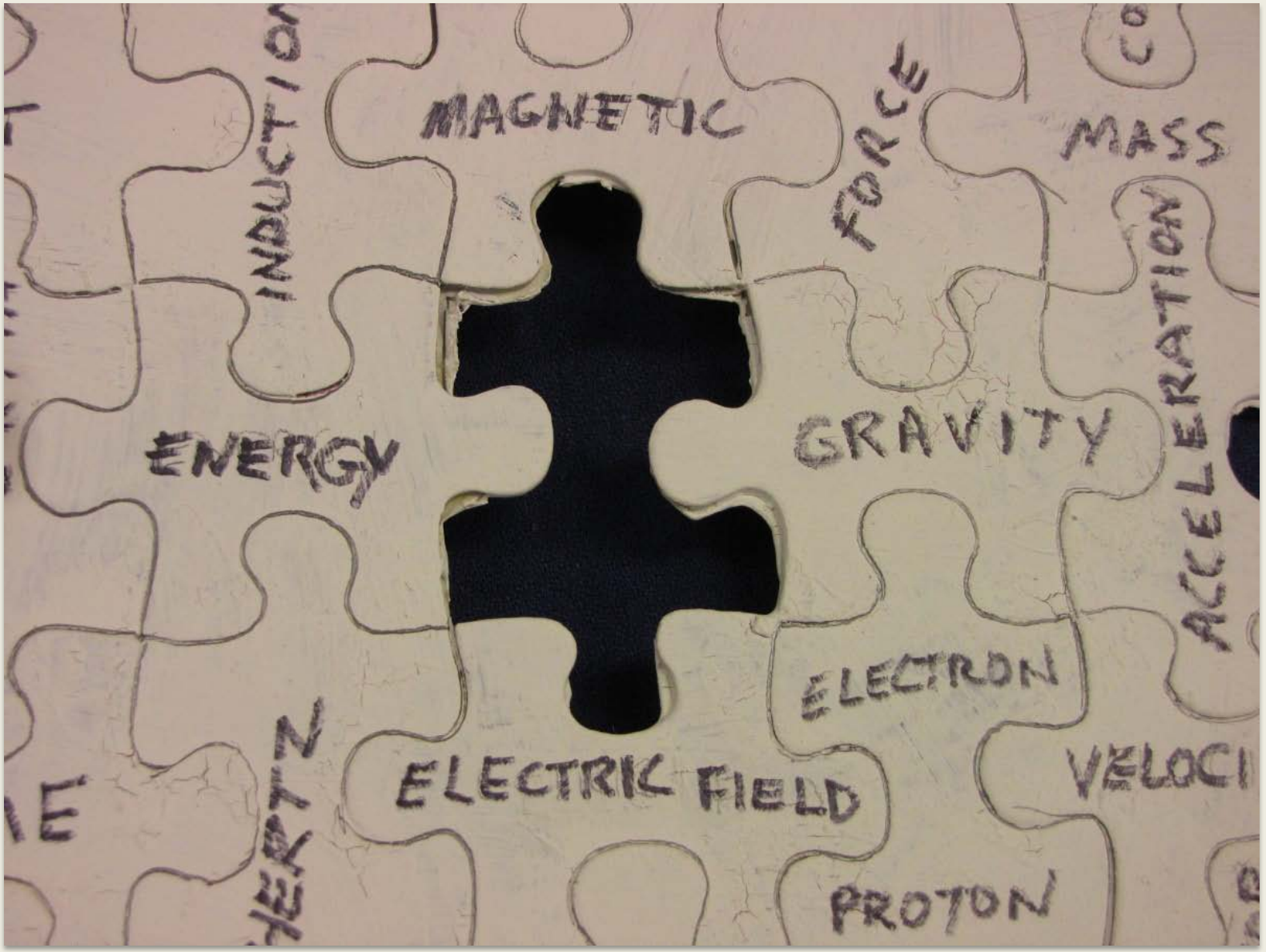
I expect Einstein sensed the error in his puzzle picture between Maxwell's constant light velocity and Newtonian laws.


FISSION
DIFFUSION
REPULSION
ANTUM
WAVE
LIGHT
INDUCTION
MAGN
RELATIVITY
ENERGY
ATION
MATTER
TIME
HERTZ

These miss-fitting pieces resulted in his relatively theories.



Einstein also saw a missing piece that caused him to search for a unified field theory.

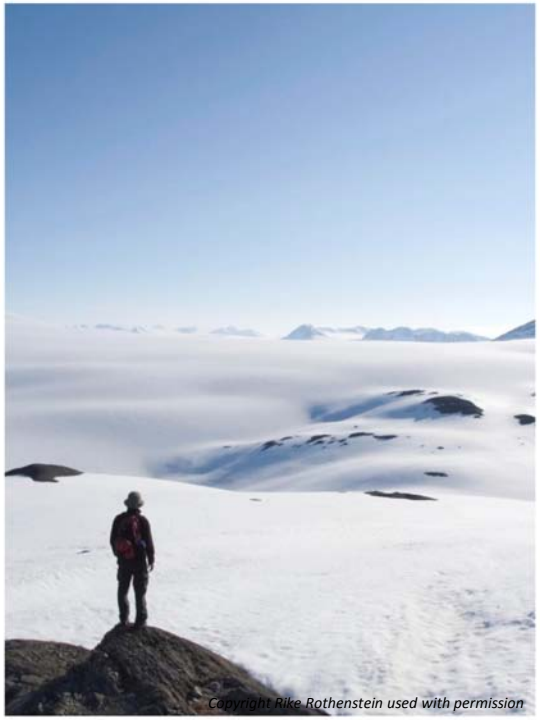

MAGNETIC
FORCE
MASS
ENERGY
GRAVITY
ELECTRON
ELECTRIC FIELD
PROTON

As learners, we must stay open to questioning our understanding and maintain a willingness to rethink our understanding…like refitting puzzle pieces.

Learning science has a similarity with putting a puzzle together, a game, but more than a game, since the results of science affect our lives dramatically.

Therefore, learning science is an adventure!

What is an adventure?



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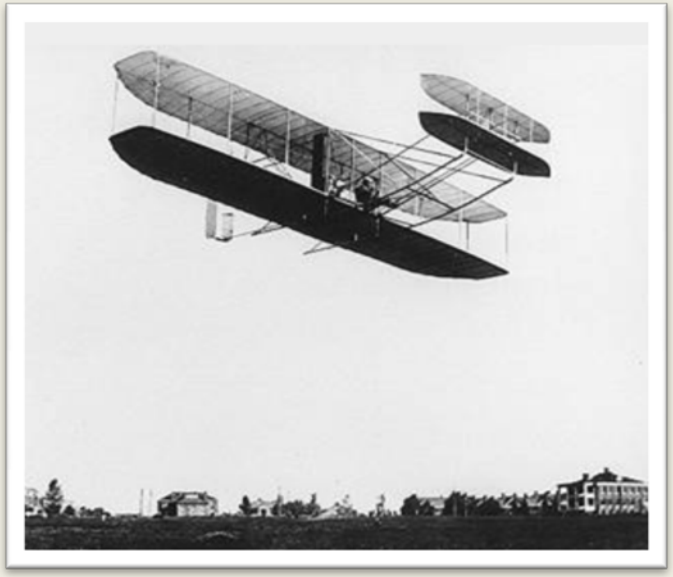
The answer can be subjective. Part of the attraction of an adventure is figuring out a puzzle of importance.

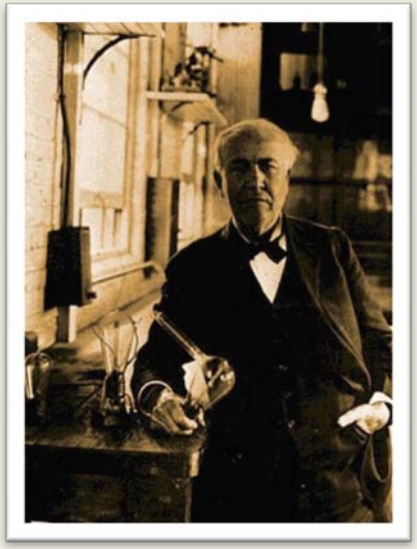
The adventure enjoyment, the eureka euphoria, comes form snapping the missing puzzle piece of experience or knowledge into your mind.

You need the surrounding pieces in place which can seem like work.

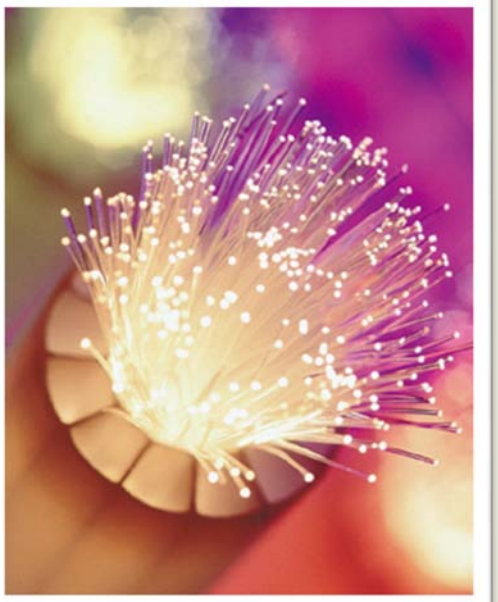
Like a climber needs to learn skills and develop strength to climb a mountain to experience that euphoric view of the blue sky.

A student of science with knowledge of light and our atmosphere will get a similar rush when he places the puzzle piece of why the sky is blue.



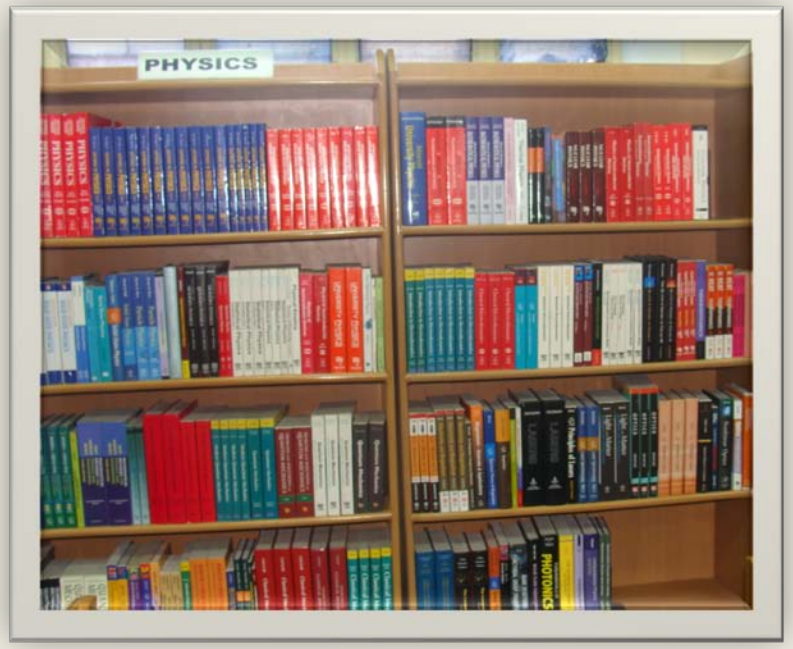


Every science fact is a puzzle to understand. If it wasn't, it wouldn't have taken the thousand of years of recorded history to develop the science puzzle pieces we have today.



USA
NASA

These science facts or theories are now recorded and available to those who want to read, think, and start putting their own puzzle picture of science together.



We can be a part of the daily science explorations by not only doing (becoming a scientist) but also by just reading newspapers and science magazines.

The unexplored mountains and valleys on earth are few, but there are ever-increasing new science related fields to explore.

Most of us probably missed the chance of exploring new areas in Africa or uncovering ancient Egyptian tombs …

There are still adventures in science!

To be part of this adventure, we need to understand how to fit the recently discovered science puzzle piece into our existing puzzle picture, doing so we become science literate.

I know of no other adventure of less physical risk, yet more intellectual rewards!

Science rewards man with a better life and those that better their lives through science gain meaningful employment as scientists and engineers.

In summary, give learning science a try.

It’s a puzzle, it is fun, and there are great rewards.

Learn science and be part of the adventure!!!

Bob is the resident engineer and technical expert for the Wright-Patterson AFB Educational Outreach Office.

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