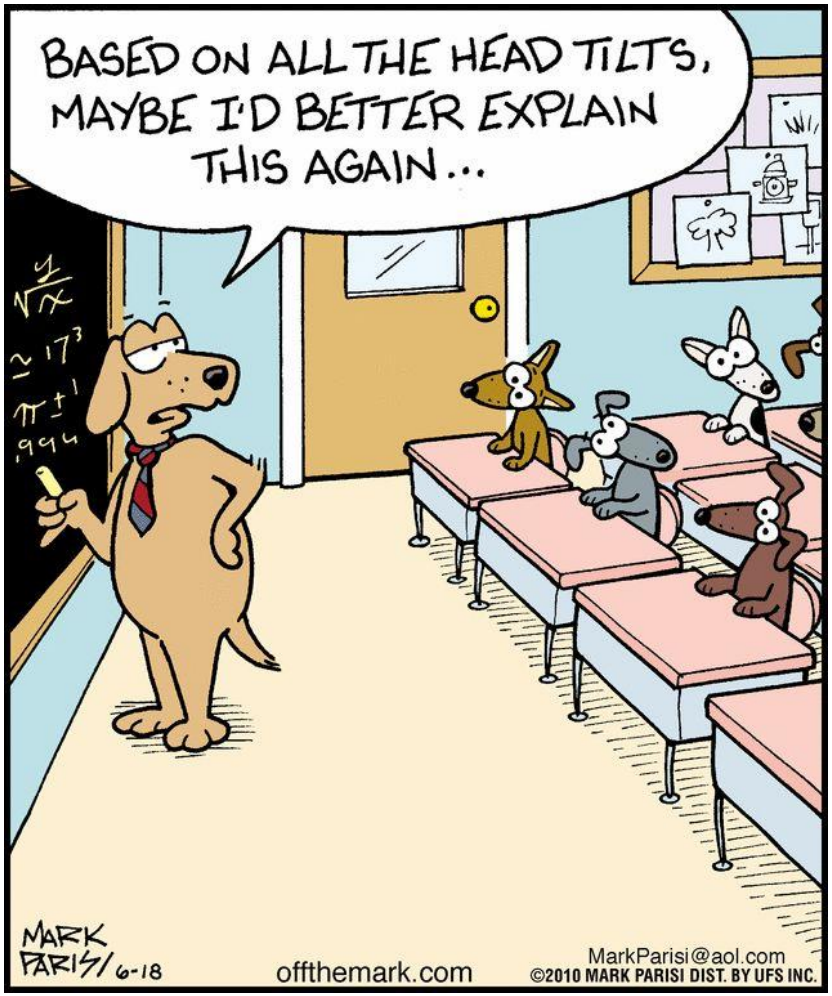
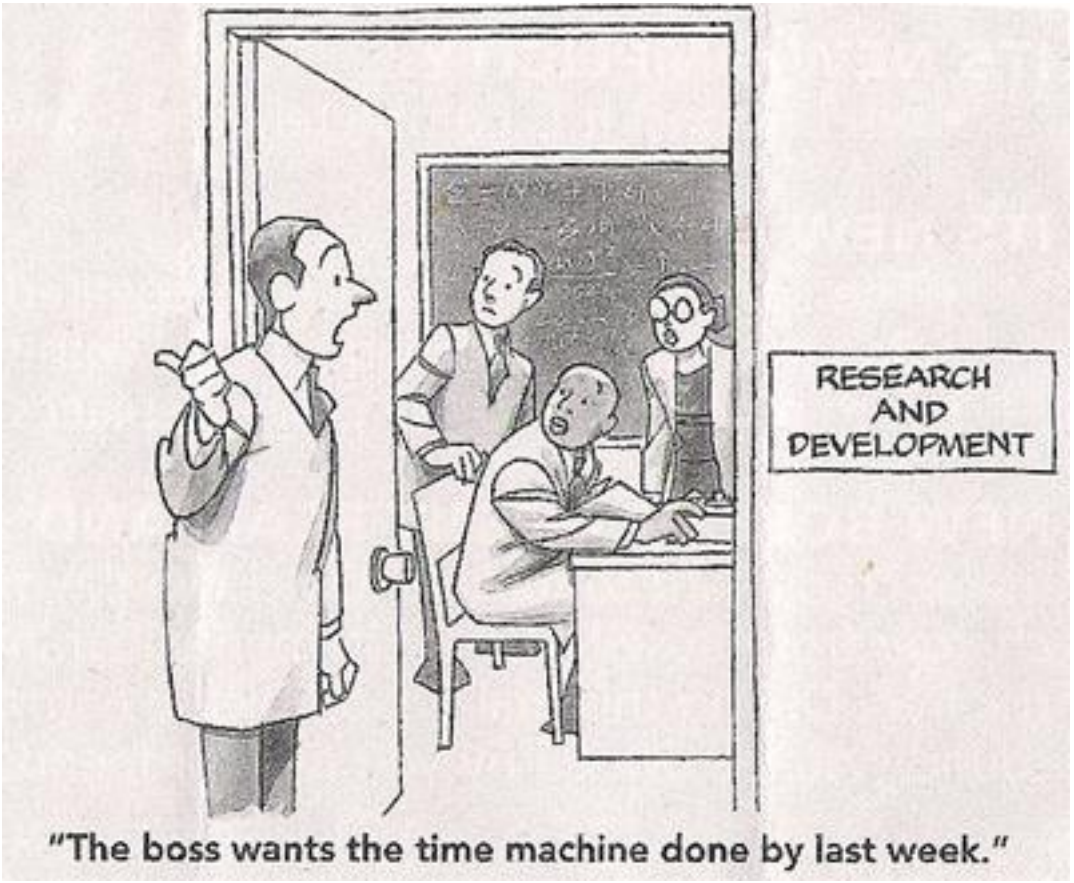
# So, You're Taking a Science Course…



# And You Really Need to Pass!



# Is There a Secret to Success?

# Yes, Words!!

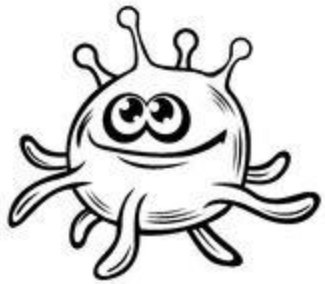
**“My name, and yours**, and the true name of the sun, or a spring of water, or an unborn child, all are syllables of the great word that is very slowly spoken by the shining of the stars. There is no other power. No other name.” *A Wizard of Earthsea by Ursula K. Le Guin*

# Some Roots

alto – high
amphi – round, both sides
anthrop - man
anti-against
aqui- - water
aster – star
atmos – air
aura – glow
batho – lith – rock, stone
bi – two
carto – map
ceno - recent
centi – 100
chrom – colored
chron - time
circum - around
cirque – circle, round
cirro – curl, like hair curl
clastic – fragments, pieces
cosm – world, universe
counter – against
cumulo – heap
cyclo – cycle, circular
deca – 10
exo – outer
ferrous, ferric – iron
fract, frag – bend, break
gene – start, beginning
geo – earth
glaci - ice
graph – chart, draw, write
halo - salt
helio – sun
hemi – half
homo – same
hydro – water
hygro – water
hyper – more than
hypo – less than
ic – adjective forming suffix
ignis – fire
iso – equal
lacco –
lati – side
logy – study of
longi
luminis – light
luna – moon
macro – large
mare – sea
meso – middle
meta – change
meter – measure
micro – small
milli – 1000
mono – one
morpho – shape
nimbo – rain
non – not
nox – night
omni – all, many
oxi – oxygen
paleo - old
per – per
peri – around

**Go back to your roots.** One of the most powerful tools for learning new words -- and for deciphering the meaning of other new words -- is studying Latin and Greek roots. Latin and Greek elements (prefixes, roots, and suffixes) are a significant part of the English language and a great tool for learning new words.

# lex·i·con

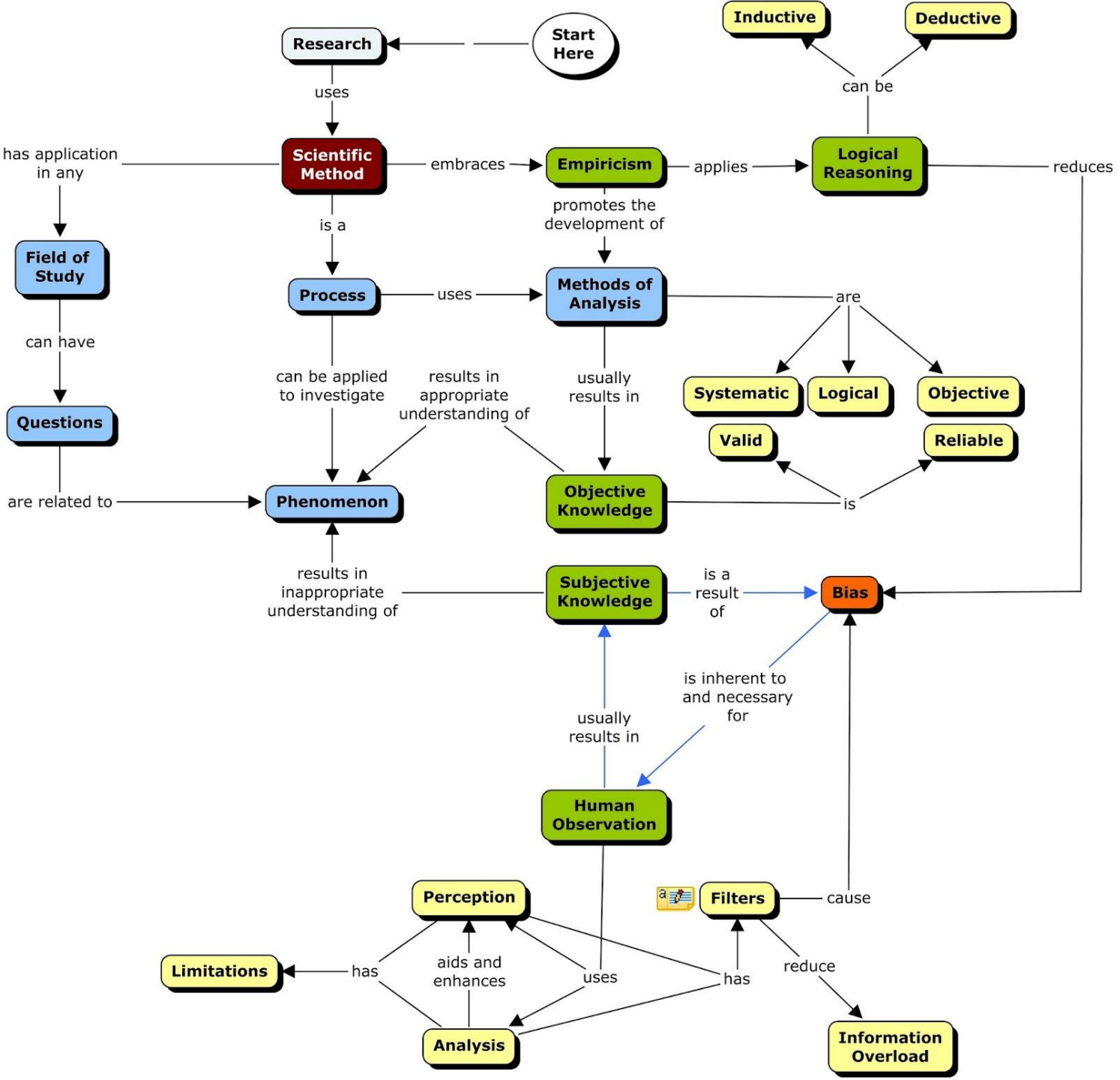


/ˈleksiˌkän,ˈleksiˌkən/

*noun*
the vocabulary of a person, language, or branch of knowledge

Different fields all have their own lexicons.

# The Scientific Method



# Terms You Need to Know!

Hypothesis
Support / Refute
Data
Qualitative
Quantitative

Experiment
Conclusion
Consensus
Theory
Law

A **hypothesis** is a statement that attempts to explain something that is either directly **observed** using our senses or observed through the instruments we have built to extend our senses. This statement is constructed based on reason. It may be either **supported or refuted** as it is tested against data and evidence.

**Data** results from either descriptions (qualitative) or measurements (quantitative).

Data records reality as we perceive it.

An **experiment** is a series of steps taken under controlled conditions to attempt to determine cause and effect relationships between events. In an experiment every effort is made to isolate variables so their specific effects may be studied.

After an experiment is carried out to test a hypothesis the **conclusion** of the experiment is a determination that either the hypothesis is supported, or it is NOT supported, or it is clearly refuted.

A **theory** is a generalized explanation of a broad class of phenomena. It is supported by many experiments and by consensus in the scientific community.

**Examples:**

The Kinetic Molecular Theory of Ideal Gases
The General Theory of Relativity
The Theory of Evolution
The Theory of Plate Tectonics
The Theory of Quantum Physics

A **law** is a concise statement of cause and effect with no known exceptions. (although there may be constraints on its application)

**Examples:**

$F=ma$

$E=mc^2$

$PV=nRT$

$F_g=Gm_1m_2/r^2$

A ROUGH GUIDE TO SPOTTING

# BAD SCIENCE

## 1. SENSATIONALISED HEADLINES


Headlines of articles are commonly designed to entice viewers into clicking on and reading the article. At best, they over-simplify the findings of research. At worst, they sensationalise and mis-represent them.

## 2. MISINTERPRETED RESULTS

News articles sometimes distort or misinterpret the findings of research for the sake of a good story, intentionally or otherwise. If possible, try to read the original research, rather than relying on the article based on it for information.

## 3. CONFLICT OF INTERESTS

Many companies employ scientists to carry out and publish research - whilst this does not necessarily invalidate research, it should be analysed with this in mind. Research can also be misrepresented for personal or financial gain.

## 4. CORRELATION & CAUSATION

Be wary of confusion of correlation & causation. Correlation between two variables doesn't automatically mean one causes the other. Global warming has increased since the 1800s, and pirate numbers decreased, but lack of pirates doesn't cause global warming.

## 5. SPECULATIVE LANGUAGE


Speculations from research are just that - speculation. Be on the look out for words such as 'may', 'could', 'might', and others, as it is unlikely the research provides hard evidence for any conclusions they precede.

## 6. SAMPLE SIZE TOO SMALL

In trials, the smaller a sample size, the lower the confidence in the results from that sample. Conclusions drawn should be considered with this in mind, though in some cases small samples are unavoidable. It may be cause for suspicion if a large sample was possible but avoided.

## 7. UNREPRESENTATIVE SAMPLES

In human trials, researchers will try to select individuals that are representative of a larger population. If the sample is different from the population as a whole, then the conclusions may well also be different.

## 8. NO CONTROL GROUP USED

In clinical trials, results from test subjects should be compared to a 'control group' not given the substance being tested. Groups should also be allocated randomly. In general experiments, a control test should be used where all variables are controlled.

## 9. NO BLIND TESTING USED

To prevent any bias, subjects should not know if they are in the test or the control group. In double-blind testing, even researchers don't know which group subjects are in until after testing. Note, blind testing isn't always feasible, or ethical.

## 10. 'CHERRY-PICKED' RESULTS

This involves selecting data from experiments which supports the conclusion of the research, whilst ignoring those that do not. If a research paper draws conclusions from a selection of its results, not all, it may be cherry-picking.

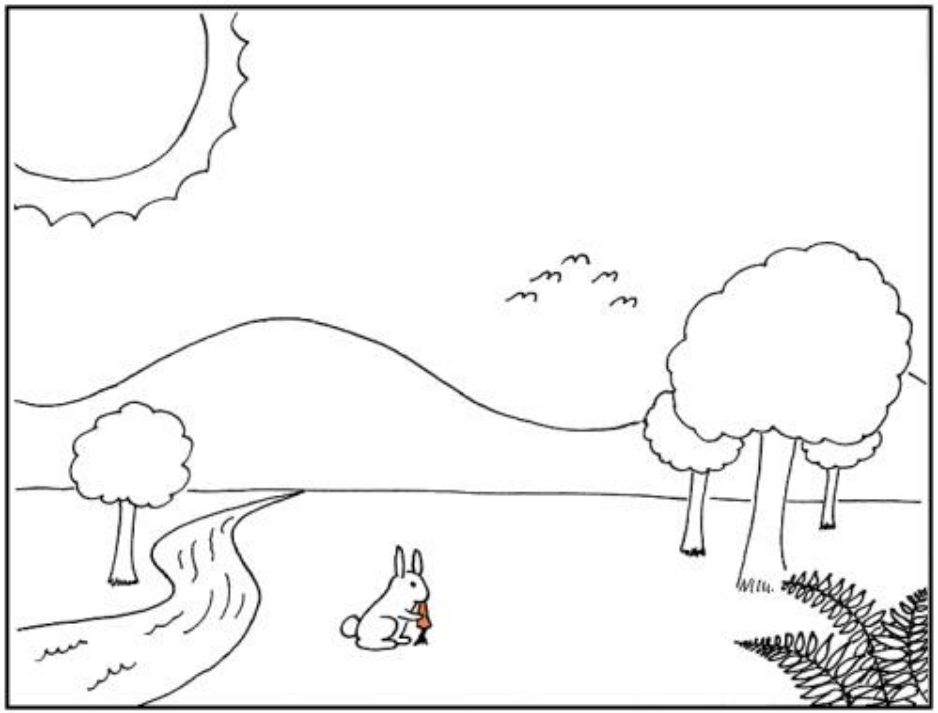
## 11. UNREPLICABLE RESULTS

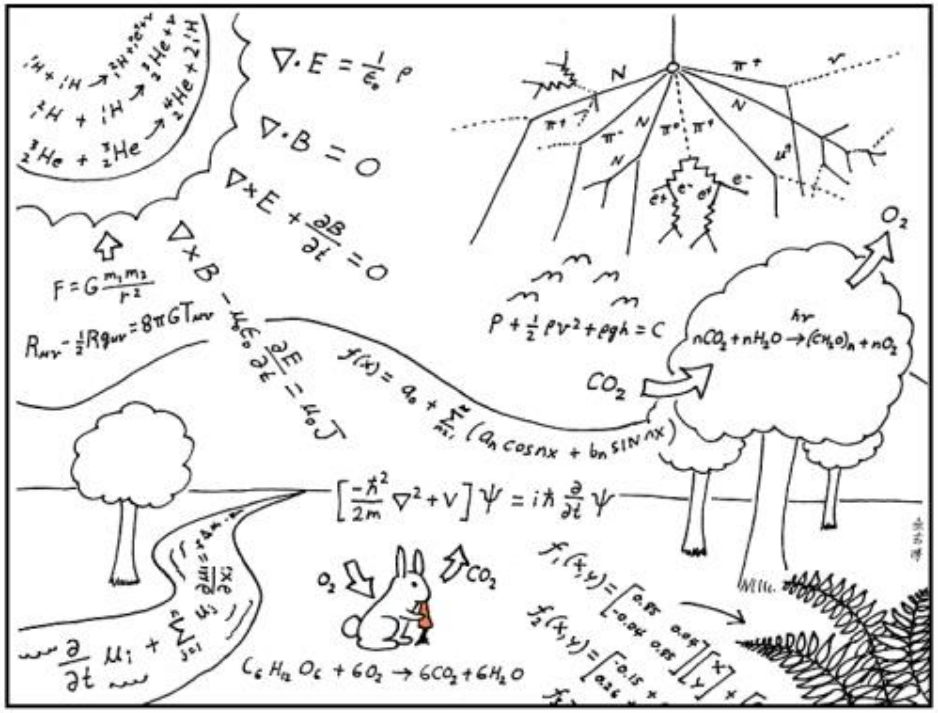
Results should be replicable by independent research, and tested over a wide range of conditions (where possible) to ensure they are generalisable. Extraordinary claims require extraordinary evidence - that is, much more than one independent study!

## 12. JOURNALS & CITATIONS

Research published to major journals will have undergone a review process, but can still be flawed, so should still be evaluated with these points in mind. Similarly, large numbers of citations do not always indicate that research is highly regarded.

Ci 2014 COMPOUND INTEREST - WWW.COMPOUNDCHEM.COM




$\nabla \cdot E = \frac{1}{\epsilon_0}\rho$
$\nabla \cdot B = 0$
$\nabla \times E + \frac{\partial B}{\partial t} = 0$
$\nabla \times B - \mu_0\epsilon_0\frac{\partial E}{\partial t} = \mu_0 J$
$F = G\frac{m_1 m_2}{r^2}$
$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = 8\pi G T_{\mu\nu}$
$P + \frac{1}{2}\rho v^2 + \rho g h = C$
$f(x) = a_0 + \sum_{n=1}^{\infty}(a_n \cos nx + b_n \sin nx)$
$\left[\frac{-\hbar^2}{2m}\nabla^2 + V\right]\Psi = i\hbar\frac{\partial}{\partial t}\Psi$
$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$
$nCO_2 + nH_2O \xrightarrow{h\nu} (CH_2O)_n + nO_2$
$CO_2$
$O_2$
$O_2$
$CO_2$
$\pi^+$
$\pi^-$
$\pi^0$
N
$e^+$
$e^-$
$\mu^+$
$\mu^-$
$\nu$