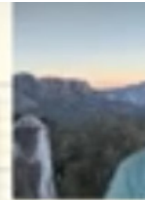


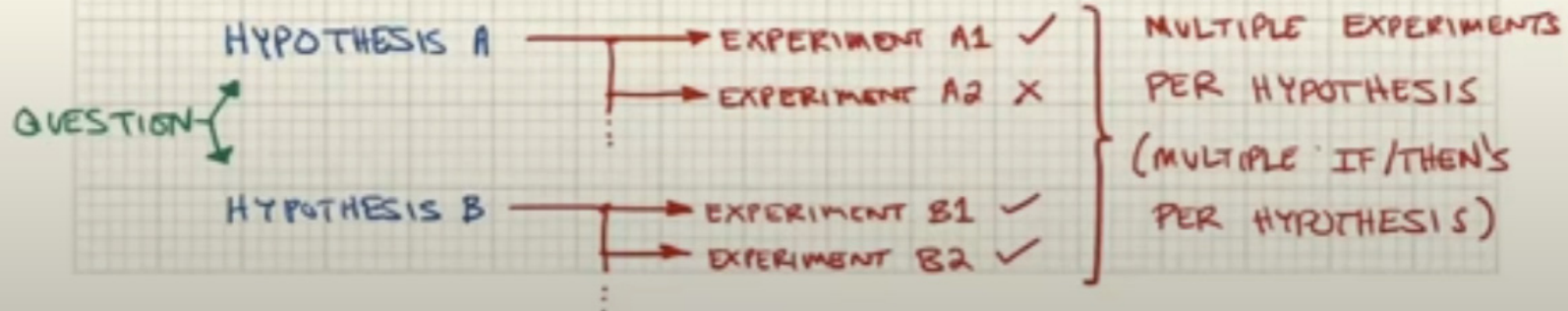
WHAT IS A HYPOTHESIS?



OBSERVATION → CAUSAL QUESTION (HOW/WHY) → POSSIBLE ANSWER
HYPOTHESIS

HYPOTHESIS TESTING

IF (experiment)
THEN (prediction)
BECAUSE (hypothesis) .



Hypothesis Driven Research

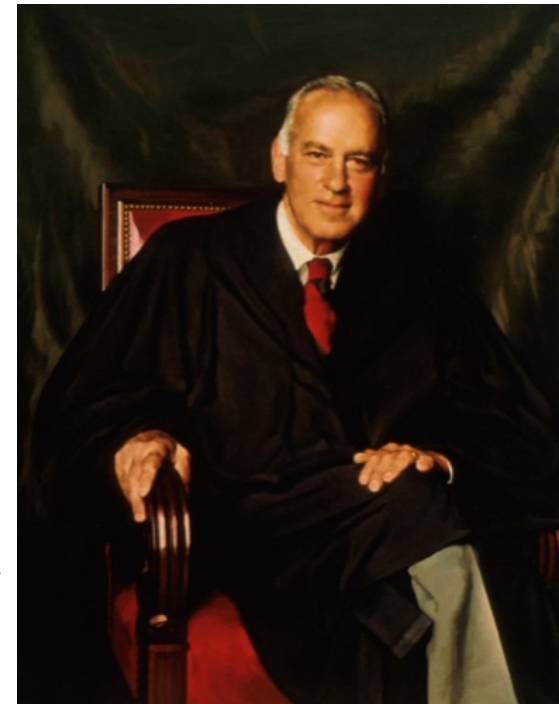
- Thesis
 - (Greek) placing a proposition
 - Theory that is put forward as a premise
- Hypothesis
 - (Greek) under a placing; foundation [of a premise]
 - Supposition made on the basis of **limited evidence** as a starting point for further investigation.
 - Testable; can be disproven
- Research question that includes the predicted or expected result of the research
 - For example, the effect of a distinct intervention



Hypothesis

- Theory or expectation based upon limited knowledge
- Includes a measurable parameter that can be used to assess a population
 - Implicitly includes a benchmark for meaningful measurable outcomes
 - Implies an approach or method to identify and isolate a predicted causal factor
 - States or implies a magnitude of difference that negates the hypothesis

Potter Stewart
SCotUS 1958-1981
"I know it when I see it."



Research Question -> Hypothesis

- What are some of the research questions being addressed this summer?
- Based on your research question, can you state an hypothesis that will be tested?
- We will test this hypothesis by ...
- If my hypothesis is correct, the effect of the intervention will be ...

Developing an Hypothesis

Stress in Biomedical Research: Six Impossible Things

Douglas R. Green

Thing #2. Ideas Come from the Eighth Dimension

To decide if it is an 8D idea, apply the coolness test—is it so absolutely cool that someone else to whom you tell it cannot stand not to know whether or not it is true?

So how do you get hold of such an idea? Or a dozen?

You are going to hate the answer: Read. A lot.



CREDIT: N.HENDRICKSON / ISTOCKPHOTO

By “read” I do not mean look at the abstract (although that is a start) or download the PDF (ditto). If you are reading five to ten papers per day, you’ve got the gist of it. If you are new to this, it is very slow going at first, but you can get very fast at this, really.

Green DR. Stress in biomedical research: six impossible things. *Mol Cell* 40: 176-178, 2010.

Discovering Literature

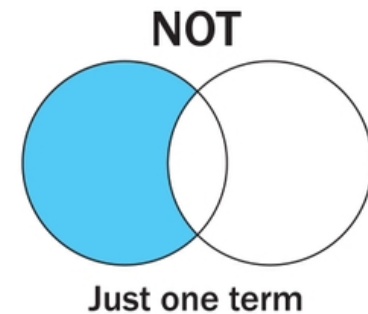
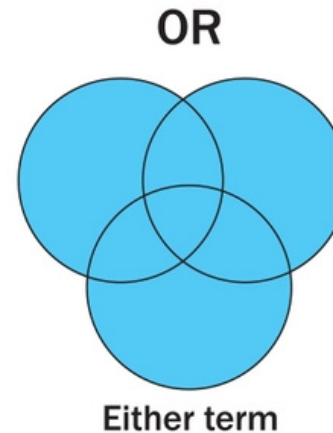
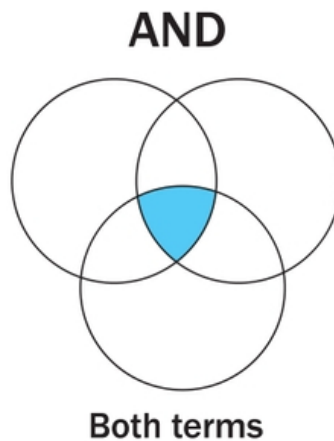
- Visit the library
- Table of Contents (Listserv / Push)
- Standing keyword search (by database)
- Focused search
 - Keywords
 - Fields



<https://www.chemistryworld.com/careers/how-to-do-a-literature-search/3009175.article>

Searching Literature - Author

- What has your mentor published (recently)?
 - Name
 - Format
 - Affiliation
 - Date
- Boolean Operators
 - AND, OR, NOT



Searching Literature - Author Example

Search number	Query	Search Details	Results
6	#2 AND #4	schultz bd[Author] AND "Kansas"[Affiliation]	42
5	#1 AND #4	"Schultz"[All Fields] AND "Kansas"[Affiliation]	185
4	Kansas[Affiliation]	"Kansas"[Affiliation]	81,449
3	Schultz bruce	schultz, bruce[Author] OR schultz, bruce[Investigator] OR schultz bruce[Author] OR schultz bruce[Investigator]	54
2	Schultz bd	schultz bd[Author]	94
1	Schultz	"Schultz"[All Fields]	22,967
7	#5 AND #6	(y, kim[Author] OR kim y[Author]) AND "Kansas"[Affiliation] AND ("coronavirus"[MeSH Terms] OR "coronavirus"[All Fields] OR "coronaviruses"[All Fields]) AND 2019/01/01:3000/12/31[Date - Entry]	20
6	("2019"[Date - Entry] : "3000"[Date - Entry])	2019/01/01:3000/12/31[Date - Entry]	7,916,900
5	#3 AND #4	(y, kim[Author] OR kim y[Author]) AND "Kansas"[Affiliation] AND ("coronavirus"[MeSH Terms] OR "coronavirus"[All Fields] OR "coronaviruses"[All Fields])	30
4	coronavirus	"coronavirus"[MeSH Terms] OR "coronavirus"[All Fields] OR "coronaviruses"[All Fields]	266,475
3	#1 AND #2	(y, kim[Author] OR kim y[Author]) AND "Kansas"[Affiliation]	303
2	Kansas[affiliation]	"Kansas"[Affiliation]	81,449
1	Kim y[au]	y, kim[Author] OR kim y[Author]	82,200

Searching Literature - Topic

- Identify critical key words

Topic: bat coronavirus proteases and their susceptibility to different antiviral protease inhibitors

- Coronavirus
- Protease
- Antiviral
- Bat

Searching Literature - Topic Example

Search number	Query	Search Details	Results
13	#11 AND #3	("coronavirus"[MeSH Terms] OR "coronavirus"[All Fields] OR "coronaviruses"[All Fields]) AND ("chiroptera"[MeSH Terms] OR "chiroptera"[All Fields] OR (((("behav anal today"[Journal] OR "bat"[All Fields]) AND ("animals"[MeSH Terms:noexp] OR "animal"[All Fields])) NOT "brown adipose tissue"[All Fields])) AND ("peptide hydrolases"[MeSH Terms] OR ("peptide"[All Fields] AND "hydrolases"[All Fields]) OR "peptide hydrolases"[All Fields] OR "protease"[All Fields] OR "proteases"[All Fields] OR "endopeptidases"[MeSH Terms] OR "endopeptidases"[All Fields] OR "protease s"[All Fields]) AND ("antiviral agents"[Pharmacological Action] OR "antiviral agents"[MeSH Terms] OR ("antiviral"[All Fields] AND "agents"[All Fields]) OR "antiviral agents"[All Fields] OR "antivirals"[All Fields] OR "antiviral"[All Fields] OR "antivirally"[All Fields]))	30
12	#10 AND #2 (review)	((("coronavirus"[MeSH Terms] OR "coronavirus"[All Fields] OR "coronaviruses"[All Fields]) AND ("chiroptera"[MeSH Terms] OR "chiroptera"[All Fields] OR (((("behav anal today"[Journal] OR "bat"[All Fields]) AND ("animals"[MeSH Terms:noexp] OR "animal"[All Fields])) NOT "brown adipose tissue"[All Fields])) AND ("peptide hydrolases"[MeSH Terms] OR ("peptide"[All Fields] AND "hydrolases"[All Fields]) OR "peptide hydrolases"[All Fields] OR "protease"[All Fields] OR "proteases"[All Fields] OR "endopeptidases"[MeSH Terms] OR "endopeptidases"[All Fields] OR "protease s"[All Fields])) AND (review[Filter]))	29
11	#10 AND #2	("coronavirus"[MeSH Terms] OR "coronavirus"[All Fields] OR "coronaviruses"[All Fields]) AND ("chiroptera"[MeSH Terms] OR "chiroptera"[All Fields] OR (((("behav anal today"[Journal] OR "bat"[All Fields]) AND ("animals"[MeSH Terms:noexp] OR "animal"[All Fields])) NOT "brown adipose tissue"[All Fields])) AND ("peptide hydrolases"[MeSH Terms] OR ("peptide"[All Fields] AND "hydrolases"[All Fields]) OR "peptide hydrolases"[All Fields] OR "protease"[All Fields] OR "proteases"[All Fields] OR "endopeptidases"[MeSH Terms] OR "endopeptidases"[All Fields] OR "protease s"[All Fields]))	205
10	#1 AND #9	("coronavirus"[MeSH Terms] OR "coronavirus"[All Fields] OR "coronaviruses"[All Fields]) AND ("chiroptera"[MeSH Terms] OR "chiroptera"[All Fields] OR (((("behav anal today"[Journal] OR "bat"[All Fields]) AND ("animals"[MeSH Terms:noexp] OR "animal"[All Fields])) NOT "brown adipose tissue"[All Fields]))	1,224
9	#5 OR #8	"chiroptera"[MeSH Terms] OR "chiroptera"[All Fields] OR (((("behav anal today"[Journal] OR "bat"[All Fields]) AND ("animals"[MeSH Terms:noexp] OR "animal"[All Fields])) NOT "brown adipose tissue"[All Fields]))	16,509
8	#6 NOT #7	((("behav anal today"[Journal] OR "bat"[All Fields]) AND ("animals"[MeSH Terms:noexp] OR "animal"[All Fields])) NOT "brown adipose tissue"[All Fields])	11,755
7	"brown adipose tissue"	"brown adipose tissue"[All Fields]	13,526
6	#4 AND animal	("behav anal today"[Journal] OR "bat"[All Fields]) AND ("animals"[MeSH Terms:noexp] OR "animal"[All Fields])	15,773
5	chiroptera	"chiroptera"[MeSH Terms] OR "chiroptera"[All Fields]	12,549
4	bat	"behav anal today"[Journal] OR "bat"[All Fields]	27,582
3	antiviral	"antiviral agents"[Pharmacological Action] OR "antiviral agents"[MeSH Terms] OR ("antiviral"[All Fields] AND "agents"[All Fields]) OR "antiviral agents"[All Fields] OR "antivirals"[All Fields] OR "antiviral"[All Fields] OR "antivirally"[All Fields]	495,043
2	protease	"peptide hydrolases"[MeSH Terms] OR ("peptide"[All Fields] AND "hydrolases"[All Fields]) OR "peptide hydrolases"[All Fields] OR "protease"[All Fields] OR "proteases"[All Fields] OR "endopeptidases"[MeSH Terms] OR "endopeptidases"[All Fields] OR "protease s"[All Fields]	696,664
1	coronavirus	"coronavirus"[MeSH Terms] OR "coronavirus"[All Fields] OR "coronaviruses"[All Fields]	266,504

Authorship

Put it before them **briefly** so they will read it, **clearly** so they will appreciate it, **picturesquely** so they will remember it and, above all, **accurately** so they will be guided by its light.

Joseph Pulitzer

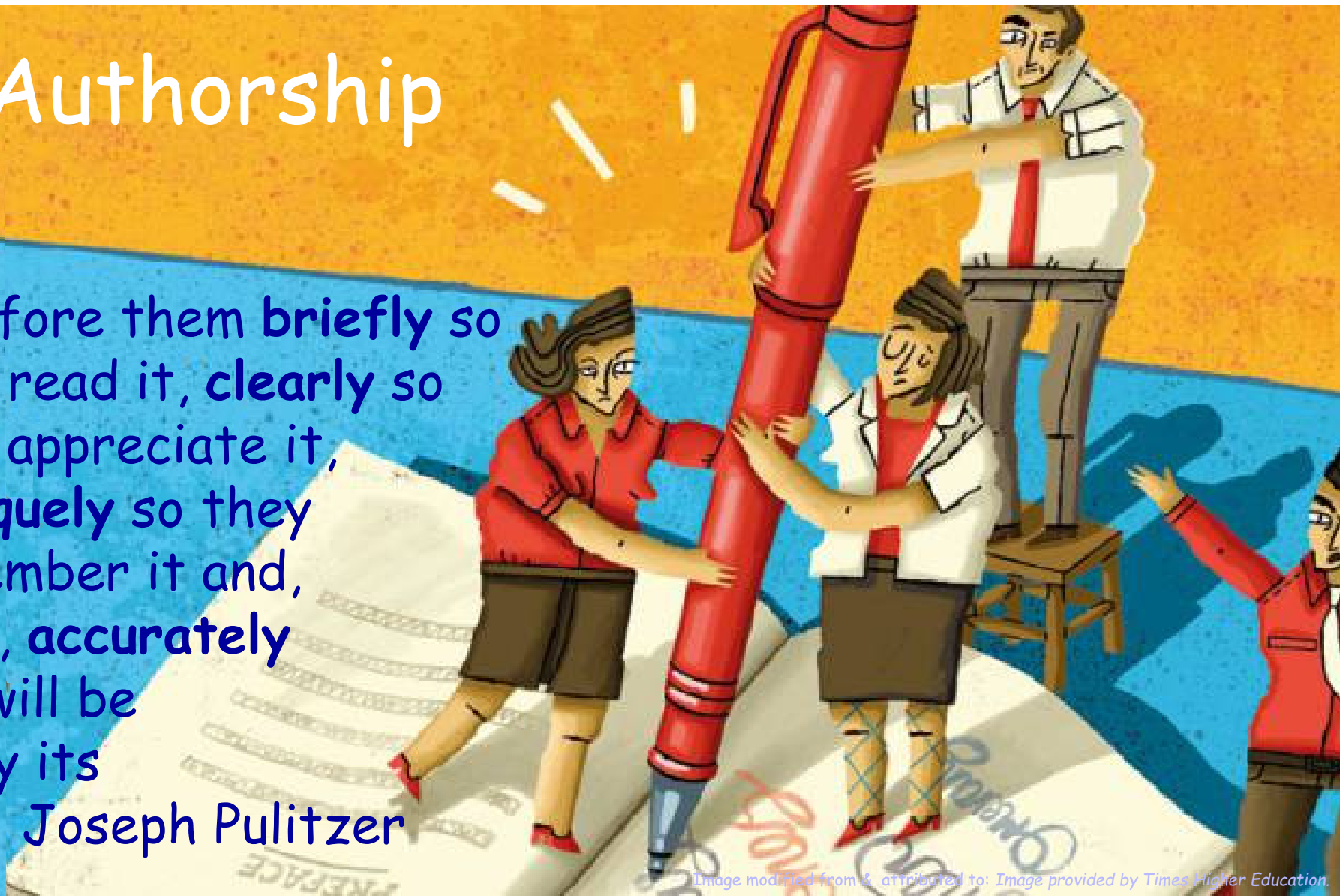


Image modified from & attributed to: Image provided by Times Higher Education.

Authorship

Resources:

- _____. *Defining the Role of Authors and Contributors*. International Committee of Medical Journal Editors. 2023.
<https://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html>
- Strange K. *Authorship: why not just toss a coin?* Am J Physiol 295: C567-575, 2008.
- Dance A. *Authorship: Who's on first?* Nature 489: 591-593, 2012.
- Albert, T & E Wager. *How to handle authorship disputes: a guide for new researchers*. The COPE Report, 2003. p 32-34.

Responsibility & Accountability

Author responsibilities:

- Direct & substantial intellectual contribution
- Engage in:
 - Concept, Conduct, Collect, Condense, Compose, Approve
 - Creativity, true intellectual content
- Discuss early & often

Author accountability

- Reveal conflicts of interest (COI)
- All authors accountable for the accuracy and integrity of all aspects of the work
 - Requires communication & trust



"Who's on first?"



Authorship Conventions

Types of authorship:

- First
- Last
- Middle
- Primary
- Senior
- Corresponding
- Guest
- Ghost
- Honorary
- Courtesy
- Posthumous
- Extortion of
- Denial of

Author order:

- First, Last
- Discipline associated
- Flip a coin?
- Discuss early

