

Science Communication for Early Career Researchers



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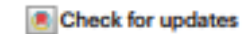


Comment

<https://doi.org/10.1038/s41593-024-01646-y>

A guide to science communication training for doctoral students

Christina Maher, Trevonn Gyles, Eric J. Nestler & Daniela Schiller



Three As of effective science communicators

Accessible

Convey scientific concepts clearly to a wide range of audiences, regardless of age and background

Accountable

Foster trust through transparent communication and responsible dissemination of information

Adaptable

Use diverse communication tools to reach audiences across media and contexts

Key modules

- Science education
- Science writing
- Science podcasting

- Data visualization
- Public outreach
- Science policy

- Social media
- Improvisation
- On-camera presentation

Table 1 | Effective science communication course breakdown

Module topic	Objective	Project	Evaluation
Written communication modules			
Science on social media	Learn to develop professional identity and create an online presence for scientific discourse	Creation of a personal website or a social media account for the purpose of conveying scientific knowledge	Feedback on ways to improve their social media presence to appeal to their professional interest
Creating a science curriculum	Learn inclusive teaching techniques for middle school science education	Design of a lesson plan, application of teaching techniques learned during workshop	Quality and relevance of lesson plan, effectiveness of teaching techniques applied
Illustration and visualization	Learn techniques for visualizing data and scientific projects	Creation of graphical abstracts of student's dissertation project	Feedback on figures to improve schematic quality
Science writing for non-science audiences	Learn principles of popular science writing and journalistic reporting	Creation of a science blog post, op-ed, or commentary geared toward non-scientists	Peer review of written pieces and implementation of feedback to improve reader accessibility
Oral communication modules			
Improvisation and on-stage performance	Develop skills in science communication through improvisation, role play, and storytelling	One time participation in on-stage performance of improvisation, storytelling or similar	Improved ability to think creatively about science communication, increased confidence in public speaking
Public engagement in neuroscience	Learn skills for engaging with the public, brainstorm ideas for public engagement initiatives	Development of a strategic plan for a public engagement initiative	Effectiveness and relevance of public engagement initiative
Science podcasting	Learn interview techniques, practice interviewing skills	Create one podcast episode and/or participate in podcast interviewing	Understanding of key elements of science podcasting, quality of interview skills demonstrated
Science policy and advocacy	Learn how to approach and pitch to local government representatives	Plan or participate in a meeting with your local representative to advocate for science	Efficacy of the communication strategy and feedback from meeting with local representative

Why learn to communicate science ?

As a Scientist

Let other scientists know about your latest work

Get your work published in the best journals

Be a good teacher

Make yourself attractive so you can get promoted or move elsewhere

Ask funding agencies for money

Convince industry your research can lead to a profitable product

Convince the government your research deserves long term support

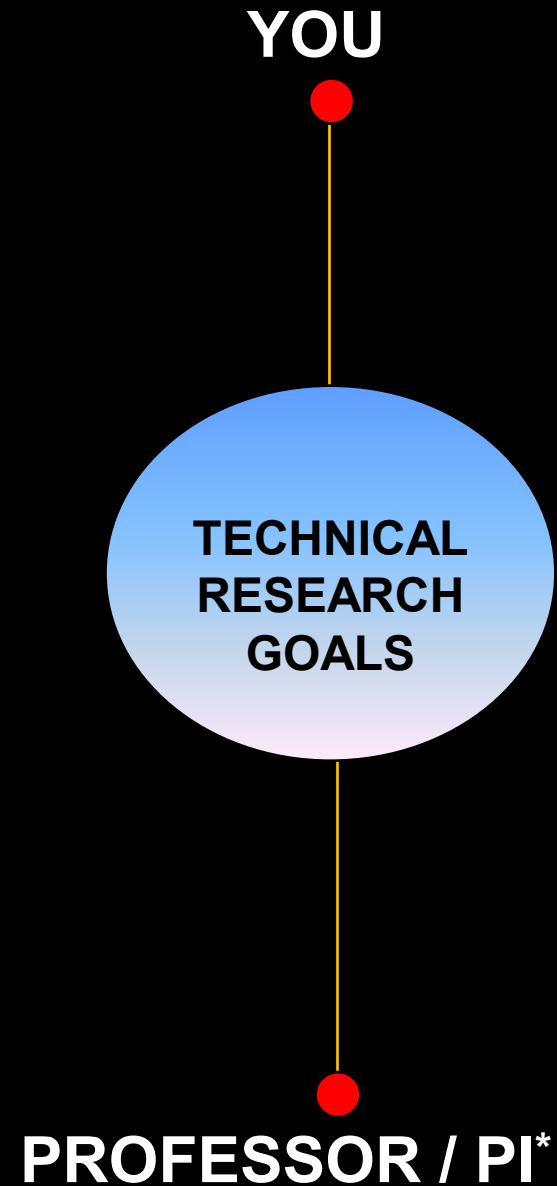
Convince the public your research is interesting

As a Science Communicator or Science Journalist

Act as the interface between scientists and the public in explaining the importance of science
and keeping the public informed on latest results

Research ecosystem

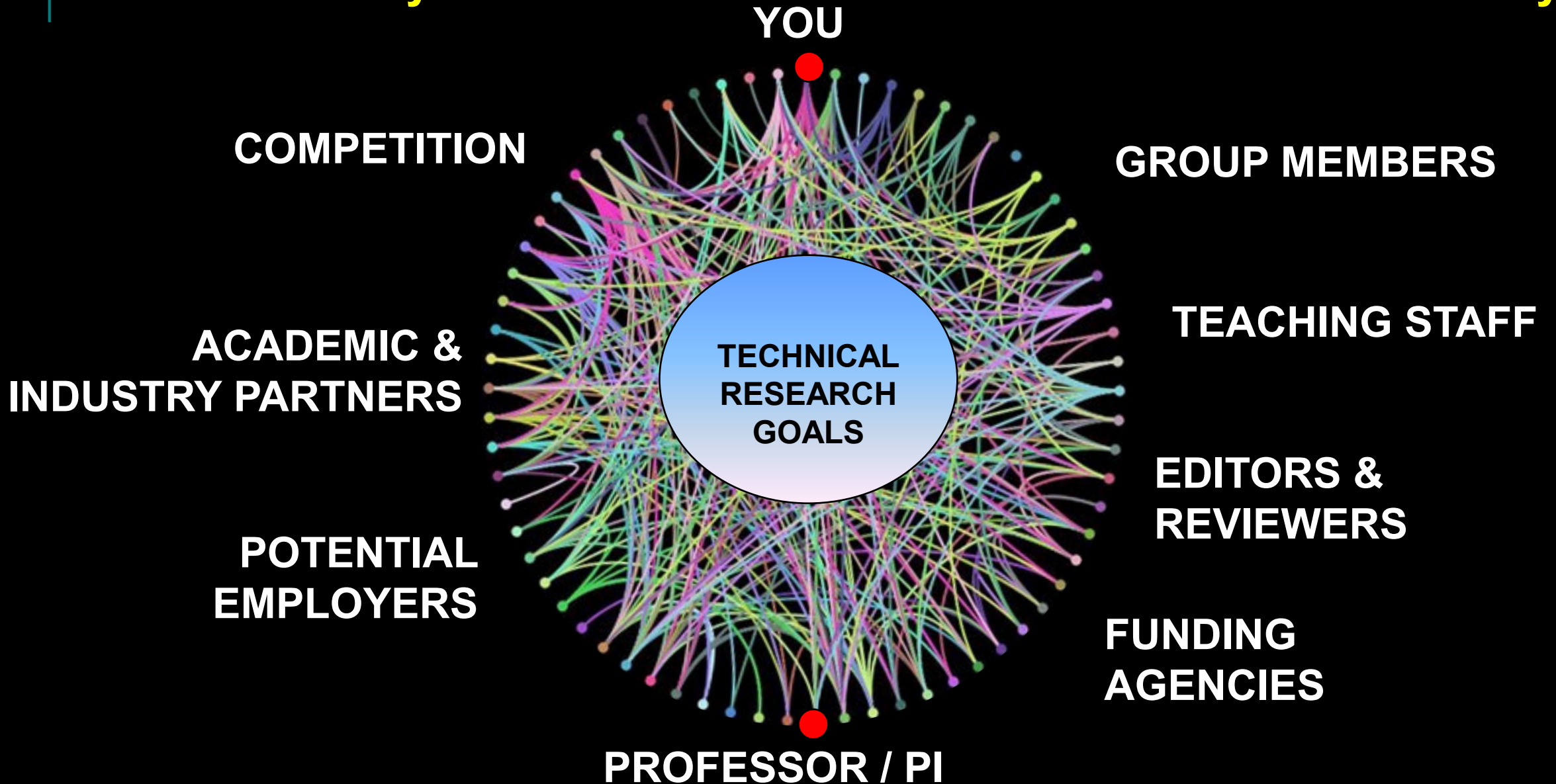
First impressions



* PI = Principal Investigator

Research ecosystem

The reality



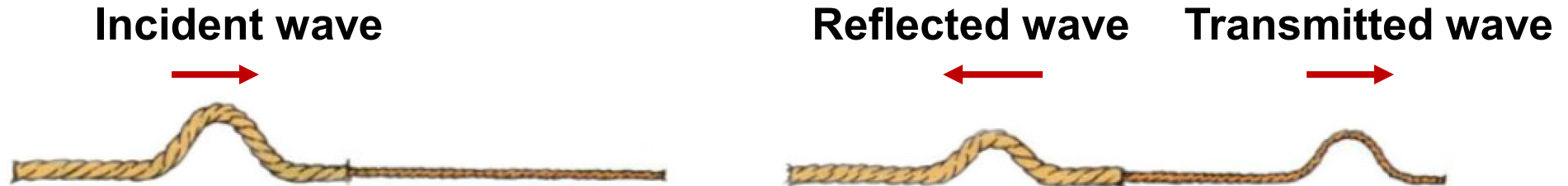
Probably the most important slide

How we communicate depends on who we are talking to and
the message we wish to communicate

Adapting the message to the audience is essential

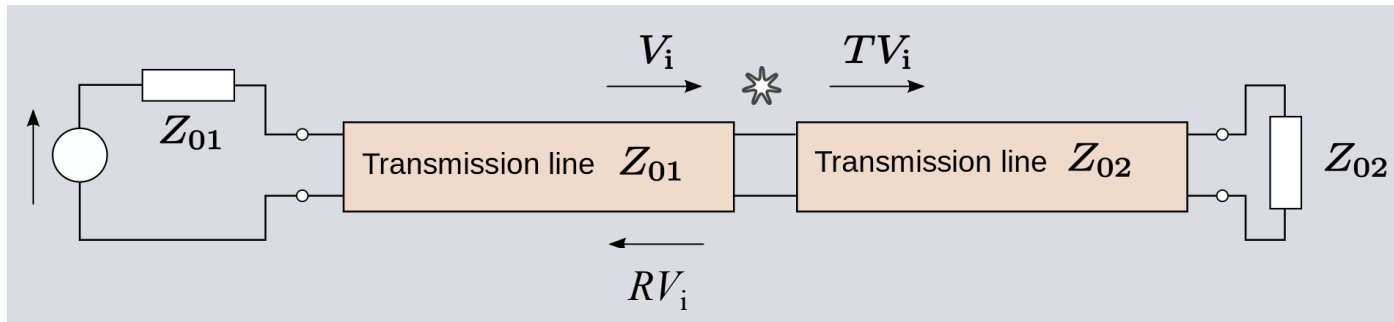
Useful Analogy

View communication as an impedance matching problem.
If you do not adapt to the audience, what you say will be reflected back !!



Useful Analogy

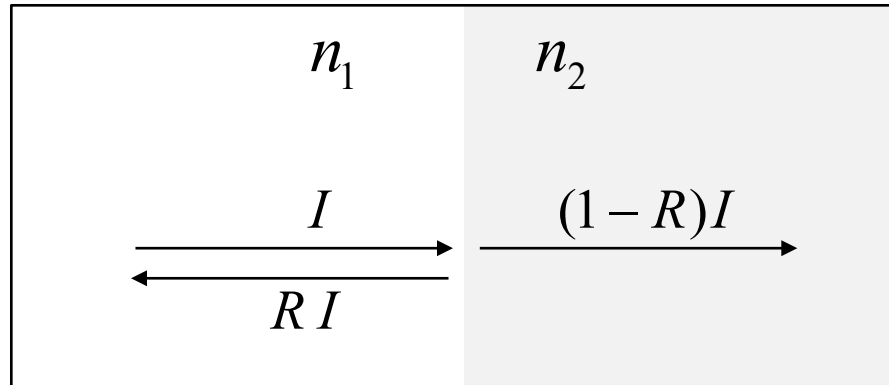
View communication as an impedance matching problem.
If you do not adapt to the audience, what you say will be reflected back !!



$$R = \frac{Z_{02} - Z_{01}}{Z_{02} + Z_{01}}$$

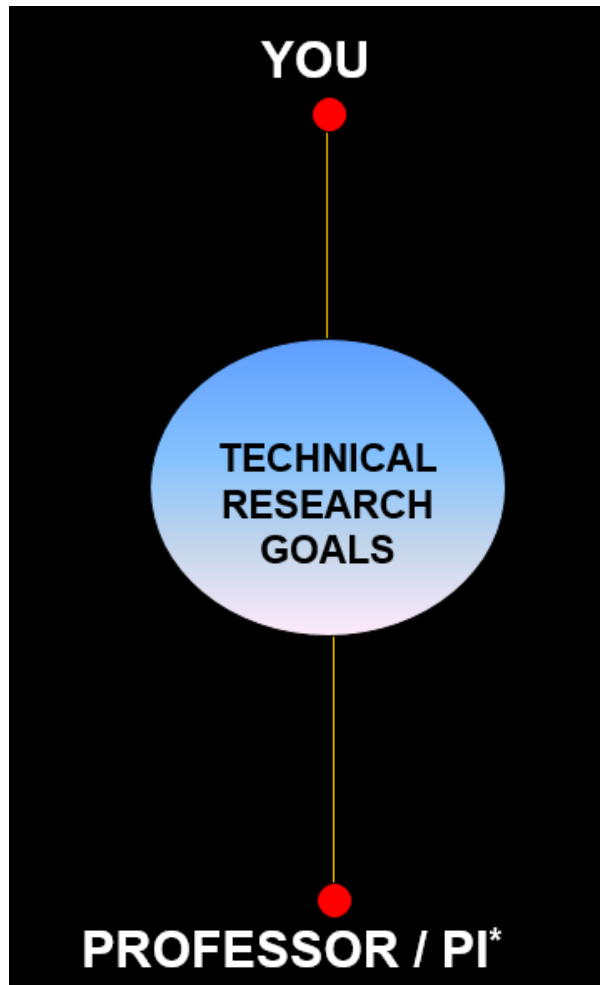
Useful Analogy

View communication as an impedance matching problem.
If you do not adapt to the audience, what you say will be reflected back !!



$$R = \left[\frac{n_2 - n_1}{n_2 + n_1} \right]^2$$

This advice applies to one-on-one interactions



Many PhD supervisors are 20-30 years older than their students (and getting older!)

Their experiences may be very different from yours

What was expected of them when they did their PhD?

Even communications expectation may vary (e.g. many professors consult email all hours, work weekends etc.)

Communication early avoids misunderstanding!

And for professors, when speaking to your students or teaching, you also take these differences into account!

A PhD is a superposition – communication is the key to survival

$$|\text{PhD Student}\rangle = \frac{1}{\sqrt{2}}|\text{Student}\rangle + \frac{1}{\sqrt{2}}|\text{Employee}\rangle$$

Some supervisors **ask for less than they expect** to see if you can figure out yourself that more needs to be done and to see if you can do it ...

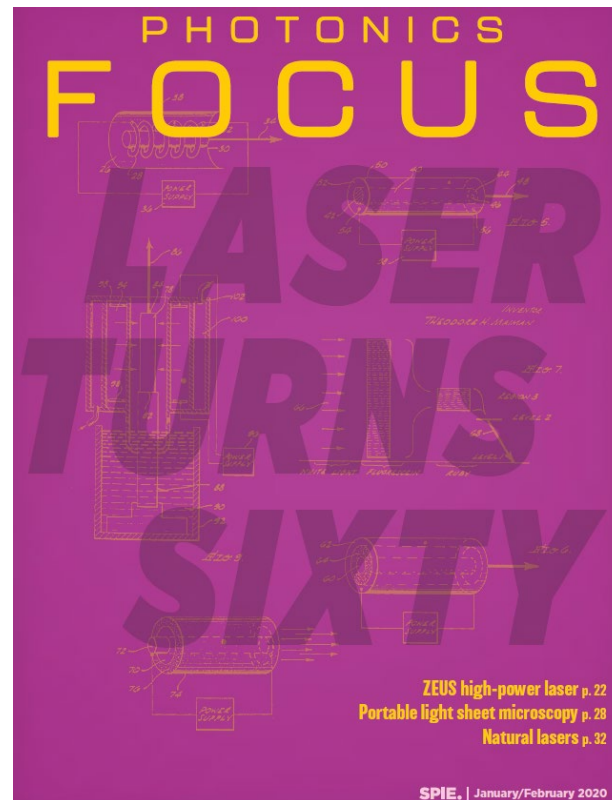
Other supervisors **ask for more than they know is possible**, simply to see what you can manage to do ...

Scientist to Scientist - publishing papers

Writing papers with minimal stress is one of the most important skills you can learn

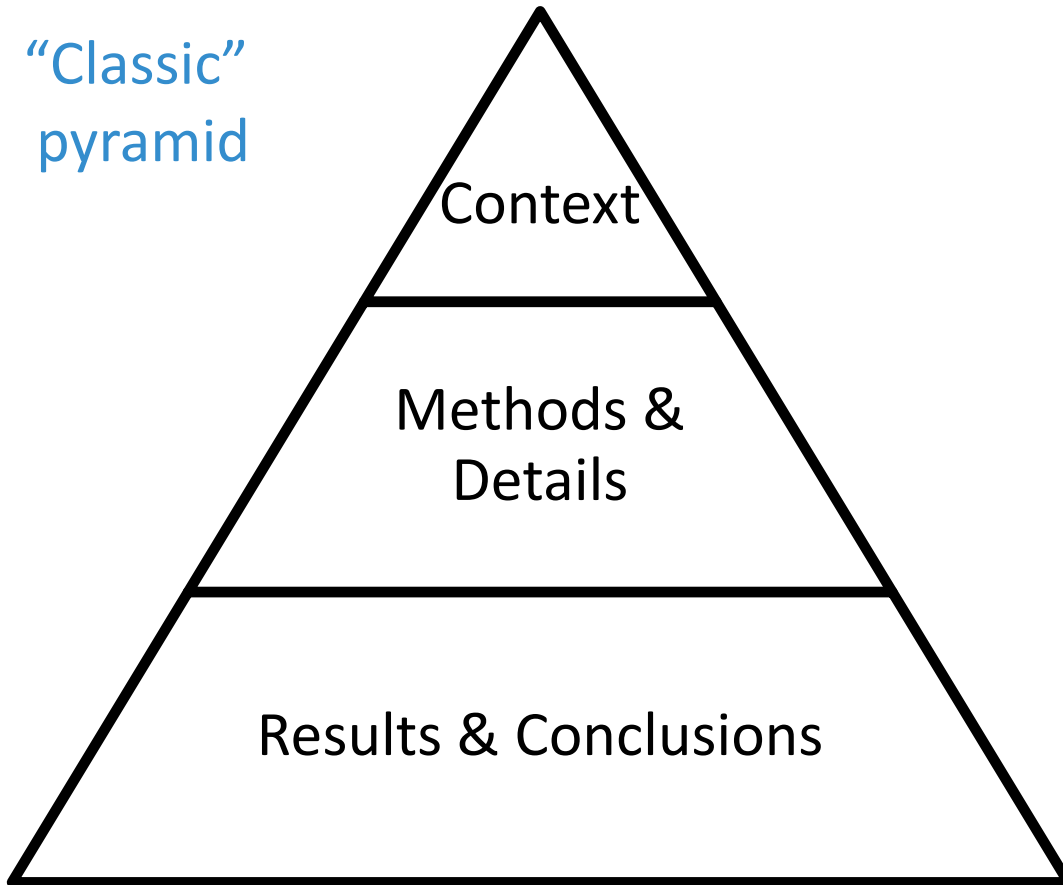
Writing puts your career under your control.

Writing seems daunting but all papers follow a similar structure. There are many useful resources!

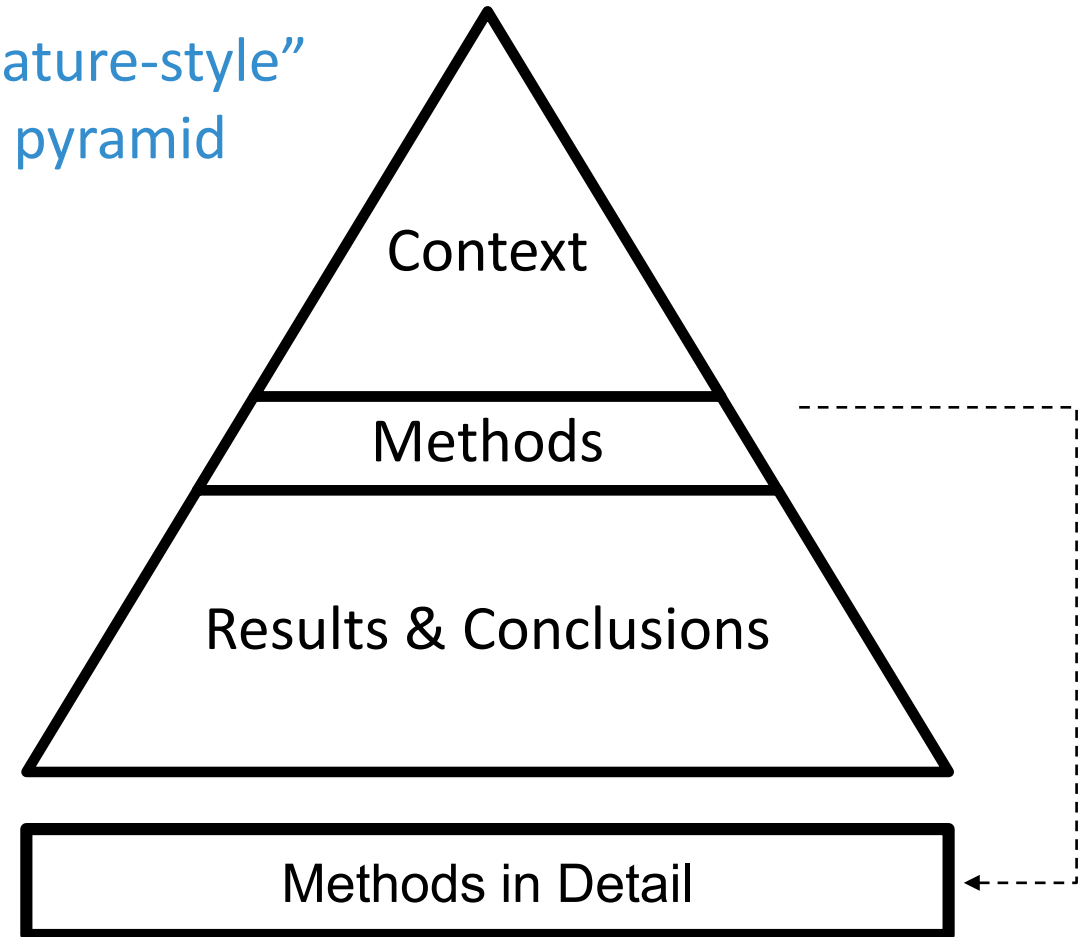


Most papers follow the same basic style

“Classic”
pyramid

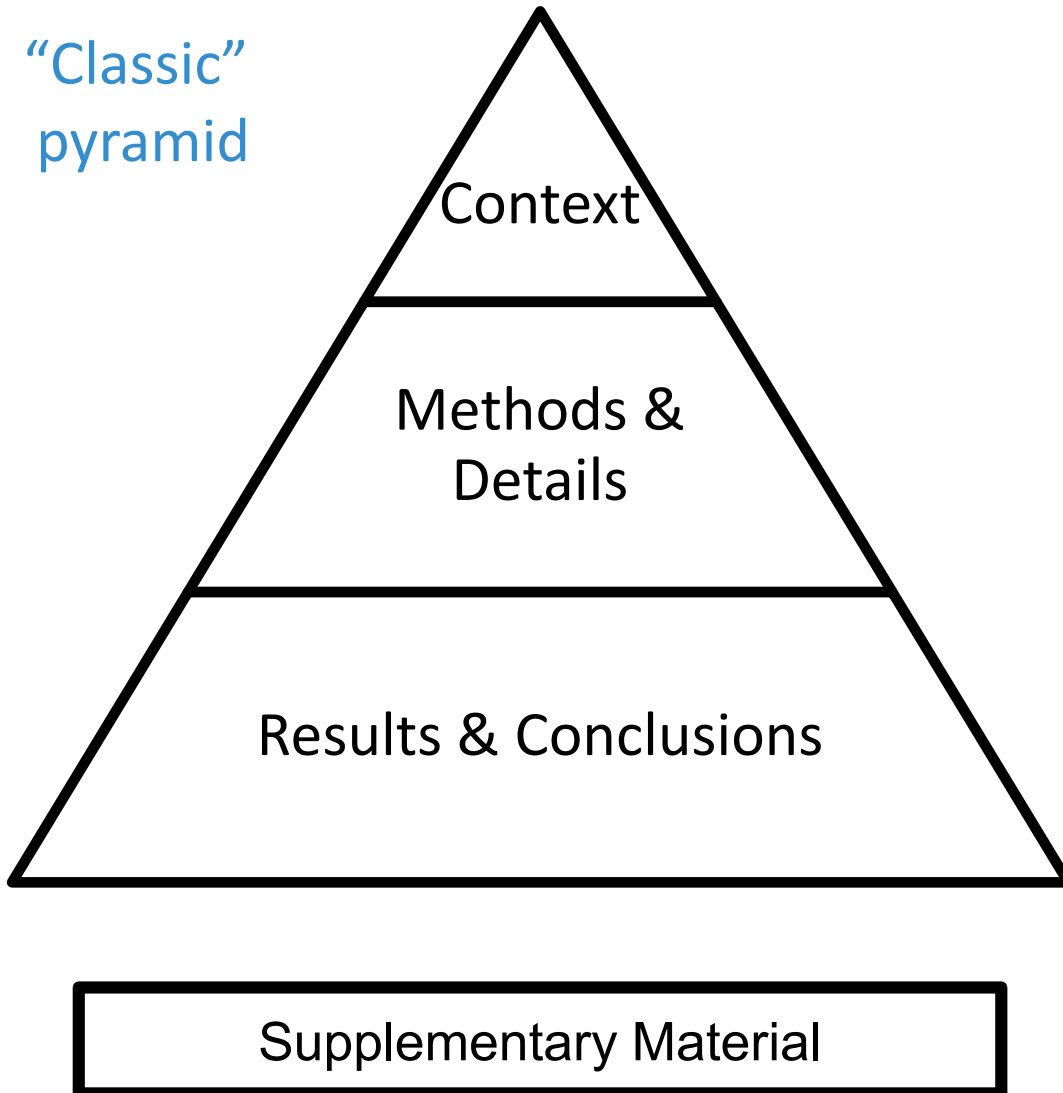


“Nature-style”
pyramid

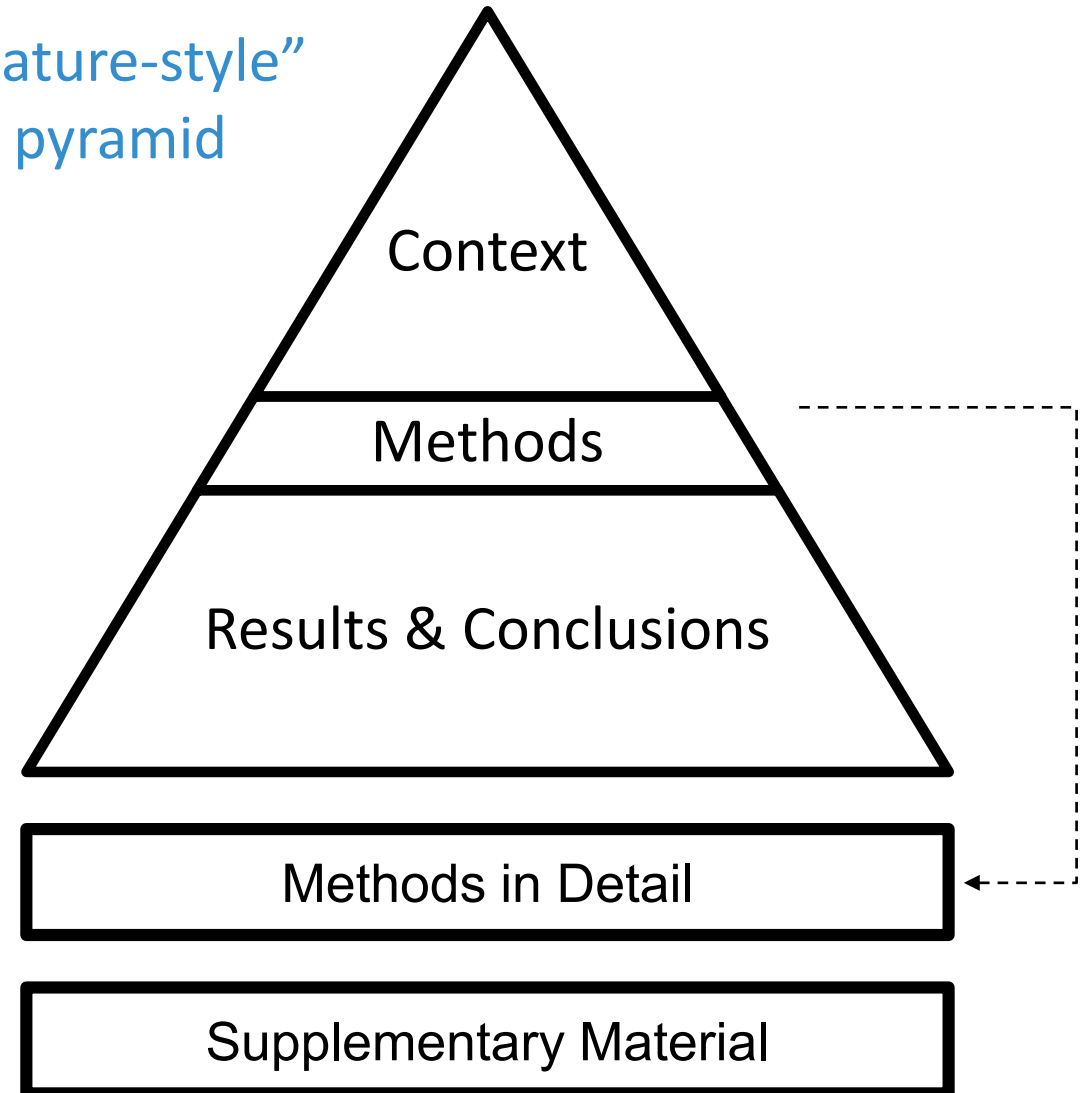


Most papers follow the same basic style

“Classic”
pyramid



“Nature-style”
pyramid



You are not writing a novel. You don't need to reinvent the wheel.

Ten Simple Steps to Writing a Scientific Paper

1. WRITE A VISION STATEMENT
2. DON'T START AT THE BEGINNING
3. STORYBOARD THE FIGURES
4. WRITE THE METHODS SECTION
5. WRITE THE RESULTS & DISCUSSION
6. WRITE THE CONCLUSION
7. NOW WRITE THE INTRODUCTION
8. ASSEMBLE THE REFERENCES
9. WRITE THE ABSTRACT
10. THE TITLE COMES LAST

Andrea Armani, SPIE Photonics Focus Jan/Feb 2020

This is an extremely useful starting template

With experience you develop a personal method that works for you

This applies to most forms of technical writing, Including industry reports etc.

Patents are usually written by experts after you provide a technical description of key “claims”

Paper writing can be broadly divided into three steps

Research & Preliminaries: doing the research, reading the literature.



The First Draft: the creative part. Resist the temptation to correct and edit to perfection as you go. Just lay out the structure.



Editing & Correction: checks for consistency, shortening. Often you need to do more research & reading, as writing raises new questions. This is normal!

You are not writing a novel. You don't need to reinvent the wheel.

Writing a first draft is like **putting sand into the bucket**. It's **later** that you build the sandcastle – Shannon Hale



SOME GOLDEN RULES

Start where it's easiest for you, not necessarily at the beginning

Drafting figures is a great way to see the structure of the paper

Then decide what to do next

A first draft is exactly that – a draft!

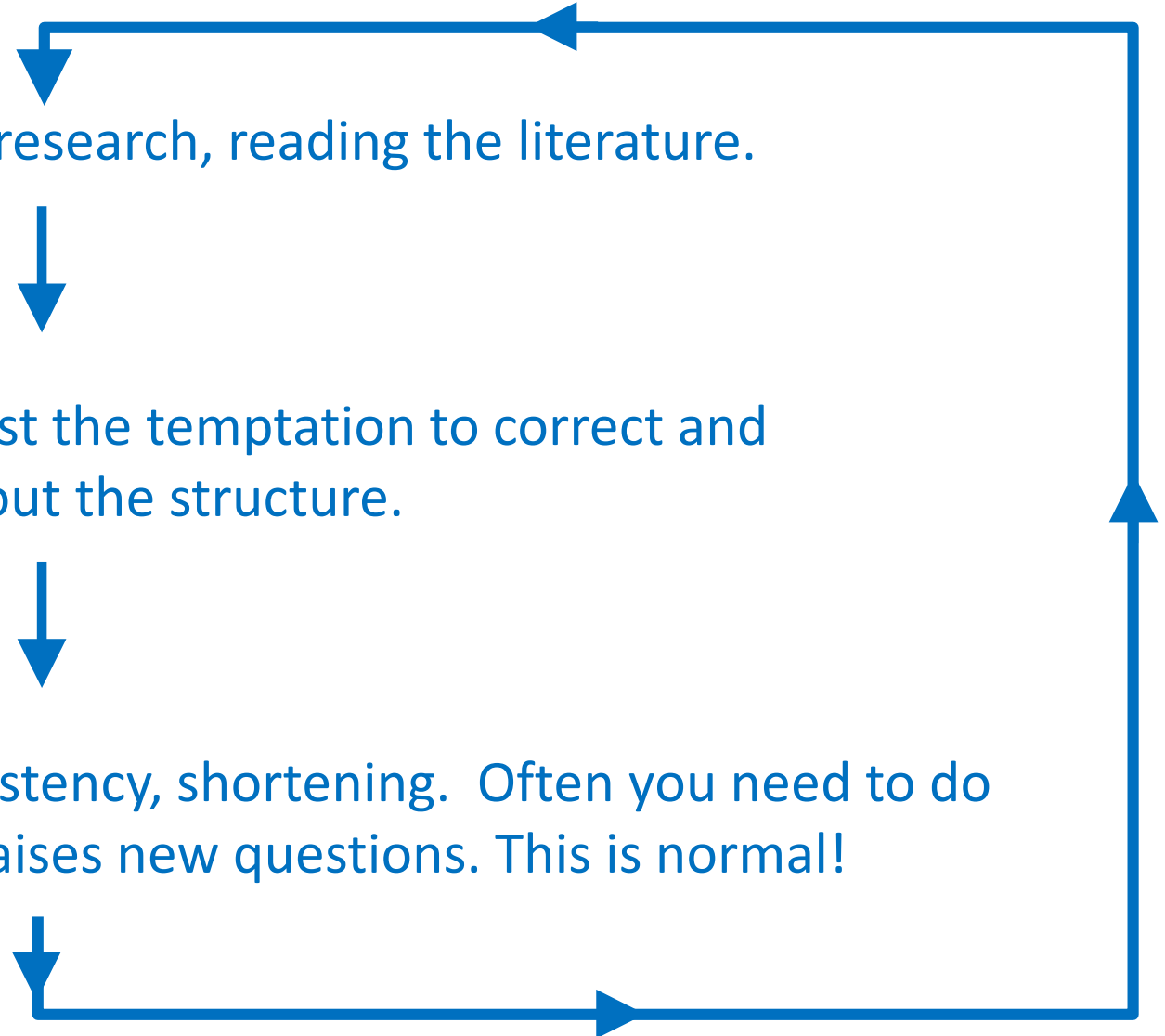
When editing, keep things short and simple wherever possible

Paper writing can be broadly divided into three steps

Research & Preliminaries: doing the research, reading the literature.

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The editing process – making things shorter & clearer



Search bar containing the text: "michal lipson writing"



 FILTER



"Scientific Writing", by Prof. Michal Lipson

6.2K views • 3 years ago



CCMR

Prof. Michal Lipson gave the below talk on scientific writing at Cornell University.

**HIGHLY
RECOMMENDED**

With practice, articles become easy to write

Articles follow a universal structure

There is no point in reinventing the wheel

3 figures and 5 paragraphs is the core of a short letter

If you have **writers' block**,

- try summarizing ideas in an email or a chat or use AI to summarise a meeting or discussion. The informal content can be transferred into paragraphs.
- ask a coauthor to do this! That's what they are for.

5 paragraphs as the core of a paper – really ?

1. Why this field is interesting, what has been done before, and what is missing
2. What we have done, how it is new, and what our main result is
3. How we did it: our experimental setup and/or theoretical approach
4. Our results
5. The consequences of our results for the field, and a summary

Citation management and paper writing tools

EndNote	Zotero	Mendeley
 MSU has made EndNote available on campus computers. You can set up preferences to search within specific databases and collect citations through a personalized interface, with hundreds of citation styles available.	 Zotero is a free software that you can download and use on Firefox, with plugins for Chrome and Safari. It saves citations and connections to online media, and takes screenshots of your internet research.	 Mendeley is a free software that you can download to your computer or use in-browser. It takes all of your PDF article files and organizes them. It allows for tagging, and has a growing community of scholars.
LEARNING CURVE		
Takes longer to learn, training recommended.	Quick to learn, especially with training.	Quick to learn, especially with training.
CONSIDERATIONS FOR USE		
Personal copies of EndNote are available for a fee through the Computer Store, or free on campus computers. Since EndNote is desktop-based, syncing between devices can be challenging, but continues to improve.	Zotero is used with your personal browser – to use it on multiple devices you have to carry your library settings on an external device or sync via Firefox, which is not secure on a public computer.	Mendeley has some difficulty downloading citations and PDF files from library databases. Older PDF files that do not have proper metadata will not give proper citation information to Mendeley.
STORAGE SPACE		
EndNote Desktop: your computer's storage capacity. EndNote Web: 2 GB free, unlimited with purchase of EndNote Desktop.	Zotero Desktop: your computer's storage capacity. Zotero Online: 300 MB free, additional space for a fee.	Mendeley Desktop: your computer's storage capacity. Mendeley Online: 2 GB free.

BIB_TE_X users

Entries extracted from the web can be full of errors or poorly formatted bibtex

A tool like JabRef can help you avoid the worst of these errors

You need to master the { }



Citation management and paper writing tools

This is not that important as a student, but it will make a good impression when you look for a PostDoc

Google Scholar Profiles are easy to set up



[Set up your Google Scholar Profile](#)

In any case, a good way to impress your supervisor is with Google Scholar alerts

Stay more aware of latest publications than your supervisor !

You send *them* the latest papers to read !!

Citation management and paper writing tools

PLoS ONE | DOI:10.1371/journal.pone.0115069 December 19, 2014



RESEARCH ARTICLE

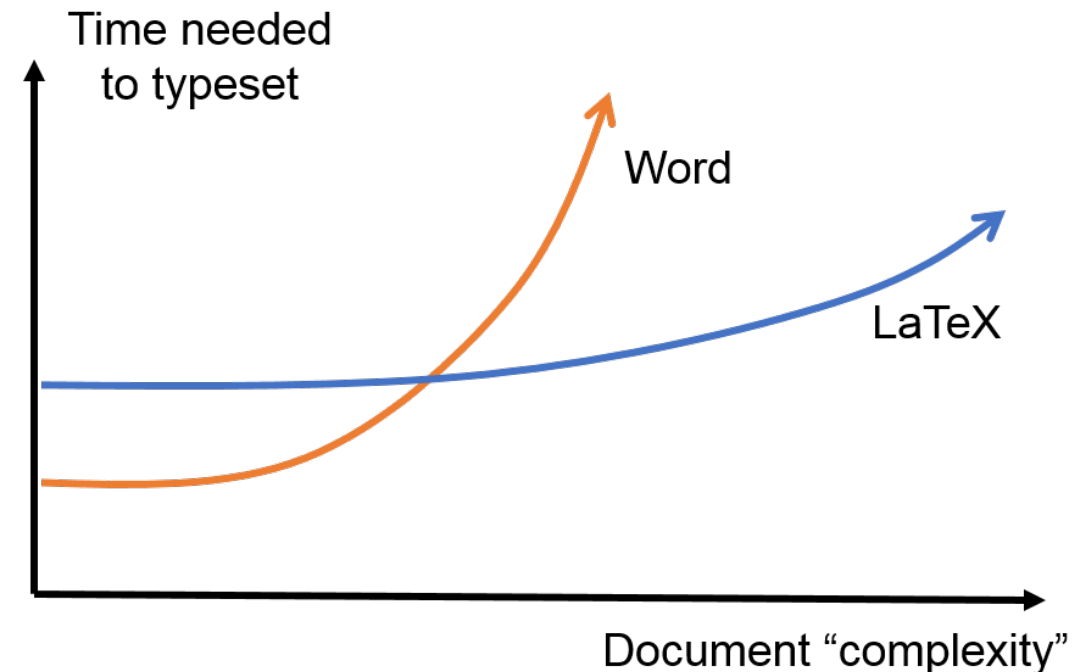
An Efficiency Comparison of Document Preparation Systems Used in Academic Research and Development

Markus Knauff*, Jelica Nejasmic

75% of submissions to scientific journals are not in LaTeX

LaTeX only outperforms Word when used by experts and, even then, only for complex documents with significant mathematics and bibliographies

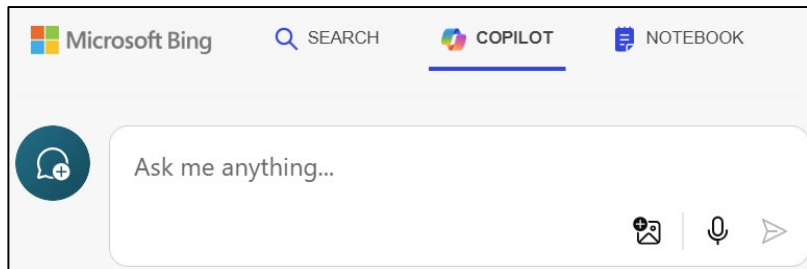
Don't neglect learning basic Office suite word processing skills. You will need to use outside academia



Citation management and paper writing tools



ChatGPT



You cannot under any circumstances “trust” these tools to get the science correct.

If you use them for papers and journals, automatic tools may detect your writing as plagiarism (“tortured phrases”)

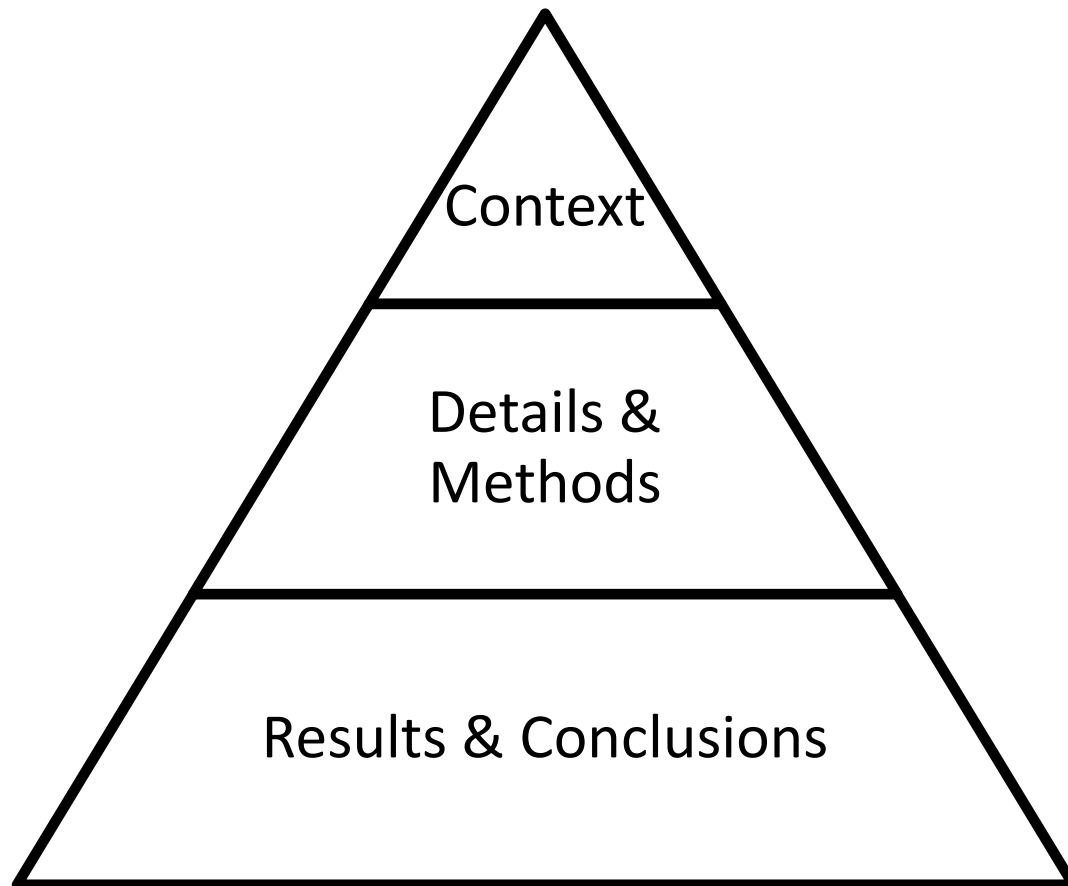
If you use the tools to create a “structure” and then add your own correct technical science, they can help you be more efficient, especially when suffering from writers block

Human iteration between co-authors will (hopefully) remove any residual trace of AI-speak ...

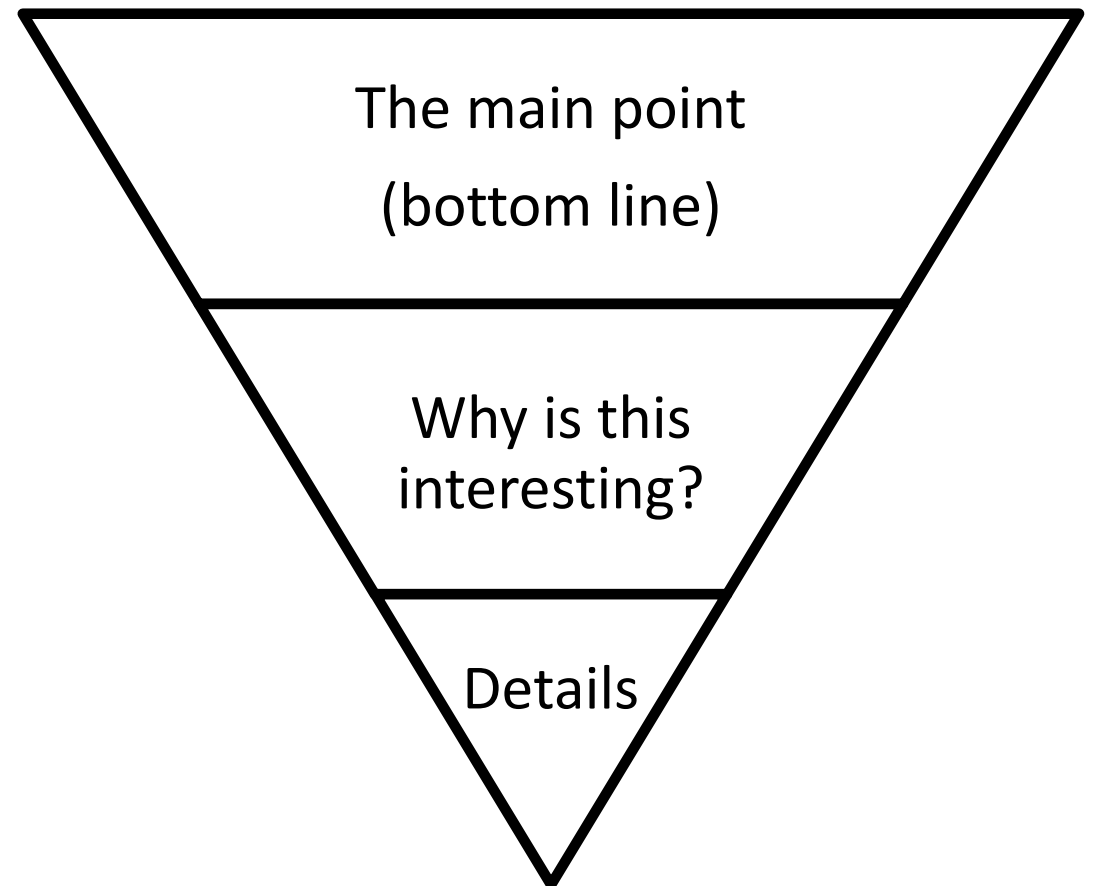
BUT BE CAREFUL

Scientist to Editor: most journals now want a cover letter

Papers – the “pyramid”



Cover letters – the “inverted pyramid”



Scientist to Editor: cover letters use a different style

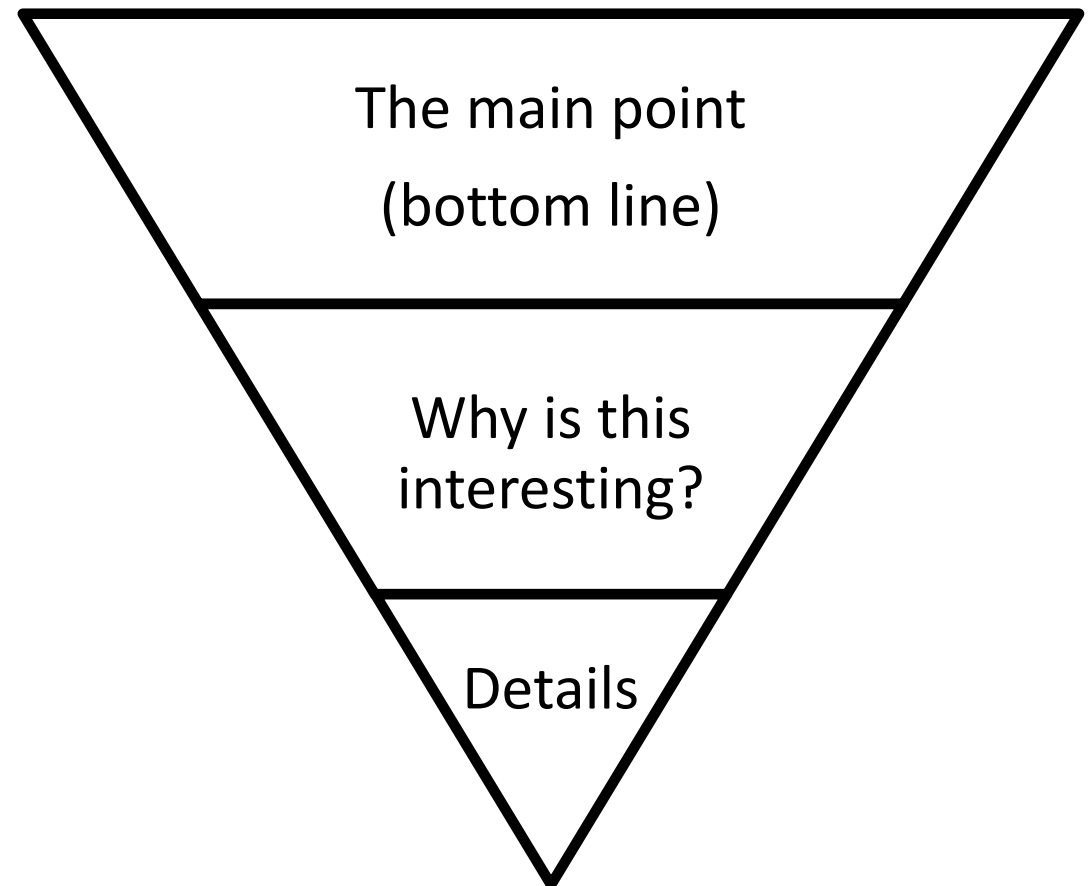
Cover letters – the “inverted pyramid”

Inverted Pyramid writing is used to get to the point quickly:

Stressing impact to pass editorial screening

Press Releases after publication

Grant Proposal abstracts

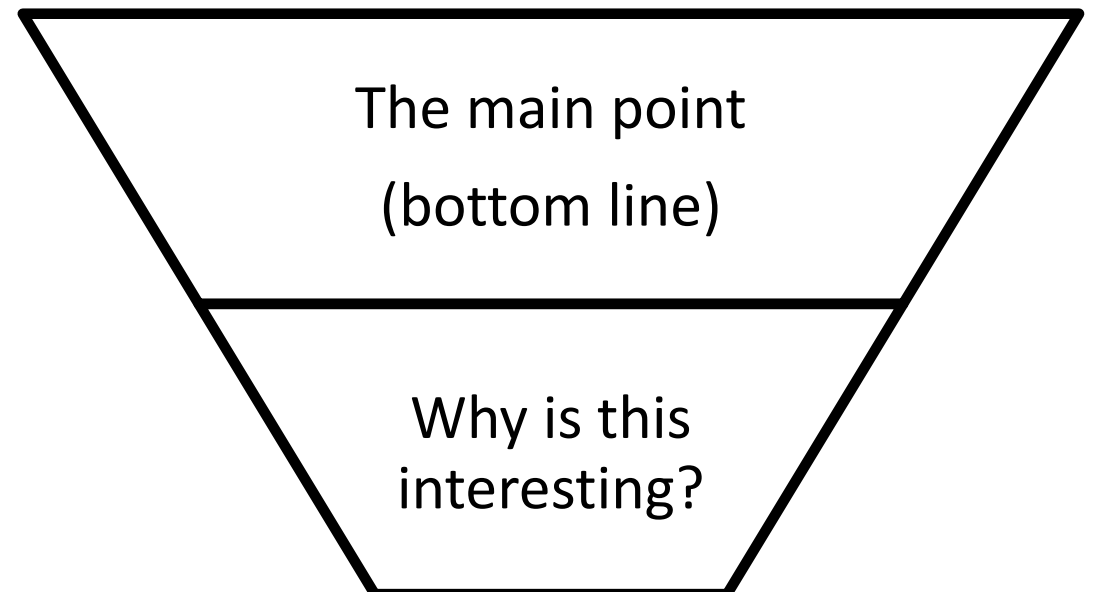


Scientist to VIP: the elevator pitch

Sometimes you need to be able to explain your work in 30 seconds
e.g. during a lab visit by VIPs

No details in this case
(unless asked!)

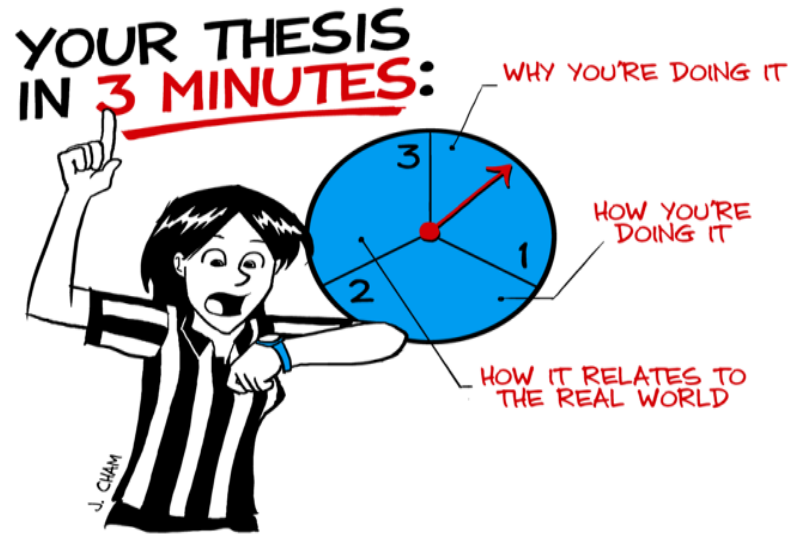
An even more condensed form



THE KEY POINT

Adapt your message to your audience

Scientist to VIP: the elevator pitch



© Jorge Cham phdcomics.com

This applies at all career stages

We ask our students to prepare concise “elevator speech” summaries of their work

We need to do the same

Prepare not improvise

THE KEY POINT

Adapt your message to your audience

Figures

It may seem obvious, but the ability to make excellent quality figures is an essential component of communicating your results to the audience.

A good “figure maker” can also become an indispensable team member.

You don’t need to be a Blender expert, but skills with Inkscape or Illustrator are essential for vector graphics, and Gimp or Photoshop for images

Graphs need to be saved as professional quality vector graphics i.e. graphics that are **uncompressed** that can be scaled while preserving full fidelity

This is because journals now **require data to be shareable** – a reader should be able to extract raw data from your figures to check it or to extend your work.

(Learn about graphics)

Raster vs. Vector

VS VS

Raster Graphics	Vector Graphics
They are composed of pixels.	They are composed of paths.
In Raster Graphics, refresh process is independent of the complexity of the image.	Vector displays flicker when the number of primitives in the image become too large.
Graphic primitives are specified in terms of end points and must be scan converted into corresponding pixels.	Scan conversion is not required.
Raster graphics can draw mathematical curves, polygons and boundaries of curved primitives only by pixel approximation.	Vector graphics draw continuous and smooth lines.
They occupy more space which depends on image quality.	They occupy less space.
File extensions: .BMP, .TIF, .GIF, .JPG	File Extensions: .SVG, .EPS, .PDF, .AI, .DXF

Quality graphs

Generally, no single package does the whole job for vector graphics

Make Data, Basic Figures



learn all the
save options



Layout Tweaks



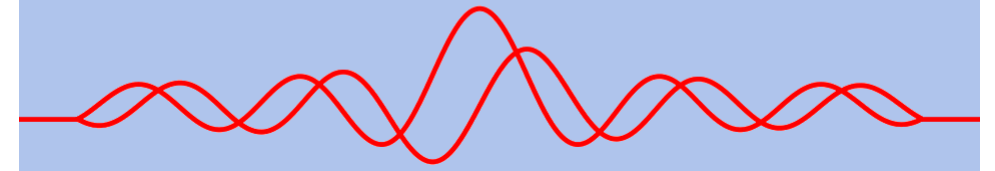
many others ...

Data and Page Layout Options



Much Faster Data Import
Much Easier Graph Customization

Igor Pro 8



many others ...

When to stop writing

There is always the temptation to do a bit more, and two simple questions can help

1. Is the content of my paper comparable to recent papers in the field?
2. Is there anything missing that could lead to rejection?

Also remember that reviewers may ask for extra information anyway and you can add extra results in later ; continuing work can be kept in hand to respond to reviewers

Generally, once the paper passes a standard where it is self-contained & checked, submit !

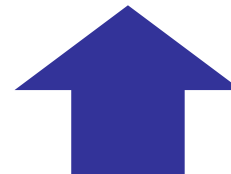
Priority is usually better than perfection – at least for the initial submission

The choice of journal is a communications problem

The impact factor of a journal (a two year rolling average of citations) is a widespread but sometimes controversial proxy of the importance of a journal and the potential impact of papers published in it

Fighting to publish in a high impact journal is not always worth it in terms of lost time

More time to write
Higher Rejection Rate
Lost Time in Multiple Reviews



**Perceived Visibility in a High
Impact Journal**

The choice of journal is a communications problem

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Student and Supervisor interests may not really align at this point

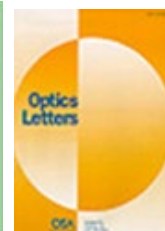
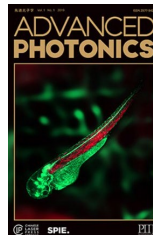
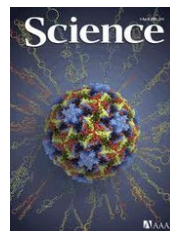
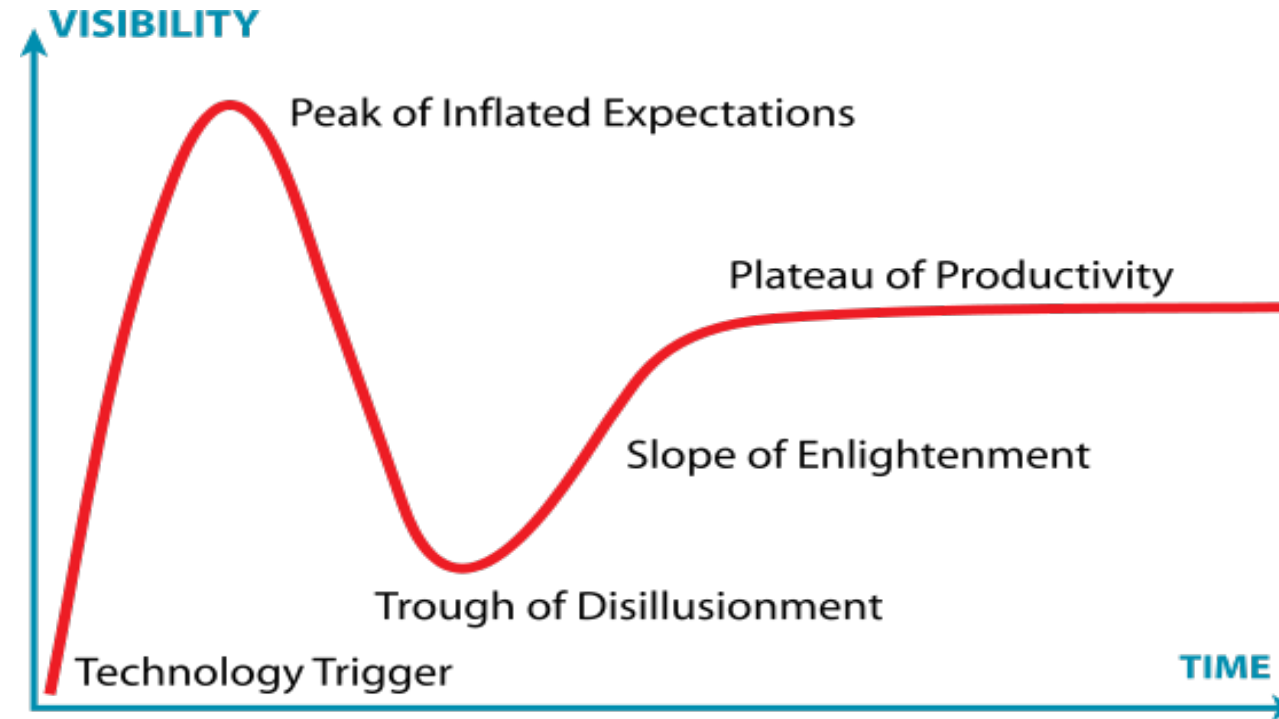
STUDENT	SUPERVISOR / PI
I need a paper soon to graduate	I don't mind waiting for 12 months
I want a high impact paper for my CV	I need a paper soon for a grant proposal

Where are you in the development cycle ?

Gartner Hype Cycle



WIKIPEDIA
The Free Encyclopedia



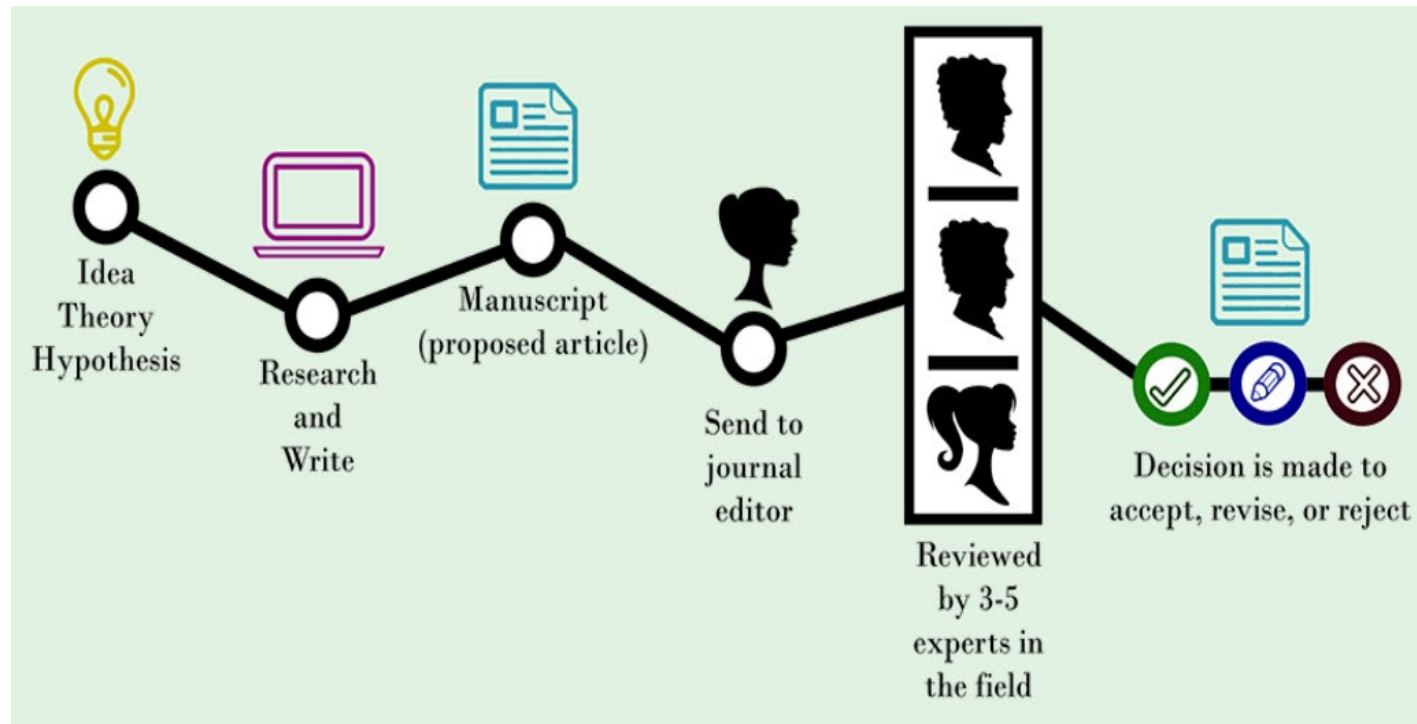


Now your paper is written – what next?

Peer review is an important first step

Peer review is the evaluation of work by one or more people with similar competences as the producers of the work (peers or referees).

It functions as a form of self-regulation and quality assurance within a field



Peer review is an important first step

Peer review is the evaluation of work by one or more people with similar competences as the producers of the work (peers or referees).

Even the giants sometimes get unhappy with peer review!

September 2005 Physics Today

Einstein Versus the *Physical Review*

Daniel Kennefick

The *Physical Review* received Einstein's submission on 1 June 1936, according to the journal's logbook. Tate returned the manuscript to Einstein on 23 July with a critical review and the mild request that he "would be glad to have [Einstein's] reaction to the various comments and criticisms the referee has made." Einstein wrote back on 27 July in high dudgeon, withdrawing the paper and dismissing out of hand the referee's comments:

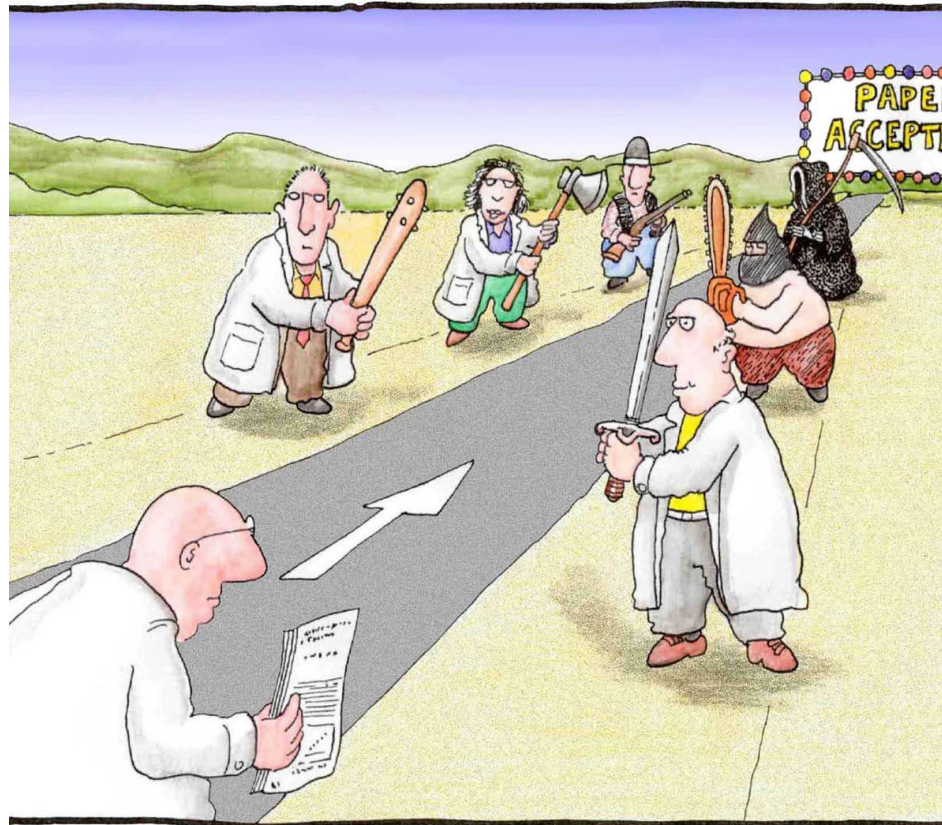
Dear Sir,

We (Mr. Rosen and I) had sent you our manuscript for publication and had not authorized you to show it to specialists before it is printed. I see no reason to address the—in any case erroneous—comments of your anonymous expert. On the basis of this incident I prefer to publish the paper elsewhere.

Respectfully,

Peer review is an important first step

Peer review is not always easy, but usually leads to a better paper in the end ...



Most scientists regarded the new streamlined peer-review process as "quite an improvement."

Final thoughts on writing papers

Do not underestimate your work

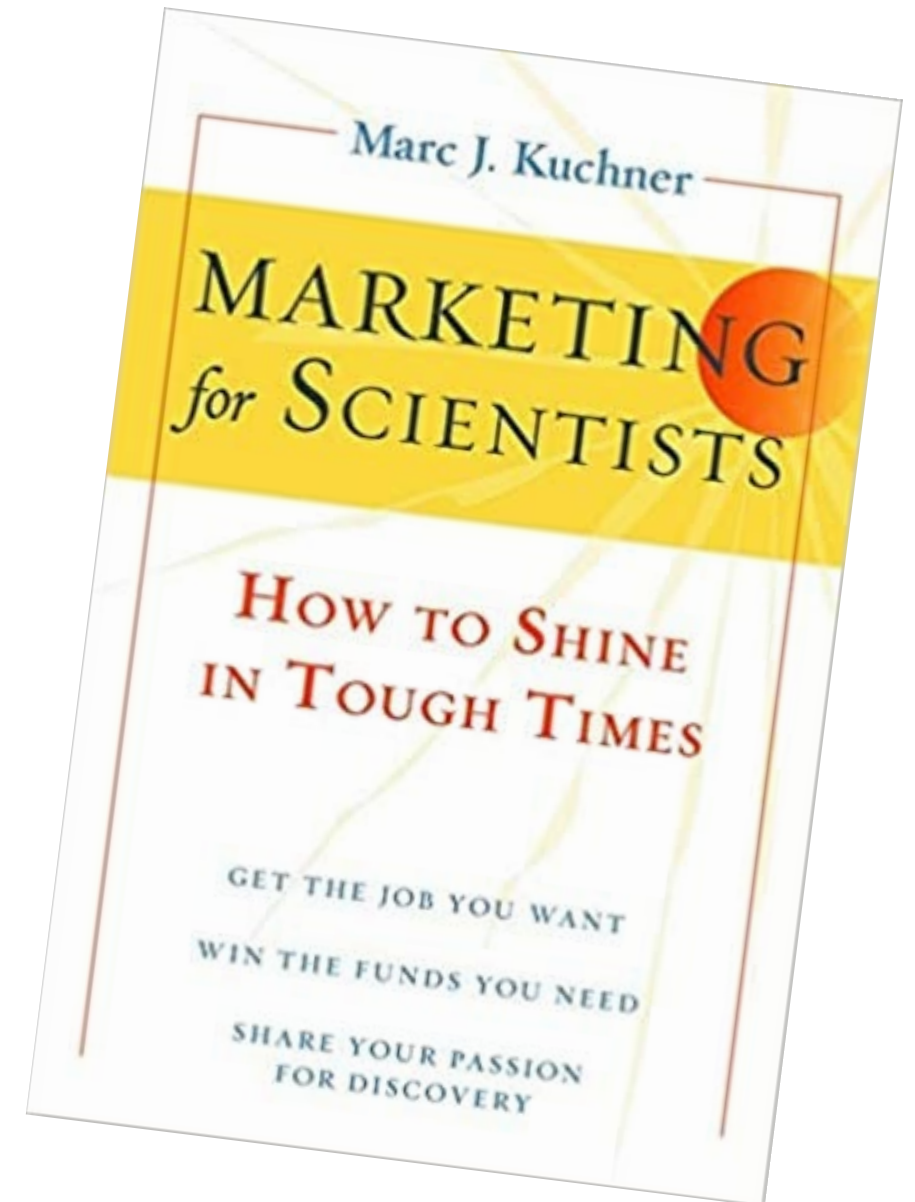
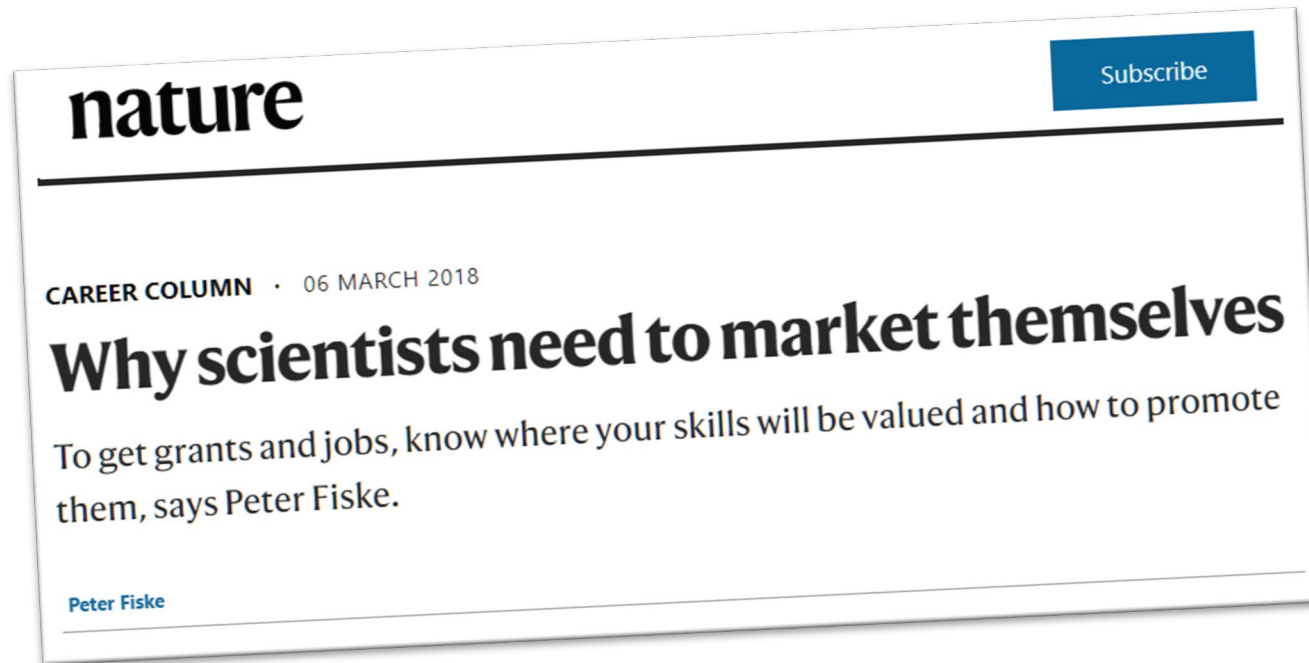
Rejection & criticism **happens to everyone** throughout their career – drafts, papers, grant proposals, jobs, prizes, ...

Reviewers can miss the point, make mistakes wrong and they can also be unkind ...
(this is getting better but slowly)



Quickly moving on from **natural feelings of discouragement** is a key skill to learn

Communicating about yourself



Communicating about yourself

It would be nice to think that we can carry out fundamental research, motivated purely by curiosity

But funding comes from multiple directions, and everybody wants to quantify “return” on investment

This is very much an example of “short-termism” and every country and institution is different

Priorities of Institution 1

- Papers published
- Talks given
- Funding obtained

.....

- Teaching experience

Priorities of Institution 2

- Funding obtained

.....

- Papers published
- Talks given
- Teaching experience

Priorities of Institution 3

- Teaching experience
- Papers published
- Talks given

.....

- Funding obtained

Your CV is probably the most important “communication document” you will write!

How much time do you spend on it? Adapt it to the intended audience!

What do scientific communication skills teach us?

Rigour & Perfectionism

Scientists and engineers are generally known for attention to detail – sometimes extreme!

Inconsistency Radar

Science trains you to look for unambiguous arguments that do not contain illogical argument or contradictions.

Economy of expression

Science communication should be short and to the point.

The idea is the key

Ideas and results matter more than the words.

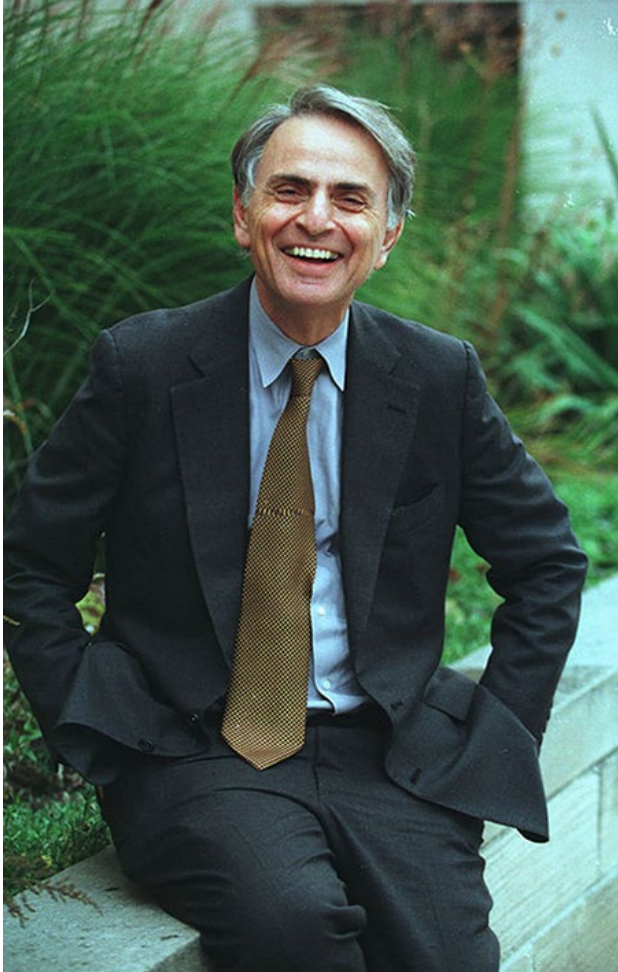
Structure

A clear logical flow of ideas from introduction to conclusion.

Honesty

We get used to being wrong and correcting our ideas.

This general training is perhaps the most important part of a PhD



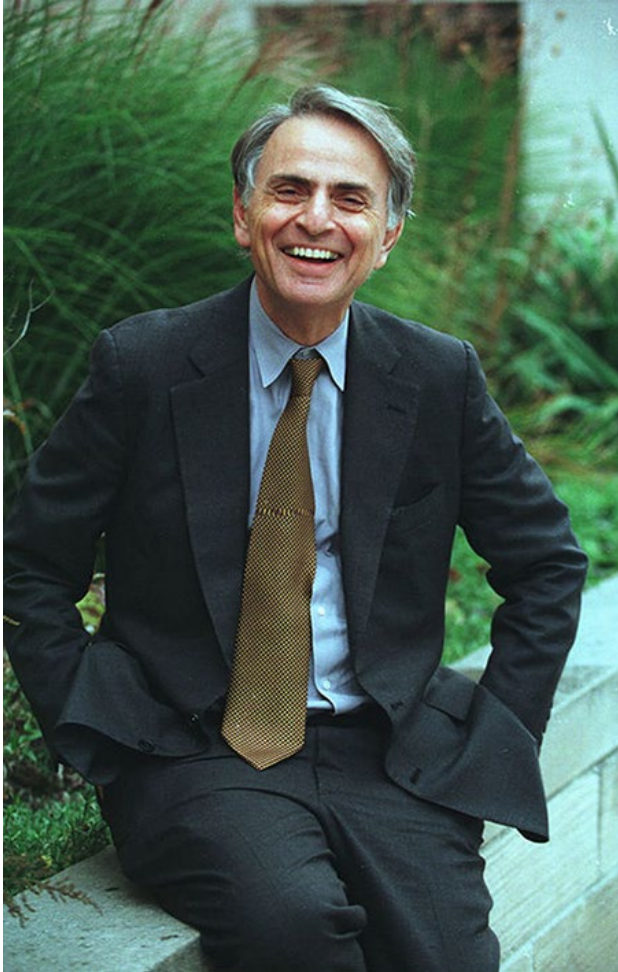
Carl Sagan (1934-1996) was an American astronomer, author, and science communicator

He assembled the first physical messages sent into space: the Pioneer plaque and the Voyager Golden Record

He advocated skeptical inquiry and the scientific method

He also popularized science through books and TV series

This general training is perhaps the most important part of a PhD



In science it often happens that scientists say, “You know that's a really good argument; my position is mistaken,” and then they would actually change their minds and you never hear that old view from them again.

They really do it. It doesn't happen as often as it should, because scientists are human and change is sometimes painful. But it happens every day.

I cannot recall the last time something like that happened in politics or religion. It's very rare that a senator replies, “That's a good argument. I will now change my political affiliation.”

Keynote address at CSICOP conference, Pasadena, California (3 Apr 1987). Printed in 'The Burden of Skepticism', *Skeptical Inquirer* (1987), **12**, No. 1.
Collected in Kendrick Frazier (ed.), *The Hundredth Monkey: And Other Paradigms of the Paranormal* (1991)

This general training is perhaps the most important part of a PhD

15 FEBRUARY 2018 | VOL 554 | NATURE | 277

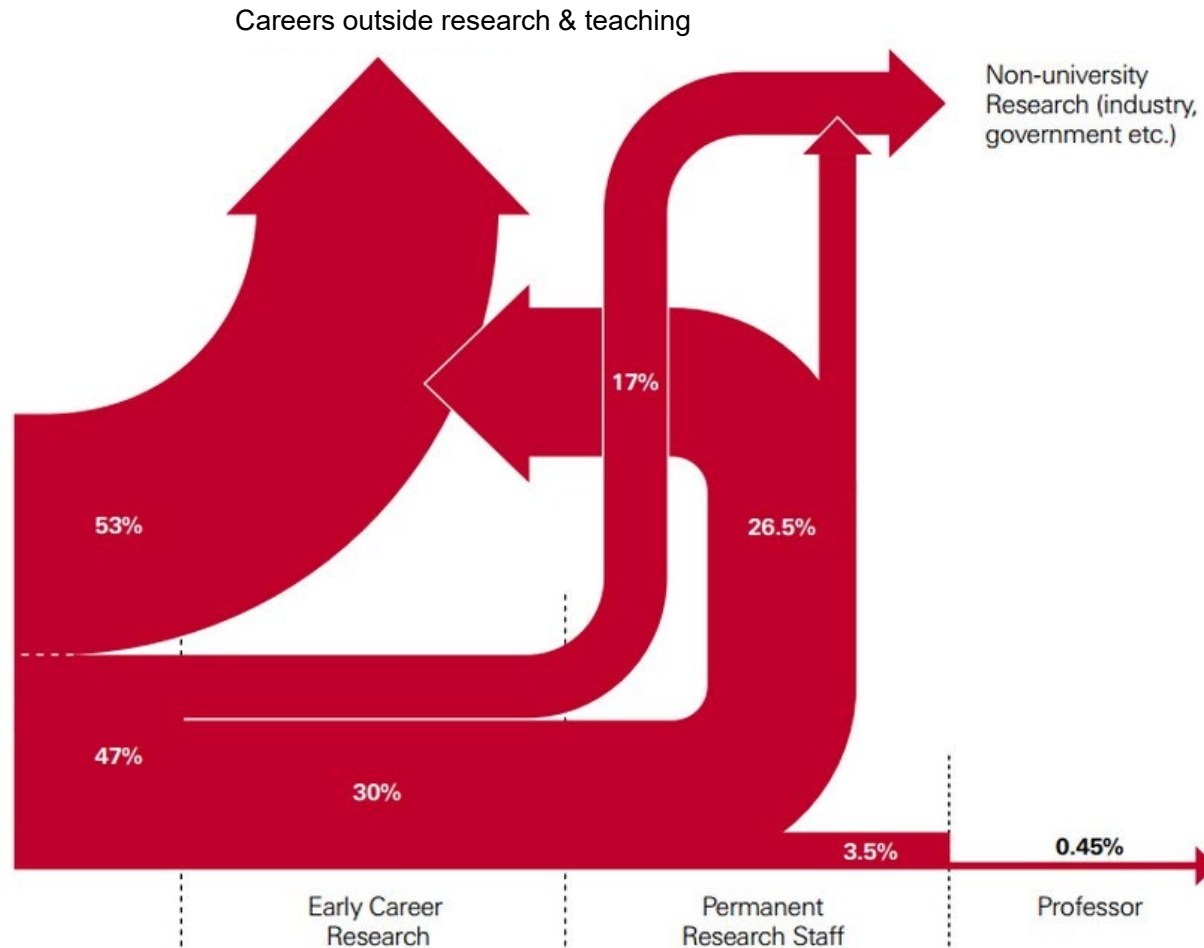
WORLD VIEW *A personal take on events*



Train PhD students to be thinkers not just specialists

*Many doctoral curricula aim to produce narrowly focused researchers rather than critical thinkers. That can and must change, says **Gundula Bosch**.*

Where do you want to end up?



Many (sometimes the majority) of people with a science degree work outside the “academic” field of research & teaching.

Communication skills are useful and important everywhere.

Moreover there is growing need for an expert community in science communication.

This diagram illustrates the transition points in typical academic scientific careers following a PhD

© The Royal Society, 2010

Where do you want to end up?

Leaving academia should never ever be considered or described as “failure”

134 | NATURE | VOL 560 | 2 AUGUST 2018

CAREERS

COLUMN

You are not a failed scientist

PhD students who leave academia should be supported, says **Philipp Kruger**.

**SCIENTIFIC
AMERICAN®**

Should Staying in Academia Be Considered a Failure?

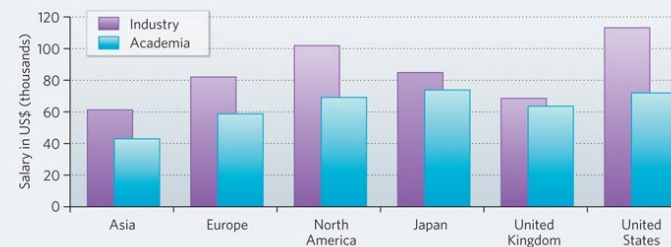
People assume that the opposite is true, but fulfilling careers and intellectual freedom are just as abundant outside of the academy—and maybe even more so

By Ahmed Alkhateeb on September 19, 2018

**OPTICS & PHOTONICS
GLOBAL SALARY
REPORT 2019**

SPIE.
THE INTERNATIONAL SOCIETY
FOR OPTICS AND PHOTONICS

SALARIES: ACADEMIA VS INDUSTRY



For-profit employees
earn more and work
fewer hours than their
academic colleagues.



Careers in science communication



As a Science Communicator or Science Journalist

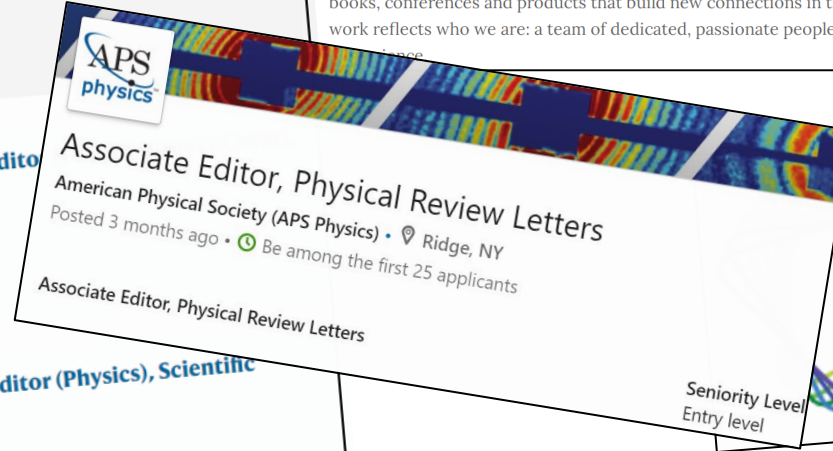
Act as the interface between scientists and the public in explaining the importance of science and keeping the public informed on latest results

Careers in science communication



Careers at AIP Publishing

Working at AIP Publishing means being part of a mission: to accelerate scientific discovery while reimagining the future of scholarly publishing. From groundbreaking journals to books, conferences and products that build new connections in the physical sciences, our work reflects who we are: a team of dedicated, passionate people who love what we do and



As a Professional Editor

Some publishers recruit editors after a PhD and 1-2 years postdoc. The “interview” might involve writing something like a short technical summary, or maybe a “News & Views”

Careers in science communication



Science & policy

There are important science-related advisory positions in governments , national academies, international organizations, NGOs etc. Many of these start with internships & fellowships so keep your eyes open if interested.

Reaching out is important

282 | JUNE 2020 | VOLUME 2

www.nature.com/natrevphys

VIEWPOINT

Reaching out

Katherine Mack, Karl Kruszelnicki, Lisa Randall, Jessica Wade, Jim Al-Khalili and Vlatko Vedral

In the midst of the COVID-19 pandemic, science is crucial to inform public policy. At the same time, mistrust of scientists and misinformation about scientific facts are rampant. Six scientists, actively involved in outreach, reflect on how to build a better understanding and trust of science.

Show the world who we are

Tell the truth

Tackle misinformation

Share the spirit of science

Stress the scientific method

Reaching out is important

NATURE REVIEWS | MATERIALS VOLUME 6 | MAY 2021 | 377

COMMENT



Communication is central to the mission of science

Sonia Contera

The future of our species and planet hinges on our scientific creativity to tackle future challenges. However, the trust of the public in scientific processes needs to be earned and kept, which will require inclusive, self-reflecting, honest and inspiring science communication.

Show the world who we are

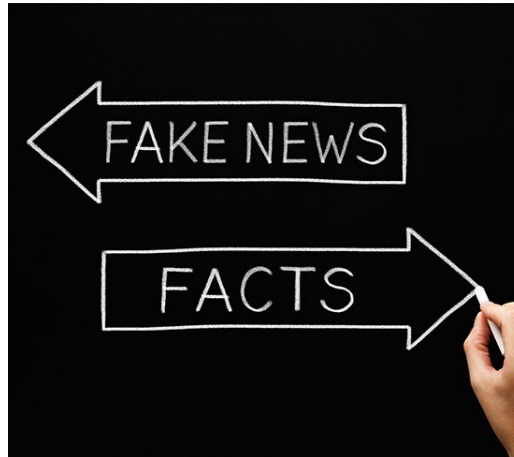
Tell the truth

Tackle misinformation

Share the spirit of science

Stress the scientific method

Our role in fighting fake news and disinformation



Definitions

Misinformation

Information that is false, out of date, or misleading but not deliberately so. It may be shared but with no intention to cause harm.

Disinformation

False or misleading information designed and spread expressly in order to deceive and/or to amplify controversies. Alternative Facts.

Fake News

Misinformation or disinformation presented as news.

Definitions

Conspiracy Theories

Explanations of events based on manipulation by political groups, ignoring simpler and more probable explanations. Often based on prejudice.

Pseudo sciences

Information that claims to be scientific but which is incompatible with the scientific method. Often characterized by contradictions and exaggerations

Post truth

An environment in which public opinion is based more on appeals to emotion and beliefs rather than objective and confirmed facts and evidence

Key message of the day

Just because someone speaks confidently and tells you what you may want to hear does not mean they are a reliable source!



This includes me, and this includes this talk!

The key message of the day is to encourage everyone to **evaluate everything** they read and everything they say using the **same criteria and methods that we use when we do science.**

How many of our “opinions” and how much of what we “believe” have **we actually evaluated and studied** using reliable sources?

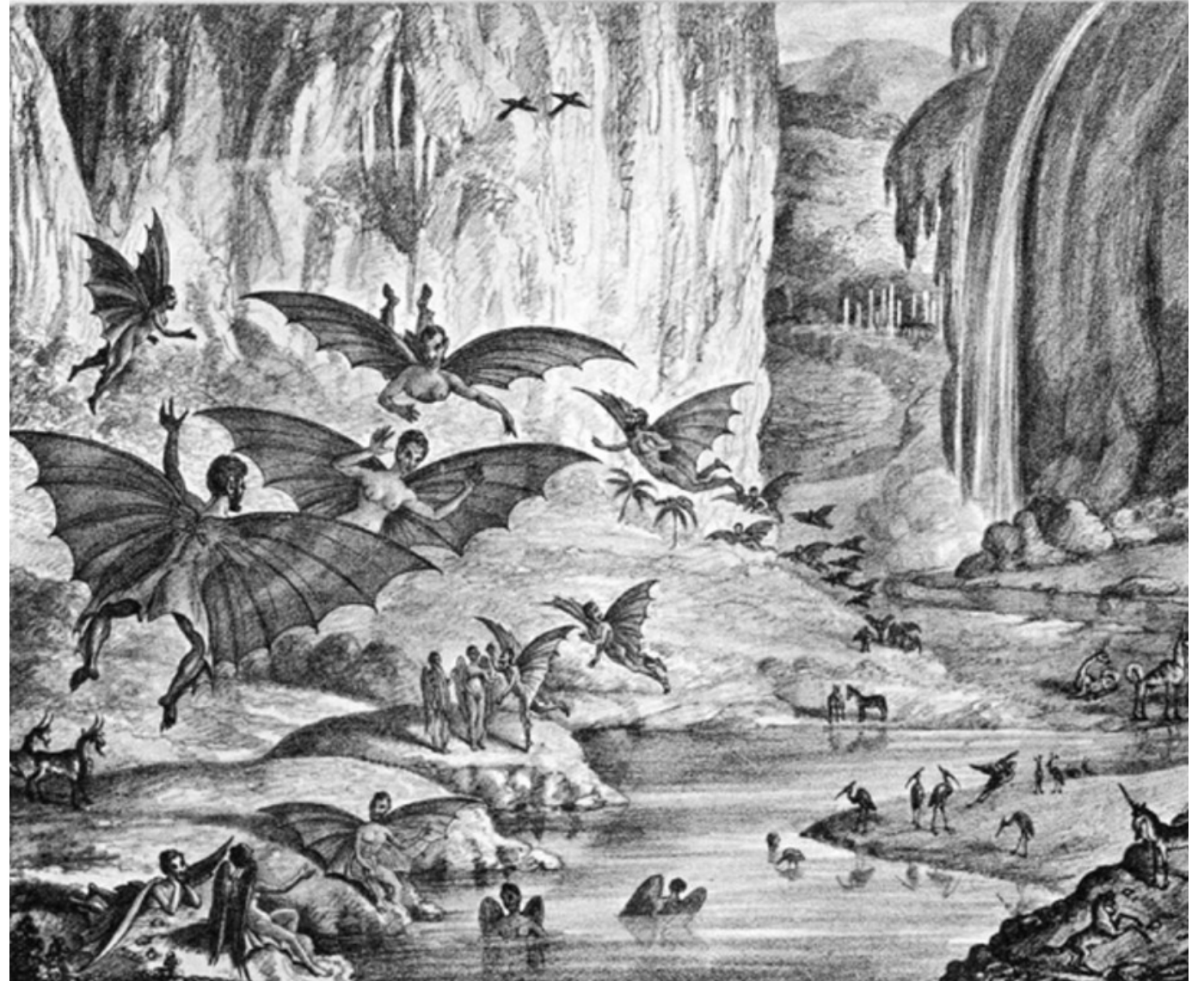
Disinformation and misinformation are not new

21 August 1835

The Great Moon Hoax

New York newspaper *The Sun*

A fictional story about the discovery of civilization on the moon, probably fabricated just to sell newspapers



The term “fake news” is over 100 years old

An 1894 illustration in the (satirical) US magazine *Puck* explaining the newspaper business



Do we become desensitized to fake news through humour?

Every country has newspapers that promote stories that are clearly false



July 23 1991



June 15 1993

Although humorous, does this create a pathway towards believing the absurd?

Do we become desensitized to fake news through humour?

Histoires de fausses nouvelles

Exposition pédagogique en 11 panneaux

1. Histoires de fausses nouvelles 2. Pastiches et canulars. Plus vrai que vrai 3. Sensationnel... et crash médiatique 4. Calomnie et diffamation. Outils de déstabilisation? 5. La Propagande. Petits arrangements des États avec la vérité 6. Rumeurs. Catalyseur de tensions communautaires 7. Complotisme et fausses nouvelles, des liaisons dangereuses... 8. Science sans confiance n'est que ruine médiatique 9. Info + intox = infox. La fausse nouvelle aujourd'hui 10. Pour y voir plus clair. Outils collectifs 11. Pour y voir plus clair. Outils individuels

Conception
à la Bibliothèque nationale
de France
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culturelle et Direction des
publics, service Éducation
artistique et culturelle
(Richard Diao, François Fénelle,
Sophie Pascal)

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la Bibliothèque nationale
de France de :
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politique, presse,
Département Philosophie,
histoire, sciences de l'homme
Département des Éditions,
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multimédias

Ministère de la Culture
Thierry Clavier, Colla Sidre
Université de Paris VIII : Pascal
Froissart, enseignant-chercheur
et Directeur de l'UPR Culture et
communication
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Boutin, Barbara Laborde,
enseignantes-chercheuses
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FRANCE / Il y a 2 semaines
Roland Garros – La Tour Eiffel
s'éteindra ce soir en mémoire des
joueurs Français

Other media frame fake news to influence politics

The UK Daily Mail is well-known for distortions and dishonest reporting



5 February 2017

The front page of The Mail newspaper from 5 February 2017. The main headline is 'EXPOSED How world leaders were duped over global warming'. A large photo shows world leaders including Justin Trudeau, Barack Obama, and Narendra Modi. A sub-headline reads 'TOP U.S. SCIENTIST: DATA THAT CONVINCED PARIS SUMMIT TO INVEST BILLIONS IN CLIMATE CHANGE WAS MANIPULATED'. Other text includes '...AND LED TO THESE GREEN COMMITMENTS' with figures like '\$100bn', '2°C', '40%', and '£320bn'. A small inset photo shows David Cameron and Prince Charles. A bottom banner reads 'HERE'S HOW: 'UNSTABLE' DATA FOR LAND TEMPERATURE WAS ADDED TO 'ADJUSTED' SEA READINGS'.

Retractions are published, but many months later



April 2018

CORRECTIONS & CLARIFICATIONS

At The Mail on Sunday we take great pride in the quality of our journalism. All our journalists are required to observe the Editors' Code of Practice and The Mail on Sunday is a member of the Independent Press Standards Organisation (IPSO), the new regulatory body for the Press set up in response to the Leveson Inquiry. We aim to correct any errors as promptly as possible.

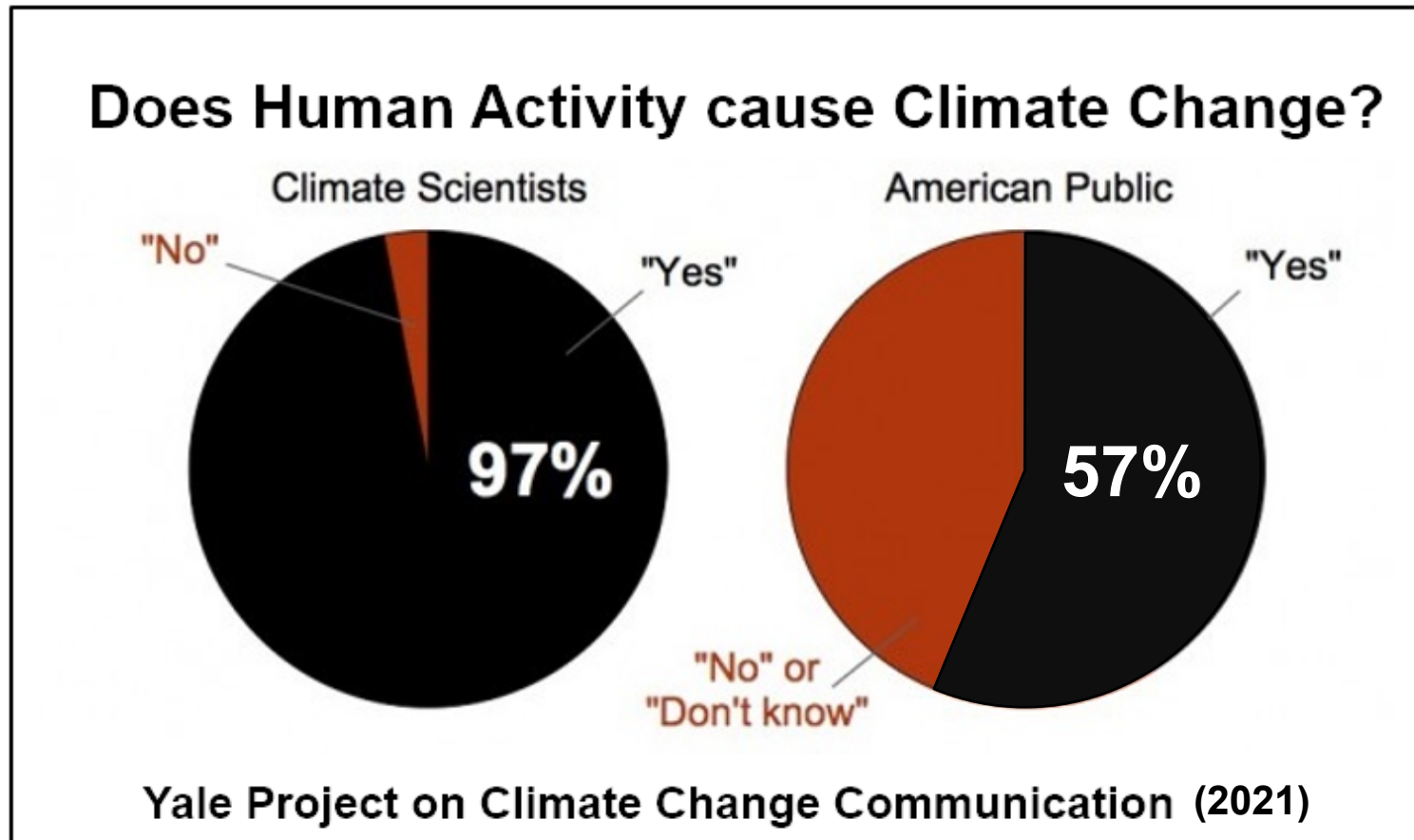
■ In September, 2017, the Independent Press Standards Organisation upheld a complaint against a February 5 article 'Exposed: How world leaders were duped over global warming'. Two subsequent

articles on February 12 and February 19 contained claims regarding an influential study about global warming, which have been found to be in breach of the Editors' Code: namely the claim that the study was

known – irrefutably and as fact – to be critically flawed, based on misleading unverified data, and had led world leaders to be duped by its findings. Corrections to these articles have been published online.

● If you wish to report an inaccuracy, please email corrections@mailonsunday.co.uk. To make a formal complaint under IPSO rules please go to www.mailonsunday.co.uk/readerseditor where you will find an easy-to-use complaints form. You can also write to Readers' Editor, The Mail on Sunday, Northcliffe House, 2 Derry Street, London W8 5TT.

US views on climate change are very concerning



<https://climatecommunication.yale.edu/>

Disinformation and Health - Smoking

In 1964 the US Surgeon General Report unambiguously linked smoking to lung cancer & other diseases.

Yet tobacco companies actively campaigned against this by claiming there was scientific “debate”.

This continues today, after the introduction of smoking bans.

Journal of Public Health Research 2017; volume 6:878

The tobacco industry: the pioneer of Fake News

Martin McKee

London School of Hygiene and Tropical Medicine, London, UK



He's one of the busiest men in town. While his door may say *Office Hours 2 to 4*, he's actually on call 24 hours a day.

The doctor is a scientist, a diplomat, and a friendly sympathetic human being all in one, no matter how long and hard his schedule.

According to a recent Nationwide survey:

MORE DOCTORS SMOKE CAMELS THAN ANY OTHER CIGARETTE

DOCTORS in every branch of medicine—113,597 in all—were queried in this nationwide study of cigarette preference. Three leading research organizations made the survey. The gist of the query was—What cigarette do you smoke, Doctor?

The brand named most was Camel!

The rich, full flavor and cool mildness of Camel's superb blend of costlier tobaccos seem to have the same appeal to the smoking tastes of doctors as to millions of other smokers. If you are a Camel smoker, this preference among doctors will hardly surprise you. If you're not—well, try Camels now.

Your "T-Zone" Will Tell You...

T for Taste...
T for Throat...
that's your proving ground for any cigarette. See if Camels don't suit your "T-Zone" to a "T."

FROM THE COLLECTION OF STANFORD RESEARCH INTO THE IMPACT OF TOBACCO
CAMELS Costlier Tobacco ADVERTISING

Disinformation and Health – Vaccines

- 1998** Andrew Wakefield in *The Lancet* proposed a link between vaccines & autism, based on a study of 12 children
- 2000-04** The results were not reproduced!
- 2004** Wakefield shown to have a conflict of interest (10's M€) in selling diagnostic kits.
- 2004** Wakefield's co-authors retract association.
- 2010** *The Lancet* found falsified data and retracted the paper

VOLUME 16 | NUMBER 3 | MARCH 2010 **NATURE MEDICINE**

NEWS

State of denial

Scientists regularly debate hypotheses and interpretations, sometimes feverishly. But in the public sphere, a different type of dissension is spreading through media outlets and online in an unprecedented way—one that challenges basic concepts held as undeniable truths by most researchers. 'Science denialism' is the rejection of the scientific consensus, often in favor of a radical and controversial point of view. Here, we list what we see as a few of today's most vocal denialists spreading ideas that counter the consensus in health fields.



—**Mark and David Geier:** This father-son duo, based in Washington, DC, was among the first to publish claims that the thimerosal preservative used in certain vaccines causes autism (*J. Am. Physicians Surg.* **8**, 6–11, 2003). Mark Geier holds a doctorate in genetics; his son, David, has a bachelor's degree in biology. Together, they promote therapies for autism including chelation, the use of chemicals to remove heavy metals from the body, and Lupron, a drug used to treat prostate cancer and chemically castrate sex offenders. Mark Geier has testified in support of the thimerosal-autism link as an expert witness at vaccine trials across the US; numerous rigorous studies, however, have dismissed this link.



—**David Rasnick:** A biochemist who studied protease inhibitors in the pharmaceutical industry, Rasnick is the former president of Rethinking AIDS, an activist group that calls for the reappraisal of the "belief" that HIV causes AIDS. Rasnick was also a member of South African president Thabo Mbeki's AIDS Advisory Panel; as part of the panel, Rasnick argued that AIDS does not exist and suggested that HIV testing be outlawed and antiretroviral drugs no longer used in the country. Although not linking their findings to Rasnick, two studies have independently estimated that more than 330,000 lives were lost in South Africa between 2000 and 2005 because of the delayed use of antiretrovirals (*J. Acquir. Immune Defic. Syndr.* **49**, 410–415, 2008; *Afr. Aff.* **107**, 157–176, 2008).

—**Sandy Swarc:** A food editor and writer, Swarc has rejected the idea that individuals with obesity face a heightened risk of premature death. Swarc, a registered nurse, calls government antiobesity efforts "a grossly exaggerated and fabricated scare campaign." On her blog "Junkfood Science," Swarc presents the 'obesity paradox,' which refers to the alleged health benefits associated with obesity, such as reports that obese individuals may have higher survival rates of coronary artery disease than their normal-weight counterparts. Scientists reviewing this data, however, have suggested that this higher survival rate might be due to more aggressive treatment of people with obesity and other factors.



—**Wolfgang Wodarg:** Wodarg is a German physician and past head of health at the Council of Europe. Wodarg recently made headlines accusing flu drug and vaccine makers of influencing the World Health Organization (WHO) to declare swine flu a pandemic. In a recent interview, Wodarg called the H1N1 outbreak "one of the greatest medical scandals of the century," and he has made a motion that the Parliamentary Assembly of the Council of Europe begin an immediate investigation into the matter. The WHO has called allegations by people who say that it created a false pandemic as "scientifically wrong" and "irresponsible." The health agency stressed that "[t]he world is going through a real pandemic."



—**Michael Fumento:** Fumento is a journalist and author of several books, including *The Myth of Heterosexual AIDS*. He writes regularly about the promise of adult stem cells and the danger of embryonic stem cells on his blog, "Advise and Dissent," and for such outlets as the *New York Post* and *Forbes Online*. Fumento claims embryonic stem cell research is both "a dead end," fueled by a greedy lobby, and dangerous, despite evidence from animal studies suggesting its promise. He uses a picture of a tumor with teeth and hair growing from it to illustrate his point.



Megan Scudellari, Durham, North Carolina

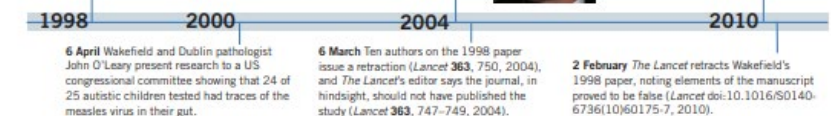
A timeline of the Wakefield retraction

28 February Gastroenterologist Andrew Wakefield reports in *The Lancet* that his team has found a "genuinely new syndrome"—a link between the measles, mumps and rubella (MMR) vaccine and an increased risk of autism (*Lancet* **351**, 637–641, 1998).

2002–2004 Numerous studies published in *BMJ*, *The New England Journal of Medicine*, *The Lancet* and other journals find no link between MMR and autism.



28 January The UK General Medical Council rules that Wakefield acted "dishonestly and irresponsibly," and showed "callous disregard" for the suffering of children involved in his controversial research.



EU survey in 2018 – are vaccines safe?

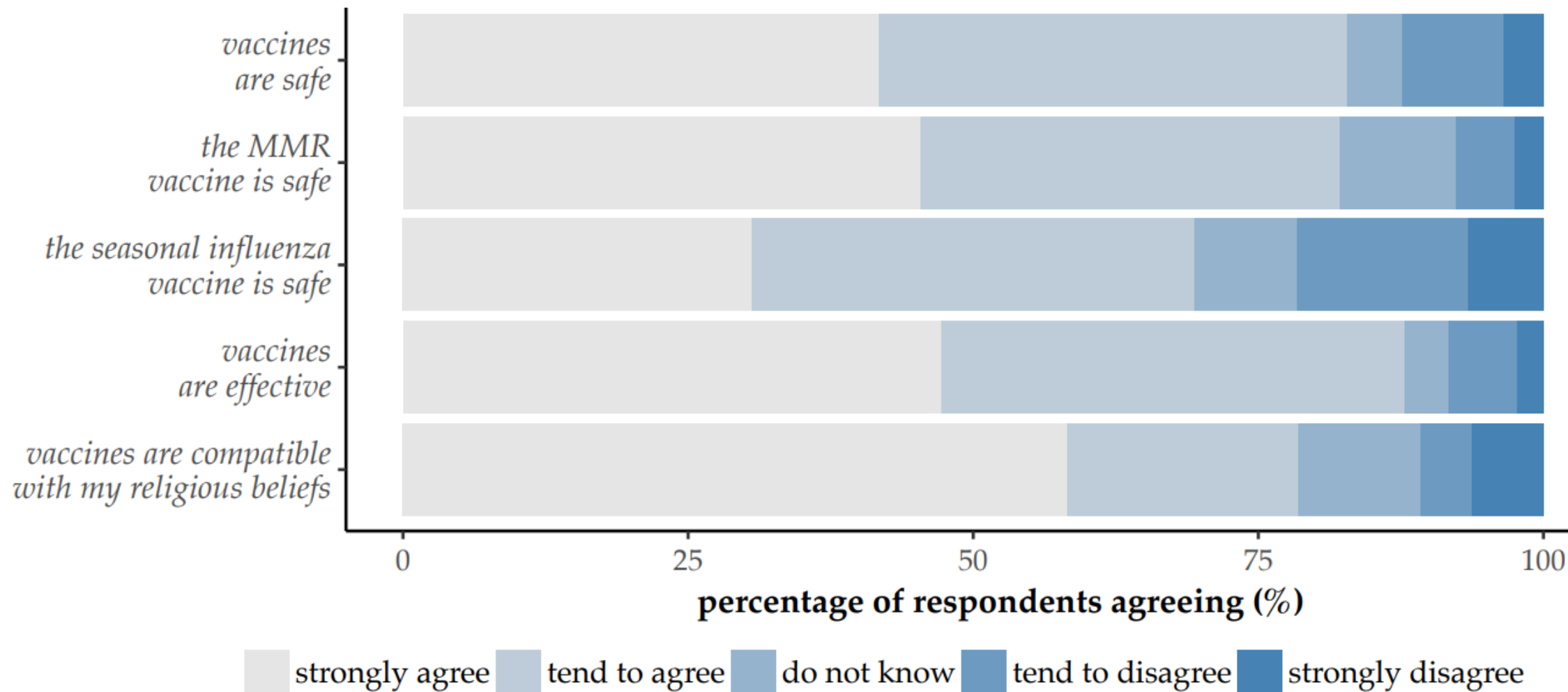


Vaccines are safe

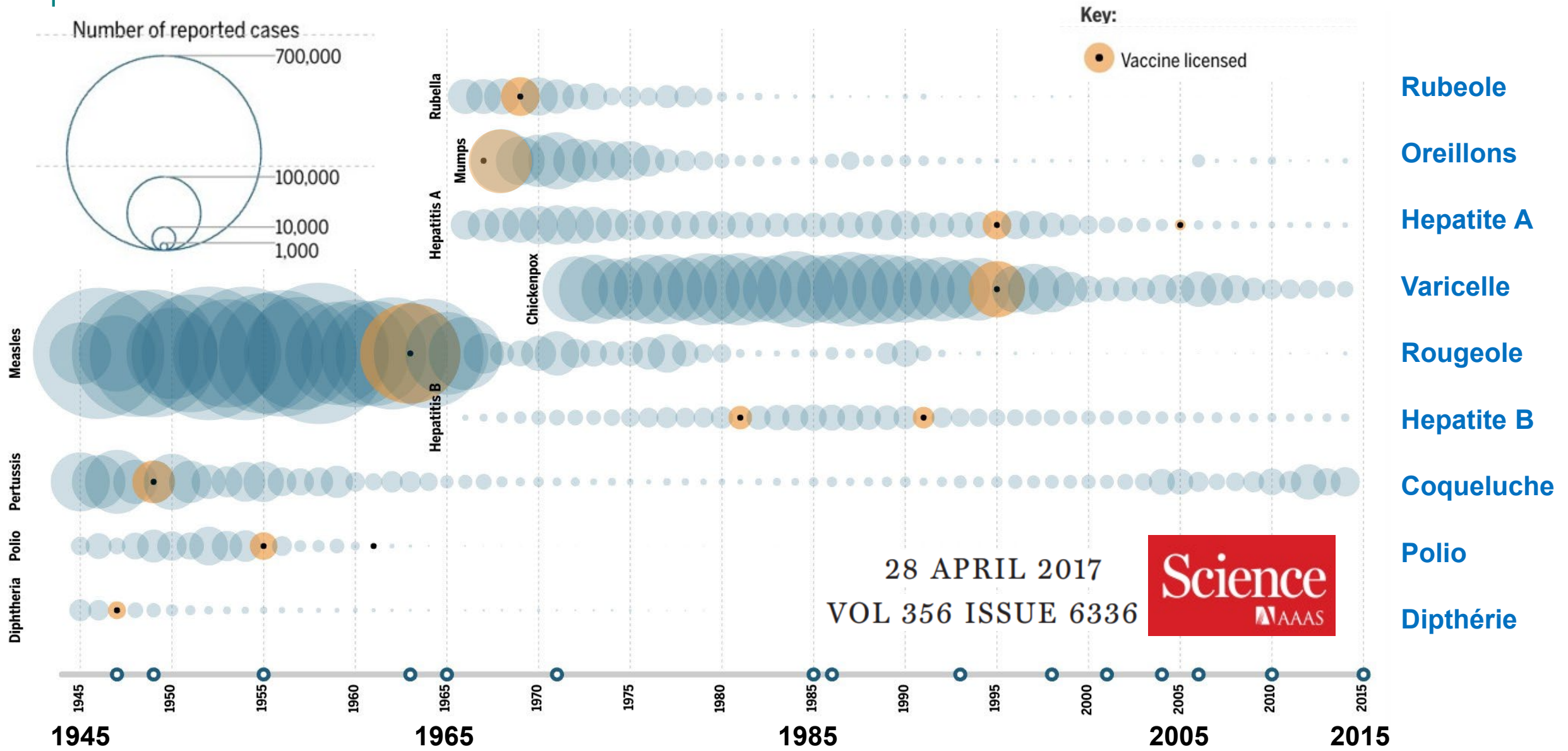
Finland	89.0% (6)
France	69.9% (26)
Germany	83.6% (13)
Sweden	83.7% (12)
UK	89.9% (5)

France ranked almost last (26/28) amongst member states when asked if vaccines are safe

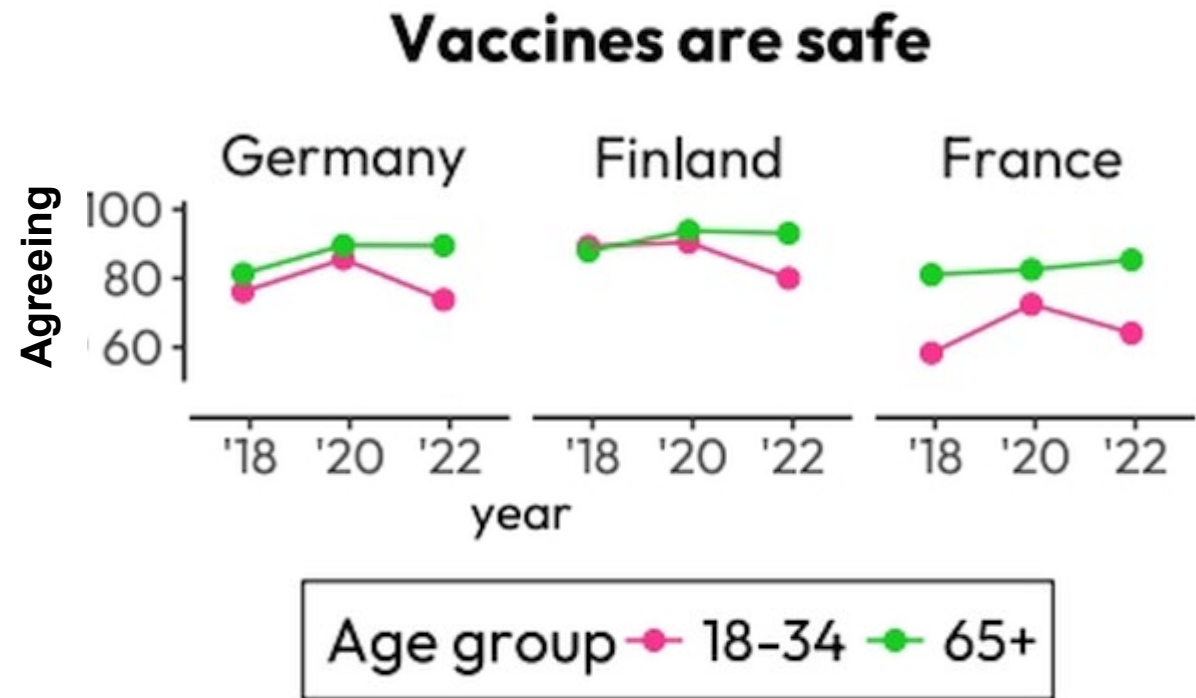
But still ... “agree” does not mean “strongly agree” !!



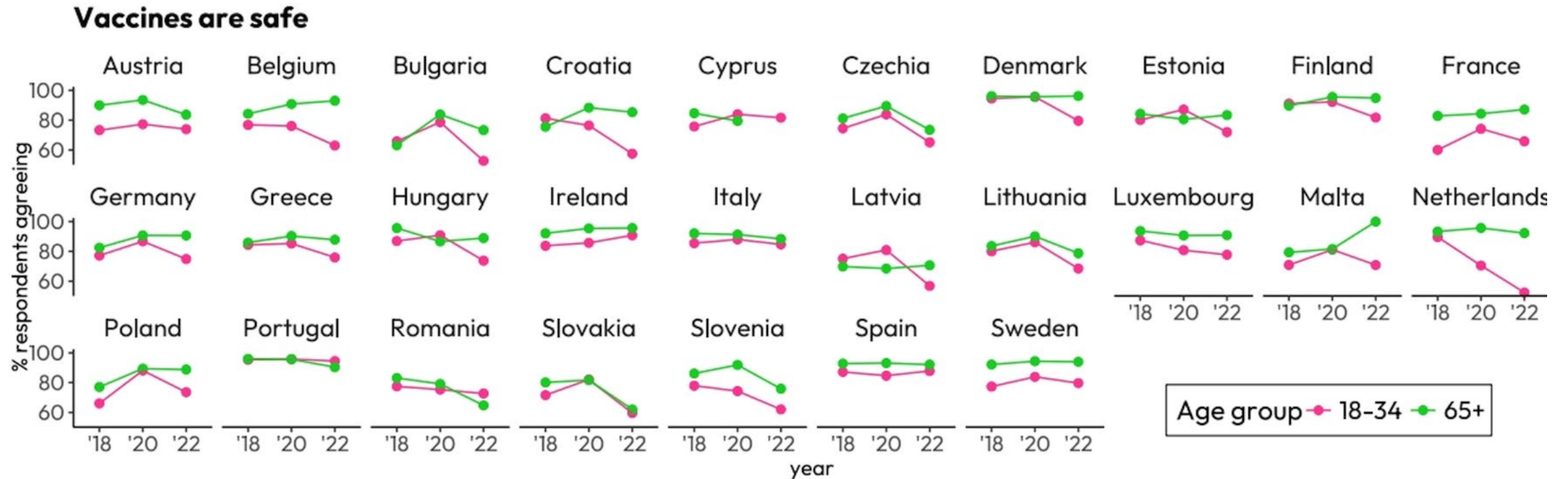
The evidence has been clear for half a century



A 2018-2022 EU study has tracked tendencies with time ...



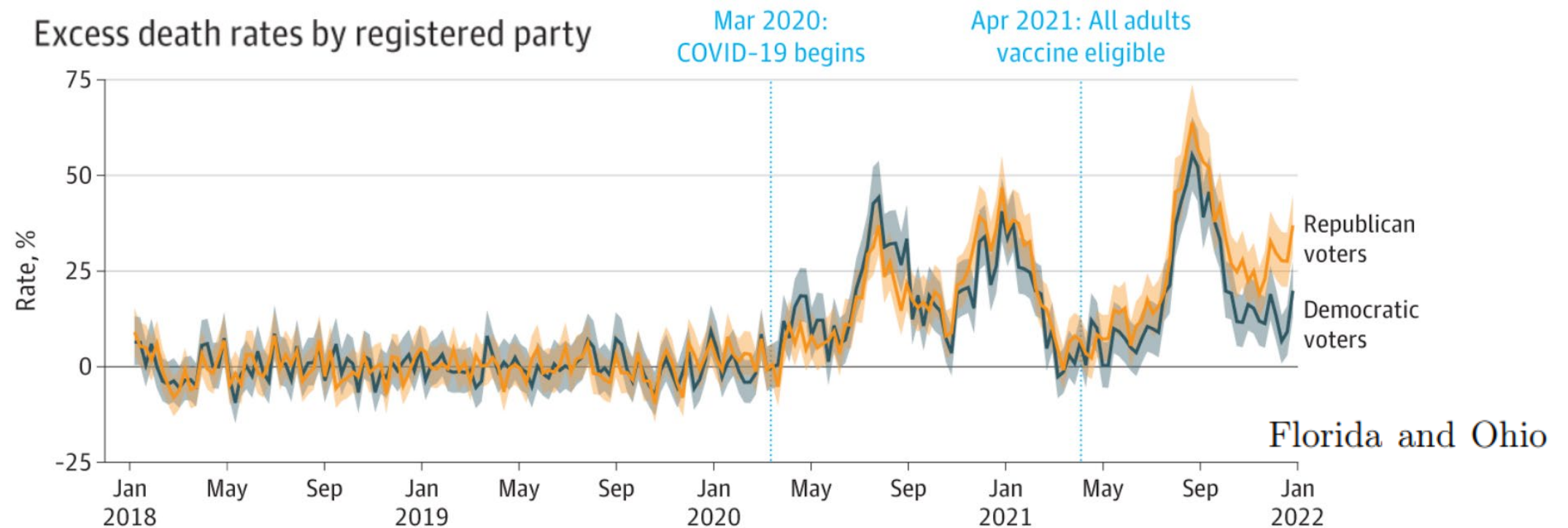
A 2018-2022 EU study has tracked tendencies with time ...



Mistrust in science seems to correlate with mistrust in governments

Governments usually decide policy incorporating scientific advice

There is evidence that people who distrust government institutions mistrust science more



Jacob Wallace, Paul Goldsmith-Pinkham, Jason L. Schwartz, Yale School of Public Health and Yale School of Management
Excess death rates for Republicans and Democrats during the Covid-19 pandemic NBER Working Paper 30512 (2022), published as *JAMA Intern Med.* **183**, 916–923 (2023)

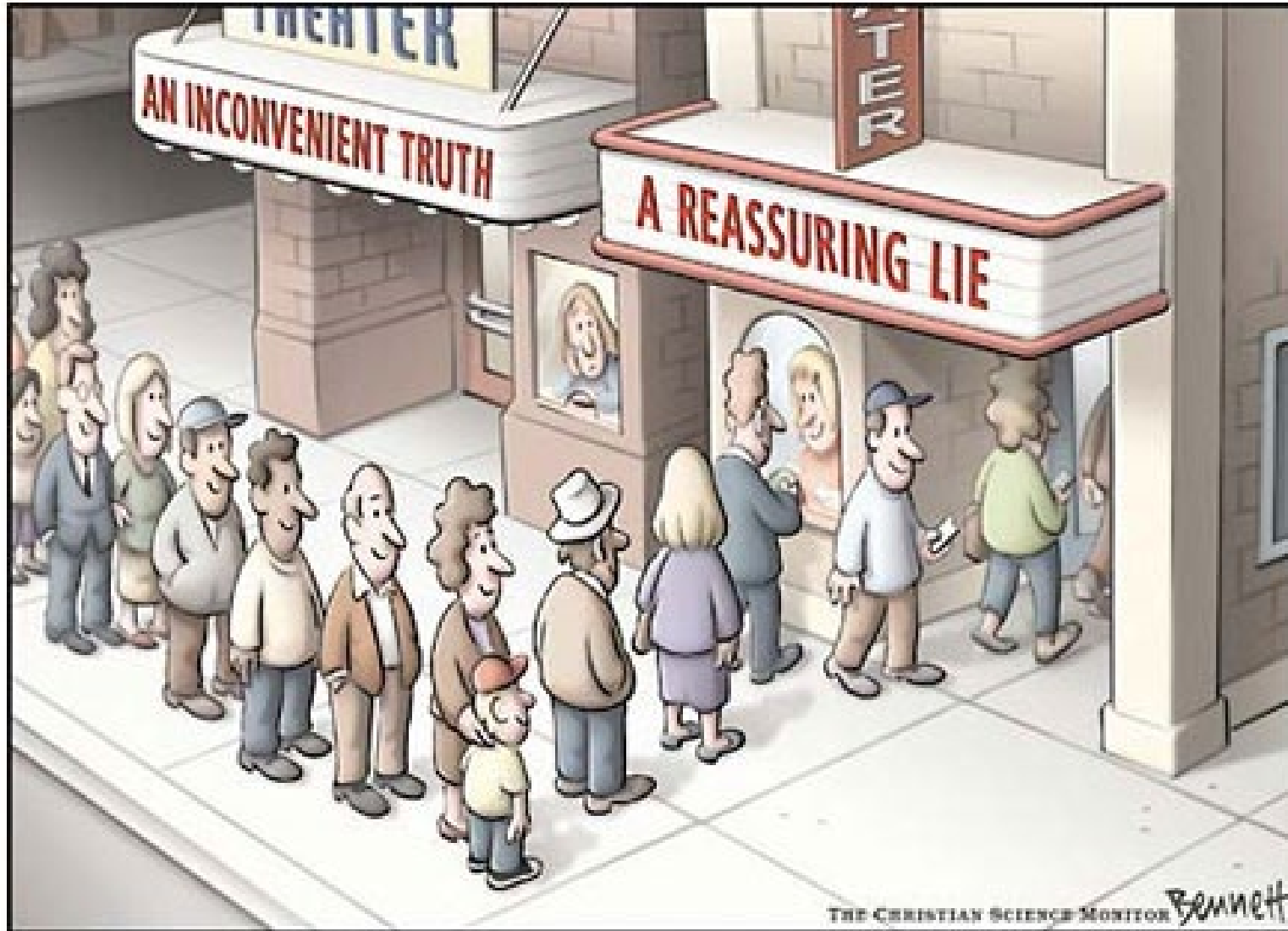
What is going on? Motivated Reasoning and anti-science

Many strongly held opinions are based on a false logic known as motivated reasoning

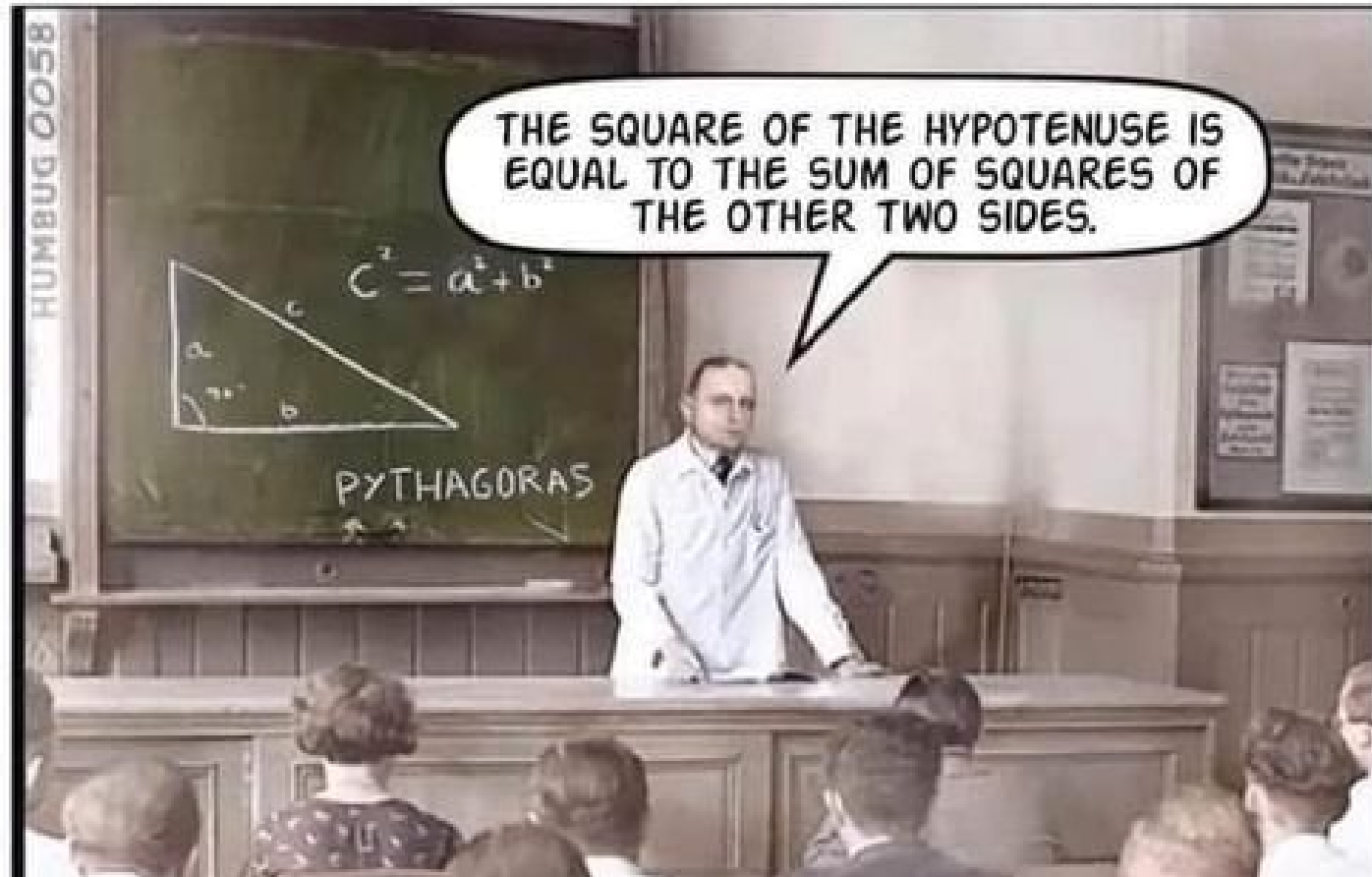
FALSE LOGIC
Science & facts suggest I need to change how I live
But I do not want to change
Therefore the science must be wrong
I will seek alternative science to support what I want to do

Why do we believe things that are not supported by evidence?

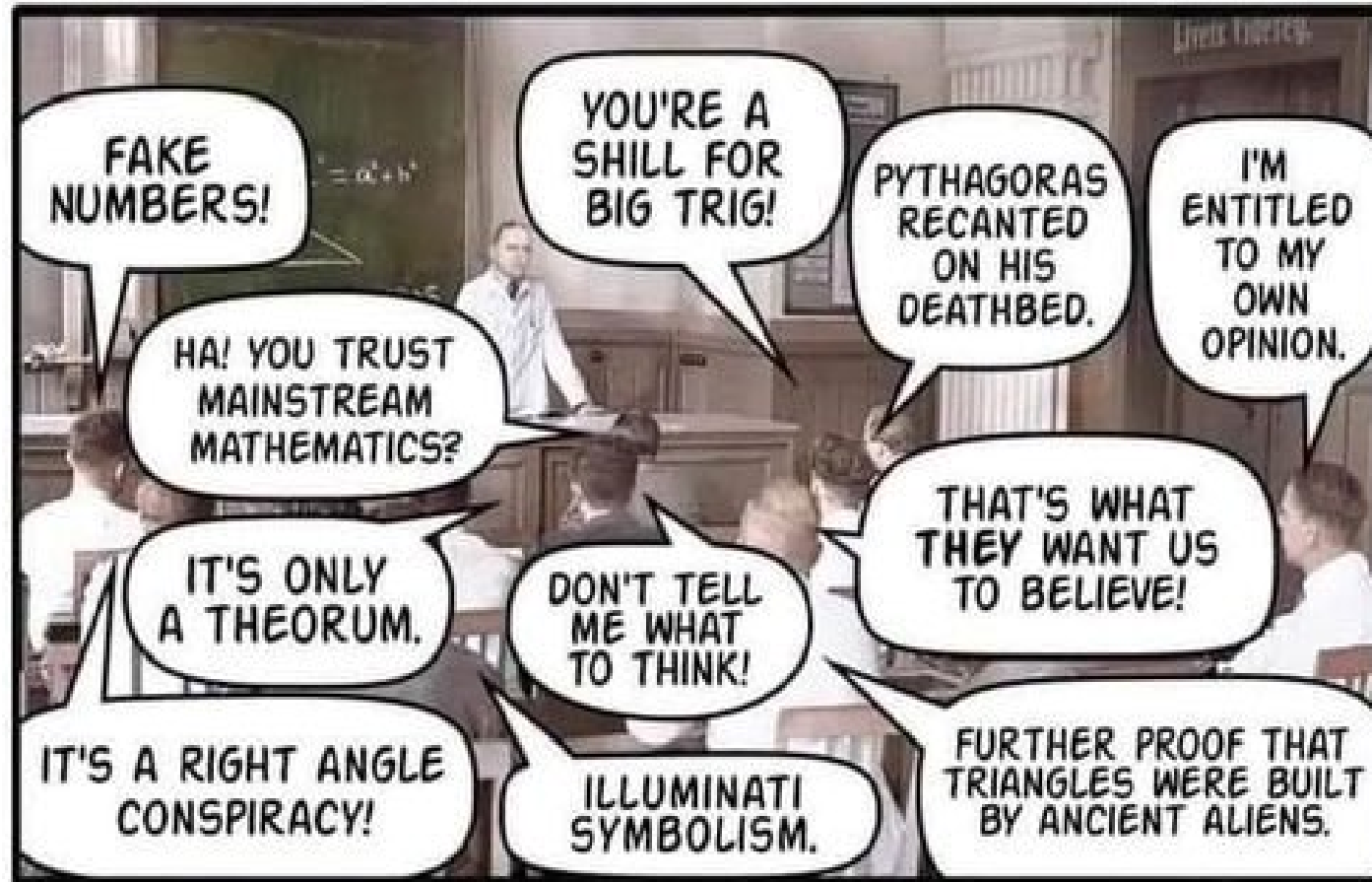
What is going on? Motivated Reasoning and anti-science



What is going on? Motivated Reasoning and anti-science



What is going on? Motivated Reasoning and anti-science



Bibliothèque de Philosophie scientifique

H. POINCARÉ

Membre de l'Institut
Professeur à la Faculté des Sciences de l'Université de Paris.

La Valeur de La Science



PARIS

ERNEST FLAMMARION, ÉDITEUR

26, RUE RACINE. 26

Douzième mille.

We also know how cruel the truth often is, and we wonder whether delusion is not more consoling...”

Henri Poincaré 1905

The social dimension of anti-science is complex

Socius
Volume 10, 2024
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<https://doi.org/10.1177/23780231241237654>

First published online April 4, 2024

Original Article



The Status Foundations of Conspiracy Beliefs

Saverio Roscigno 

Abstract

Prior survey research has mostly centered on the psychological dispositions and political leanings associated with conspiracy beliefs rather than underlying and potentially consequential status dynamics. Drawing on prior scholarship and recent national survey data, I analyze the social patterning of conspiracy beliefs and their variations by several status attributes. Notably, and rather than the typical assumption that such beliefs are mostly held by those of lower education, my findings point clearly to a bimodal (U-shaped) distribution by socioeconomic status. Specifically, and unique to my results, there exists a cluster of graduate-degree-holding white men who display a penchant for conspiracy beliefs. Further analyses highlight important variation between specific beliefs, with distinctly taboo beliefs being exceptionally popular among those in this highly educated group—a pattern corroborated with additional data sources. I conclude by discussing potential mechanisms and avenues that future sociological work on conspiracy beliefs might consider.

The social dimension of anti-science is complex

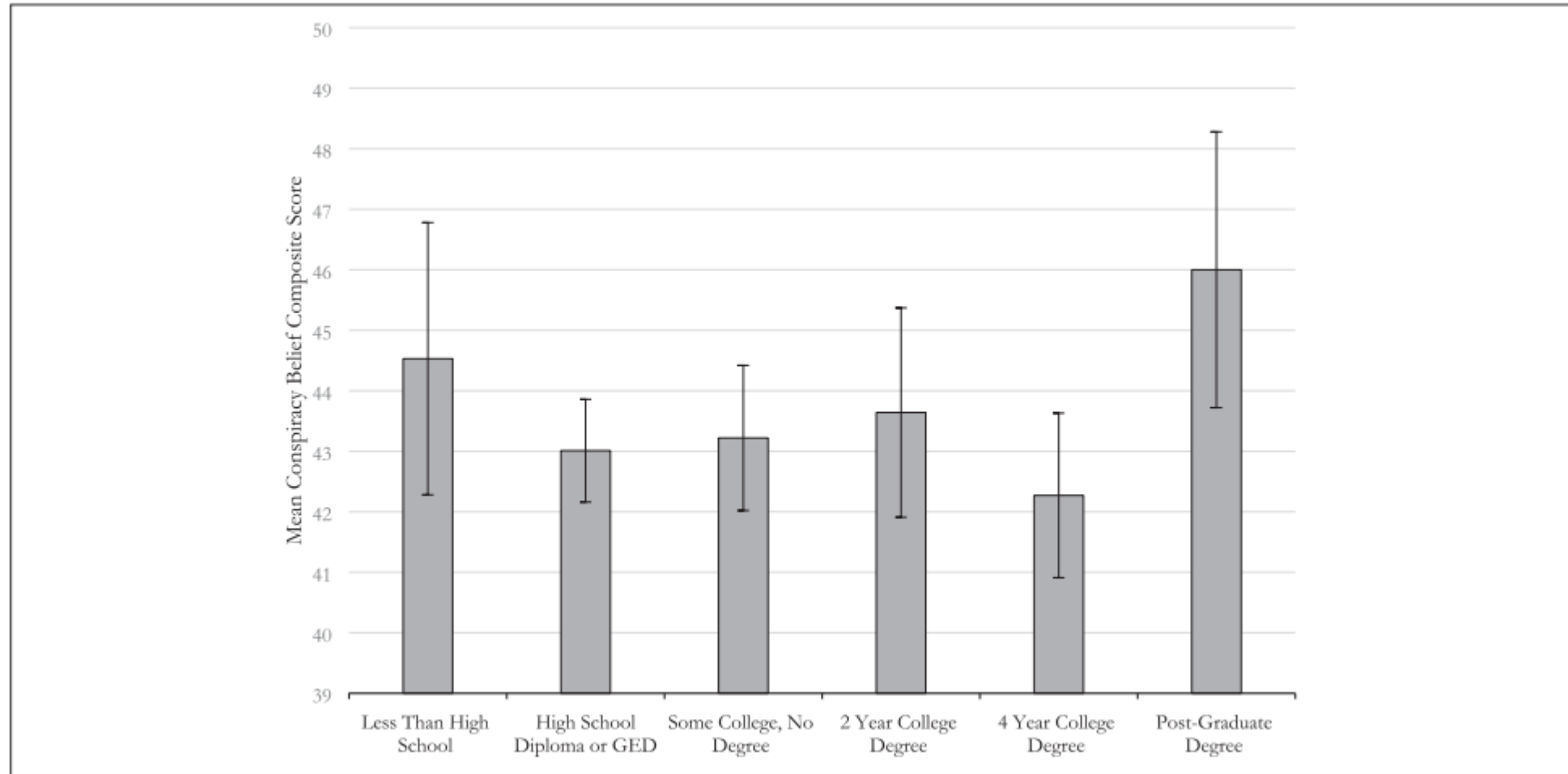


Figure 1. Bivariate association between conspiracy beliefs and education (N=2,015).

The social dimension of anti-science is complex

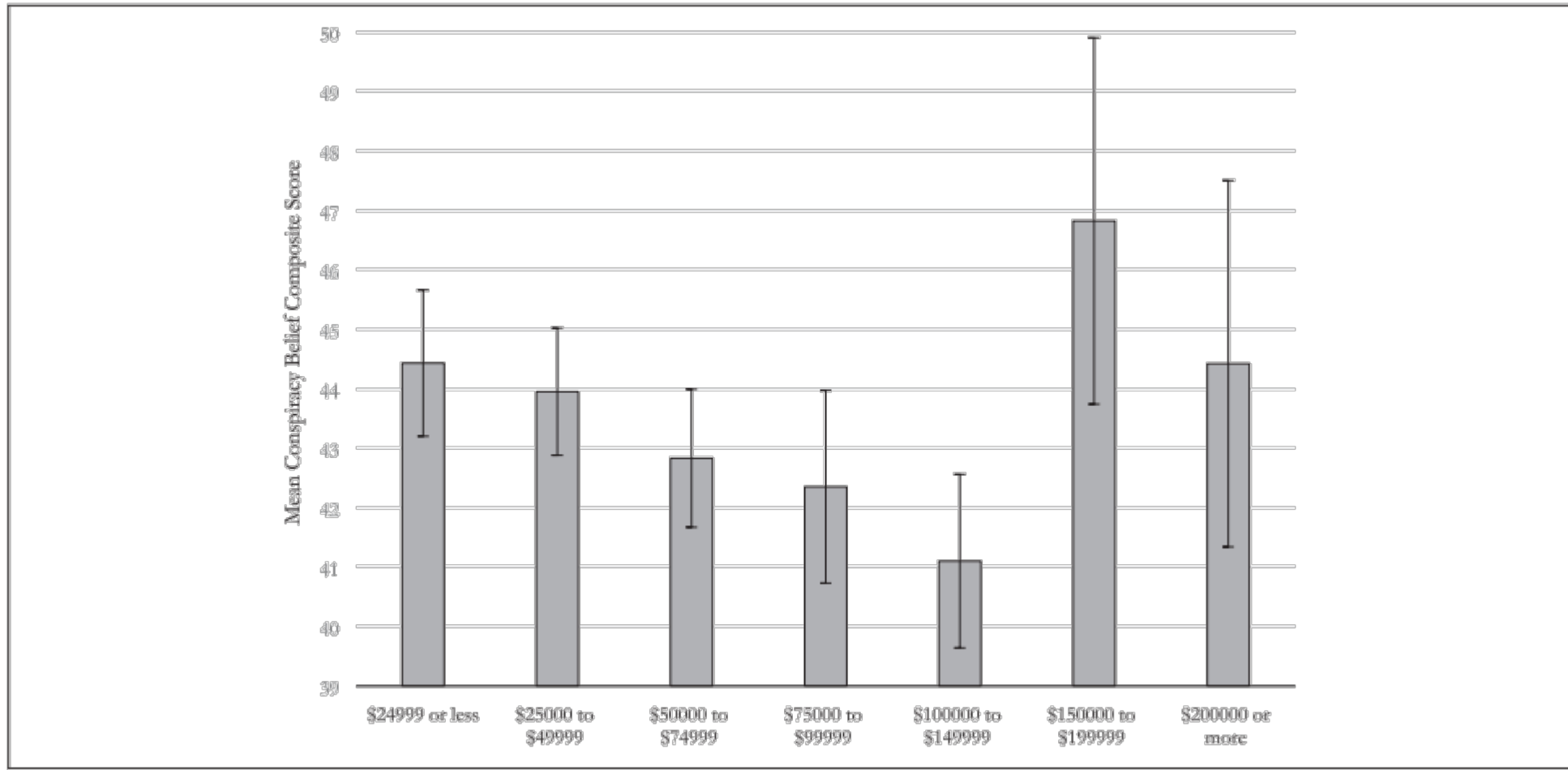


Figure 2. Bivariate association between conspiracy beliefs and income (N=2,015).

How to explain the scientific process

Science is not “a collection of facts,” but it’s a **method** to understand the universe

One single paper does not contain all the results on any subject and it may be incorrect

Science evolves by independent studies being individual elements or pieces of the answer

A scientific consensus is not a “vote”

A scientific consensus means that the overwhelming majority of results and replications all point to a common conclusion

Language is used differently

Scientists use language in a way that is not always understood in the same way by others

e.g. a creationist may say it's just a **theory** of evolution so it is not true!

Theories and models are open to revision

But many theories are so well tested and confirmed that they provide the foundation of whole fields of science and technology.

e.g. the theory of fluid dynamics allows us to build planes that fly

e.g. the theory of relativity allows us to use GPS on our phones

e.g. Maxwell's equations underpin all of communications

Responding to common objections

“It is scientific to keep an open mind”

Climate and vaccine “skeptics” often defend their approach as scientific and open-minded

Science puts tight constraints on what we accept as factual (testability, reproducibility etc)

We are not free to ignore facts we do not like. Science speaks about likelihoods

“Science doesn’t explain everything”

Science is not a collection of facts but a method to understand the world around us

This method has proven itself to be most reliable means of developing understanding and technology

The existence of an unanswered scientific questions doesn’t justify the promotion of pseudoscience.

We are not free to invent (usually untestable) laws of nature to fill in the gaps

Responding to common objections

“It is scientific to keep an open mind”

Keeping an open mind is a virtue but not so open that your brains fall out.

— Carl Sagan, Walter Kotschnig

“Science doesn’t explain everything”

Problems with pharmaceutical companies does not mean that pseudoscience works.
Problems in aircraft design do not mean that magic carpets can actually fly.

— Ben Goldacre

False balance in the media (even science journalism)

False balance, or “both sides-ism” is a bias that gives equal weight to opposing viewpoints

Especially common in sensationalist and **adversarial science debate** in the media

If someone says it's raining, and another person says it's dry, it's not your job to quote them both. Your job is to look out the window, find out which is true, and report that!

Jonathan Foster – Professor of Journalism at Sheffield

Opposing opinions or ideas do not necessarily have equal validity

What about debate within the scientific community?

Peer review is **not a definitive answer** on whether results are “true”

Peer review mainly ensures that new results can be tested by ensuring that **assumptions and methods used are clear**.

The real heart of science is “**post publication peer review and replication**”

Contradictory results in an early phase of any scientific study are normal, but this is often exploited for partisan & political objectives

There are new tools in publication to help

There is an active community of groups and sometimes individuals who personally scrutinize science and scientists that appear untrustworthy

Two of the most neutral sites that backup opinion with evidence are

Retraction Watch

Tracking retractions as a window
into the scientific process



PUBPEER
The online Journal club

Useful real-time discussion takes place on Social Media

Common “red flags” include ethical shortcuts, data “cherry picking”, ambiguous methods, poor use of statistics



Flo Débarre
@flodebarre

Publication ethics: a short-story in 3 pictures



International Journal of Antimicrobial Agents

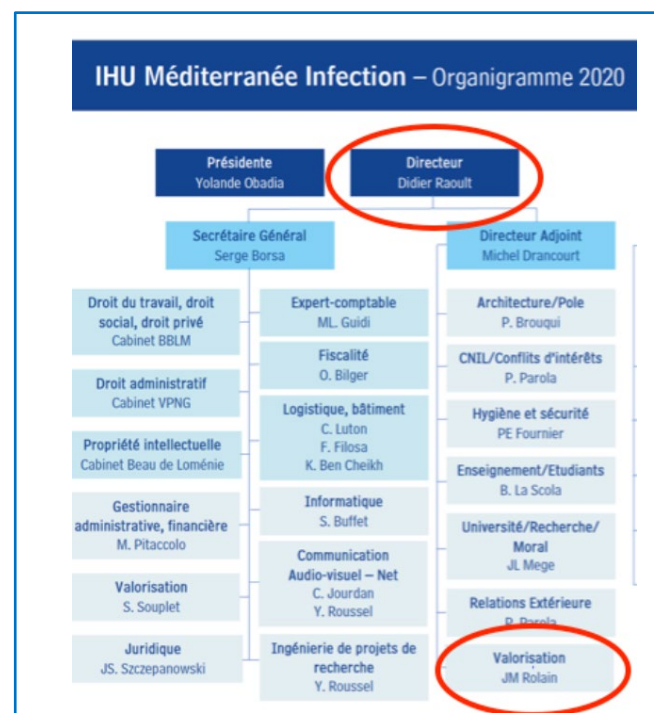
Available online 20 March 2020, 105949
In Press, Journal Pre-proof

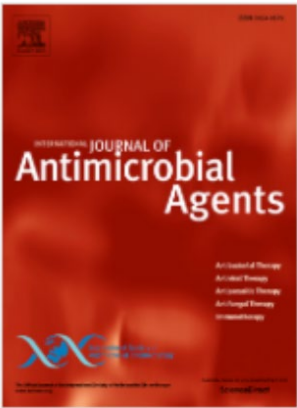


Hydroxychloroquine and azithromycin as a treatment of COVID-19: results of an open-label non-randomized clinical trial

Philippe Gautret ^{a, b, §}, Jean-Christophe Lagier ^{a, c, §}, Philippe Parola ^{a, b}, Van Thuan Hoang ^{a, b, d}, Line Meddeb ^a, Morgane Mailhe ^a, Barbara Doudier ^a, Johan Courjon ^{a, f, g}, Valérie Giordanengo ^h, Vera Esteves Vieira ^a, Hervé Tissot Dupont ^{a, c}, Stéphane Honoré ^{b, i}, Philippe Colson ^{a, c}, Eric Chabrière ^{a, c}, Bernard La Scola ^a, Jean-Marc Rolain ^{a, c}, Philippe Brouqui ^a, Didier Raoult ^{a, c, §}

^a IHU-Méditerranée Infection, Marseille, France
^b Aix Marseille Univ, IRD, AP-HM, SSA, VITROME, Marseille, France
^c Aix Marseille Univ, IRD, APHM, MEPHI, Marseille, France





3.59
CiteScore

4.615
Impact Factor

Editor-in-Chief: J.M. Rolain
[View editorial board](#)

7:54 PM · Mar 21, 2020 · Twitter Web App

468 Retweets 93 Quote Tweets 1,134 Likes

Concerns over dozens of papers from Marseilles medical institute

Plos puts warnings on almost 50 papers after alleged reuse of ethical approvals, undeclared conflicts of interest and publication rates equivalent to an article every three days

December 14, 2022

[Ben Upton](#)



These papers do not concern only COVID but date back many years

The concern is currently focussed on general “warning flags” which are often associated with other issues in methodology

Retraction Watch

📅 April 3, 2024

Embattled researcher Didier Raoult earns more than 100 expressions of concern and another retraction

An Elsevier journal has issued just over 100 expressions of concern for papers published by a group of researchers led by the French microbiologist Didier Raoult, who also notched a new retraction – his tenth – in a separate publication.



Didier Raoult

As we and others have reported, Raoult’s work during the COVID-19 pandemic drew intense scrutiny from data sleuths, most notably Elisabeth Bik – whose critiques, which extended beyond his COVID studies, were met with vicious online trolling and a legal complaint filed by Raoult himself.



Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com



LETTER TO EDITOR

Why the article that led to the widespread use of hydroxychloroquine in COVID-19 should be retracted

the groups repartition by age (control 34, IQR 14.5–64.3 vs. treatment 51.5, IQR 41.5–59.3) may also explain a higher viral load in the control group since peak viral load is associated with age.

Furthermore, in January 2021, Gautret et al. published

Discussion

The consequences of this article, with results quickly spread all around the world by influencers and several politicians including presidents, were countless. Hydroxychloroquine was rapidly promoted as an easy fix, allowing government leaders to downplay the seriousness of the COVID-19 pandemic and ignore advices formulated by numerous medical experts [4]. Despite many attempts to replicate the results of the Gautret et al. paper, later systematic reviews and meta-analyses found no evidence that HCQ prophylaxis or treatment (associated or not with azithromycin) reduced COVID-19 related mortality,

The flawed conclusions from Gautret et al. have quickly disseminated globally. The scientific community identified the methodological, biomedical and ethical concerns days after its publication. Nevertheless, three years and more than 6,000 citations later, the paper has not been retracted. If its influence on medical professionals and policymakers seems to be declining with time, it remains still prominent among conspiracist groups, with potentially devastating effects, leading to increased mortality directly associated with hydroxychloroquine's adverse side effects, or indirectly by strengthening anti-isolation and antivaccination opinions.

This touches on all fields ...

List of scientific misconduct incidents



- 1 Biomedical sciences
- 2 Chemistry
- 3 Computer science and mathematics
- 4 Philosophy
- 5 Physics and engineering
- 6 Plant biology
- 7 Social sciences



Note: Wikipedia is a very good source of impartial and reliable information on topics of science “debate” but it is useful to check in multiple languages !



Allegations of Scientific Misconduct Mount as Physicist Makes His Biggest Claim Yet

March 9, 2023 • *Physics* 16, 40

Condensed-matter physicist Ranga Dias and his colleagues reported on Tuesday the discovery of a room-temperature, near-ambient-pressure superconductor; Dias is also being accused of committing scientific misconduct, including data manipulation and plagiarism.

nature

NEWS FEATURE | 08 March 2024

Superconductivity scandal: the inside story of deception in a rising star's physics lab

Ranga Dias claimed to have discovered the first room-temperature superconductors, but the work was later retracted. An investigation by *Nature's* news team reveals new details about what happened – and how institutions missed red flags.

Key message

The key message of the day is to encourage everyone to **evaluate everything** they read and everything they say using the same **criteria and methods that we use when we do science.**

How much of what we may “believe” to be true have **we actually evaluated and studied** using reliable sources?

Key message

Even in fields beyond our specific expertise, our training gives us the skills to comment usefully on all issues relating to the abuse of the scientific method.

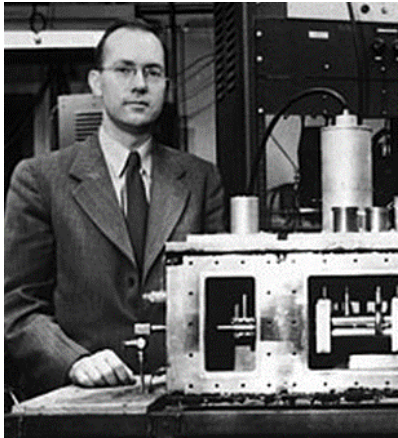
The consequences of saying nothing are clear.

Is fighting disinformation our job?

If we do not use our skills to do something, who will?

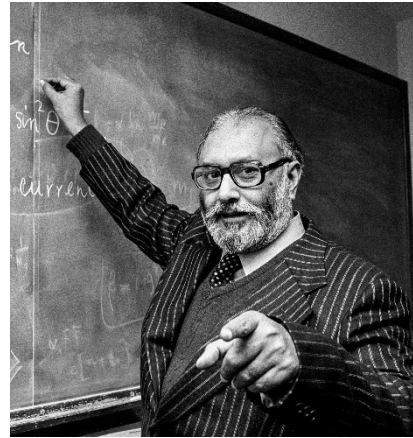
Key message

Scientists have regularly shown leadership on issues that bridge science, politics, & society



I have always felt that scientists should provide public service ...

Charles Townes
How the Laser Happened: Adventures of a Scientist.



Let us strive to provide equal opportunities to all

Abdus Salam
Nobel Banquet, December 10, 1979.



For a successful technology, reality must take precedence over public relations ...

Richard Feynman
Personal Observations on the Reliability of the Shuttle, 1986

We first use our scientific knowledge to solve specific problems, but increasingly we must also speak out more to combat misinformation. But this has to be done the right way.

ask me

anything