

The background features a 3D molecular model with yellow, red, and cyan spheres connected by white and red bonds. This model is positioned above a colorful, wavy energy landscape surface that transitions from blue to green to yellow. The overall scene is set against a dark background.

# How to Keep up with Scientific Literature

**Maxim S. Pshenichnikov**  
([M.S.Pchenitchnikov@rug.nl](mailto:M.S.Pchenitchnikov@rug.nl))

**Faculty of Sciences and Engineering**  
**University of Groningen, the Netherlands**

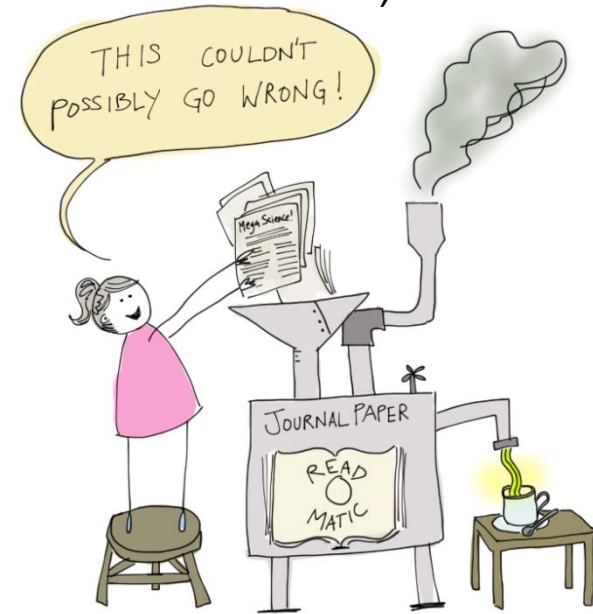


# Why Bother Reading Scientific Literature?

Scientific papers are one of the **major ways scientists communicate** their results and ideas

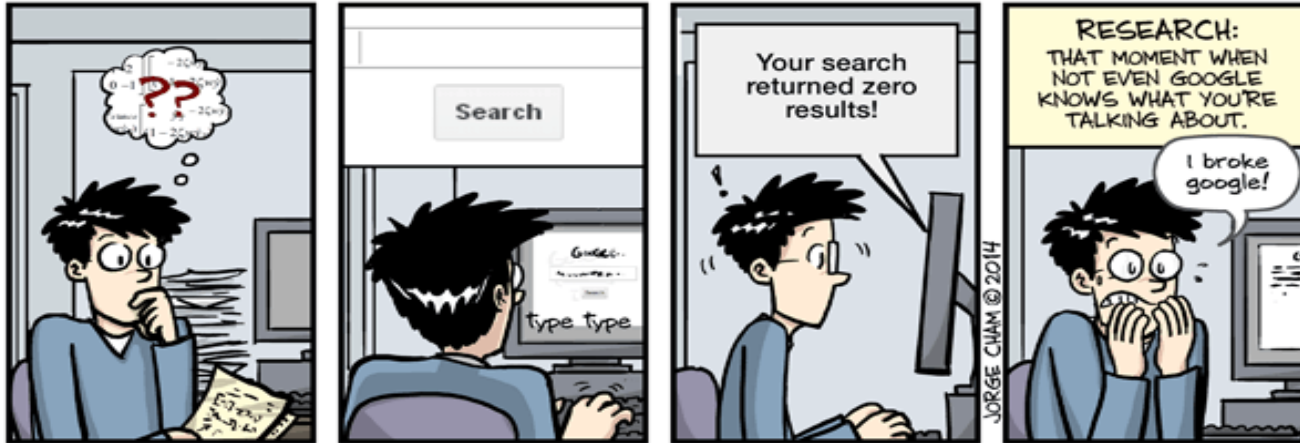
- The most **up-to-date information** about a field (who did what-when-why)
- One question is answered, two are risen (**an idea for your own research**)
- Specific information:
  - \* how experiments were conducted
  - \* the equipment and materials necessary
  - \* details of theoretical approaches
  - \* other details

If you are considering doing original scientific research, **reading the scientific literature is a must!**



# Benefits of Skills in Reading

- You will be able to **provide a stronger background, justification and discussion** for your own study
- Relevant studies yield **valuable insights and tips** to improve your own study
- You might obtain the **theoretical foundation** to understand your results
- You will be able to **find gaps and weaknesses** of the existing research and thereby **come up with useful and meaningful research** questions
- It might **rescue you from embarrassing moments** during your talks



# Scientific Literature

Staying up to date with the literature is the **single most important skill** that remains crucial throughout a researcher's career

Without knowing where the current gaps are, **your findings will either be old hat or too odd** to be cited right away

**The exponentially increasing number** of published papers (2.5 million per year by one estimate) makes it more and more difficult to manage the flood of scientific information

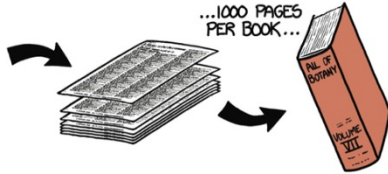


For young scientists in particular, there is the additional challenge of trying to **stay on top** of newly published literature **while still building up knowledge** of their research areas

# HOW MUCH SCIENCE IS THERE?

SCIENTIFIC PUBLISHING HAS BEEN ACCELERATING—A NEW PAPER IS NOW PUBLISHED ROUGHLY EVERY 20 SECONDS. LET'S IMAGINE A BIBLIOGRAPHY LISTING EVERY SCHOLARLY PAPER EVER WRITTEN. HOW LONG WOULD IT BE?

IF WE CAN FIT 140 CITATIONS PER PAGE...



...AND THEN WE START STACKING BOOKS...



A LIST OF PAPERS PUBLISHED IN 1880 WOULD FILL 100 PAGES.

BY 1920, THE LIST WOULD BE GROWING BY 500 PAGES PER YEAR.

THE 1975 SECTION WOULD FILL FOUR HUGE VOLUMES.

TODAY, WE'RE UP TO 15 VOLUMES PER YEAR—A PAGE EVERY 45 MINUTES.

...THIS IS WHAT THE FULL LIST WOULD LOOK LIKE:

1880: ALL SCHOLARLY ARTICLES FROM BEFORE 1880 FIT IN JUST A FEW VOLUMES.

1910: AUSTRIAN A. ON A PAPER BY AUSTRIAN A. "UBER DIE VON AUSTRIAN A. "ZUR ELEKTRODYNAMIK" VON A. "DIE THEORIE"

1930: DOBBIE, E. "EFFECTS OF SHIFTS ON THE DISTRIBUTION OF MELANIN" PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES 1930: 22-24

# HOW OPEN IS IT?

SINCE THE ADVENT OF THE WEB, MUCH OF SCIENTIFIC PUBLISHING HAS BEEN MOVING TO OPEN ACCESS. ACCORDING TO SCIENCE-METRIX, OPEN ACCESS REACHED A "TIPPING POINT" AROUND 2011: MORE THAN 50% OF NEW RESEARCH IS NOW MADE AVAILABLE FREE ONLINE.

## OPEN-ACCESS PAPERS

AS JOURNALS MOVE TO OPEN ACCESS AND DIGITIZE THEIR ARCHIVES, OLD PAPERS FROM EVERY PERIOD MOVE UP HERE...

...IN ADDITION TO THE FLOOD OF NEW PAPERS BEING PUBLISHED HERE DIRECTLY.

25% OF OPEN-ACCESS PAPERS ARE FREELY AVAILABLE ON PUBLICATION.

THE REST BECOME FREE WITHIN 12 MONTHS ON JOURNAL WEBSITES OR OTHER REPOSITORIES.

## TRADITIONAL PUBLICATION

1991: PAUL GINSBURG LAUNCHES ARXIV FOR PHYSICS PREPRINTS

1987-89: FIRST ONLINE JOURNALS APPEAR

1991: RICHARD SCHLEGEL, "NECESSARY PROPERTIES OF A CHEMICAL ELEMENT" PHYSICAL REVIEWS

1953: WATSON, CRICK, AND WILKINS, "MOLECULAR STRUCTURE OF NUCLEIC ACIDS"

1927: MODEL, KURT; RICHARD SCHLEGEL, "NECESSARY PROPERTIES OF A CHEMICAL ELEMENT" PHYSICAL REVIEWS

1913: SPHER, R. A. AND G. GRAY, "THE ORIGIN OF CHEMICAL ELEMENTS" PHYSICAL REVIEWS

MOVED TO OPEN ACCESS

1869: FIRST ISSUE OF NATURE

1880: SCIENCE FOUNDED

1999: NIH DIRECTOR PROPOSES AN ARCHIVE OF FREE, BIOMED PAPERS

2000: PUBMED CENTRAL DEBUTS PLOS FOUNDED

2001: 30,000 SCIENTISTS CALL FOR BOYCOTT OF JOURNALS THAT DON'T ALLOW FREE ACCESS ON PUBMED WITHIN 6 MONTHS

2002: BIOMED CENTRAL BEGINS CHARGING \$500 AUTHOR FEE. HMTI AGREES TO PAY AUTHOR FEES FOR OPEN-ACCESS PUBLICATION

2003: PLOS BIOLOGY LAUNCHED, CHARGES \$1500 AUTHOR'S FEE

2006: U.K. MEDICAL RESEARCH COUNCIL MANDATES FREE ACCESS WITHIN 6 MONTHS. PLOS RAISES TOP AUTHOR FEE TO \$2500, LAUNCHES PLOS ONE, WHICH REVIEWS FOR SCIENTIFIC RIGOR, NOT IMPORTANCE.

2008: NIH REQUIRES THAT PAPERS IT FUNDS BE MADE FREE WITHIN 12 MONTHS. HARVARD FACULTY AGREE TO POST PAPERS IN UNIVERSITY REPOSITORY

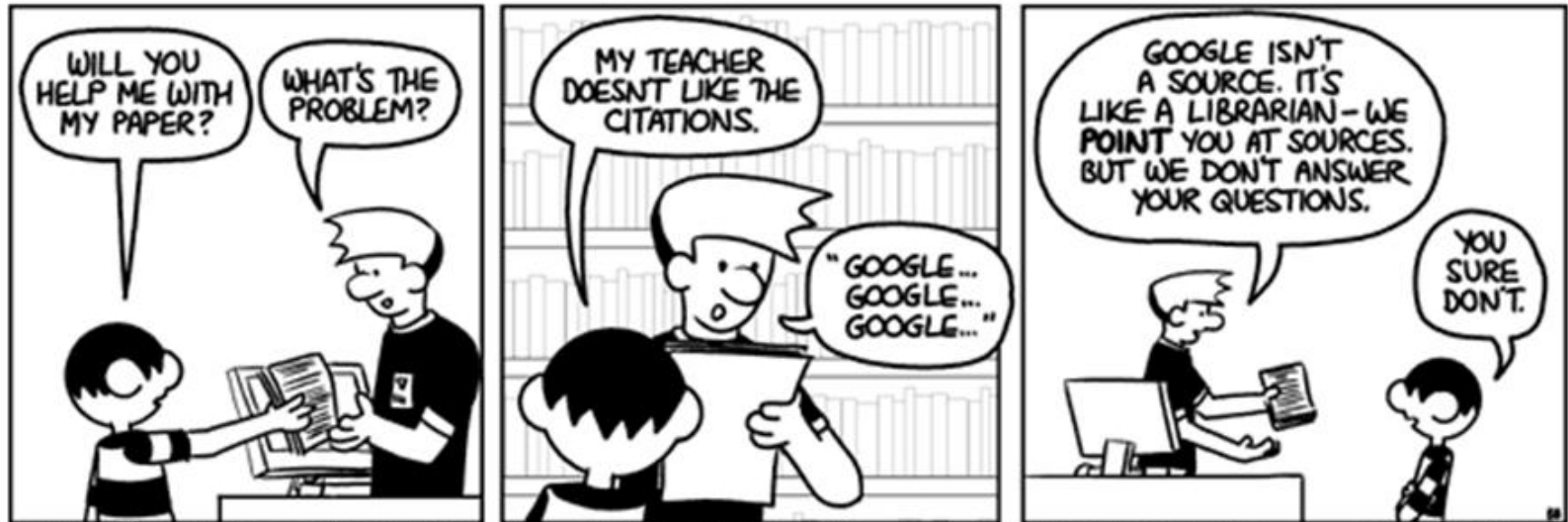
2010: PLOS BECOMES PROFITABLE. PLOS ONE BECOMES WORLD'S BIGGEST SCIENTIFIC PUBLISHER BY VOLUME.

2013: WHITE HOUSE ORDERS ALL SCIENCE AGENCIES TO PLAN TO MAKE PAPERS FREE WITHIN 12 MONTHS

2014: EUROPEAN COMMISSION WILL REQUIRE FREE ACCESS WITHIN 6-12 MONTHS

# Challenges in Keeping up with Literature

- There are so **many papers** out there to digest !!!
- Reading papers can feel like **dead time**, because it is such a slow and absorbing process
- Reading can also **feel disheartening**, as you will often find that other people have already published on what you thought was a really novel or original idea



# Keeping up with Scientific Literature

The process of keeping up with scientific literature will go much faster if you have a **system**

It is critical to develop a ***modus operandi*** for achieving a rapid, purposeful, effective and useful method to search for and read scientific papers

**Objective of this lecture:**

**To outline a logical and orderly approach to keeping up with scientific literature**

**Two main parts:**

- 1. Searching for a paper**
- 2. Reading the paper**

This paper won't read itself.



# Two Main Types of Scientific Papers

---

- Primary research articles:** the original data and conclusions of the researchers
- **details** about how the experiments were done ("supplemental data")
  - allow **evaluating** for yourself **the validity** of the authors' conclusions
  - examples on **how experts** in the field **represent their data**

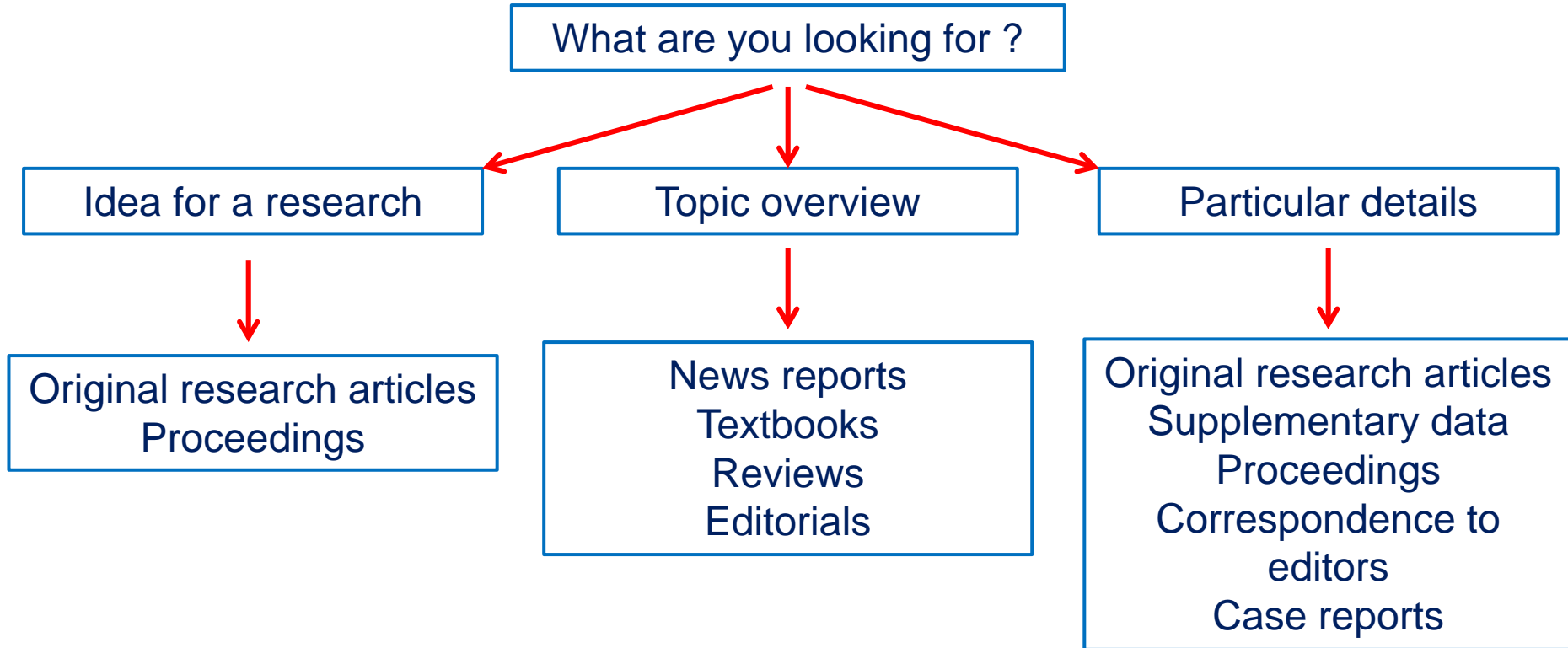
Primary research articles should be consulted any time you need to get more information about how an experiment was carried out

- Review articles:** an overview of the scientific field or topic by summarizing the data and conclusions from many studies
- a **good starting place** for a summary of what has been happening in the field.
  - often contain more **background information** than primary research articles
  - several reviews by different authors for a **well-rounded perspective** of the field

If at any point you're confused while reading the primary literature, it will help to go back and look at reviews



# Choosing the Right Type of Articles



# Strategies of Good Literature Search

The university libraries maintain subscriptions to **thousands of journals**

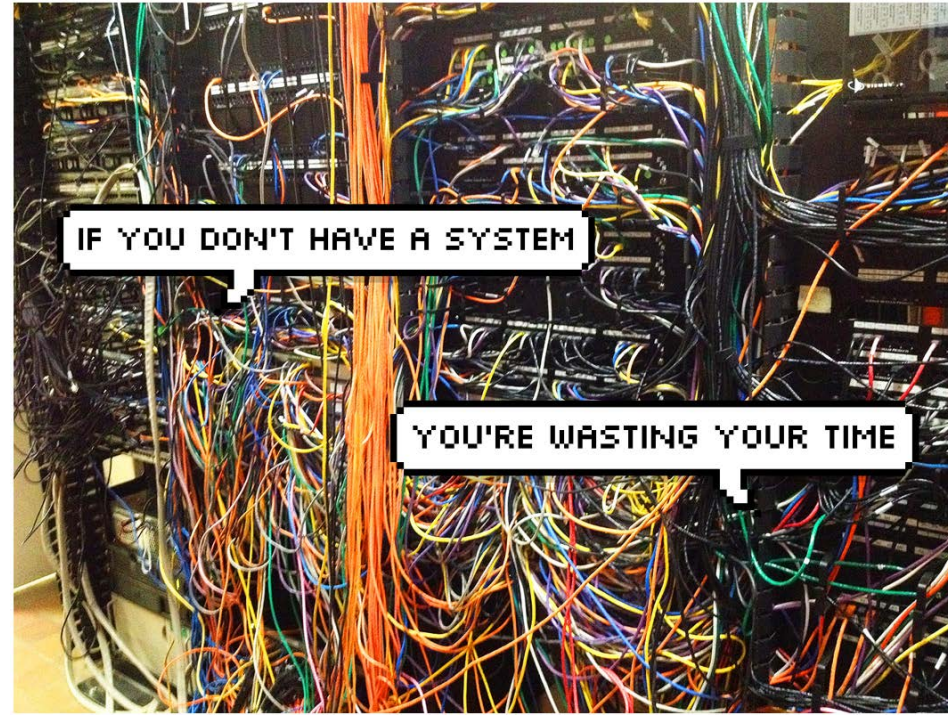
In the good old day, you simply go to the library!

To access their content, you simply need to visit the publisher's website from a university-linked IP address

Does it help?

**NO.**

**You should follow general strategies**  
of literature search  
which are independent of a particular  
search engine



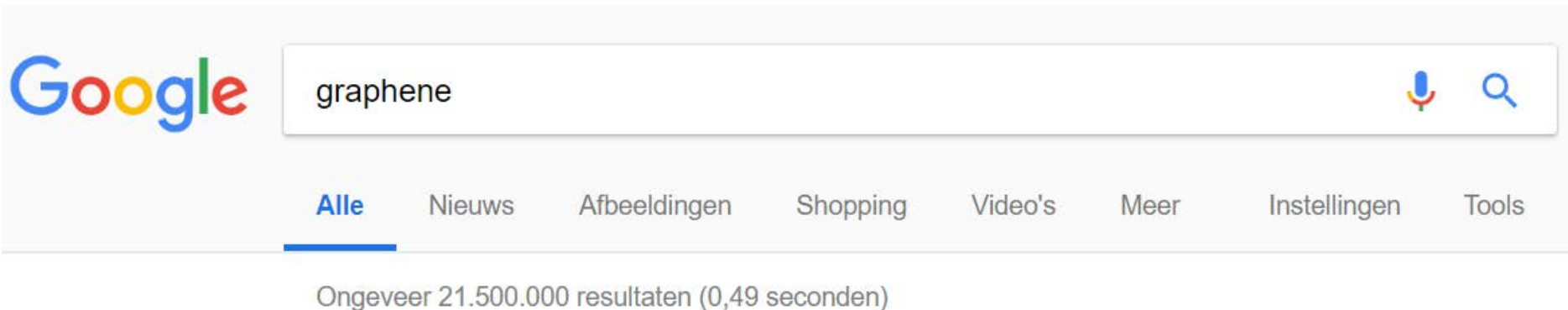
# What about Keyword Searching?

## IS NOT USEFUL!

When you write a paper or design a project, YOU supply **keywords**

Let's try a keyword search for "graphene"

Do you think that will turn up work on "exfoliated graphene"?



The **keyword mentality** is an **infectious** disease contracted from the modern Internet. It contributes to the wide-spread phenomenon of "forgotten papers"

## DO NOT RELY ON IT!

# Search Engines

A better method is to find a starting point – a paper, an author, a journal *etc* – and then work your way out from there

<b>Bibliographic/general databases</b>	<b>Published databases and journal websites</b>	<b>Subject-specific databases</b>
ISI Web of Knowledge Scifinder Google Scholar	APS, ACS, OCA, RSC Elsevier's ScienceDirect SpringerLink	Arxiv.org MathSciNet PhychINFO
Use to - Browse for popular and high quality articles - Start the discovery process and find an initial set of papers	Use to - Browse through journals that frequently publish your topic of interests - Browse through journals specific to your specialization	Used to - Look for articles in a specific discipline - Do in-depth research on a particular topic - Look for articles on obscure or niche topics

# Web of Knowledge

The Web of Knowledge is maintained by Thompson Reuters and indexes just about **everything worth indexing**

The screenshot shows the top navigation bar of the Web of Knowledge website. It includes links for 'Web of Science', 'InCites', 'Journal Citation Reports', 'Essential Science Indicators', 'EndNote', and 'Publons'. On the right side of the navigation bar, there are links for 'Sign In', 'Help', and 'English'. Below the navigation bar is the 'Web of Science' logo in orange and the 'Clarivate Analytics' logo. A search bar is located below the logo, with a dropdown menu set to 'All Databases' and a 'Learn More' link. To the right of the search bar is a 'P' logo and the text 'Join the Publons community of reviewers for Peer Review Week'. Below the search bar are three tabs: 'Basic Search' (which is underlined), 'Cited Reference Search', and 'Advanced Search'. The 'Basic Search' tab contains a search input field with the example text 'Example: oil spill\* mediterranean', a 'Topic' dropdown menu, and a blue 'Search' button. Below the search input field are links for '+ Add Another Field' and 'Reset Form'. To the right of the search button is a link that says 'Click here for tips to improve your search.' At the bottom right of the screenshot, the URL 'http://webofknowledge.com' is displayed.

However, sometimes it is difficult to narrow the results down to a manageable level

# Web of Knowledge

Web of Science



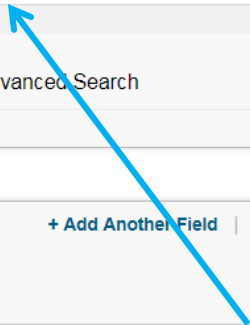
Select a database

[Learn More](#)

 Join the Publons community of reviewers for Peer Review Week

[+ Add Another Field](#) | [Reset Form](#)

[Click here for tips to improve your search.](#)



An easy way to narrow your search to scientific journals

**TIMESPAN**

All years

From  to

[▶ MORE SETTINGS](#)

# Web of Knowledge

Basic Search   Cited Reference Search   Advanced Search

Pshenichnikov, M\*   Author   Search

+ Add Another Field   Reset Form   Select from Index

**TIMESPAN**

All years

From 1900 to 2017

**MORE SETTINGS**

Auto-suggest publication names  
On

Search language to use  
Auto select

Default Number of Search Fields to Display  
1 field (Topic)

(To save these permanently, sign in or register)

Different journals index author names differently  
Wildcards (\*) ensure that you get all results back

Time/database limits are often more useful than keyword/topic searches

# Web of Knowledge: Backward Search

To get a feeling for how “important” a paper is, you can sort by citations instead of date

**Results: 96**  
(from All Databases)

You searched for: AUTHOR: (Pshenichnikov, M\*) ...More

**Refine Results**

Search within results for...

Filter results by:

- Highly Cited in Field (2)

Publication Years

- 2017 (7)
- 2016 (7)
- 2009 (6)
- 1998 (6)
- 2007 (5)

more options / values...

Sort by: Publication Date -- newest to oldest

- Publication Date -- newest to oldest
- Publication Date -- oldest to newest
- Recently Added
- Times Cited -- highest to lowest
- Times Cited -- lowest to highest
- Usage Count -- Last 180 days
- Usage Count -- Since 2013
- Relevance

Page 1 of 10

to EndNote online Add to Marked List

**cs in diluted alcohols**  
Shinokita, Keisuke; et al.  
JOURNAL OF PHYSICAL CHEMISTRY LETTERS Volume: 19 Issue: 41 Pages: 27960-27967 Published: NOV 7 2017

**ilic Molecular Nanostructures via Halogen Exchange**  
By: Kriete, Bjorn; Bondarenko, Anna S.; Jumde, Varsha R.; et al.  
JOURNAL OF PHYSICAL CHEMISTRY LETTERS Volume: 8 Issue: 13 Pages: 2895-2901 Published: JUL 6 2017

**Get it!** **View Abstract**

3. **Interplay between Hydrogen Bonding and Vibrational Coupling in Liquid N-Methylacetamide**  
By: Cunha, Ana V.; Salamatova, Evgeniia; Bloem, Robbert; et al.  
JOURNAL OF PHYSICAL CHEMISTRY LETTERS Volume: 8 Issue: 11 Pages: 2438-2444 Published: JUN 1 2017

**Get it!** **View Abstract**

4. **Luminescent Organic Semiconducting Langmuir Monolayers**  
By: Agina, Elena V.; Mannanov, Artur A.; Sizov, Alexey S.; et al.

**Times Cited: 0**  
(from All Databases)

**Usage Count**

**Times Cited: 1**  
(from All Databases)

**Usage Count**

**Times Cited: 2**  
(from All Databases)

**Usage Count**

**Times Cited: 0**  
(from All Databases)

**Create Citation Report**

**Analyze Results**



# Web of Knowledge: Forward Search

Sort by: Times Cited -- highest to lowest

Page 1 of 10

Select Page | 5K | Save to EndNote online | Add to Marked List | Create Citation Report | Analyze Results

1. **The Role of Driving Energy and Delocalized States for Charge Separation in Organic Semiconductors**  
By: Bakulin, Artem A.; Rao, Akshay; Pavelyev, Vlad G.; et al.  
SCIENCE Volume: 335 Issue: 6074 Pages: 1340-1344 Published: MAR 16 2012

**Times Cited: 559**  
*(from All Databases)*

**Highly Cited Paper**

Usage Count ▾

One of the best features of WoS  
is the “times cited” search

Press it!

# Web of Knowledge: Forward Search

Citing Articles: 528

(from All Databases)

**For:** The Role of Driving Energy and Delocalized States for Charge Separation in Organic Semiconductors  
...More

Times Cited Counts

559 in All Databases

558 in Web of Science Core Collection

69 in BIOSIS Citation Index

3 in Chinese Science Citation Database

0 data sets in Data Citation Index

0 publication in Data Citation Index

0 in Russian Science Citation Index

0 in SciELO Citation Index

[View Additional Times Cited Counts](#)

Sort by: Times Cited -- highest to lowest

Page 1 of 53

Select Page



Save to EndNote online

Add to Marked List

Create Citation Report

Analyze Results

Times Cited: 456

(from All Databases)

Highly Cited Paper

Usage Count

Times Cited: 449

(from All Databases)

Highly Cited Paper

Usage Count

Times Cited: 412

(from All Databases)

Hot Paper

Highly Cited Paper

Usage Count

Times Cited: 330

(from All Databases)

Highly Cited Paper

1. **Polymer solar cells with enhanced fill factors**

By: Guo, Xugang; Zhou, Nanjia; Lou, Sylvia J.; et al.  
NATURE PHOTONICS Volume: 7 Issue: 10 Pages: 825-833 Published: OCT 2013

Get it!

View Abstract

2. **Spatial separation of photogenerated electrons and holes among {010} and {110} crystal facets of BiVO<sub>4</sub>**

By: Li, Rengui; Zhang, Fuxiang; Wang, Donge; et al.  
NATURE COMMUNICATIONS Volume: 4 Article Number: 1432 Published: FEB 2013

Get it!

Full Text from Publisher

View Abstract

Ref Sort by times cited and voila, relevant review articles for a topic, starting from a paper

**mer Solar Cells with over 11% Efficiency and Excellent Thermal Stability**

ian, Deping; Zhang, Shaoqing; et al.  
LS Volume: 28 Issue: 23 Pages: 4734-4739 Published: JUN 15 2016

ext from Publisher

View Abstract

Filter results by:

Highly Cited in Field (37)



Hot Papers in Field (2)



Refine

4. **Ultrafast Long-Range Charge Separation in Organic Semiconductor Photovoltaic Diodes**

By: Gelinas, Simon; Rao, Akshay; Kumar, Abhishek; et al.  
SCIENCE Volume: 343 Issue: 6170 Pages: 512-516 Published: JAN 31 2014

Get it!

View Abstract

# The “Web” of Science

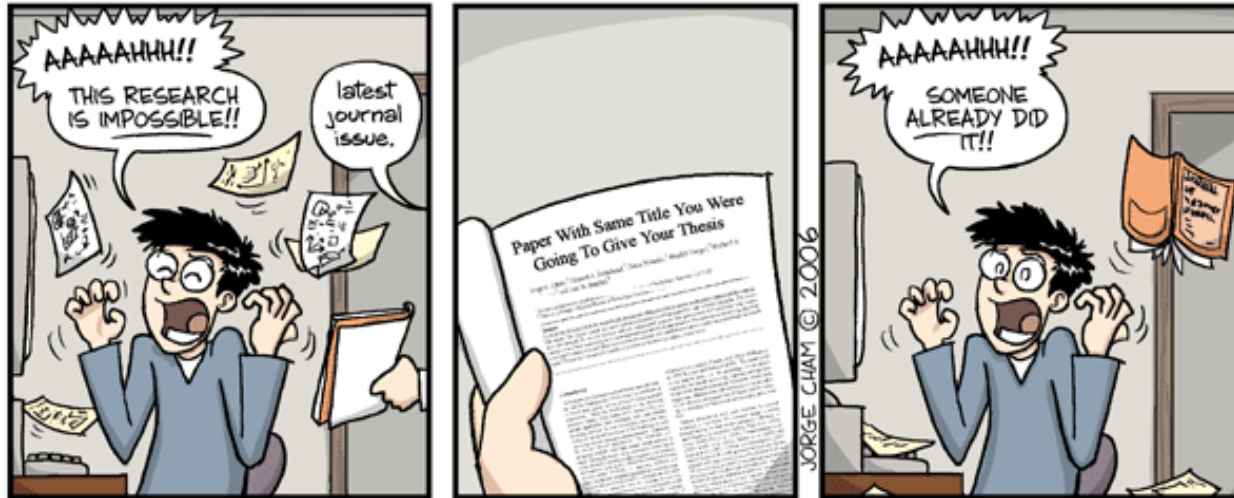
Think of WoS searches as a “**web**” of **papers** connected by citations and authors

**Start:** a known quantity, such as a specific paper or author

**Next:** follow the web to get a feeling for how it fits into the literature

This type of searching is critical for grant proposals and similar “background” searches

**You know you are doing a good job if your search results make you depressed because everything has already been thought of and tried**



# Scifinder

Most fields of materials science use **chemical compounds** in some context  
**Searching by names**, particularly in the non-chemistry literature is **inefficient**  
Scifinder is good for **structure-based searching**, finding reactions for specific transformations, and gauging how difficult and/or common the synthesis of something is



**SciFinder®**  
The choice for chemistry research.™

Your session is no longer valid. Sign in again to SciFinder.

### Sign In

Username

Password

Remember me for two weeks unless I sign out  
(Do not use on a shared computer)

[Sign In](#)

[Forgot Username or Password?](#)

Your SciFinder username and password are assigned to you alone and may not be shared with anyone else.

### News & Updates

**Welcome to SciFinder**

**Watch Part 2 of Our New Science in the News Podcast on Molecular Gastronomy**

Part 2 of our Science in the News podcast on molecular gastronomy features a pioneer in the field, RD Cooper, chef and owner of Rogue 24 in Washington, DC. Watch it now and stay tuned for more Science in the News podcasts coming soon!

**Join CAS at the ACS National Meeting & Exposition in Indianapolis**

Join us at the 246th ACS National Meeting & Exposition in Indianapolis to see how CAS and SciFinder can help you learn more about the science that is transforming the transportation industry. See what we have planned.

**Be Our Guide to an Even Better SciFinder Experience**

Sign up today to participate in a variety of user research activities, ranging from short surveys to 1-hour Web-based discussions.

The Treasury of Evolution Chemical

<https://scifinder.cas.org/scifinder/login>


# Free Online Search Engines

Academic Search Engine	URL	Disciplines	Help Files
Google Scholar	<a href="http://scholar.google.com">scholar.google.com</a> ( <a href="http://scholar.google.com">http://scholar.google.com</a> )	All	<a href="http://scholar.google.com/intl/en/scholar/help.html">scholar.google.com/intl/en/scholar/help.html</a> ( <a href="http://scholar.google.com/intl/en/scholar/help.html">http://scholar.google.com/intl/en/scholar/help.html</a> )
ScienceDirect	<a href="http://www.sciencedirect.com/science/search">http://www.sciencedirect.com/science/search</a> ( <a href="http://www.sciencedirect.com/science/search">http://www.sciencedirect.com/science/search</a> )	All	NA
Pubmed	<a href="http://www.ncbi.nlm.nih.gov/pubmed">www.ncbi.nlm.nih.gov/pubmed</a> ( <a href="http://www.ncbi.nlm.nih.gov/pubmed/">http://www.ncbi.nlm.nih.gov/pubmed/</a> )	Life sciences	<a href="http://www.nlm.nih.gov/bsd/disted/pubmedtutorial">www.nlm.nih.gov/bsd/disted/pubmedtutorial</a> ( <a href="http://www.nlm.nih.gov/bsd/disted/pubmedtutorial/">http://www.nlm.nih.gov/bsd/disted/pubmedtutorial/</a> )
IEEE Xplore	<a href="http://ieeexplore.ieee.org/Xplore/guesthome.jsp">ieeexplore.ieee.org/Xplore/guesthome.jsp</a> ( <a href="http://ieeexplore.ieee.org/Xplore/guesthome.jsp">http://ieeexplore.ieee.org/Xplore/guesthome.jsp</a> )	Electronics, Electrical engineering, Computer science	NA
Education Resources Information Center (ERIC)	<a href="http://eric.ed.gov">eric.ed.gov</a> ( <a href="http://eric.ed.gov/">http://eric.ed.gov/</a> )	Education	NA

# Google Scholar

Google Scholar

<http://scholar.google.com/>

Articles  Case law

## Recommended articles

Highly soluble and thermally stable alkyl-free star-shaped D- $\pi$ -A oligomer with electron-withdrawing phenyldicyanovinyl groups for organic photovoltaics

YN Luponosov, AN Solodukhin, AL Mannanov... - Organic Electronics, 2017

Plastic Solar Cells: Where the Current Begins

O Kozlov

[See all recommendations](#)

**Stand on the shoulders of giants**

[Go to Google Scholar](#)

Google Scholar is good for searching while **off campus**, but it returns a lot of **irrelevant results**

It is less restrictive than WoS

# Publishers' Websites

Publishers often offer nice search features right on their own websites  
Societies generally do it better than for-profit journals, however

[pubs.acs.org](http://pubs.acs.org)

[pubs.rsc.org](http://pubs.rsc.org)

[journals.aip.org](http://journals.aip.org)

[www.aps.org/publications/journals](http://www.aps.org/publications/journals)

[onlinelibrary.wiley.com](http://onlinelibrary.wiley.com)

[sciencedirect.com](http://sciencedirect.com)

[www.aaas.org/publications](http://www.aaas.org/publications)

[www.nature.com/siteindex](http://www.nature.com/siteindex)



# Publishers' Websites

Publishers often offer nice search features right on their own websites  
Societies generally do it better than for-profit journals, however



Search Citation Subject **Advanced Search**

J. Am. Chem. Soc. vol page Citation Search

MENU

Subscriber access provided by University of Groningen  
Access provided by University of Groningen SIGN IN

## AIP Applied Physics Letters



SUBMIT YOUR ARTICLE

HOME ISSUES INFO FOR AUTHORS COLLECTIONS

SIGN UP FOR ALERTS

Publishing Journals Books Databases



Advanced



ROYAL SOCIETY OF CHEMISTRY

Network access provided by: University of Groningen

### Advanced Search

Search For  All RSC Content  Journal Articles  Book Chapters

Full Text

with all of the words

Advanced Search Tips

Journal Articles / Books Chapters



# Citation Alerts

Publishers offer **alert services**

These are mostly useful for following specific topics in specific journals



Search Citation Subject **Advanced Search**

Enter search text / DOI  Anywhere

Subscriber access provided by University of Groningen



Authors & Reviewers

Librarians & Account Managers

ACS Members

Alerts

About Us

ACS & Open Access

Follow ACS



e-Alerts



RSS Feeds



Facebook



Twitter



YouTube



Podcasts



Communities



Mobile

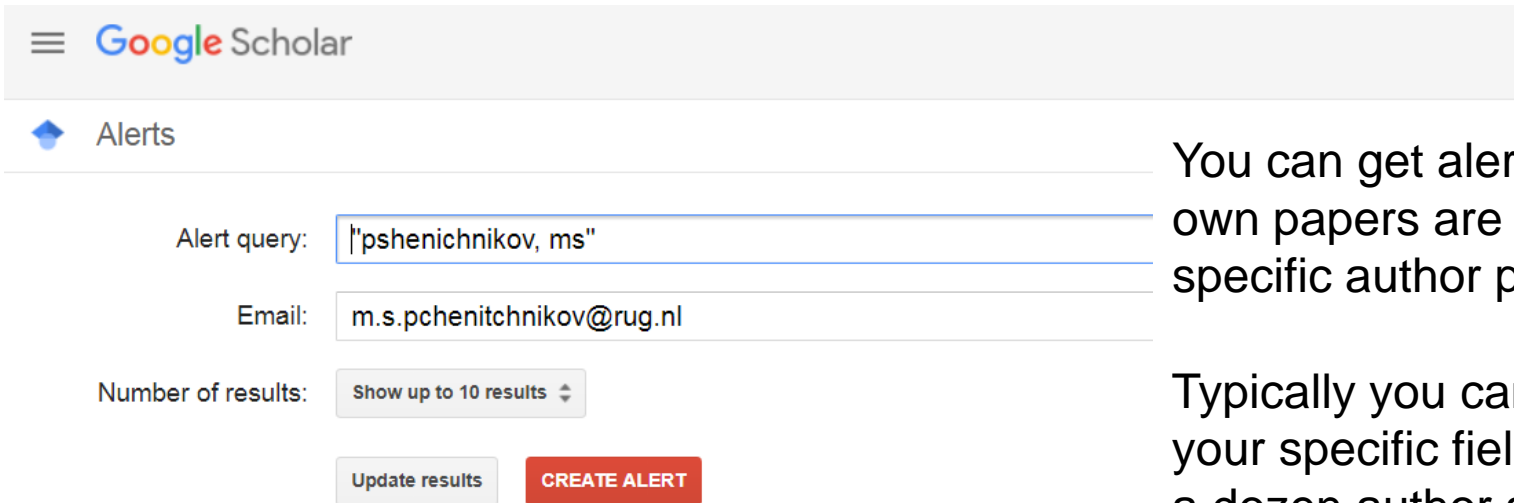
## ASAP<sup>SM</sup> Alerts

Daily or weekly email alerts when individual articles (Articles ASAP<sup>SM</sup>) from the journal(s) you have selected are released on the web.

## Table of Contents (TOC) Alerts

Email alerts with the Table of Contents for specific issues on the day the complete issue is posted to the web.

# Citation Alerts in Google Scholar



Google Scholar

Alerts

Alert query: "pshenichnikov, ms"

Email: m.s.pchenitchnikov@rug.nl

Number of results: Show up to 10 results

Update results CREATE ALERT

You can get alerts when your own papers are cited, or when a specific author publishes a paper

Typically you can keep track of your specific field with fewer than a dozen author alerts

## Sample results since 2017:

[\[HTML\] Interplay Between Hydrogen Bonding and Vibrational Coupling in Liquid N-Methylacetamide](#)

AM Cunha, E Salamatova, R Bloem, SJ Roeters... - *The Journal of Physical Chemistry*, 2017

Intrinsically disordered proteins play an important role in biology, and unraveling their labile structure presents a vital challenge. However, the dynamical structure of such proteins thwarts their study by standard techniques such as x-ray diffraction and NMR spectroscopy.

[Hydrogen bond and lifetime dynamics in diluted alcohols](#)

E Salamatova, AV Cunha, K Shinokita, TLC Jansen... - *Chemistry Chemical Physics*, 2017

Hydrogen-bonding plays a crucial role in many chemical and biochemical reactions. Alcohols, with their hydrophilic and hydrophobic groups, constitute an important class of

# Social-Literature Search

Community-based, social sites like **Research Gate, LinkedIn, Facebook** are becoming **increasingly popular**



But they all suffer from the **generational problem**: science is driven by mid-to-late career scientists, essentially **none of whom use social media**

If you want to interact with other students and junior researchers, then these are great  
But **do not rely on them** for anything else !

Advance your research

Discover scientific knowledge, and make your research visible.

Join for free

 Connect with LinkedIn  Connect with Facebook

# Open Access

Everyone likes the idea of **open access scientific journals**

There are some top-tier, free, open access journals

Journals > physics > open access

Open Physics

Atmospheric Chemistry and Physics

Progress in Physics

Living Reviews in Relativity

European Physical Journal

Journal of Physics: Conference Series

Electronic Journal of Theoretical Ph...

Living Reviews in Solar Ph

Physical Review X

Research Letters in Physics

Journal of Cosmology and Astropart...

Physics in Medicine and B

Journal of High Energy Physics

Advances in Theoretical and Mathe...

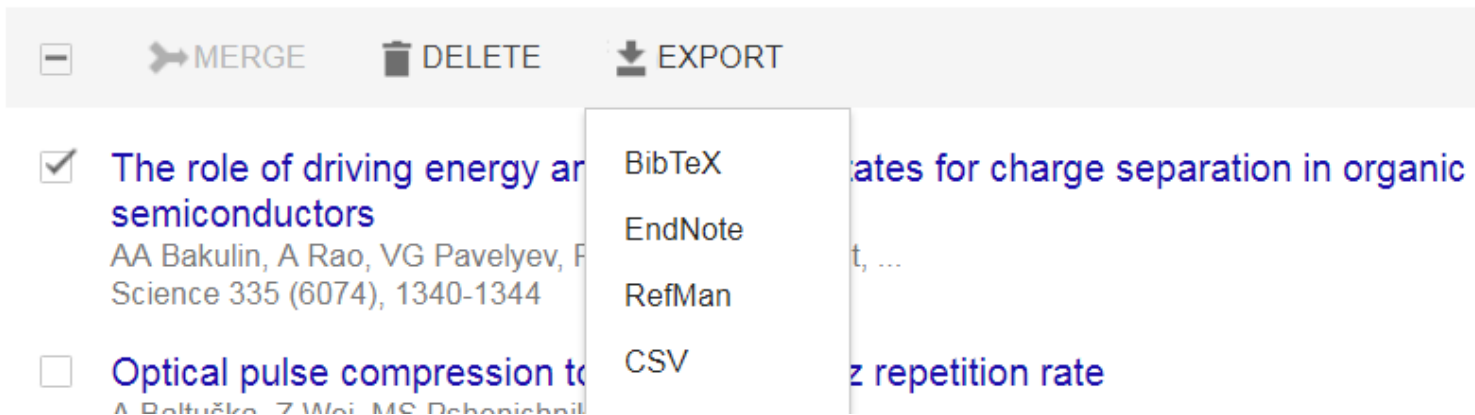
Astrophysics and Space Science

Journal of Optics

On the other hand, the **proliferation** of journals is **out of control**. The push for open access has created an entire **new industry of for-profit publishers** whose “peer review” system is a mere technicality. You do need to be extra careful when citing “grey” literature in your paper.

**Get to know your field!**

# Reference Management Software



**Pick one**, any one, it doesn't make a difference. But develop good habits!

**Use tags!** A few tags reminding you of why you were interested in a particular paper can be a lifesaver months or years later.

**Don't Be Afraid to delete!** Don't hoard papers — if, once you take the time to read a paper, you realize it is useless, delete it. You won't miss it

**Use Groups/Folders!** As soon as you have a target — a manuscript, a thesis chapter, a grant proposal *etc.* — create a folder and start populating it

# Part II. Reading Scientific Literature

There are simply **too many articles** so that reading them would absorb all your time

Experienced scientists go through a **sequential process** (“*phases*”) of studying the article - all the while deciding whether or not to give it further attention

The decision is **based on many factors**:

- Whether the article is of sufficient interest
- Whether the article is relevant to their work
- Whether the article is of general importance
- Whether the article is of high quality and accurate
- Whether the article is clearly written
- Whether the article is "meaty"
- Whether the article is short



“Of course we’ll make a decision ...  
once we have considered the 5243 factors.”

# Write on the Article as You Read

Reading is an **active task**. Effective readers **write on** the article while reading!

- Circle words you do not know
- Check important points
- Question things you do not understand
- Question things that do not make sense
- X-off things that are wrong
- Note down further ideas or questions
- Check references for further reading

## INTRODUCTION

The spectacular rise in photovoltaic conversion efficiency (PCE) of halide perovskite solar cells (PSCs) based on  $\text{CH}_3\text{NH}_3\text{PbI}_3$  and related materials has fueled intensive interests in hybrid organic-inorganic perovskites,<sup>1-3</sup> yet the very crystalline structure of  $\text{CH}_3\text{NH}_3\text{PbI}_3$  remains ambiguous after extensive researches. While it is generally accepted that its room temperature lattice is tetragonal and thus possesses ferroic ordering, there is heated debate on whether such order is polar or not,<sup>4,5</sup> and advocates for either structure can find their supporting evidences in X-ray and neutron diffractions,<sup>6-9</sup> optic second harmonic generation (SHG),<sup>4,5</sup> macroscopic pyroelectric, and ferroelectric measurement,<sup>4,10,11</sup> microscopic piezoresponse force microscopy (PFM),<sup>12-16</sup> and density functional theory (DFT) and molecular dynamics (MD) simulations.<sup>17-20</sup> A consequence of a polar order is ferroelectricity and its implications to photovoltaics, yet the ferroelectric nature of  $\text{CH}_3\text{NH}_3\text{PbI}_3$  remains controversial as well,<sup>4,5,11</sup> and the correlation between photovoltaic conversion and possible ferroelectricity has not been established except for a number of theoretical studies.<sup>17-19</sup> Here, we present compelling evidences that single-crystalline  $\text{CH}_3\text{NH}_3\text{PbI}_3$  films possess ferroic domains with alternating instead of pure polar and nonpolar orders, and that polar domains exhibit reduced photocurrent in contrast to previous theoretical expectations.<sup>17-19</sup>

look up!

By when? look up!

SHG? (circled)

What about other perovskites? (circled)

<sup>1</sup>Shenzhen Key Laboratory of Nanobiomechanics, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen, Guangdong, China

<sup>2</sup>Department of Mechanical Engineering, University of Washington, Seattle, WA 98195-2600

# Organization of Scientific Paper (IMRADDC)

## Reminder of the previous-year Evening Lecture

1. Title: Topic and information about the authors
2. Abstract: Brief overview of the article
3. **I**ntroduction: Background information and statement of the research hypothesis
4. **M**ethods: Details of procedures, instruments, materials etc
5. **R**esults: All the data of the study along with figures and/or tables
6. **D**iscussion: The interpretation of the results and implications of the study
7. **C**onclusions: Brief overview of the results and perspectives
8. References: Citations of sources from where the information was obtained

NB 1: In some papers the method section may be presented at the end of the main body for a better flow of reading.

NB 2: Review articles might not follow the above pattern



# The Cardinal Rule

---

**Never start reading an article from the beginning to the end!**

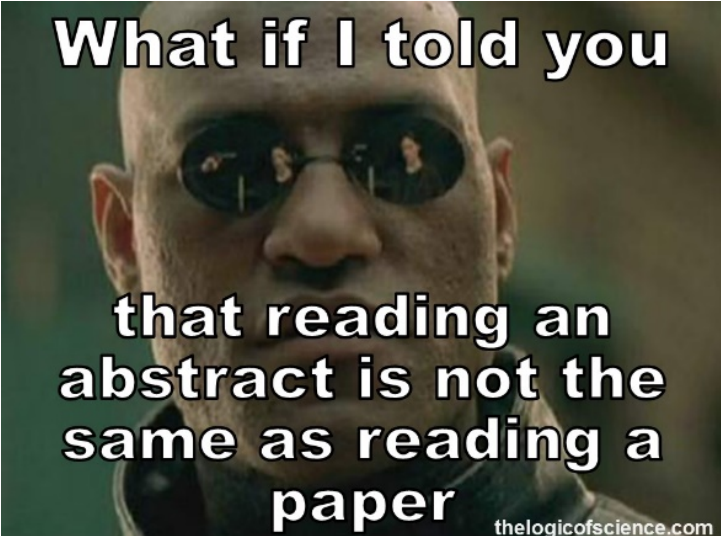
It is better to begin with identifying the conclusions of the study by reading the title and the conclusions at the end

If you still deem the paper be interesting or useful, then the entire article can be read

**And what about the abstract?**

NEVER begin with the abstract as it contains little relevant information

ALWAYS end up with the abstract and evaluate whether or not it matches your own understanding of the article

A meme featuring a close-up of Morpheus from the movie The Matrix. He is wearing his signature black sunglasses and has a serious expression. The text is overlaid on the image in a white, bold, sans-serif font.

**What if I told you**

**that reading an  
abstract is not the  
same as reading a  
paper**

# Phase I: Screening the Article

**The title** of the article is the one which attracts a reader in the first place

*“Novel Organic Crystals: Shine as a Crazy Diamond”*

→ idea about the article in general, but no indication on what the paper is about

*“Highly-Emissive Solution-Grown Furan/Phenylene Co-Oligomer Single Crystals”*

→ provides a better understanding of the content

- What is the type of the paper (regular or review)?
- Does the title make any sense?
- Who are **the authors**? Do you know them?
- What is the publication date?
- What are the keywords? (NB: might be meaningless)



COMMUNICATION

[View Article Online](#)  
[View Journal](#) | [View Issue](#)



Highly-emissive solution-grown furan/phenylene  
co-oligomer single crystals†

# Phase II: Getting the Punch Line

---

**Get the big picture** of the paper

**Introduction** provides the rationale for conducting the study. The aims and objectives are usually mentioned at the end of the introduction

**Conclusions** provide authors' summary of their findings and perspectives

- What is the research problem?
- What is the general background?
- Is there any mention of previous studies on the topic? by whom are they?
- Am I familiar with the references? (good time to get updated)
- What is the study hypothesis?
- What are the aims and objectives of the study?
- What are the conclusions?
- What are the large-scale implications of the findings?

# Phase III: Understanding the Approach

---

Go through **results**, and **few first and last paragraphs of discussion**

Find out whether **the results are reliable** (same results over time) and **valid** (measure what it is supposed to measure)

- How do the researchers attempt to answer research questions?
- How are the results grouped?
- What are the key findings?
- Are the graphs/tables easy to comprehend?
- Do the results answer the research question?

You might not understand everything this first time, but this will help you know what to look for when you actually read the article.

*Remember:* You can re-read sections as often as you desire and look at figures as long as you want

# Phase IV: Re-Reading

Skim the **introduction** once again.

Skim the **methods** section (does not to be studied carefully unless you intend to use it in your research).

Read the **results** section once again

Read the **discussion** (remember that the discussion contains the authors' interpretations and opinions, and not necessarily facts)

Study the **figures and tables**

- Are the methods adequate?
- Which variable are measured in Results?
- Are the results self-consistent?
- Are the results statistically significant?
- Is the analysis relevant to the research questions?
- How are the results different/similar as compared to other studies?
- Are all the subjects in the beginning were accounted for at the end of the study?



# Phase V: Interpreting

**Reread the article in its entirety** (you may wish to read several times)

- Do I need to consult a textbook? a few more references?
- What are the strengths of the study?
- What are limitations of the study?
- Are there any unjustified extrapolations of the findings?
- Are the results reliable?
- Are the conclusions based upon data and analysis?
- Are the conclusions reasonable and logical?
- Why was this study performed?
- Was the study worth doing?
- Will the study be useful for further research?



Before leaving the article, **read the abstract**. Do you **understand it NOW?**

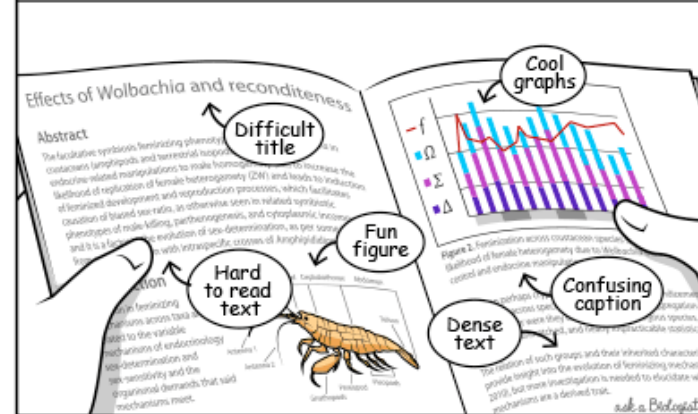
# Phase VI: Summarizing

Effective readers **take notes** — it improves comprehension and recall

Develop a **template** for recording notes on articles you read, which **provides a summary** of the paper

As you accumulate a large collection of articles, this template will help you **distinguish articles** and **quickly locate** the correct reference for your own writing

The time spent filling out the form will **save you hours** of re-reading when you write your own paper







# Simple Rules for Keeping up with Literature

---

## **1. Facilitate an in-depth knowledge of your field**

Having identified seminal papers, typically by the number of times they are cited, enables to explore the network for other frequently cited papers

## **2. Identify and read the papers which are the most important to your research**

Papers of extraordinary interest will form the seeds from which you can mine for new literature

## **3. Always stay on-top of the literature**

Create citation alerts for the papers of extraordinary interest

## **4. Archive**

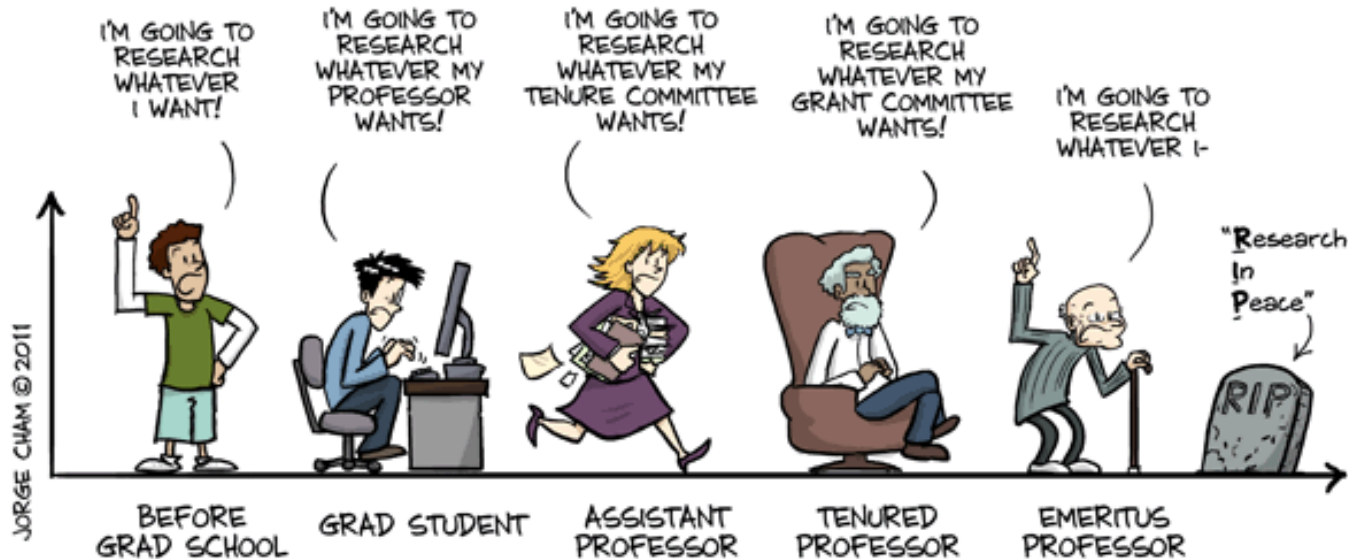
digital copies, references and your notes in a citation program immediately

## **5. Label unread papers with what you expect from it; use tags and groupings**

# Conclusions

**The purpose** of this lecture is to help you keep up with the scientific literature  
You can effectively search and read the scientific literature with a systematic approach!

Ultimately, **searching and reading the literature are the skills** that you have to **develop and maintain** in order to keep up with changing technologies, trends in research and publishers



# Resources

---

<https://www.editage.com/insights/tips-for-effective-literature-searching-and-keeping-up-with-new-publications>

<http://libguides.humboldt.edu/c.php?g=303801&p=2028842>

<https://www.sciencebuddies.org/science-fair-projects/competitions/finding-and-accessing-scientific-papers> 3/

Bauer, “Ten Simple Rules for Searching and Organizing the Scientific Literature”

<http://precedings.nature.com/documents/3867/version/1>

<https://www.elsevier.com/connect/infographic-how-to-read-a-scientific-paper>

<https://www.lib.purdue.edu/help/tutorials/scientific-paper>

[https://www.huffingtonpost.com/jennifer-raff/how-to-read-and-understand-a-scientific-paper\\_b\\_5501628.html?guccounter=1](https://www.huffingtonpost.com/jennifer-raff/how-to-read-and-understand-a-scientific-paper_b_5501628.html?guccounter=1)

<http://www.sciencemag.org/careers/2016/01/how-read-scientific-paper>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3687192/>

<http://www.owl.net.rice.edu/~cainproj/courses/HowToReadSciArticle.pdf>

<https://violentmetaphors.com/2013/08/25/how-to-read-and-understand-a-scientific-paper-2/>

<https://web.stanford.edu/~siegelr/readingsci.htm>

<http://blogs.lse.ac.uk/impactofsocialsciences/2016/05/09/how-to-read-and-understand-a-scientific-paper-a-guide-for-non-scientists/>

<https://www.editage.com/insights/tips-for-effective-literature-searching-and-keeping-up-with-new-publications>

# 10 Stages of Reading a Scientific Paper

---

1. **Optimism.** This can't be too difficult! After all, I've been reading *words* for decades.
2. **Fear.** Uh... I don't think all of these *are* words.
3. **Regret.** Why, oh why, why did I think I could read the article in a single metro ride?
4. **Corner-cutting.** Blessed be the editors who provide an abstract!
5. **Bafflement.** Was that abstract supposed to explain something? Why did the authors use the word "characterize" five times?
6. **Distraction.** What if there were, like, a smartphone for ducks? How would that work? What would they use it for? And what was that Roger Waters' lyric, from "Wish You Were Here", "welcome to the machine"? Shame about the Novichok. Can you put coffee in a humidifier?
7. **Realization.** I haven't progressed to the next sentence in 15 minutes!
8. **Determination.** Really gonna read this time. Yuppies, readin' words is what you do.
9. **Rage.** HOW COULD ANY HUMAN BRAIN PRODUCE SUCH SENTENCES?
10. **Acceptance.** I'd better consider a career in the humanities, right? RIGHT?

# Metrics

---

Metrics like **impact factors** are not useful because it is not clear what they measure

The **impact factor (IF)** is the **number of citations**, received in that year, of articles published in that journal during the two preceding years, divided by the total number of articles published in that journal during the two preceding years

The only metric that matters is **readership**

Specialty journals often contain **the most rigorous science** in a field, but will have a **low impact factor** because of the narrowness of the topic

Conversely, broad-topic journals (Nature, Science etc.) tend to publish condensed versions of major claims that are better described in follow-up publications in topical journals

**Learn what journals are read in your field**

# Impact Factors: Physics

Rank	Journals Title	2017	2016
1	<u><a href="#">NATURE Photonics</a></u>	37,852	31,167
2	<u><a href="#">Reviews Of Modern Physics</a></u>	36,917	33,177
3	<u><a href="#">Annual Review Of Astronomy And Astrophysics</a></u>	30,733	37,846
4	<u><a href="#">Energy &amp; Environmental Science</a></u>	29,518	25,427
5	<u><a href="#">Living Reviews In Relativity</a></u>	29,300	32,000
6	<u><a href="#">NATURE Physics</a></u>	22,806	18,791
7	<u><a href="#">Advances In Physics</a></u>	21,818	18,000
8	<u><a href="#">Annual Review Of Condensed Matter Physics</a></u>	18,588	16,379
9	<u><a href="#">Advances In Optics And Photonics</a></u>	17,833	12,368
10	<u><a href="#">Nano Today</a></u>	17,476	13,157
11	<u><a href="#">Physics Reports: Review Section Of Physics Letters</a></u>	17,425	
12	<u><a href="#">Progress In Energy And Combustion Science</a></u>	17,382	16,784
13	<u><a href="#">Advanced Energy Materials</a></u>	16,721	15,230
14	<u><a href="#">Reports On Progress In Physics</a></u>	14,311	12,933
15	<u><a href="#">Light: Science &amp; Applications</a></u>	14,098	13,600
16	<u><a href="#">Annual Review Of Fluid Mechanics</a></u>	14,020	12,333

# Impact Factors: Physics

Rank	Journals Title	2017	2016
1	<a href="#"><u>NATURE Photonics</u></a>	37,852	31,167
2	<a href="#"><u>Reviews Of Modern Physics</u></a>	36,917	33,177
3	<a href="#"><u>Annual Review Of Astronomy And Astrophysics</u></a>	30,733	37,846
4	<a href="#"><u>Energy &amp; Environmental Science</u></a>	29,518	25,427
5	<a href="#"><u>Living Reviews In Relativity</u></a>	29,300	32,000
6	<a href="#"><u>NATURE Physics</u></a>	22,806	18,791
7	<a href="#"><u>Advances In Physics</u></a>	21,818	18,000
8	<a href="#"><u>Annual Review Of Condensed Matter Physics</u></a>	18,588	16,379

## Medicine 2017 - Impact Factor Ranking

Rank	Journals Title	2017	2016
1	<a href="#"><u>New England Journal Of Medicine</u></a>	72,406	59,558
2	<a href="#"><u>Lancet</u></a>	47,831	44,002
3	<a href="#"><u>JAMA: Journal Of The American Medical Association</u></a>	44,405	
4	<a href="#"><u>NATURE Medicine</u></a>	29,886	30,357

# Impact Factors

---

## Who likes impact factors?

**Editors hate impact factors.** Consider a small, specialized journal that publishes monthly versus a letter/communication journal that publishes bimonthly or an accounts/review journal that publishes quarterly. They will have widely different impact factors based only on how they are structured and having nothing to do with the quality of the content.

**Scientists hate impact factors.** We want to publish in respectable journals that are read by our peers, not journals that some algorithm deem important

**Funding agencies likes impact factors.** In the modern era of “accountability” funding agencies need metrics to justify diverting taxpayer money to endeavors that are published in paywalled journals and that lead to patents owned by universities

**Get to know your field!**



# Decision-making: Shall I Read This Article?

Is the title related to the topic that I am looking for?

YES

Read the **Summary / Conclusions**

*Clear-cut aims and objectives?*

*Well-defined research hypothesis?*

*Are the conclusions precise?*

YES

**Continue with reading**

NO

**Skip the article and  
go to the next**

NO

