Physics 4601

scientific papers

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http://simbac.gatech.edu/phys4601/

School of Physics | Georgia Tech | Spring 2024

*with inspiration from Simon Sponberg (GT)
Publications are the “currency” of science

- scientific publications are how we communicate new results
- papers are grouped together in journals
- started in 1665 with the French *Journal des sçavans* and the English *Philosophical Transactions of the Royal Society*

- There are now 30,000 journals (estimated), organized around a variety of topics and a range of generalness
- all scientists are expected to publish regularly, with the rate highly dependent on the field (“publish or perish”)
- a person’s publication record encapsulates their career up to that point

*cover of first issue of Nature, Nov. 1869*
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...

A list of papers published in 1880 would fill 100 pages. ~14k

By 1920, the list would be growing by 500 pages per year. ~70k

The 1975 section would fill four huge volumes. ~560k

Today, we’re up to 15 volumes per year—a page every 45 minutes. ~2.1m

https://www.sciencemag.org/site/special/scicomm/index.xhtml
Anatomy of a paper

despite the plethora of journals and distinct formats, all papers have a basically similar structure with only minor variations, e.g., methods after the introduction or at the end

https://askabiologist.asu.edu/explore/anatomy-of-an-article
The Contribution of the Ankyrin Repeat Domain of TRPV1 as a Thermal Module

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1Facultad de Medicina, Departamento de Fisiología, 2Facultad de Química, Departamento de Fisiología Química, 3Facultad de Medicina, Departamento de Biología, and 3Instituto de Biología Celular, Universidad Nacional Autónoma de México, Mexico City, Mexico.

ABSTRACT

The TRPV1 cation nonselective ion channel plays an essential role in thermosensation and perception of noxious stimuli. TRPV1 can be activated by low extracellular pH, high temperature, or naturally occurring pungent molecules such as capsaicin, vanillic acid, or resiniferatoxin. Its noxious thermal sensitivity makes it an important participant as a thermal sensor in many cell types. Over the years, we have used a combination of approaches to try to understand the role of the ankyrin repeat domain (ARD) in channel behavior. First, a computational modeling approach by coarse-grained molecular dynamics simulation of the whole TRPV1 embedded in a phosphatidylcholine and phosphatidy ethanolamine membrane provides insights into the dynamics of this channel domain. Global analysis of the structural ensemble shows that the ARD is a region that sustains high fluctuations during dynamics at different temperatures. We then performed biochemical and thermal stability studies of the purified ARD by the means of circular dichroism and tryptophan fluorescence and demonstrated that this region undergoes structural changes at similar temperatures that lead to TRPV1 activation. Our data suggest that the ARD is a dynamic module and that it may participate in controlling the temperature sensitvity of TRPV1.

INTRODUCTION

TRPV1 is a nonselective ion channel implicated in nociception by chemicals, temperature, and pH (1–3). This channel is one of the chemosensors involved in the sensation of pain and thermal stimuli, and it participates in a diverse range of cellular processes (4,5). The latter has been evidenced from studies in which the deletion of TRPV1 in mice alters nociceptive and mild temperature sensitivity (6,7), whereas knockout of other thermo-TRPs such as TRPV2, TRPV3, and TRPV4 shows little effect in sensory transduction in rodents (6,8,9). Moreover, whereas deletion of TRPV1 in rodents does not affect corporal temperature, blockade of TRPV1 in vivo triggers hyperthermia (10).

The rat TRPV1 structure is a tetramer (Fig. 1 a), with every monomer consisting of 1,130 amino acids (Fig. 1 c). The structure solved by cryo-EM is from a maximal-functional TRPV1 that lacks 100 amino acids from the N termini and 80 amino acids in the C termini and also missing a longer SS pore extracellular loop named the lucipherin. This minimal-functional 566 amino acid construct provides a model for the full-length channel, although without unslid loop. In TRPV1, the structure of the membrane-embedded domain is canonical with other ion channels like voltage-gated potassium, sodium, and calcium ion channels. A tetramer is formed by a voltage-sensor-like domain (VSD)-like domain, surrounding a pore formed by the contribution of the four pore domains (PD) of each subunit.

SIGNIFICANCE

This work demonstrates that the temperature-dependent dynamics of the ankyrin repeat domain of TRPV1 channels, as probed by coarse-grained molecular dynamics, correspond to the experimentally determined dynamics of an isolated ankyrin repeat domain. These results show that this region of TRPV1 channels undergoes significant conformational change as a function of increased temperature and suggest that it participates in the temperature-dependent structural changes that lead to channel opening.

Author order is field dependent!

published paper

typical letter (few, or even no sections!)

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Published by the American Physical Society
How to read a paper?

“Every week I would sit with the article, read every single sentence, and then discover that I hadn’t learned a single thing.”

https://www.sciencemag.org/careers/2016/01/how-read-scientific-paper

do NOT read a paper from start to finish!
How to read a paper?

There’s a ton of advice out there - here is my approach:

- Start with the title and abstract.
- Look at the figures next - do they make sense?
- If you are not an expert in this area, look at the introduction to understand the context of their work (if you are an expert, you can circle back to this part later).
- Read the discussion/conclusions - what do they think are their most important results?
- Read the results - do their conclusions follow convincingly from their data?
- Finally, read the methods.

The “paper box” (from Heather Lerner, Earlham) provides a structure to help you get organized.
<table>
<thead>
<tr>
<th>AUDIENCE</th>
<th>SPECIFIC RESEARCH QUESTION</th>
<th>PREVIOUS KNOWLEDGE</th>
<th>DATA COLLECTION AND ANALYSIS</th>
<th>EXISTING GAP</th>
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<tbody>
<tr>
<td><strong>Journal Description</strong>&lt;br&gt; <em>Who is the target audience for this paper?</em>&lt;br&gt; Is this in a specialized journal or are the authors writing for a broader audience? Is this a review article that is written for a newcomer to the field?</td>
<td><strong>Introduction/Background, sometimes Methods or Results</strong>&lt;br&gt; <em>What is the testable hypothesis or hypotheses (including the null hypothesis)?</em>&lt;br&gt; Make clear exactly what is being measured/compared, including species names, and any spatial and temporal components.</td>
<td><strong>Introduction/Background</strong>&lt;br&gt; <em>What are the 2-3 most important known ideas or pieces of information that led to this study?</em>&lt;br&gt; Describe the key findings from other research that inspired this project. It’s a good idea to also put a short citation with each finding (i.e. author, year) but a citation should not replace the description of the findings.</td>
<td><strong>Methods Section</strong>&lt;br&gt; <em>How were the data gathered and what methods are used to analyze the data?</em>&lt;br&gt; <strong>Describe the dataset</strong>, specifically the <em>type</em> of samples collected and the <em>number</em> of samples. &lt;br&gt; Also list or describe the way the samples were analyzed, being careful to focus on the <em>method</em> (e.g. Bayes statistics) rather than the name of the software (e.g. Mr. Bayes) or other equipment.</td>
<td><strong>Introduction/Background</strong>&lt;br&gt; <em>What is the gap in knowledge this project aims to contribute to filling?</em>&lt;br&gt; This is often described as the BIG remaining question(s) in the field, though it does not need to be stated as a question. This is almost never a directly testable hypothesis because it is a big and broad area of research.</td>
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<tr>
<td><strong>Discussion/Conclusion</strong>&lt;br&gt; <em>How is this research broadly important to the field and to society?</em>&lt;br&gt; Describe both types of contribution. Focus on interpretation of the results and their application to other study systems and to solving problems of importance to society.</td>
<td><strong>Results or Results and Discussion</strong>&lt;br&gt; <em>What are the most important (i.e. major) research findings described in the paper?</em>&lt;br&gt; List 2-3 major research findings. Be selective. Look for results that are novel, well-supported, and answer the specific research question(s) from above. Note: negative results can be important!</td>
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How to find papers of interest

• a biophysicist might regularly read *Biophysical Journal*, a chemist *Journal of the American Chemical Society*, and so on

• However, now, most people find papers in ways other than just skimming the Table of Contents for a few journals

• Google Scholar alerts

• Journal-specific and arXiv alerts on specific topics

arXiv / Help / To Subscribe to the E-Mail Alerting Service

To Subscribe to the E-Mail Alerting Service

• Science twitter
Where to submit your paper?

- **Congratulations!** You have made a scientific discovery!
- first and foremost, you want to publish in a venue where interested people are likely to find your paper (although less critical than before)
- typically we aim for the journal with the highest impact factor (IF) that we think will publish it

IF is the ratio of citations in a given year of papers from the previous two years dividing by the number of those papers

\[
\text{IF}_y = \frac{\text{Citations}_y}{\text{Publications}_y + \text{Publications}_{y-1}}.
\]

- Top journals (Nature, Science) are around IF 50-70
- Mid-tier are around 10-20
- Society-level journals are often around 5-10

**Note: this is field-specific** (e.g., math has fewer citations)
Congratulations! You have made a scientific discovery!

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Pre-print servers

- because the time to publication can be quite long (months to a year or more), pre-print servers offer a way to distribute scientific results quickly
- typically before or during submission to a journal, an author can submit their manuscript to a pre-print server, where it will become immediately available with no additional formatting or peer review

arXiv is the best known, mainly for physics, math, CS (1991)

bioRxiv was created specifically for bio papers (2013)

ChemRxiv (2017)

The process

Worthy of consideration?
Many papers are rejected at this stage for having insufficient general interest/impact

Timeframe
Journals often given reviewers 2-4 weeks to submit their reviews; sometimes another reviewer is needed to adjudicate a disagreement

Editor’s role
Editor reads reviews and makes a decision whether to accept, reject, or ask for revisions

https://www.elsevier.com/reviewers/what-is-peer-review

Typically 1-2x at most
Peer review

• currently, all* scientific papers are peer reviewed, by 1 (yay!) to 4 (groan!) reviewers (*in legitimate journals)
• the reviewers evaluate the scientific accuracy and quality (always) as well as the impact (almost all journals)
• surprisingly, peer review only became common in the mid 20th century

Even Einstein bristled at his paper being peer reviewed by Physical Review (1936)!

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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,

P.S. Mr. Rosen, who has left for the Soviet Union, has authorized me to represent him in this matter.

_Historical note: the reviewer was correct!_
A universal truth: reviewer #3 is loathed

Reviewer Number 3
@thirdreviewer

the following revision would greatly improve this paper
Cost to publish?

- publishing is rarely free - either the author or the reader pays (sometimes both!)
- author charges can range widely, from $500 (Biophysical Journal) to $6790 (Nature Communications)
- Open-access journals like PLoS charge ~$1700-$3000
- some journals, like those of the American Chemical Society are all free to publish in but charge huge subscription fees
- although subscriptions are negotiated and private, they represent a huge chunk of the library’s budget

Institutions are pushing back!

- UC system canceled their $11 million contract with Elsevier in 2019


- They renegotiated the deal in 2021 to the tune of $13 million

“Open access”

- pre-internet, scientific journals were real publications, printed on paper and distributed at some cost
- now, while many are still printed (albeit at smaller numbers), many more are distributed online only
- with distribution costs approaching zero, some journals moved to a model in which final papers are made freely available to read
“Open access”

• one of the most well known open-access publishers is the Public Library of Science (PLoS), a non-profit founded in 2000

• all major publishers now have at least one “open access” journal (with large publication fees!)
“Open access”

- many major funders make open access a condition of funding

- National Institutes of Health has a database called PubMed Central in which all NIH-funded publications are made available within 12 months (but lacking the journal-specific formatting)

- NSF now has a similar requirement, although it’s not as well known still

- Many European funding agencies have organized around a “Plan S” to make all funded work be openly accessible, and cap publication fees, paid by the funder

[Link to article: https://www.sciencemag.org/news/2019/01/will-world-embrace-plan-s-radical-proposal-mandate-open-access-science-papers]
Predatory publishing

Dear Dr. Gumbart

Good Morning.

You must be having a busy day, so I wouldn’t want to take much of your time.

I am Sana Anjum, Associate managing editor for eMedical Research journal, writing this email to invite you to contribute a manuscript for upcoming issue of the journal.

All submissions will undergo anonymous review to guarantee high scientific quality and relevance to the subject. The issue will be published in first half of 2020, which means that we will need your manuscript by April 05th, 2020.

To view further details about journal, click here

Note: The manuscripts funded by NIH will be available on PubMed after its online publication

If you have any questions or concerns, don’t hesitate to let me know.

Yours Sincerely,

Sana Anjum
Associate Managing Editor,
eMedical Research
E-mail: sanaanjum@emresonline.org

This is the majority of my email every morning! (plus scam conferences)

However, some are not as obvious!
Predatory publishing: Warning signs

- Flattering emails, poor language, etc.
- Journal title is similar to a respectable publication but mixed
- Website is amateurish, unprofessional
- No standard metrics, indexing (e.g., DOI)
- No verified impact factor (see Journal Citation Reports)
- Article process is unclear, lack transparency about fees

One great resource to check is Beall’s List*

*Nature | News

Controversial website that lists ‘predatory’ publishers shuts down

Librarian Jeffrey Beall won’t say why he has unpublished his widely read blog.

Andrew Silver

18 January 2017 | Corrected: 18 January 2017

*Jeffrey Beall deactivated the list after threat of lawsuits, but it lives on in other ways

https://en.wikipedia.org/wiki/Beall%27s_List