Writing in the Sciences

Module 8.1: How to do a Peer Review

Peer Review

- If you are the reviewer, a few tips...

Peer Review: Tone

- Assume there is some poor graduate student on the other end who did all the work, and whose confidence and career depend on your critique.
- Tone matters!
  - E.g. “The authors should delete table 5; not only is it completely irrelevant, but it also reveals their utter lack of statistical understanding.”
  - vs. “Table 5 contains unnecessary information (for example...), and a Pearson’s correlation coefficient may not be appropriate here. The authors should consider revising or omitting the table.”

Peer Review: Tone

- Avoid criticizing the authors! Criticize the work.
- Avoid generalizations; point out specific errors.
- Use positive instead of negative language where possible: “The paper is poorly written.” vs. “The writing and presentation could be improved. For example...”
- Avoid “lecturing” to the authors.

Types of Peer Review

- Single-blind
  - Most common; authors are blinded to reviewers
- Double-blind
  - Reviewers are additionally blinded to authors
- Open
  - Neither reviewers nor authors are blinded; reviewers names (and reviews) may be publicly available
- Post-publication Peer Review
  - Blogs, online comments, etc. More formal systems for post-publication vetting may soon be available.

Peer Review: Process

My system:

- **1. Scan the abstract.**
- **2. Jump to the data: review the tables and figures first.**
  - Draw your own conclusions.
  - Do the tables and figures stand on their own?
  - Are there any obvious statistical errors?
  - Is there repetitive information?
- **3. Read the paper once through.**
  - Do the authors conclusions match their data?
  - Is the paper clearly written, or did you struggle to get through it? You should not have to struggle!
  - Is the length of the paper justified given the amount of new information that the data provide?

Peer Review: Process

- **4. Read the introduction carefully.**
  - Is it sufficiently succinct?
  - Does it roughly follow: known-->unknown-->research question/hypothesis?
  - Is there a clear statement of the hypotheses or aim of the study?
  - Is there detailed information about *what was done* that belongs in the methods?
  - Is there information about *what was found* that belongs in results?
  - Is there distracting information about previous studies or mechanisms that are not directly relevant to the hypothesis being tested. If so, it should be moved to the discussion.
  - Do the authors tell you what gaps in the literature they are trying to fill in?

Peer Review: Process

5. Read the methods carefully.

- Scan this section to find answers to your questions about the data.
- Were things measured objectively or subjectively? What instruments were used?
- Are there flaws in the study design, such as no control group?
- Read the statistics section carefully.

6. Read the results carefully.

- Read this section with the tables and figures in front of you.
- Does each section roughly correspond to one table or figure?
- Do the authors summarize the main trends and themes from the table, or do they just repeat what is in the tables?
- If there are graphs, do the authors give precise numerical values in the text if it is not given in the graph?
- Are the authors honest or do they try to draw your eye to what they want you to see??
- Do the authors over-interpret statistical significance, by ignoring the fact that the magnitude is small or by ignoring the fact that they have done multiple subgroup analyses?
- Is this section unnecessarily long?

Peer Review: Process

7. Look at each table and figure.
   - Did the authors choose the correct statistics?
   - Are there multiple tables or figures that tell the same story? For example, Table 1 gives the mean values for two groups and indicates statistical significance from a ttest and Table 2 gives confidence intervals for the differences in means for the same data.
   - Is there evidence of cherry-picking or purposefully omitting data?
   - Are any graphs misleading, e.g. through manipulation of area or axes?
   - Is the “treatment” group always compared with a proper control/placebo group?
   - Are there inconsistencies in the data they present from one table to the next?
   - Did the authors make transcribing errors when going from the data in tables/results to the abstract?

Peer Review: Process

8. Read the discussion carefully.
   - Does the first paragraph succinctly and clearly tell you what was found and what is new?
   - Are the authors' conclusions justified or are they overreaching?
   - Do they clearly distinguish hypothesis-driven conclusions and exploratory conclusions?
   - Is the writing clear and to the point (active voice!)? Is there some sense of order and structure or are they just rambling on aimlessly?
   - Could the discussion be shortened?
   - Did they address the limitations you care about? (as opposed to any old irrelevant limitations that they threw in just to have some)
   - Are the references that they cite current?
   - Have they omitted key references?

Peer Review: Content

Comments to authors:

- 1**. Start with a one-paragraph "general overview."**
  - **State what you think is the major finding and importance of the work**
  - **Give 2-3 positive, encouraging statements about the work**. If the methods are problematic, is the writing nice, for example? Is the research question particularly interesting or novel? (E.g., "This is an interesting manuscript, with several strengths." "The authors should be commended for ..." "The finding that XX is important.)
  - **State 1-2 major limitations** (if there are any) to the study design, writing/presentation, or conclusions. (E.g., "The study is limited because there is no control group." "The overall writing or presentation needs improvement." "The authors may have over-stated their findings." "The paper provides only weak evidence for its conclusions." "The study is exploratory, not hypothesis-driven.")
  - **Do <u>not</u> tell the authors your overall recommendation** (rejection, acceptance).

Peer Review: Content

Comments to authors:

- 2. In a *numbered* list, give 5-15 specific criticisms/suggestions for revision. The number will often correspond to your recommendation (give the most if you are recommending “opportunity for revision.”)
  - Point out specific mistakes.
  - List the issues that you found in your review.
  - Give specific recommendations for revision.

REVIEWER ≠ COPY EDITOR!!!

- Do not be spend your time nit-picking.
- Focus on big-picture issues.
- If the manuscript has a lot of copy-editing errors, point this out in a general way and give one or two examples, e.g. “The manuscript contains typos, such as...”

Peer Review: Content

Comments to editors (authors don't see these):

- 1. Fill out journal "grading sheet" (if applicable).**
- 2. Choose your recommendation:
  - Reject
  - Reject with opportunity to revise.
  - Accept with minor revisions
  - Accept
- 3. Give a succinct overall statement to the editors that justifies your ranking. Be frank with the editors about your opinion and concerns.

Peer Review: **grading sheet, example

Impact of Research

TOP 10% __

TOP 25% __

Top 50% __

Bottom 50% _X_

Bottom 25% __

Bottom 10% __

Originality of Results...

Methodology and Data Quality...

OVERALL MANUSCRIPT RANK...

Peer Review: Final comments

The first one you do will take a long time. You will get progressively faster at these as you go along.

Review unto others as you would want to be reviewed!

Writing in the Sciences

Module 8.2: Communicating with journalists and the lay public

Being Interviewed by a Journalist:

**What the journalist is waiting to hear, and will use in his/her article:

- big picture ties
- how your research affects people (i.e., their readers)
- what's different or new about your results (the "news hook")
- colorful prose
- interesting stories (anecdotes)
- paradox/irony/surprise
- people-focused stories
- historical facts/the development of the idea
- sweeping comments about the significance of the work (makes a good first quote)
- controversy/criticism or laudatory praise, if you are being asked to comment on a peer's research

Being Interviewed by a Journalist:

**Your job as the interviewee:

- Be prepared.
- Avoid jargon. Pretend that you are talking to your aunt/uncle/grandmother/grandfather.
- Give the journalist clear take-home messages.
- Anticipate confusions/misinterpretations; and explain them away.
- Give a clear statement of the key limitations of the work.
- Think carefully about how to present data/numbers in a way that is understandable to a general audience.
  - Make units understandable.
  - Present risks in an easy-to-understand, transparent way.

Explaining risk to a journalist/lay public

- Whole numbers are easier to understand than fractions and percents.
- Relative risk can be high even if absolute risk is low.

Case Study: Women's Health Initiative

- Women's Health Initiative: large randomized, double-blind study of postmenopausal hormones versus placebo
- Halted in 2002 because hormones were found to significantly increase the risks of breast cancer and heart disease
- 14 million women were on hormones at the time the study was halted

Results: Relative Risks

- Relative risk for invasive breast cancer = 1.26
- Relative risk for coronary heart disease = 1.29

- Best translation for the public?
- “Women who take hormones have a 26% increased risk of breast cancer and a 29% increased risk of heart disease”?

Results: Absolute Risks

Risk of invasive breast cancer:

- On hormones: .38% per year
- On placebo: .30% per year
- ∴Risk increase due to hormones: .08% per year

Risk of heart disease:

- On hormones: .37% per year
- On placebo: .30% per year
- ∴ Risk increase due to hormones: .07% per year

Results: Absolute Risks and Whole Numbers

Risk of invasive breast cancer:

- On hormones: 38 per 10,000 women per year
- On placebo: 30 per 10,000 women per year
- ∴Risk increase due to hormones: 8 additional cases per 10,000 women

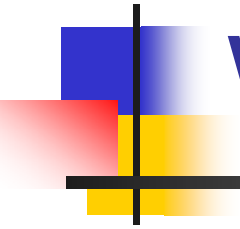
Risk of heart disease:

- On hormones: 37 per 10,000 women per year
- On placebo: 30 per 10,000 women per year
- ∴Risk increase due to hormones: 7 additional cases per 10,000 women

Best Translation for the Public?

- 26% increased risk of breast cancer and 29% increased risk of heart disease sounds impressive and scary.

- Better to report:
  - 8 more invasive breast cancers per 10,000 women/year
  - 7 more heart attacks per 10,000 women/year



Writing in the Sciences

Module 8.4: Demo Edit #3

- Traditional methods for controlling biological signals in cells are a sledgehammer: they are global, slow, and often non-specific. The authors of this paper describe their new technique to generate local, fast, and targeted cell signaling in live cells that are genetically altered to have light-sensitive proteins. They engineered a cellular perturbation system applicable to many signaling proteins. The main requirement for the candidate signaling protein is to be naturally activated by interactions that re-localize it to the membrane.
- Levskaya et al. built this membrane recruitment system using photosensitive proteins named Phytochromes. These proteins from plants detect red and near-infrared light through the photoisomerization of a bound chromophore. This light detection changes the Phytochrome's conformation between a state under red light that binds directly to a phytochrome interacting factor (PIF) and a state under infrared light that doesn't bind to PIF. The scientist added a membrane-localization part to the Phytochrome, and attached a signaling protein to the PIF to complete their system. A cell illuminated with infrared light under the microscope will have inactive, free-floating, PIF-attached signaling proteins. When the scientist points a red laser in the phytochrome-rich membrane, the PIF-attached proteins are forced to stay close to the membrane; effectively increasing the activity of the signaling proteins. Turning off the red laser frees the proteins and turns off the cellular signal.
- To demonstrate the feasibility of this new technique they focused on the signaling proteins Tiam and intersectin, precursors of the Rho-GTPases Rac1 and Cdc42 that have crucial role in the organization of actin cytoskeleton during cell movement. They performed three main experiments: The first experiment tested if membrane recruitment of a small part of intersectin (ITSN-DH-PH) that regulates Cdc42, was effectively inducing transient increases of local protein activity. They shown images of local enrichment of biosensors responsive to Cdc42 activity in the membrane that disappeared few seconds after turning off the red laser. The second experiment tested if membrane recruitment of a part of Tiam (Tiam DH-PH domain) was sufficient to induce changes in the shape of NIH3T3 cells. They illuminated the whole cell with red light for 20 minutes and inmediatly after counted the percentage of cells that made new lamellipodia (actin cytoskeletal projection on the mobile edge of the cell). The result was that almost 80% of cells made new lamellipodia under red-light treatment, compared with a 10% of control populations. To make things even more interesting, in a third experiment they pointed a red laser dot on the edge of one cell and gradually moved it outward, slowly extending this red-targeted region from the cell body. They show in movies that they effectively guided the direction followed by the new lamellopodium-- the first reported control of cell movement in real time using light-sensitive proteins!
- "Spatiotemporal control of cell signalling using a light-switchable protein interaction." Levskaya et al. Nature 2009.

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Traditional·methods·for·controlling·biological·signals·in·cells·are·a·sledgehammer:·global,·slow,·and·often·non-specific.·But·in·a·2009·paper·in·*Nature*·Levskaya·et·al.·describe·a·new·technique·to·generate·local,·fast,·and·targeted·cell·signaling·in·live·cells.·They·reported·the·first·control·of·cell·movement·in·real·time·using·light-sensitive·proteins.¶

The·researchers·genetically·altered·cells·to·contain·plant·proteins·named·Phytochromes,·which·detect·red·and·near-infrared·light.·When·exposed·to·red·light,·Phytochromes·bind·to·phytochrome·interacting·factor·(PIF);·when·exposed·to·infrared·light,·they·release·PIF.·Levskaya·et·al.·added·a·membrane-localization·domain·to·the·Phytochrome,·and·attached·a·signaling·protein·to·the·PIF.·The·system·works·for·any·signaling·proteins·that·are·activated·by·interactions·with·the·membrane.·When·the·scientist·points·a·red·laser·at·the·cell·membrane,·membrane-bound·phytochromes·bind·to·PIF,·thus·bringing·the·signaling·proteins·close·to·the·membrane·and·increasing·their·activity.·Turning·off·the·red·laser·frees·the·proteins·and·turns·off·the·cellular·signal.¶

To·demonstrate·the·feasibility·of·this·new·technique,·they·performed·three·main·experiments·focusing·on·the·signaling·proteins·Tiam·and·intersectin,·which·help·organize·actin·cytoskeleton·during·cell·movement.·The·first·experiment·showed·that·membrane·recruitment·of·a·small·part·of·intersectin·(ITSN-DH-PH)·that·transiently·increased·local·protein·activity,·and·that·this·effect·disappeared·few·seconds·after·turning·off·the·red·laser.·The·second·experiment·showed·that·membrane·recruitment·of·a·part·of·Tiam·(Tiam·DH-PH·domain)·was·sufficient·to·induce·changes·in·the·shape·of·NIH3T3·cells.·When·they·illuminated·the·whole·cell·with·red·light·for·20·minutes,·almost·80%·of·cells·made·new·lamellipodia·(actin·cytoskeletal·projections·on·the·mobile·edge·of·the·cell),·compared·with·a·10%·of·control·cells.·Even·more·interesting,·in·a·third·experiment·they·pointed·a·red·laser·dot·on·the·edge·of·one·cell·and·gradually·moved·it·outward,·slowly·extending·this·red-targeted·region·from·the·cell·body.·They·show·in·movies·that·they·effectively·guided·the·direction·followed·by·the·new·lamellopodium—thus·controlling·the·movement·of·the·cell.¶

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SHORT··CONCLUSUION:·WHAT·ARE·OTHER·POTENTIAL·APPLICATIONS·OF·THIS·RESEARCH?¶

“Spatiotemporal·control·of·cell·signalling·using·a·light-switchable·protein·interaction.”·Levskaya·et·al.·Nature·2009.¶

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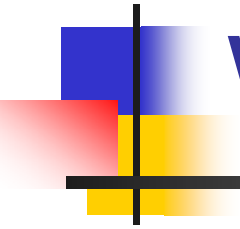

Writing in the Sciences

Module 8.5: Demo Edit #4

- In a recent work on ‘Interactions with Big Data Analytics’, authors Danyel Fisher et.al. talk about interesting developments in the world of analyzing data. Authors define analytics as a term that refers to any data driven decision. An example of application of analytics is Zynga, an online games company that studies how its audience plays the game and uses that data effectively to modify the games.
- The paper reports the state of practice by interviewing sixteen pioneering analysts in this field. The paper discusses about the definition of big data, contemporary ways of analyzing data, challenges peculiar to big data, and proposes a five step workflow type of an approach to analyzing big data. In our digital lives (interactions through information technology devices) we generate huge amounts of data: social relationships, purchasing behavior, watching of videos, etc. Big Data Analytics aims to construct the big picture from the minutia of our digital lives.
- The authors draw a refreshing parallel to the old age mainframe computing where the work would be submitted to massive systems and the results would be obtained after a period of time. Big data analytics, argue the authors, is very similar: that it involves hypothesis and needs huge computing power, that it is often submitted and results are available after a period of time, and that the end user computers are only used for viewing the results and not for processing.
- Pivotal contribution of the paper is the generalization of how big data analytics can be approached. Acquiring data, choosing the right architecture for analyzing the acquired data, fitting the data for the chosen architecture, coding and debugging, and fine tuning are the five steps suggested by the authors. This five step process repeats itself as many times as necessary until meaningful results are obtained. The paper cautions the skill gap in bringing the right proportion of scientific flavor in models created by business users.
- Of immediate significance, is the potential to apply big data analytics to design more user friendly interfaces, enrich customer experience by analyzing the ways customer uses the product, understand healthcare spending, etc. The limitation is only our human ability to think creatively and harness the exploding world of data.

In our digital lives, we generate huge amounts of data: social relationships, purchasing behavior, and video watching. Companies are analyzing these data and using them to drive decisions, a practice called "big data analytics." For example, the online gaming company Zynga studies how its audience plays the game and uses that data effectively to modify the games.¶

In a recent work on 'Interactions with Big Data Analytics', Danyel Fisher and colleagues review the state of the field by interviewing sixteen pioneering big data analysts. The authors discuss the definition of big data, contemporary ways of analyzing data, and challenges peculiar to big data; they also propose a pivotal five-step workflow for analyzing big data.¶

The authors draw a refreshing parallel to the old-age mainframe computing where analysts submitted the work to massive systems and had to wait for hours/days/weeks to obtain results. With big data analytics, the analyses require huge computing power, so scientists must submit the results to a super-computer and wait for the results. End user computers display but do not process the results. WHAT IMPLICATIONS DOES THIS PARALLEL HAVE?¶

ADD MORE ABOUT: "definition of big data, contemporary ways of analyzing data, and challenges peculiar to big data."¶

The authors propose a general, five-step approach for big data analytics: acquiring data, choosing the right architecture for analyzing the data, fitting the data for the chosen architecture, coding and debugging, and fine tuning. This five-step process is repeated as many times as necessary until meaningful results are obtained. The paper cautions that many business users currently lack many of the skills needed to perform this workflow. They propose XX to address this skill gap?¶

The potential of big data analytics is vast; for example, companies can design more user-friendly interfaces, enrich customer experience by analyzing the ways customers use the product, and understand healthcare spending. In harnessing this exploding world of data, we are constrained only by the limits of our human ability to think creatively.¶

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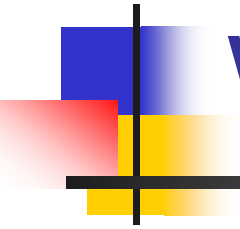

Writing in the Sciences

Module 8.6: Concluding Remarks

Take-home messages

Effective scientific writing conveys an idea clearly and concisely.

Scientific writing should be easy and even enjoyable to read.

Clear writing improves transparency and speeds up scientific progress.

References/further reading

- **Books on writing:**
  - *On Writing Well*, William Zinsser
  - *The Elements of Style*, Strunk and White
  - *Sin and Syntax*, Constance Hale
- **Books on scientific writing:**
  - *Essentials of Writing Biomedical Research Papers*, Mimi Zeiger
  - *Successful Scientific Writing: A Step-by-Step Guide for the Biological and Medical Sciences,* Matthews and Matthews
  - *Guidebook to better medical writing*, Robert Iles
  - *Scientific writing and communication*, Angelika Hofmann.
- **Articles on scientific writing:**
  - http://www.aacc.org/publications/clin_chem/ccgsw/Pages/default.aspx#
- **Tips from journals:**
  - http://www.nature.com/authors/author_resources/how_write.html
- **Editorials:**
  - Friedman GD. Be kind to your reader. *Am J Epidemiol*. 1990 Oct;132(4):591-3.