CIHR IRSC
Canadian Institutes of Health Research / Instituts de recherche en santé du Canada
Institute of Genetics / L'Institut de génétique

Guidebook for New Principal Investigators

Advice on Applying for a Grant, Writing Papers, Setting up a Research Team and Managing Your Time

Institute of Genetics, CIHR
Roderick McInnes • Brenda Andrews • Richard Rachubinski

Good reports and presentations are formulaic.
Preparing them is a learned skill.

They are not 'inspiration at midnight'.
Your raw ideas may be, but their refinement isn't.

http://www.cihr-irsc.gc.ca/e/27491.html

Common errors

1. Forgetting who your audience is
2. Failing to give the 'big picture'
3. Failing to provide rationale
4. Too much detail

"Good writing reflects clear and precise thinking."

"Writing generally forces clear and precise thinking."

"Write a report, or make a presentation, that will interest your audience."

"Learn from the papers you read and the talks you attend."

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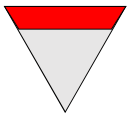
One main point per paragraph or slide

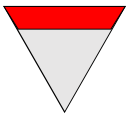
Paragraph organization



Lead sentence: Main point

Elaboration (text)

Slide organization



Title: Main point

Elaboration (data, diagrams, bullet points)

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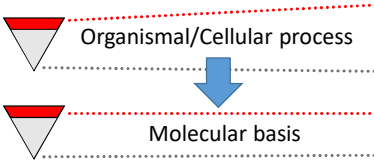
Examples for the Introduction section



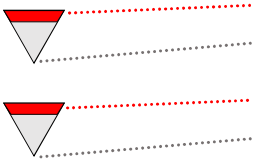
"Cell division is fundamental to the growth, development and homeostasis of all multi-cellular organisms"

The outstanding question related to your research

"A conserved molecular network directs cell division"

The outstanding question related to your research

Examples for the Results section



To understand how {…}, I {…}.

Basic conclusion from this analysis alone (broader connections only in Discussion)

To determine if {…}, I {…}.

Basic conclusion from this analysis alone (broader connections only in Discussion)

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Write daily (between experiments in the weeks before the due date)

1. Write and revise an outline of headings and lead sentences
   - the 'story' should be clear from the lead sentences alone

2. Complete paragraphs with imperfect sentences and go over page limits
   - just get it down
   - add citations while you write (e.g. endnote or refworks--http://sites.utoronto.ca/ic/software/)

3. Quantify your data and prepare figures

4. Edit to make paragraphs and sentences concise
   - remove unnecessary points and use simple language
   - confirm accuracy
   - read all headings and lead sentences to make sure the 'story' is intact

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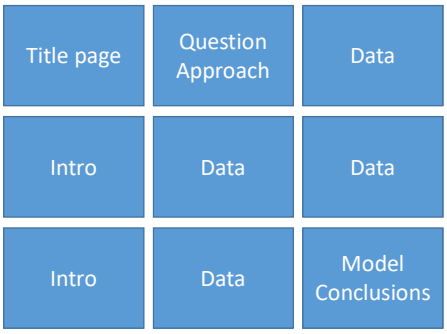
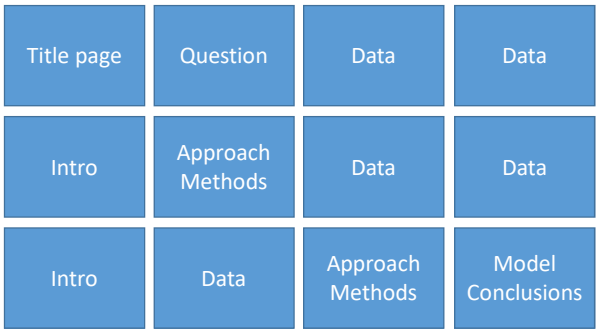
Our poster boards are 4 feet by 4 feet

Typical poster size: 9-12 letter-sized (8.5 by 11 inch) pages





Print in colour on quality paper

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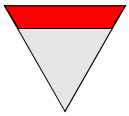
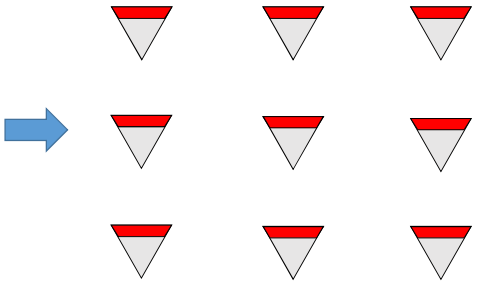
Slide organization



Title: Main point (Main conclusion)

Elaboration (data, diagrams, bullet points)

Title page	Question Approach	Data
Intro	Data	Data
Intro	Data	Model Conclusions



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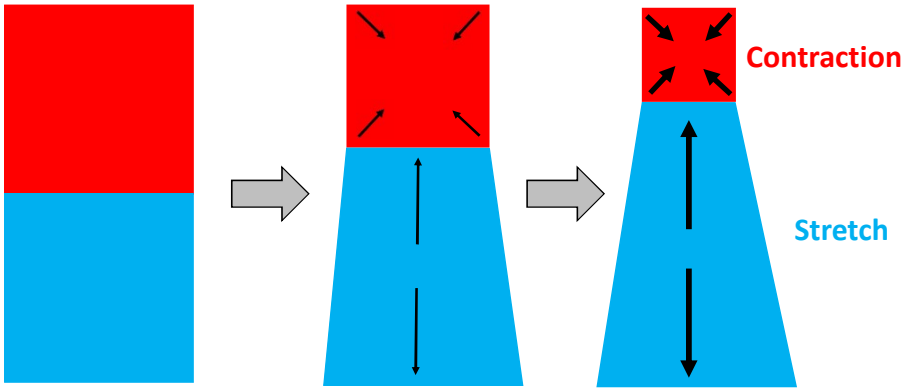
Concepts can be presented with simple diagrams

(avoid using review article diagrams that display unrelated concepts)

Contraction of one tissue region
is often coupled with elongation of another



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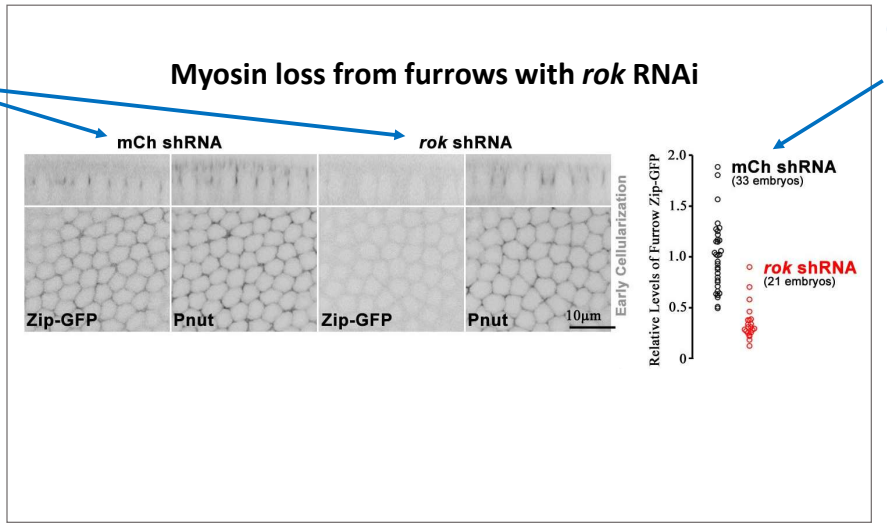
Presenting data from one replicated and controlled experiment

Representative samples

Quantification of all samples



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General advice

- keep backgrounds and fonts simple so your schematics and data stand out
- fonts should be clearly readable 4 feet away
- avoid jargon (terms that might only be used in your lab or a specific research area)
- minimize text (for "all-text" slides→title plus 4, 1-2-line bullet points maximum)

- get feedback from lab mates on a full draft of the poster

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Title page
- include the lab PI and the person who supervised you directly
  (allows you to present ideas from the lab that may not have been your own)

Introduction
- What is the big picture? Why is the problem important?
- What is the specific rationale for your research questions?

Methods
- use schematics

Results
- present in a logical order (not by the chronology they were done)

Conclusions
- a synthesis of the data that will require some thought (discuss with lab mates)

Include any acknowledgments of specific help or reagents at the base of Results slides or at the base of the Conclusions slide

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Your poster is an aid for an oral presentation

Ask your lab PI if there is any data from the lab that should be kept confidential?

Practice your presentation (~12 minutes without interruption)

Don't worry about nervousness—convert it into enthusiasm

Speak clearly

Maximize eye contact

Sense and pause for questions (listen to them carefully, ask for clarification)

Be yourself and show excitement for your work

Don't be apologetic for incomplete work—suggest the next step

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Present you data truthfully and openly

Of my many replicate micrographs or blots, which one should I show?

If my data failed to support my hypothesis, should I show it?

How do I present partially complete data?

What is "N"?

Should I show my quantifications as bar graphs?

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PLOS | BIOLOGY

What exactly is '*N*' in cell culture and animal experiments?

Stanley E. Lazic[1]*, Charlie J. Clarke-Williams[2], Marcus R. Munafò[3]

Biologists determine experimental effects by perturbing biological entities or units. When done appropriately, independent replication of the entity–intervention pair contributes to the sample size (*N*) and forms the basis of statistical inference. If the wrong entity–intervention pair is chosen, an experiment cannot address the question of interest. We surveyed a random sample of published animal experiments from 2011 to 2016 where interventions were applied to parents and effects examined in the offspring, as regulatory authorities provide clear guidelines on replication with such designs. We found that only 22% of studies (95% CI = 17%–29%) replicated the correct entity–intervention pair and thus made valid statistical inferences. Nearly half of the studies (46%, 95% CI = 38%–53%) had pseudoreplication while 32% (95% CI = 26%–39%) provided insufficient information to make a judgement. Pseudoreplication artificially inflates the sample size, and thus the evidence for a scientific claim, resulting in false positives. We argue that distinguishing between biological units, experimental units, and observational units clarifies where replication should occur, describe the criteria for genuine replication, and provide concrete examples of in vitro, ex vivo, and in vivo experimental designs.

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True replication increases the sample size (N) and thus tests a hypothesis.

Pseudoreplication does not increase N.

"Suppose researchers hypothesize that male mice have lighter brains than female mice. They could…
(1) weigh the brain of 1 male and 1 female mouse 5 times, or
(2) weigh the brain of 5 male and 5 female mice once.

Both designs provide 10 data points to calculate a *p*-value, but the *p*-value is meaningless for the first design because the hypothesis is about sex differences, and there is only 1 member of each sex"

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Experimental unit (EU): the entity that is randomly and independently assigned to experimental conditions. The sample size (*N*) is equal to the number of EUs.

EUs must be independently allocated to experimental conditions
→ because animals in a litter, seeds in a pod, or cells in a tissue sample are expected to be more alike than individuals from different litters, pods or tissues

The experimental intervention must be applied independently to each EU
→ because you cannot exactly replicate the application of a treatment to all individuals

EUs must not influence each other, especially on the measured outcomes

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What is N?

You hypothesize that a drug affects nuclear size.

1. You bath 10 embryos together in a drug, and quantify the size of the nucleus in 100 cells per embryo.
2. You individually inject 10 embryos with a drug, and quantify the size of the nucleus in 100 cells per embryo.
3. You repeat 1. in three separate weeks.

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PLOS | BIOLOGY

Beyond Bar and Line Graphs: Time for a New Data Presentation Paradigm

Tracey L. Weissgerber[1]*, Natasa M. Milic[1,2], Stacey J. Winham[3], Vesna D. Garovic[1]

Figures in scientific publications are critically important because they often show the data supporting key findings. Our systematic review of research articles published in top physiology journals (n = 703) suggests that, as scientists, we urgently need to change our practices for presenting continuous data in small sample size studies. Papers rarely included scatterplots, box plots, and histograms that allow readers to critically evaluate continuous data. Most papers presented continuous data in bar and line graphs. This is problematic, as many different data distributions can lead to the same bar or line graph. The full data may suggest different conclusions from the summary statistics. We recommend training investigators in data presentation, encouraging a more complete presentation of data, and changing journal editorial policies. Investigators can quickly make univariate scatterplots for small sample size studies using our Excel templates.

You can use these

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Fig 1. Many different datasets can lead to the same bar graph.
The full data may suggest different conclusions from the summary statistics.
The means and SEs for the four example datasets shown in Panels B–E
are all within 0.5 units of the means and SEs shown in the bar graph (Panel A).

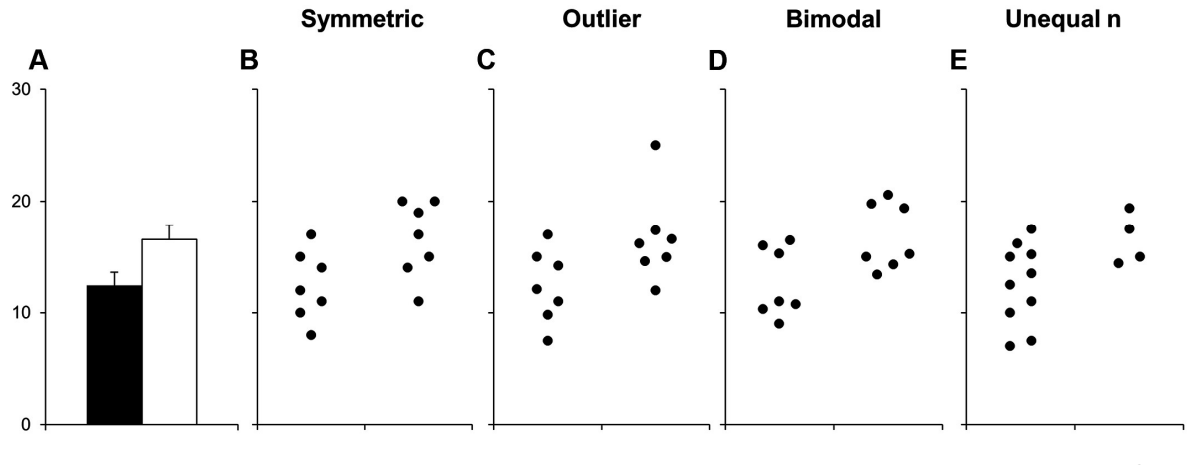
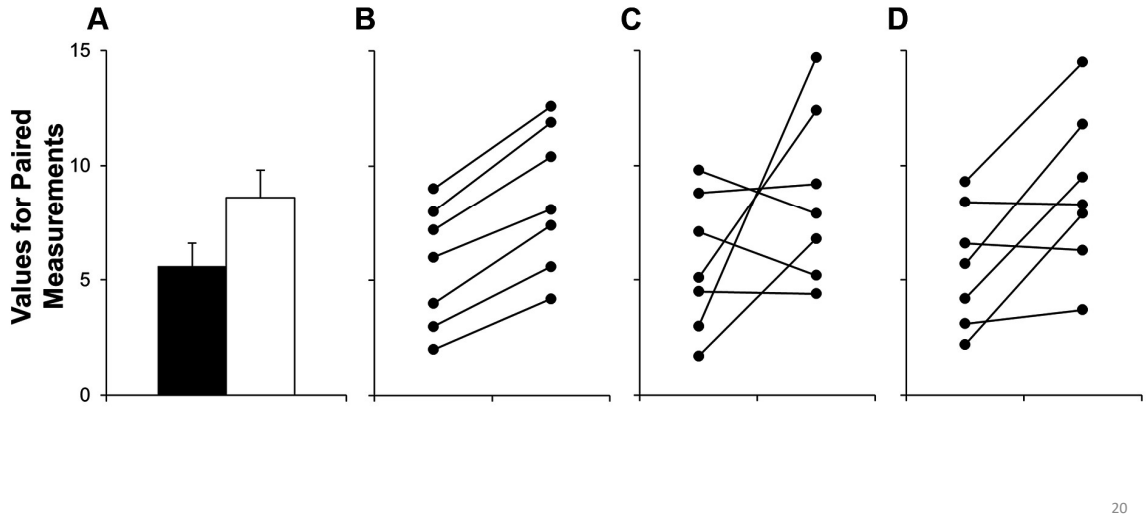


Fig 2. Additional problems with using bar graphs to show paired data.
The bar graph (mean ± SE) suggests that the groups are independent and
provides no information about whether changes are consistent across individuals.



2 reasons to avoid sloppiness

Did they take as much care with their experiments as this did with this presentation?

Small mistake put people on edge, making them more criticl of the overall work

(discussed by author Daniel Kahneman in *Thinking Fast and Slow*)

Strive for excellence not perfection

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http://www.artsci.utoronto.ca/current/advising/ell

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- Please leave your poster up so that other students can see it over the term
- If you need your poster for another event, please collect it before that event
- We will recycle your poster just before our next undergraduate research poster symposium (events held in September and April)

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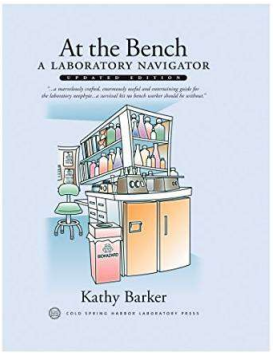
Additional source



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