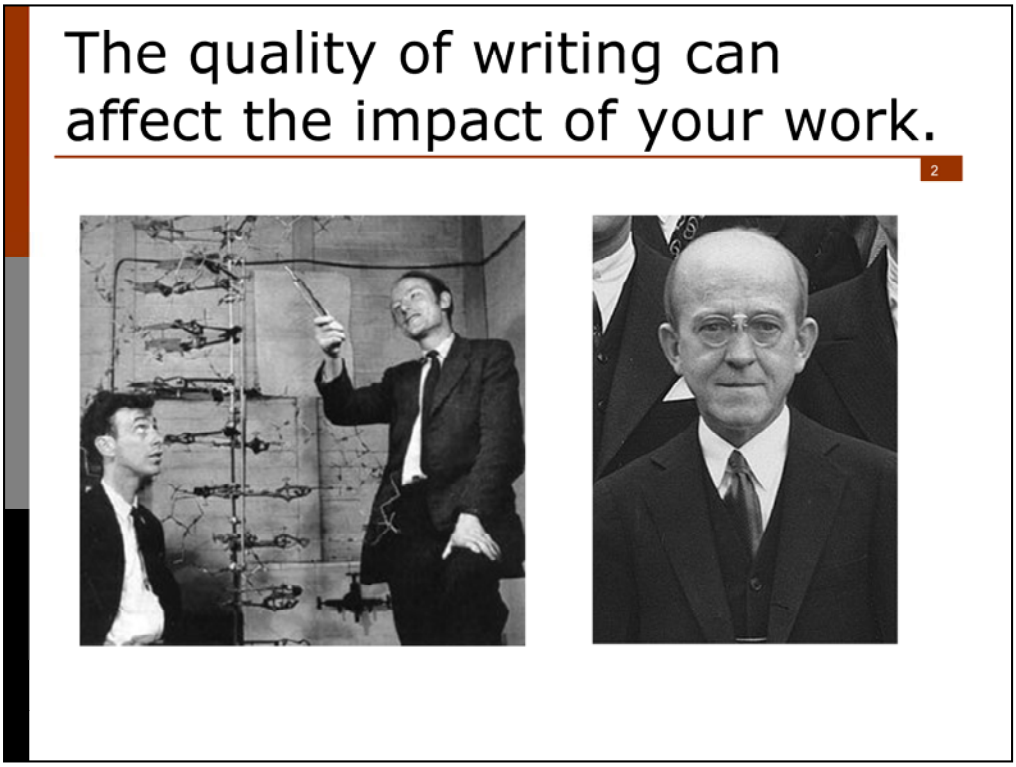
Scientific Writing

20.109
Fall 2012

Photo credit: Theresa Walunas, http://www.keyboardbiologist.net/knitblog/



Watson & Crick, 1953: discovered the structure of DNA

Oswald Avery, Colin MacLeod, Maclyn McCarty, 1944: discovered that DNA is responsible for passing on heritable traits

-Long

-Difficult to read

-No claims of importance

-No confidence in work

The goal of scientific writing is to communicate ideas.

"The purpose of a scientific paper is to communicate results and analysis to the wider scientific community. The better a paper is written, the more readers it will attract and the more citations it is likely to receive."

Bredan & van Roy (2006) EMBO 7:846-9.

The IMRaD structure helps you communicate effectively.

- Introduction *(prologue)*
- Methods *(narrative)*
- Results *(proof)*
- Discussion (*epilogue*)

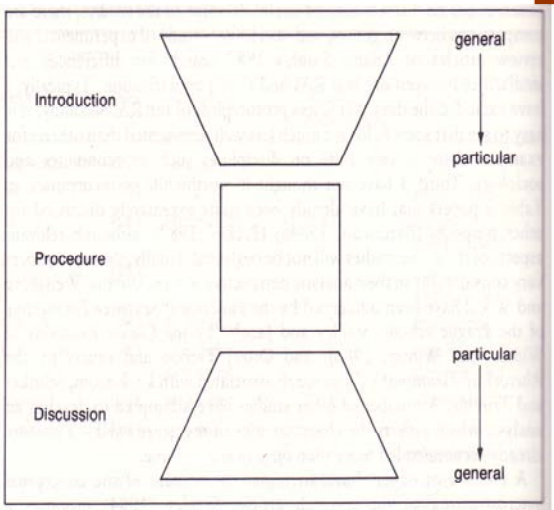


Figure 7 Overall organization of the research paper (Hill et al., 1982).

Article scramble: Identify the section of each passage.

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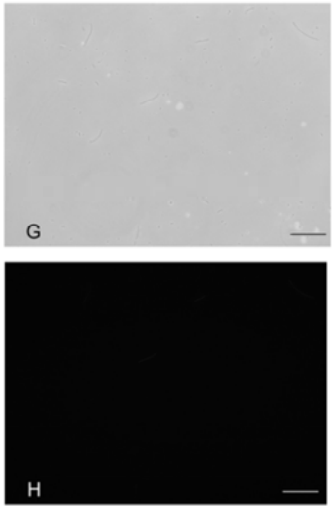
- Introduction
- Methods
- Results
- Discussion
- Figure legend



DIRECTIONS: The following passages come from a different section of a paper that describes a novel bacterial time-recording device (Bhomkar et al. PLoS One. 6:e27559 (2011)). Determine to which section each passage belongs: Introduction, Methods, Results, Discussion, Figure legend.

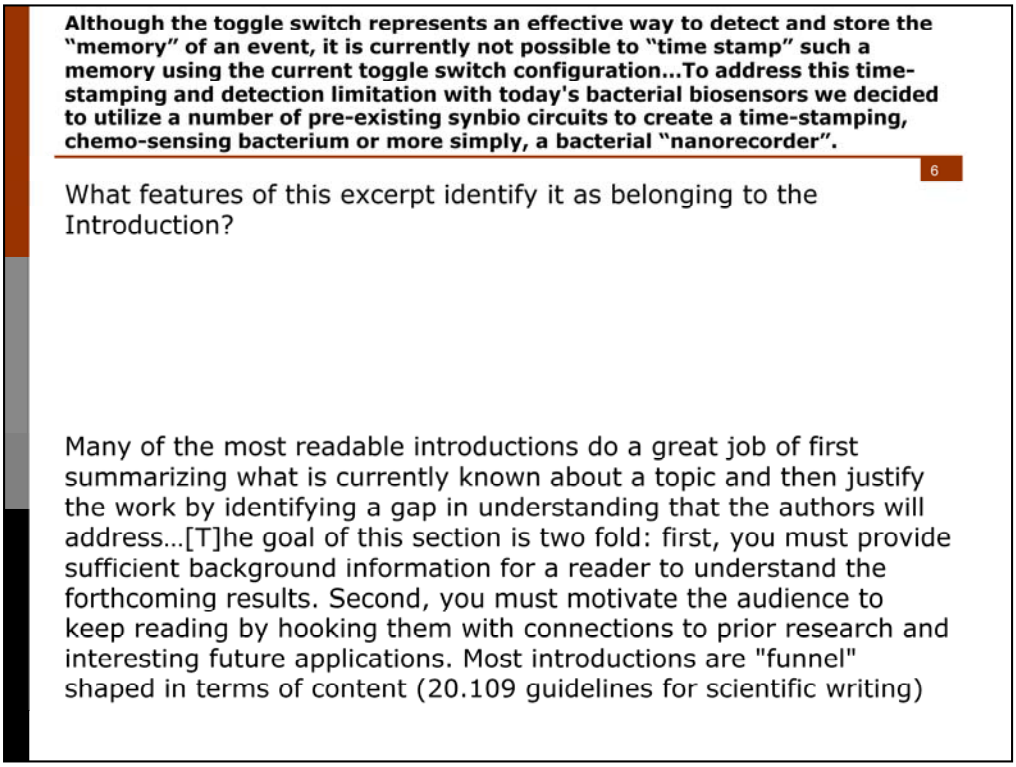
"Memory effect" upon short-term IPTG exposure. Visible light and UV-light images of PB103: p TAK117-minC exposed to 10 mM IPTG for 15 min (E, F), 30 min (G, H) and 60 min (I, J) before washing and resuspending the cells in IPTG-less LB amp50 medium. Controls include cells not exposed to IPTG (A, B) and cells grown under continuous exposure to 2 mM IPTG (C, D). Images were taken after 2 h 30 min of exposure to 10 mM IPTG. Scale bar is 50 μm.

[C]ells were incubated with [2-20 mM] IPTG for [15-60] min. After exposure the cells were briefly pelleted, washed twice in LB medium before suspending them in LB (50 mg/L ampicillin, without IPTG) and retransferred to culture tubes for further growth. The cells were observed at 30-min intervals to record their fluorescence signal intensity and cell length. Aliquots from the same culture grown with 2 mM IPTG and in IPTG-less media were included as positive and negative controls.

[O]ur study suggests that stochastic fluctuations in gene expression may be accentuated by subtle changes in growth conditions and result in long-term changes in epigenotypes. In the reverse case scenario, Tan et al. [28] reported that changes in bacterial host physiology were responsible for a counter-intuitive situation, wherein bistable gene expression was displayed by a simple positive feedback circuit. These studies along with our results suggest that unexpected interactions between a genetic circuit and its host can result in unintended perturbations in the dynamics of gene expression.

Irrespective of the duration of exposure, PB103:pTAK117-minC cells exposed to 2 mM or 5 mM IPTG did not elongate or express GFP after transfer to IPTG-less growth medium. Filamentation was observed in cultures exposed to 10 mM (and 20 mM) IPTG for 30 min (Figure 4G). In other words, the IPTG nanorecorder required at least a 30 min exposure to a minimum concentration of 10 mM IPTG to register the presence of the chemical signal and begin recording.

Although the toggle switch represents an effective way to detect and store the "memory" of an event, it is currently not possible to "time stamp" such a memory using the current toggle switch configuration...To address this time-stamping and detection limitation with today's bacterial biosensors we decided to utilize a number of pre-existing synbio circuits to create a time-stamping, chemo-sensing bacterium or more simply, a bacterial "nanorecorder".



TR responses:

-General to specific: background to what they're about to do.

-Talks about previous research of lack of research into a topic.

-"To address this…": problem, goal of the researchers

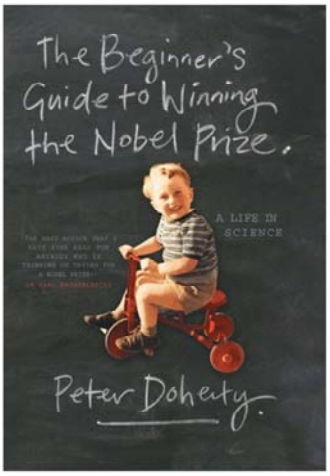
WF responses:

-Describes a current problem, and how they attempt to solve it

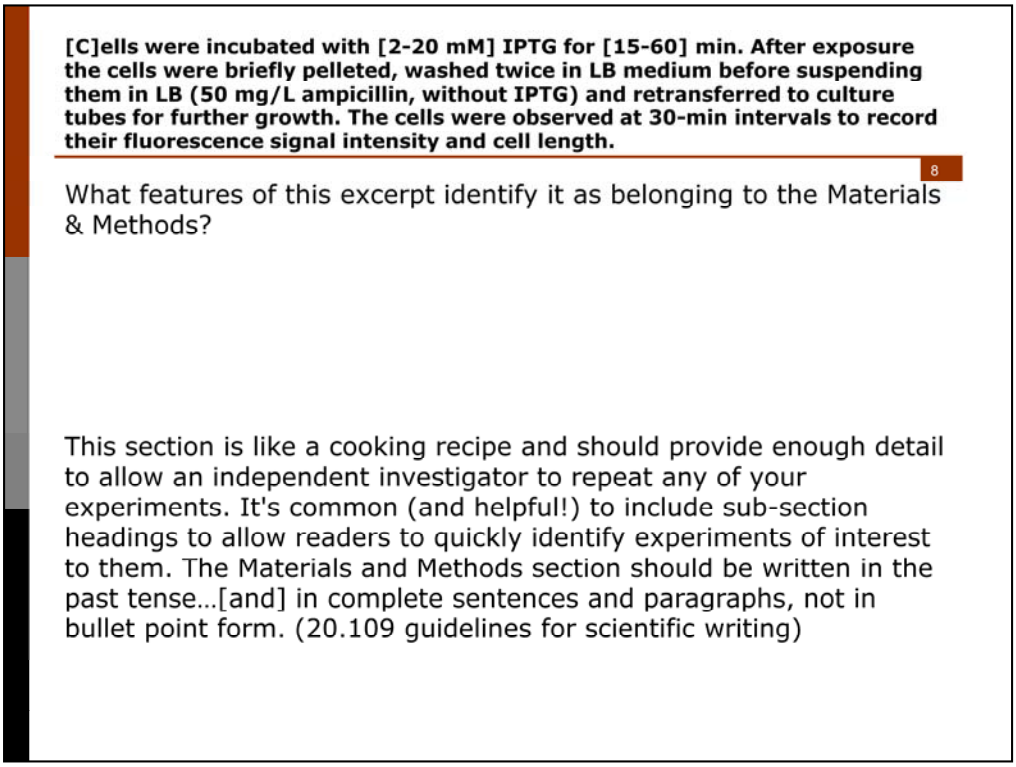
-Not very specific: no details about methodology.

-Talks about previous work.

Introduction gives the context, focus, and justification.



- Start broadly; end with your goal
- Identify what is (un)known
- Explain how you will address the unknown



TR responses:

[Lost – sorry!]

WF responses:

-Specific details about how the experiments were carried out.

-Verbs are in past tense.

-Written in the passive voice.

-No interpretation; just what they did in the lab.

The M&M allows replication or interpretation of your work.

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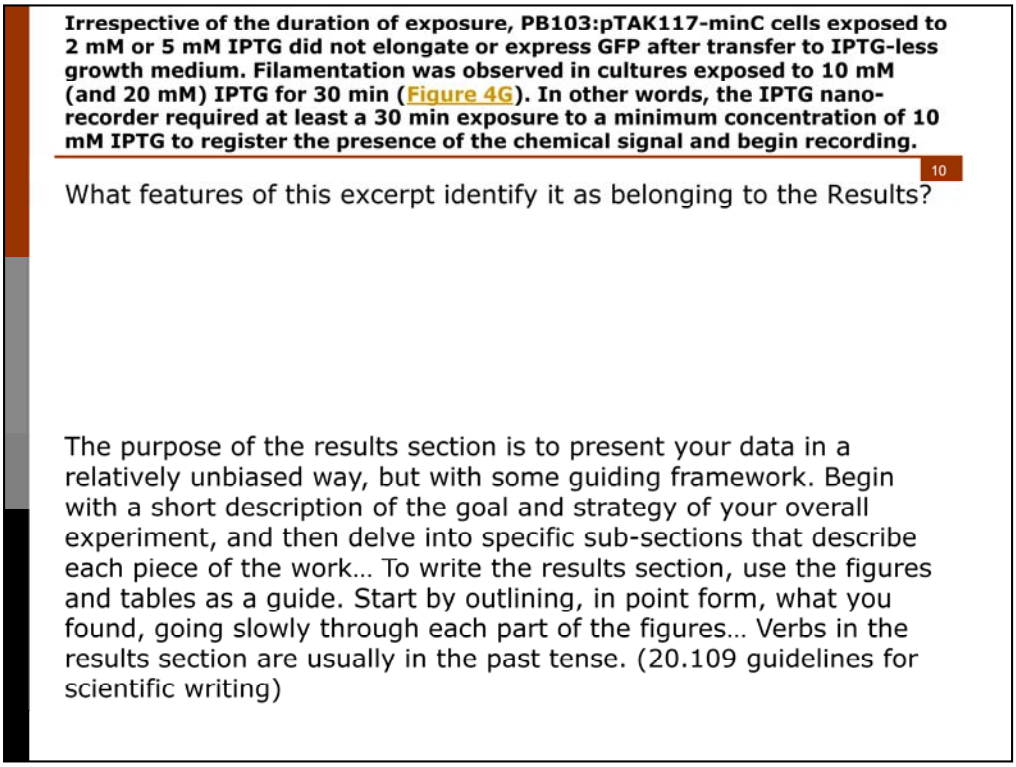
- Provide the right level of detail
- List the methods in logical order
- Use proper grammar



TR responses:

-Talked about the results.

-Still pretty specific; talks about just their project/experiment.

-Figure citation.

WF responses:

-Draws specific conclusions from the data.

-Has specific “this is what we got” numbers.

-Cites figures.

The Results tells a story about your data.

- Select data carefully
- Provide context
- Describe illustrations

"Memory effect" upon short-term IPTG exposure. Visible light and UV-light images of PB103: p TAK117-minC exposed to 10 mM IPTG for 15 min (E, F), 30 min (G, H) and 60 min (I, J) before washing and resuspending the cells in IPTG-less LB amp50 medium. Controls include cells not exposed to IPTG (A, B) and cells grown under continuous exposure to 2 mM IPTG (C, D). Images were taken after 2 h 30 min of exposure to 10 mM IPTG. Scale bar is 50 µm.

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What features of this excerpt identify it as a Figure Legend?

Legends to the figures and tables explain the elements that appear in the illustration. Conclusions about the data are NOT included in the legends. As you write your first draft, state in a short simple sentence, what the point of the figure or table is. In later drafts, make sure each element of the figure or table is explained. Your figure legends should be written in the present tense since you are explaining elements that still exist at the time that you are writing the paper. (20.109 guidelines for scientific writing)

TR responses:

-Figure title.

-Scale bar.

-Explains the conditions of the different parts of the figure (in letters).

-Does not describe the illustration.

WF responses:

-References scale bar, letters.

-First phrase is a summary of the paragraph – figure title.

-[Should have complete sentences, except the title.]

-Doesn't have interpretation.

-Describes methods – but very specific to the figure itself.

Legends allow illustrations to stand on their own.

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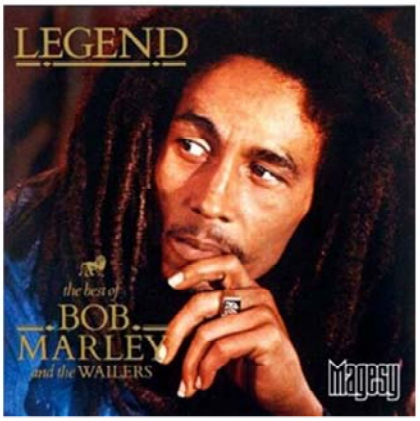
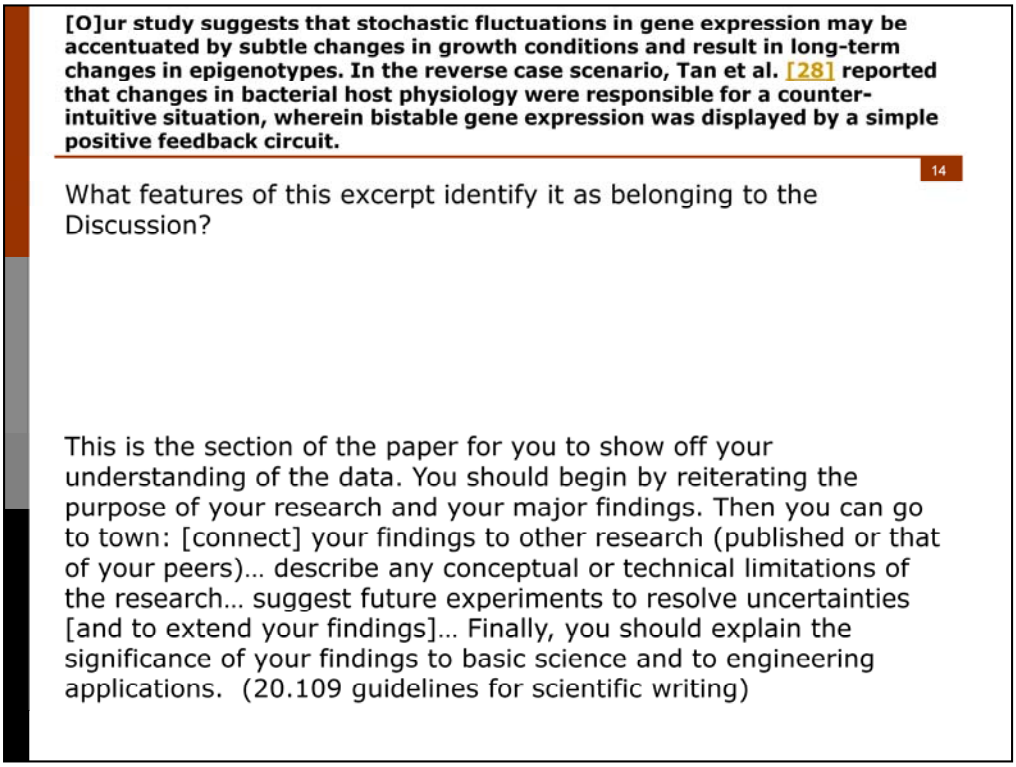
- Describe experiment
- Explain abbrev, symbols
- Do not interpret or describe data





TR responses:

-Makes conclusions about the results.

-Compares the project with other studies.

WF responses:

-All interpretation.

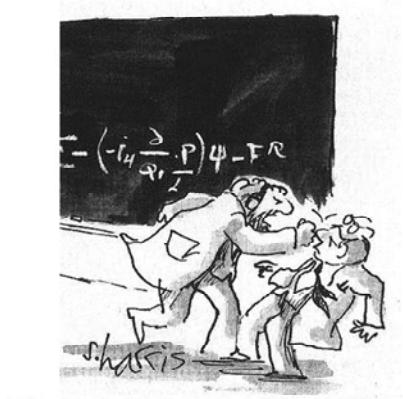
-Suggests how research could go further; has the word “suggests”.

-Draws broad conclusions from the data.

-Cites previous work as a comparison to their work.

The Discussion is an argument about your data.

- Interpret data
- Explain contribution to field
- Admit limitations and flaws



"YOU WANT PROOF? I'LL GIVE YOU PROOF!"

In sum, understand IMRD to improve scientific writing.

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- Introduction: What did you know?
- M&M: What did you do?
- Results: What did you see?
- Discussion: What does it mean?

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