Scientific Writing

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Why be a good writer?

• Peers will take you more seriously and value your input
• Research more likely to lead to publications
• Grants more likely to be funded
• Publications are the currency of an academic position (Steve Potter, PhD)
How to become a *good* writer

- Practice writing and editing as much as possible
- Read good literature
- Consult useful guides
- Get feedback!!!
- Check what you have written to see if you followed the “rules”
Scientific Writing

• First Meeting
  – General Tips for Writing
  – Structure of Scientific Papers
  – Writing an Abstract

• Second Meeting
  – Graphics
  – Specific advice for preparing your poster
Overall Important Points

• Write to inform and convince your readers that your findings are **correct, interesting** and **significant**!

• Write with your **audience** in mind.
General Tips for Scientific Writing

• Be **Simple** and **Direct**
  – Straightforward
  – Avoid redundancy
  – Avoid digression (keep to the point)
  – Don’t over-explain
  – Be precise in word selection
    • Ex: If you know an occurrence is one, don’t use the word “some”
  – Avoid over-specification or putting too much detail in a paragraph
General Tips for Scientific Writing

• Be **Positive**
  – Negative results in a positive light
    • Example:
      – No differences in arthritic scores were observed in wildtype versus mutant mice.
      – Similar arthritic scores were observed between wildtype and mutant mice.
    • Avoid arrogant phrases
      “As is well-known”, “Clearly demonstrates”, “It is obvious”

• Be **Persuasive**
  – Support your purpose!
  – Why is the result important?
  – Use your data to support your arguments.
General Tips for Scientific Writing

• **Be Clear**
  – Avoid indefinites
  – Ex: “This is”, “It is”, “There are”;
    • There are over 20 receptors for hormones in the human body.
    • Over 20 receptors for hormones are present in the human body.

• **Be Fluid**
  – Vary sentence structure
  – Vary sentence length
  – Transitions are key, first sentence of paragraph needs to connect to preceding paragraphs.

• **Be Correct**
  – Proofread! spell check doesn’t catch everything!
  – “assess” forget the last “s” and it does not bode well!
General Tips for Scientific Writing

- **Be Imagistic**
  - Describe using 5 senses
  - Analogies (Einstein used frequently)
  - Examples

- **Be Active**
  - Passive: tells what is done to the subject
  - Active: subject of sentence carries out the action, conveys to reader sense of immediacy and conciseness
General Tips for Scientific Writing

Richard Lanham, a professor of English at UCLA, invented an easy-to-use method for making your writing clearer and more concise. The Writing Center strongly advocates Lanham's "Paramedic Method" for your writing. Here's how to do it:

1. Circle unnecessary elements

   1a. Circle the Prepositions. Too many prepositions can drain all the action out of a sentence. Get rid of the prepositions, and find a strong active verb to make the sentence direct:

      Original: In this passage is an example of the use of the rule of justice in argumentation.
      Revised: This passage exemplifies argumentation using the rule of justice.

   1b. Circle the "is" forms. Using "is" in a sentence gets it off to a slow start, and makes the sentence weak. Replace as many "to be" verbs with action verbs as you can, and change all passive voice ("is defended by") to an active voice ("defends").

      Original: The point I wish to make is that fish sleep with their eyes open.
      Revised: Fish sleep with their eyes open.

http://writing2.richmond.edu/writing/wweb/concise.html
2. Ask, "Where's the action?" "Who's kicking who?" (using Lanham's own terminology here--to be precise, it would be "Who kicks whom?"). If you get stuck in a passive sentence always ask the question: "Who does what to whom?" If you use that formula you will always write active sentences.

*Original*: Burning books is considered censorship by some people.

*Revised*: Some people consider burning books censorship.
General Tips for Scientific Writing

3. Put this "kicking" action in a simple active verb.

*Original*: The theory of relativity isn't demonstrated by this experiment.
*Revised*: This experiment does not demonstrate the theory of relativity.

4. Start fast—no slow windups. Stick to the action and avoid opening sentences with phrases like these:

- My opinion is that....
- The point I wish to make is that ...
- The fact of the matter is that...

http://writing2.richmond.edu/writing/wweb/concise.html
The Drill

• You work in the lab
• Maybe you get some exciting results…
• Maybe things don’t work out so well…
• You still will have a great time preparing and presenting a poster on your summer work at

The Capstone Poster Session:
July 30\textsuperscript{th} and July 31\textsuperscript{st} !!
Writing a Scientific Paper

• Formulate your idea of the paper
  – Paper should describe a single major new idea or finding
  – Thinking of the title may help!
  – Start thinking about the paper while still doing experiments
  – Think of the figures needed to illustrate your finding
IMRD System

• **Introduction**
• **Methods**
• **Results**
• **Discussion**

• Also:
  – Title
  – Abstract
  – Figures & Tables
  – Bibliography
Title

• A concise statement of the major finding
• Or, a brief description of the study

• “Surfactant Protein D-Mediated Decrease of Allergen-Induced Inflammation Is Dependent upon CTLA4”

is much better than

• “Effects of Surfactant Protein D on Allergen-Induced Inflammation”

Ko-Wei Lin, et al., JI 2010
Title

• **Be Specific:**
  
  – Index or abstract services, or Pubmed searches depend on the accuracy of the title.
  
  – Think of keywords that can be searched in databases. The wrong title may not reach your intended audience.
Abstract

- Basic content of document to reader.
- Mini-synopsis of the article.
- Title and Abstract are what the reader may use to determine interest in a scientific paper.

Plasminogen is a joint-specific positive or negative determinant of arthritis pathogenesis in mice.

Raghu H, Jone A, Cruz C, Rewerts CL, Frederick MD, Thornton S, Degen JL, Flick MJ.

Objective: A fundamental metric in the diagnosis of arthropathies is the pattern of joint involvement, including differences in proximal versus distal joints and patterns of symmetric or asymmetric disease. The basis for joint selectivity among arthritides and/or within a defined disease such as rheumatoid arthritis remains enigmatic. Coagulation and fibrinolytic activity are observed in both experimental animals with inflammatory joint disease and patients with inflammatory arthritis. However, the contribution of specific hemostatic factors to joint disease is not fully defined. We sought to determine the contribution of the fibrinolytic protease, plasminogen, to tumor necrosis factor α (TNFα)-driven arthritis in distinct joints in mice.

Methods: The impact of plasminogen and/or fibrinogen genetic deficiencies on arthritis progression was evaluated in Tg197 mice genetically predisposed to spontaneous, nonabating, and erosive polyarthritis due to exuberant human TNFα expression.

Results: Elimination of plasminogen in Tg197 mice significantly exacerbated the incidence and severity of arthritis within the paw joints, but simultaneously and dramatically diminished the entire spectrum of pathologies within the knee joints of the same animals. These opposing outcomes were both mechanistically linked to fibrin(ogen), in that superimposing fibrinogen deficiency reversed both the proarthritic phenotype in the paws and arthritis resistance in the knees of plasminogen-deficient mice. Intriguingly, the change in disease severity in the knees, but not the paws, was associated with a plasminogen-dependent reduction in matrix metalloproteinase 9 activity.

Conclusion: Plasminogen is a key molecular determinant of inflammatory joint disease capable of simultaneously driving or ameliorating arthritis pathogenesis in distinct anatomic locations in the same subject.
Plasminogen Is a Joint-Specific Positive or Negative Determinant of Arthritis Pathogenesis in Mice

Harini Raghu, Alice Jone, Carolina Cruz, Cheryl L. Rewerts, Malinda D. Frederick, Sherry Thornton, Jay L. Degen, and Matthew J. Flick

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Rheumatoid arthritis (RA) is a chronic autoimmune disease of the joints that affects ~1.5 million people in the US (1). RA is a complex, heterogeneous disease with considerable variation among patients in disease progression and severity. It is well documented that RA affects multiple joints of the body, but certain joints, particularly the peripheral joints of the wrists, proximal interphalangeal joints, metacarpophalangeal joints, and ankle joints, are more susceptible to disease manifestation. Less commonly, RA may also manifest in large joints such as the knees, hips, and shoulders (2,3). Despite the well-characterized predilection for arthritis development in peripheral joints, the precise basis for differential joint involvement in RA, including underlying molecular determinants, is unknown.
Abstract

Format:

– **Introduction**: State principal objectives and scope of study

– **Methods and Approach**: How you addressed the objectives

– **Results**: What you observed—concise summary

– **Conclusions**: Summarize principal findings
Abstract

Things not to include:

– References to literature
– References to tables and figures in the paper
– Rarely include methods and not specific methods
A Typical Introduction

• A paragraph that introduces the topic from a very broad or global perspective

• A paragraph that offers some specific information and begins to narrow the focus

• A paragraph or two that focus on the particular topic of the paper and provide some specific background information

• A final paragraph that describes the approach used and summarizes the major findings
In this study, we directly explored the role of the plasminogen–fibrinogen axis in the pathogenesis of inflammatory arthritis in human TNF–transgenic Tg197 mice that develop spontaneous polyarthritis in the absence of any exogenous manipulation (e.g., intraarticular injection, immunization with heterologous antigens) (21). Our results demonstrate for the first time that plasminogen is a powerful modifier of TNF–induced inflammatory joint disease; however, the impact of plasminogen on arthritis is shown to be highly context dependent and can either drive or ameliorate arthritis, even within the same animal, as a function of precise anatomic location, the availability of fibrinogen, and potentially, the activation status of matrix metalloproteinase 9 (MMP-9).
Methods Section

• Provide enough information for another researcher to reproduce your studies.

• Describe materials and equipment exactly, including the manufacturer and location in the first reference, and only the manufacturer in subsequent references.
  – Ex: T cells were labeled with anti-CD4 FITC-labeled antibody (BD Biosciences, San Jose, CA). FACSAria II cell sorter (BD Biosciences) was used for sorting cell populations.

• Briefly describe methods that have been previously published and reference the previous publication.

• Results normally are not included in the Methods.
The Results Section

*Short and Sweet*

- Describes the results, generally by referring to figures or tables.
- Generally divided into sections with specific headings that state findings, usually addressing specific questions.

Example:
- Genetic elimination of plasminogen results in opposing, joint-specific differences in TNF-induced arthritis severity.
- The proarthritic and antiarthritic properties of plasminogen are mechanistically tied to the presence of fibrinogen.
- Correlation of local proinflammatory and anti-inflammatory cytokine expression with arthritis severity.
- Reduced MMP-9 activity specifically in the knee joints, but not in the paws, of plasminogen-deficient Tg197 mice.
The Results Section

*Short and Sweet*

- Under the headings:
  - Describe the experiment (how did you test your question?)
  - State the result
  - Draw narrow conclusions
  - Sometimes lead to next question (flow, transition)

- Do not interpret results or discuss significance
Headings in Results

• Best: State the conclusion of the section: “Genetic elimination of plasminogen results in opposing, joint-specific differences in TNF–induced arthritis severity.”

• If this is not possible, then give a generic description: “Correlation of local proinflammatory and anti-inflammatory cytokine expression with arthritis severity.”
Results

Tips

• Significant numbers (digits); mean and standard deviation (SD) should be consistent.

• If values are not significantly different, you can indicate that the values “trend” to be higher, but you cannot say the values differ.

• Figure legends:
  – Do not reproduce the methods. Legends should be able to stand alone with the figure.
  – Title of figure legend should be informative and comprehensive.
  – Be sure to address all parts of the figure in the figure legend.
    • Ex: Bars represent the mean with error bars representing +/- the SD.
Discussion Sections May Do Many Things

- Summarize the key findings
- Discuss the validity of the findings
  - Discuss validity or limitations of methods
  - Indicate if a conclusion is supported by several experiments
  - Discuss relationship of your findings to other work
- Speculate! Possible mechanisms, significance, applications
- Suggest implications or future directions
- Conclude, with summary or statement of significance
Discussion Sections

Tips

• Relate to Introduction.
  – Did you answer your primary question?
  – Was the result what you thought?

• Keep the big picture in mind.

• Illustrations (diagrams of potential mechanisms) can be a useful part of the Discussion.
References

• Authors, title of article, journal name, year of publication, volume and pages.
• Endnote is a wonderful program for bibliographies.
• Online searches
Download file to computer and open in Endnote or other Citation program
Revision, Revision, Revision!!

- Start early
- Read out loud to yourself
- Many revisions of your own
- Solicit criticism
Submitting a Scientific Paper

• Instructions to Authors
  – Journal of Immunology
  – http://www.jimmunol.org/site/misc/authorinstructions.xhtml

• Manuscript sent to 2-3 anonymous reviewers

• Editor sends you a decision letter
  – Accepted
  – Accept with Revisions
  – Needs Revision
  – Rejected
  – Not of interest to readership

• Your response
Publishing your work from this summer

The Ohio Journal of Science

The Ohio Journal of Science (OJS) welcomes manuscripts from high school students, undergraduate, and graduate students as well as Academic professionals working within Ohio.

The Ohio Journal of Science prints two issues a year (April and December), and all articles are published online as soon as they are peer-reviewed, revised, and accepted for publication.

http://www.ohiosci.org/
Your (optional?) assignment

• **Write an abstract** of 125 – 250 words that succinctly summarizes the overall goals, methods, results, and conclusions from your work this summer. (If experiments are incomplete, feel free to make up the results!)

• Mail to me at
  
  sherry.thornton@cchmc.org

• I will edit, correct, make suggestions, and return to you by email or at next meeting.
Abstract

• A one-paragraph summary of the paper – usually 125-250 words
• Gives background (1-2 sentences)
• May describe experimental approach (1 sentence)
• States each of the experimental findings
• Conclusion or significance (1 sentence)
Abstract

- Introduction
- Methods/Approach
- Results
- Discussion
Sample Abstract

Surfactant Protein D-Mediated Decrease of Allergen-Induced Inflammation Is Dependent upon CTLA4

Ko-Wei Lin, Kai Yu Jen, Carlos Jose Suarez, Erika C. Crouch, David L. Perkins and Patricia W. Finn

*J. Immunol.* 2010;184;6343-6349; originally published online Apr 30, 2010;
doi:10.4049/jimmunol.0901947
http://www.jimmunol.org/cgi/content/full/184/11/6343
Pulmonary surfactant protein D (SP-D), a member of the collectin family, is an innate immune molecule critical for defense that can also modulate adaptive immune responses. We previously showed that SP-D–deficient mice exhibit enhanced allergic responses and that SP-D induction requires lymphocytes. Thus, we postulated that SP-D may decrease adaptive allergic responses through interaction with T cells. In this study, we used two forms of SP-D, a dodecamer and a shorter fragment containing the trimeric neck and carbohydrate recognition domains (SP-D NCRD). Both forms decreased immune responses in vitro and in a murine model of pulmonary inflammation. SP-D NCRD increased transcription of CTLA4, a negative regulator of T cell activation, in T cells. SP-D NCRD no longer decreased lymphoproliferation and IL-2 cytokine production when CTLA4 signals were abrogated. Administration of SP-D NCRD in vivo no longer decreased allergen induced responses when CTLA4 was inhibited. Our results indicate that SP-D decreases allergen responses, an effect that may be mediated by increase of CTLA4 in T cells.
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Discussion
Abstract

Introduction

Methods/Approach

Results

Discussion
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• I will edit, correct, make suggestions, and return to you by email or at the next session.
Your assignment

- Write a sentence for each of the IMRD categories.
- Find a partner and discuss this with them.
- Listen to your partner’s IMRD and discuss with them.
The Capstone Poster Session
Thursday, August 4\textsuperscript{th} and Friday, August 5\textsuperscript{th}

- Sign up to participate (last date:)
- Make arrangements to print your poster
- Prepare poster
- Get poster printed
- You will receive a number and location
- Mount poster, late afternoon day before or early day of presentation.
Options for printing your poster

• All programs, you have a few options:
  – The Health Sciences Library ($40)*
  – Kinko’s (> $100)

• CCHMC students go to the following link on the CCHMC intranet (Centerlink):

  http://centerlink.cchmc.org/content1/24843/