# Pompe Journal Club

3

**Vocabulary:**
**Peer-review** is the act of having another writer read what you have written and respond in terms of its effectiveness. This reader attempts to identify the writing's strengths and weaknesses, particularly how sound the science is, and then suggests strategies for revising it. The hope is that not only will the specific piece of writing be improved, but that future writing attempts will also be more successful. Peer-review happens with all types of writing, at any stage of the process, and with all levels of writers.

## Lesson Summary:

Using a reading guide, students work in pairs to read a journal article and share their interpretations during a whole class activity. After completing the introductory reading activity, students utilize a reading guide to work independently to read and identify key information before sharing their understanding with others in a small group. If time allows, students translate their paper into a poster to share with classmates during a gallery walk and subsequent poster presentation.

## Student Learning Objectives:

The student will be able to...

1. Identify key developments in the treatment of Pompe disease
2. Improve scientific literacy by reading primary sources
3. Read a scientific paper for understanding
4. Recognize that science is ever growing and building on previous discoveries
5. Conclude that research takes place around the globe and through publishing, discoveries are shared

## Standards:

See table on page 11-13.

| | | | | |
|---|---|---|---|---|
| SC.912.L.14.6 | SC.912.L.18.1 | SC.912.N.1.3 | SC.912.N.1.5 | SC.912.N.2.5 |
| SC.912.L.16.9 | SC.912.N.1.2 | SC.912.N.1.4 | SC.912.N.2.4 | |

## Materials:

- Copies of *Guide to Reading Scientific Papers*, one per student
- Copies of *Guide to Reading Scientific Papers Worksheet*, one per student
- Copies of introductory journal article, one per student or student pair
- Copies of journal articles (choose three to five articles for the class and make multiple copies of each, allowing one per student)

**KEY QUESTION(S):**
- How do you read a scientific journal article for understanding?

**TIME ESTIMATE:**
- Advanced Preparation: 90 minutes including reading articles
- Student Procedure:
  Day 1: 45 minutes
  Day 2: 45 minutes
  Day 3: 30 minutes

**LEARNING STYLES:**
- Visual and auditory

Small, manageable doses of primary literature in a guided manner will allow students to gain comfort using and understanding original research articles.

## Background Information:

Little was known about Pompe disease until the latter part of the 20th century. There have been several reviews of literature and reported cases published, but most attention from the research and clinical community is focused on treatment and cure. Therefore many of the papers published are related to a treatment and heavy on academic jargon.

Students need to be scientifically literate, and part of that effort includes their use and familiarity with primary sources of information, namely articles peer-reviewed and published in scientific journals. Many high school and undergraduate students are intimidated by these articles because they approach them in the wrong manner. They are not novels to be consumed at one time. They are jargon-filled texts that are often presented in a dry and painful manner. Students are bogged down by the vocabulary and the methods, so they can not focus on the bigger, important ideas of the paper, the "take-home message". Small, manageable doses of primary literature in a guided manner will allow students to gain comfort using and understanding original research articles.

## Advance Preparation:

***Implementation note:*** Determine size of groups for journal discussions and choose papers accordingly. For a class of 32 students, if the journal clubs (groups) are 8 students each you will need to select 4 papers and make 8 copies of each. The usual standard is to keep groups as small as possible. In this situation however, a group of 6-8 students discussing a paper would be fine and could encourage discussion and generate more ideas. If you opt for smaller groups of 4, you will need to select (and read!) 8 papers.

- Make copies of *Guide to Reading Scientific Papers*, one per student
- Select and copy journal articles (choose three to five articles for the class, depending on how large the groups will be, and make multiple copies of each, allowing one per student). Most research journals have restricted access. The AMDA has a site with many important publications related to Pompe disease and it is available freely. (http://www.amda-pompe.org/index.php/main/research/publications/) Suggested articles are listed in the resources below.
- Read the selected articles.

***Implementation Notes:***

This activity is intended to build on the discoveries presented in the previous timeline lesson. It also provides background information for the gene therapy role play and subsequent ethics class discussion later in the unit. As written, three class days are devoted to this activity, stressing the importance of communicating science. Students need to know where to find primary sources of scientific literature as well as how to read and present the information for understanding. Due to the rare nature of Pompe disease, there has not been much written in popular media outlets other than a few first person accounts and many of those are the result of publicity surrounding the movie Extraordinary Measures.

It also assumes students are not familiar with reading science journal articles so it models the steps of reading and discussing a paper as the first part of the lesson. For advanced and/or experienced students, you may elect to skip the day one component and begin with assigning students papers to read for homework and discuss in small groups the following day.

For classes accustomed to the use of blogs or other social media outlets, this lesson would be well suited for discussion to take place outside of the classroom. In this situation, you may wish to assign the entire class a paper one night and ask them to respond to a blog post or wiki prompt. They could repeat this process for multiple papers throughout the unit. The poster and gallery walk could also be held virtually through the use of glogs.

## Procedure and Discussion Questions with Time Estimates:

### DAY ONE (45 MIN)

1. **(5 min)** Introduce the importance of publishing scientific findings. Tell the students that in science, information is primarily shared with others through writing papers that are reviewed by other scientists for accuracy and clarity (peer-review). These publications are the primary means to share new findings with others across the world and allow researchers to build on prior findings to make new discoveries. It is important for scientists to be good written and oral communicators.
2. **(5 min)** Give each student a copy of *Guide to Reading Scientific Papers*. Instruct the students to read the *Guide* silently.
3. While students are reading, provide a copy of the first article to each student or student pair.
4. Project the first article (feel free to select a different article)
   Disease severity in children and adults with Pompe disease related to age and disease duration http://amdapompe.ehclients.com/downloads/publications/Hagemans_Neurology_280605.pdf
5. **(5 min)** Review the *Guide to Reading Scientific Papers* with them, stressing which sections students should read a bit more carefully (abstract, introduction), and which can be skimmed or skipped (methods/materials). Use the projected article to indicate these sections. Direct their attention to the questions at the bottom to focus their reading. You may wish to have students highlight or underline the answers on the article.
6. **(15 min)** Ask the student pairs to work together to read the article and formulate a summary. Encourage them to use the *Guide to Reading Scientific Papers*. Point out that to read a paper for full comprehension, it takes longer, but this is a beginning exercise to get them acquainted with scientific papers.
7. **(10 min)** Call on student pairs to give a summary of each key section (abstract, introduction, results, and conclusions). The *Teachers Page: Discussing Science Journals* provides a teacher's guide for this discussion. Ask other students to add to the summary that has already been given, asking them if they thought there were other important aspects. Prompt them with the questions below:
   1. What was the purpose of the study?
   2. What questions were asked?
   3. What were the final answers?
   4. What was unique about the study?
   5. What is the next step?
8. **(5 min)** Distribute a copy of one paper to each student. Choose 3-5 papers so there will be multiple students reading the same paper.
9. Instruct the students to follow the same procedure they just did as a class tonight for homework, using the *Guide to Reading Scientific Papers* and completing the *Guide to Reading Scientific Papers Worksheet*. Tell them to be prepared to share their paper in small groups tomorrow.

### DAY TWO (45 MIN)

1. Present students with the following quick write prompt as a bell ringer:
   *A. In three complete sentences, summarize the journal article you read last night.*
   *B. List one thing you learned.*
   *C. List one question you still have.*
2. Allow students 5 minutes to complete the prompt. Collect the writings.

In science, information is primarily shared with others through writing papers that are reviewed by other scientists for accuracy and clarity **(peer-review).** These publications are the primary means to share new findings with others across the world and allow researchers to build on prior findings to make new discoveries. It is important for scientists to be good written and oral communicators.

3. **(15 min)** Ask students to gather in groups according to the paper they read. Allow the students to self-sort. Instruct them that within the group, they should share their understanding of the paper, discuss anything they did not understand, and decide on the important points using the questions in the *Guide* as prompts. This is similar to a journal club in a research setting.
4. **(10 min)** After the students have had the opportunity to discuss their paper, they will now make a poster using the five questions from their reading guide to share with the class during a gallery walk.

> ***Implementation note:*** *Instead of posters and a gallery walk, student could do a modified jigsaw, forming groups with members from different papers. Each should share with the new group the summary and important points from their individual paper. Allow 20 minutes for the groups to assemble and share. Have them complete an exit slip during the last 5 minutes asking them to state one thing they learned and one thing they still have a question about.*

5. **(15 min)** Have groups affix their poster to the wall when completed. Students should move around the room and read the other posters. Give them post-it notes and ask them to generate at least one question and place it next to the corresponding poster (similar to an exit slip). It cannot be the same question someone else has already posted. (If wanting to use for assessment purposes, students should include their name on the back of the post-it.)
6. Teacher homework: review the quick writes and make note of any reoccurring questions or concerns expressed by the students. Review the post-it note exit slips and make note of thoughtful questions to address the following day. As the student groups are presenting to the class, prompt them with the questions and provide wrap-up for each poster after the students are finished to clarify any misunderstandings.

### DAY THREE (45 MIN)

1. As students enter, they should visit their poster and read the questions their classmates posted.
2. **(5 min)** Encourage student groups to discuss the questions posed and decide on a main speaker for the group to present the paper abstract; the additional members of the group should each answer one of the questions posed by their classmates.
3. **(5-10 mins)** Allow the first group 3-5 minutes to present their paper/poster to the class and answer questions. (The number of questions answered may vary based on complexity of the answer and classroom engagement.) Help to clarify concepts and correct any misconceptions. The questions might be beyond the scope of knowledge for the students, so it is critical that the teacher is ready to assist with answering, correcting, or encouraging students to investigate further to find the answer.
4. **(20 min)** Repeat with the remaining groups.
5. **(10 min)** When all groups have presented, engage in a whole class discussion about the findings of the papers, focusing the students' attention on the following:
    a. Did it build on previous work?
    b. Where does it fit in our timeline from lesson 2?
    c. Key finding(s)
6. **(5 min)** Help the students understand that science is an ever-growing body of knowledge. Only by sharing results can forward progress be made.

## Assessment Suggestions:

- Homework and/or quickwrite collected
- Participation grades for the exit slip and paper/poster presentation.

## RESOURCES/REFERENCES:

How to read scientific papers:
http://hampshire.edu/~apmNS/design/RESOURCES/HOW_READ.html

Nice list of research tools including how to read a research article and citations.
https://pantherfile.uwm.edu/ajpetto/www/Research_tools.htm

The AMDA has an extensive list of publications with linked pdfs. The suggested articles below can be found on their site: http://www.amda-pompe.org/index.php/main/research/publications/. There are additional articles in the References section at the end of this curriculum (as well as full citations for the links below) that would be excellent for students to read and discuss. Unfortunately, access is limited. For assistance accessing a desired article, feel free to contact us at julie@cpet.ufl.edu.

### Disease Pathology

Disease severity in children and adults with Pompe disease related to age and disease duration
http://amdapompe.ehclients.com/downloads/publications/Hagemans_Neurology_280605.pdf

### Enzyme Replacement Therapy

Autophagy and Mistargeting of Therapeutic Enzyme in Skeletal Muscle in Pompe Disease
http://amdapompe.ehclients.com/downloads/publications/autophagy.pdf

Clinical and Metabolic Correction of Pompe Disease by Enzyme Therapy in Acid Maltase–deficient Quail
http://amdapompe.ehclients.com/downloads/publications/JCI1014827.pdf

Long-Term Intravenous Treatment of Pompe Disease With Recombinant Human -Glucosidase From Milk.
http://amdapompe.ehclients.com/downloads/publications/rabbitGAA.pdf

A Randomized Study of Alglucosidase Alfa in Late-Onset Pompe's Disease
http://amdapompe.ehclients.com/downloads/publications/nejmoa0909859.pdf

### Myozyme Clinical Trial

Early Treatment With Alglucosidase Alfa Prolongs Long-Term Survival of Infants With Pompe Disease
http://amdapompe.ehclients.com/downloads/publications/Early_Treatment_With_Alglucosidase_Alfa_Prolongs16.pdf

Effect of enzyme therapy in juvenile patients with Pompe disease: A three-year open-label study.
http://amdapompe.ehclients.com/downloads/publications/MiniLOTS_Genzyme_Sponsored_Single_Center_Study.pdf

### Gene Therapy

Pompe disease gene therapy.
http://amdapompe.ehclients.com/downloads/publications/Byrne-HMG2011.pdf

A New Method for Recombinant Adeno-associated Virus Vector Delivery to Murine Diaphragm
http://amdapompe.ehclients.com/downloads/publications/VirusDeliveryDIAPHRAGM.pdf

Efficacy of an Adeno-associated Virus 8-Pseudotyped Vector in Glycogen Storage Disease Type II
http://amdapompe.ehclients.com/downloads/publications/Amalfitano2005.pdf

Spinal Delivery of AAV Vector Restores Enzyme Activity and Increases Ventilation in Pompe Mice
http://amdapompe.ehclients.com/downloads/publications/byrne.pdf

### Chemical Chaperones

Chemical chaperones improve transport and enhance stability of mutant a-glucosidases in glycogen storage disease type II
http://amdapompe.ehclients.com/downloads/publications/chaperones.pdf

## EXTENSIONS:

Students compose an essay or poster to inform the general public of Pompe disease or another orphan disease.

After students have completed the entire activity, have them read the following editorial: http://amdapompe.ehclients.com/downloads/publications/Where_do_we_stand--Ans_letter.pdf

Based on what they have learned so far, do they agree with the author? Is there bias in her comments? Is it acceptable for the author to present her opinion in an editorial piece?

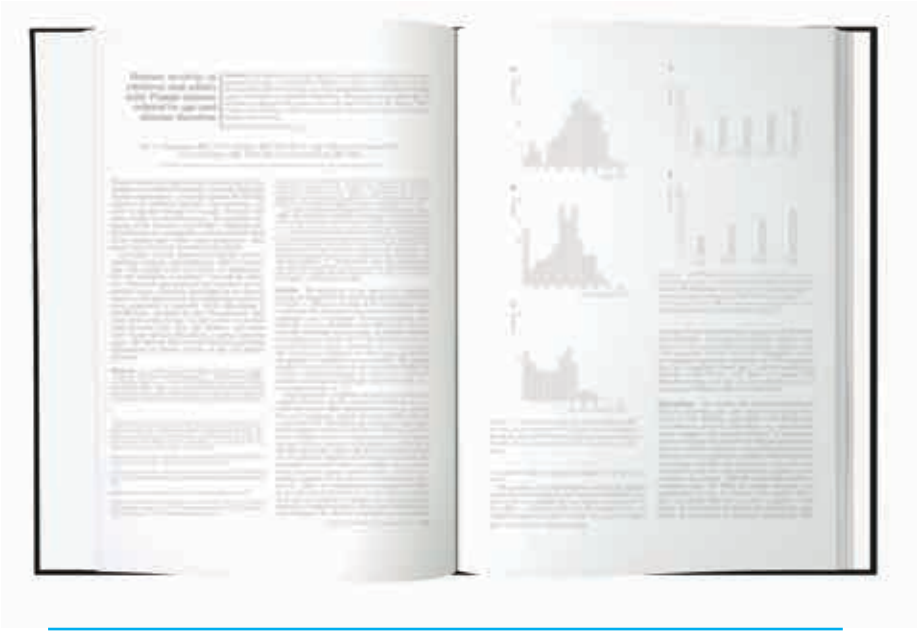
# Discussing a Science Journal Article

Disease severity in children and adults with Pompe disease related to age and disease duration http://amdapompe.ehclients.com/downloads/publications/Hagemans_Neurology_280605.pdf

Feel free to use any article. This one was selected to model because it is short and not very complicated, which will allow students to focus on the main parts and how to read an article rather than be burdened with jargon and methods during the introduction.

Things to point out:

1. Read the title: Disease severity in children and adults with Pompe disease related to age and disease duration.
2. Note the journal: Neurology. This is a peer-reviewed and highly respected journal.
3. Multiple authors contributed, indicating collaboration among many individuals. In this case, the funding for the project and the main research lab is indicated by the last name listed, Van der Ploeg.
4. In the bottom left, note the institutions represented, who funded the project, and potential conflict of interest. This information is telling regarding any bias that might be apparent or inadvertent.
5. Also, note the date the paper was originally received: Dec. 21, 2004. This is the date it was submitted to the journal. After going through peer review, suggested modifications are sent to the authors for the chance to revise. The revision is then either approved or denied publishing. In this case, it was accepted on March 23, 2005 and appeared in print in June, 2005.
6. The layout of papers differ. Each journal has its own way of arranging the text on the page, as well as specific sections they do or do not want included.



Each journal has its own way of arranging the text on the page, as well as specific sections they do or do not want included. Use the reading guide with the students, calling attention to each section and highlighting key points.

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The **Abstract** provides a nice summary of the paper.

- This one is particularly short, reflective of a short paper. 255 individuals with Pompe completed a survey to gather information about the natural course of the disease.

The **Introduction** gives a history of the topic and discusses what

others have found. It also poses the research question(s).

- The author devotes the first paragraph to a description of Pompe. This provides background. They then discuss what the current treatment available is – ERT is just in clinical trials (this is why it is important to note the date). The authors want to help determine the ideal time to administer the treatment, so they need to understand the natural course of the disease, particularly for individuals with late-onset.

**Methods and Materials** are most meaningful to those in the field who might want to repeat the research or to help clarify results. Skip this section, but note that as you become more experienced with reading primary sources, it can be helpful to return to this section to better understand some of the results and discussion.

- Interesting how tiny the font is for the methods section in this journal, indicating this section is really for those that need to know all the details of carrying out the experiment. Not necessary for our students to understand the paper.

**Results** are just that. There is no discussion or explanation. They are worth a glance, particularly if any tables are included that summarize the findings neatly. Just a skim of this section will suffice.

- Font size is increased a bit, but not as large as the introduction or conclusions. There are a lot of percentages given, and description of the figures. It does give some nice descriptions of the symptoms and pathologies affected individuals reported, and the age of onset.

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The **Discussion/Conclusion** is where the author explains what happened. In this section, the questions should be answered. This is usually where the author reflects on the work and its meaning in relation to other findings and to the field in general.

- General findings are discussed such as disease severity increases with duration. This is a progressive disease, so not unexpected. It was not correlated with age however, supporting the diverse set of symptoms that present at all ages. Other than the classic infantile form, all other forms are heterogeneous. They do point out the subset of children who were affected very young, as presenting more severe symptoms earlier and consistently: those who are respirator dependent, are likely to be wheelchair dependent. There concluding remarks suggest ERT should be started as early as possible, before "irreversible damage has occurred" such as muscle weakness requiring a wheelchair or respiratory assistance.

Add your own interpretations to these:

- What was the purpose of the study? Compile and analyze data about the natural course of Pompe disease (how does it progress in individuals not on enzyme replacement therapy?)
- What questions were asked? Is there a relation between age of onset, duration, and symptom severity?
- What were the final answers? Only in those presenting symptoms very young is there an expected course; all others present a mix of symptoms.
- What was unique about the study? Surveyed 255 patients, quite a large sample size for a disease so rare, to record the natural history of the disease with one standard questionnaire. Rather than piecing bits of case reports together for the literature, they were able to standardize the questions and therefore the results.
- What is the next step? Compare to the next generation who receives ERT. Does ERT make a difference in severity and duration? Can those who present symptoms early, be treated with enzyme replacement therapy and delay serious symptoms? For how long?

# Guide to Reading Scientific Papers

Scientific papers can be daunting, full of details and language that is unfamiliar. Scientific papers are best read and considered in small, manageable pieces. Unless you plan to repeat the experiment, you really just need to get the general idea of the questions and answers along with the big idea of the paper. As you become more comfortable with reading journal articles, you will naturally read for more depth and content. When starting out however, the key is knowing what to read, what to skim, and what to skip. Yes. There are parts of a paper that you can skip.

The paper is divided into sections, based generally on the scientific method. Most research papers contain the following sections: Abstract, Introduction, Methods/Materials, Results, Discussion, sometimes Conclusions, and References.

The **Abstract** provides a nice summary of the paper. It might have some unknown words or numbers, but it gives the overall flavor of the paper. It should be read and then re-read at the end.

The **Introduction** gives a history of the topic and discusses what others have found. It also poses the research question(s).

**Methods and Materials** are most meaningful to those in the field who might want to repeat the research or to help clarify results. Skip this section, but note that as you become more experienced with reading primary sources, it can be helpful to return to this section to better understand some of the results and discussion.

**Results** are just that. There is no discussion or explanation. They are worth a glance, particularly if any tables are included that summarize the findings neatly. Just a skim of this section will suffice.

The **Discussion/Conclusion** is where the author explains what happened. In this section, the questions should be answered. This is usually where the author reflects on the work and its meaning in relation to other findings and to the field in general.

Re-read the Abstract. Does it make more sense now? It should tie everything together.

Vocabulary. You may need to look words up if you can't figure them out using context clues. You can miss a really important point of the paper if you do not understand the language.

In summary:

- Absolutely read the Abstract, Introduction, Discussion, and then the Abstract again.
- Skim the results.
- Skip the methods/materials.

In the end, you want to be able to answer the following questions with some confidence:

- What was the purpose of the study?
- What questions were asked?
- What were the final answers?
- What was unique about the study?
- What is the next step?

# Guide to Reading Scientific Papers

NAME DATE

1. What was the purpose of the study?

2. What questions were asked?

3. What were the final answers?

4. What was unique about the study?

5. What is the next step?

Notes: