

# Target Reading of the Literature

Writing for Chemists  
CHEM 360  
Krishna L. Foster  
Monday April 2, 2007

## Types of Readers

Creators and critics  
of new ideas



Experts in  
training



**Experts**

Readers who are very knowledgeable about a topic.

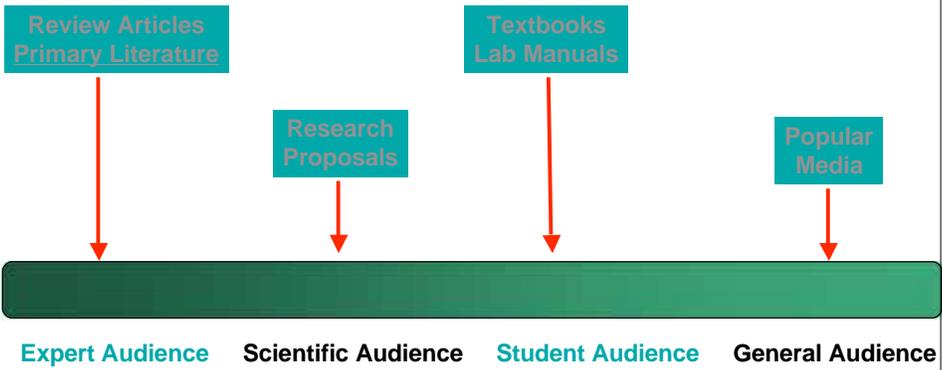
**Professional Scientists**

**Students**

**General Public**

Readers who have little, if any, knowledge about a topic

## Types of Scientific Literature



**Student Reader**  **Expert Reader**

Learn to read critically!

## Day One Outline

- Polycyclic aromatic hydrocarbon photodegradation background
- Dissection of a primary article
- Target reading techniques
- Application of target reading techniques to Bernstein, *Science*, 1999.

\* \* Notes on the motivations for PAH photodegradation studies have been omitted from the on-line version of this lecture.\* \*

## The Big Question

What is the role of solvent on the types and yields of PAH derivatives?

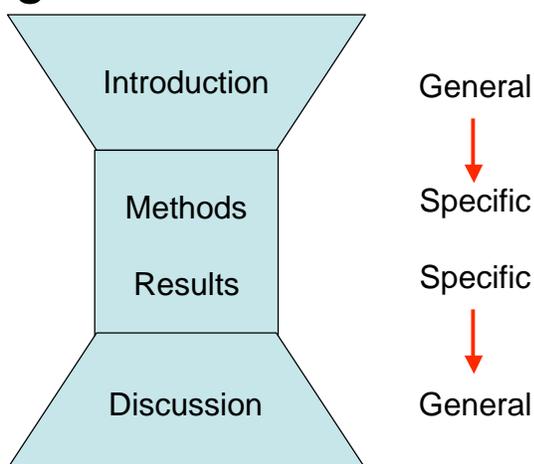
## Where Can We Learn More?

- Textbooks: Simplified statements of facts written to introduce general concepts to a student audience.
- Review Articles: Reflection on the current state-of-affairs in a specific sub-topic of chemistry (many citations).
- Primary Literature (peer-reviewed articles): new experiments, the results, and discussion of these results written for an expert audience.

## Primary Literature Case Study

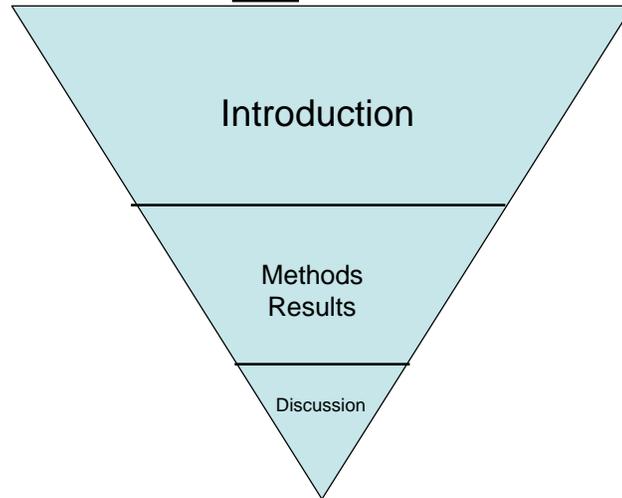
- Bernstein, M.P., S.A. Sandford, L.J. Allamandola, J.S. Gillette, S.J. Clemett, R.N. Zare (1999). "UV Irradiation of Polycyclic Aromatic Hydrocarbons in Ices: Production of Alcohols, Quinones, and Ethers." *Science* 283: 1135-1138.

## Hourglass IMRD Format



SOURCE: Robinson, M., Stoller, F., Jones, J., Costanza-Robinson, Fig. 2.1. *Write Like a Chemist* (Pilot Version, 2005-2006).

## How not to read!



## The Introduction

- Identifies the area of research to be reported, provides background information, cites and summarizes key literature in the field, points out what still needs to be studied, and introduces the reader to the work presented in the paper.

## The Methods

- (also known as Materials and Methods or the Experimental Section) describes how the study was performed.

## The Results and Discussion

- **Results**: summarizes quantitative and qualitative data collected during the study.
- **Discussion**: author's interpretation of their data and presentation of the larger implications or applications of their

**Heart of the critical reading process!!**

## Exercise

- **Number the paragraphs in the Bernstein paper. Which paragraphs form the introduction, methods, results, and discussion section? Read the topic sentences of each paragraph to identify these sections.**

Introduction: P1- 2 (12%)    Results: P6- 12 (41%)  
Methods: P3- 5 (18%)      Discussion: P13- 17 (29%)

## Targeted Reading

- Screening procedure used by busy people (*not* critical reading)!
- Target a given section to look for specific information before reading the article.
- Quickly answer three important questions:
  - 1. What is the study about?
  - 2. What methods were used?
  - 3. What conclusions were drawn?

## How to Target Read

- Read the title, abstract (synopsis), and key words
- Read the conclusions or last paragraph
- Quickly study figures
- Read subtitles or topic sentences

## EXERCISE

- With only a cursory glance at the title, abstract, key words, and the IMRD sections of the Bernstein article, determine the topic of research, the methods used, and summarize the conclusions. (Note: You should be able to identify the topic and methods, even if you do not understand them.)

<b>TOPIC:</b>	Formation of PAH derivatives by UV irradiation in water ice.
<b>METHODS:</b>	UV irradiated ices analyzed with Fourier transform infrared spectroscopy and microprobe laser desorption, laser ionization mass spectrometry.
<b>CONCLUSIONS:</b>	<p><b>(1)</b> UV irradiation → peripheral carbon oxidation → oxidized PAH alcohols, ketones and ethers, <b>AND</b> UV irradiation → reduced partially hydrogenated aromatic hydrocarbons. Implications for biogenesis.</p> <p><b>(2)</b> H and D exchange rapidly between PAHs and ice. May explain D enrichment in meteorites.</p>

## HOMEWORK

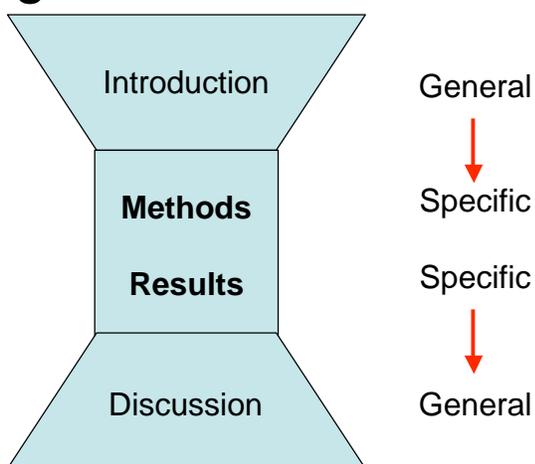
**Due: 04/04/2007, 9:30 AM**

Read the article again, this time paying closer attention to the results and discussion sections. Spend some time analyzing the data presented in the figures and tables to facilitate this process. Determine if the results support the conclusions stated in the paper. Underline sections that you do not understand. Be prepared to discuss ANY figure or table in the article.

# Critical Reading of the Literature

Writing for Chemists  
CHEM 360  
Krishna L. Foster  
Wednesday April 4, 2007

## Hourglass IMRD Format



## The BIG EXERCISE: Critical Reading

**Do the experiments support the conclusions stated in the article?**



**Dissect the methods and results to critique the article.**

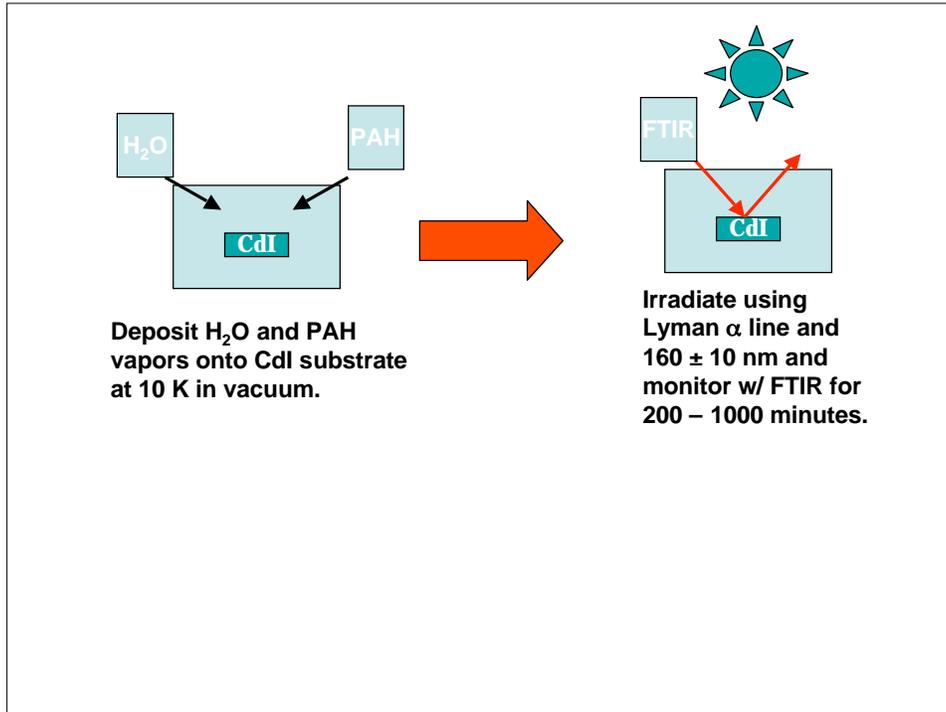
## Guide for Analysis of Tables and Figures

- What is the question being asked in the experiment?
- What experiment is being done to answer the question? What techniques are being used to carry out the experiment?
  - Do the techniques makes sense given the question being asked?
- What are the results of the experiment?
  - – and what should we be looking for in the figure?
- What conclusions does your group draw from the data?
  - Do your conclusions support the authors' claims?
- Additional questions or comments regarding the experimental design.

# Bernstein et al., 1999

## Table 1

- QUESTION → Functional groups on PAH photoproducts?
- EXPERIMENT/  
TECHNIQUES
- RESULTS:
- CONCLUSIONS:
- YOUR  
QUESTION?:



- FTIR examines vibrational molecular motion\*
- Measures % transmission through sample as a function of wavenumber (cm<sup>-1</sup>)\*
- Uses spectra to determine structural features of the sample.\*

NOTE: Images explaining each of these concepts are available at:  
<http://sis.bris.ac.uk/~sd9319/spec/IR.htm>

- QUESTION → Functional groups on PAH photoproducts?
- EXPERIMENT/  
TECHNIQUES → Sample vapor deposition in vacuum, UV irradiation, and FTIR spectroscopy analysis.
- RESULTS:
- CONCLUSIONS:
- YOUR  
QUESTION?:

Bernstein et al., 1999  
Table 1

- **QUESTION** → Functional groups on PAH photoproducts?
- **EXPERIMENT/ TECHNIQUES** → Sample vapor deposition in vacuum, UV irradiation, and FTIR spectroscopy analysis.
- **RESULTS:** → Wavenumbers used to identify structural features of photoproducts.
- **CONCLUSIONS:** → Confirmed presence of alcohols and ketones.
- **YOUR QUESTION?:** → How did they insure the surface temperature was the same as the substrate? Are the select wavelengths for irradiation representative of all possible forms of photoexcitation? Are the select wavelengths present in interstellar medium?

## EXERCISE

- Analyze each figure in groups, and determine if experiments support the conclusions.

**Bernstein et al., 1999**  
**Figure 1**

- **QUESTION** → Structural information of OH and O groups proposed in IR experiments?
- **EXPERIMENT/ TECHNIQUES** → Search for “mass spectrometry” for information on microprobe laser desorption laser ionization mass spectrometry ( $\mu\text{L}^2$  MS)
- **RESULTS:** →  $m/z$  representative of coronene, and coronene plus 1-3 oxygens.
- **CONCLUSIONS:** → Hydroxyl and oxygen functional groups possible on coronene.
- **YOUR QUESTION?:** → More oxygens observed with higher instrument sensitivity? Are the oxygens MS artifacts (soft ionization or space charge effects) or real? Other possible assignments for these masses?

**Bernstein et al., 1999**  
**Figure 2**

**Bernstein et al., 1999**  
**Figure 3**

**Bernstein et al., 1999**  
**Figure 4**