

Scientific Writing – Part II

CU- Boulder
CHEM-4181
Instrumental Analysis Laboratory

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Lecture will be posted on course web page

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The Parts of a Paper / Report I

- Cover Page
 - Title of experiment
 - Your name(s)
 - Date of the experiment
 - 1-paragraph abstract

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Example Cover Page

The Measurement of Polyaromatic Hydrocarbons (PAHs) in Cigarette Smoke

Performed and written by a student in the Spring 2000 class

March 13, 2000 and March 15, 2000

The concentration of naphthalene and benzo(a)pyrene in a cigarette smoke sample were evaluated using high-performance liquid chromatography (HPLC) with both fluorescence and absorbance detection. The best experimental method for this lab was determined by comparing the results for a 16 PAH standard using an isocratic solvent of 100% acetonitrile and a solvent gradient composed of a mixture of acetonitrile and water. Since the peak separation was more distinct in the solvent gradient method, this was the method used for the remaining standard and samples. Three calibration plots were made, two for benzo(a)pyrene and one for naphthalene. Both fluorescence and absorbance were used to make calibration curves for benzo(a)pyrene. However, since naphthalene is not fluorescent, only an absorbance plot was made for this PAH. A cigarette sample was prepared and analyzed in the HPLC. Only a naphthalene peak was seen in the absorbance chromatogram. From the calibration plot of naphthalene it was determined that there was 229 ng of naphthalene in 0.4453 g of the cigarette, or 514 ng in every 1.0 g of a cigarette.

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The Parts of a Paper / Report II

- Introduction
 - Background for the study
 - Why is your study of interest?
 - How does it relate to previous work in this field?
 - Why was the technique used appropriate?
 - Start broad, end with what you are doing

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Example Introduction

Introduction

The objective of this lab was to analyze two polyaromatic hydrocarbons in a sample of cigarette smoke using HPLC with both fluorescence and absorbance detection.

Polyaromatic hydrocarbons consist of any number of fused benzene and pentadiene rings. They are produced in the incomplete combustion of organic matter of all types.¹ PAHs are of concern in the environment since several are potent carcinogens.¹⁻³ The most notable is benzo(a)pyrene, which was first isolated in 1933 to check if this was a cause of cancer in coal tar workers.¹ PAHs are not cancer causing by themselves, instead, biochemical metabolic processes form epoxides as intermediates that can bind to DNA and cause mutations and cancer.⁴ It has recently been discovered that since PAHs are found almost entirely in the size of less than 2.5 μm diameter, they may be a contributor to asthma which affects many people.

HPLC with both fluorescence and absorbance detection was used since in the standards and cigarette sample the PAHs had to be dissolved in a liquid for analysis. Since the PAHs are not very volatile HPLC was the best way to analyze all standards and the cigarette sample. Both a fluorescent and absorption detector was used since benzo(a)pyrene is fluorescent and fluorescence is able to detect a lower concentration. This gives a better analysis of benzo(a)pyrene itself since one can compare the calibration plots between the two detectors.

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The Parts of a Paper / Report III

- Experimental
 - How you performed your study
 - Provide enough info for (knowledgeable) reader to duplicate your work
 - Instrument used, settings, etc.
 - Specific topics
 - Study design
 - Techniques used
 - Modifications of techniques
 - Blanks, duplicates, standards
 - Data processing

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Example Experimental

Experimental

All standards and samples were prepared as outlined in the lab manual. The 16 and 5 PAH standards were already prepared, along with the naphthalene and benzo(a)pyrene standards. The 16 PAH standard was used in the determination of the appropriate HPLC method to use. The peak separation was more distinct with the solvent gradient method than seen using an isocratic solvent, therefore, a solvent gradient was used for the lab. A sample of cigarette smoke from an unfiltered Camel cigarette was collected using a 50 mL Hirsch funnel connected to a vacuum. To remove and collect the residue from the frit, the extraction solvent, made by adding 5.0 mL of methanol to 5.0 mL methylene chloride, was poured onto the funnel. The funnel was then covered with parafilm to force the solvent through. This liquid was filtered using a 0.2 μm nylon filter. The solvent was dried with N_2 inert gas bubbling through the extracted sample. Finally, the evaporated sample extract was dissolved in 50 μL of acetonitrile. A spike was also prepared by using the 5 PAH standard and extracting in the same manner as the cigarette sample

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The Parts of a Paper / Report IV

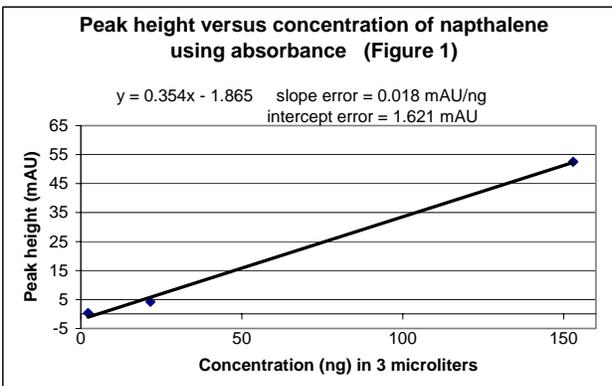
- Results & Discussion
 - Generally NOT raw data
 - Summarized in readable Tables & Graphs
 - Remember to label properly
 - Your analysis of what the data mean
 - A discussion of the reliability of your data
 - If data are reliable => a conclusion

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Example Results & Discussion

Results and Discussion

The average retention times found for naphthalene and benzo(a)pyrene were 5.82 ± 0.32 minutes and 14.19 ± 0.37 , respectively. These were found by averaging the retention times from the standard of each of the PAH along with the retention times found from the 16 and 5 PAH standard. From the chromatogram of the cigarette sample it is seen that only naphthalene was detected in the sample.



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ACS References Part I

• WEB SITES

- Author (if any). Title of Site. URL (accessed date).
- Chm 250 Homepage.
<http://www.bradley.edu/las/chm/Course/351> (1/21/2002).

• BOOKS

– Without Editors

- Author followed by title (in italics), publisher, year, and volume, chapter, and or page information.
- Brown, W.H.; Foote C.S. *Organic Chemistry*, 2nd ed.; Saunders: New York, 1998; p. 21.

– With Editors

- Author followed by title (in italics), editor, publisher, year, and volume, chapter, and or page information.
- *Organic Syntheses*, Coffin D.L., Ed.; American Chemical Society: Washington D.C., 1993; p. 6.

ACS References Part II

- **JOURNALS**

- Author followed by the abbreviated journal title (in italics), the year (in bold), the volume (in italics), and the first page of the article.
- Friessen, R. W.; Vanderwal, C. J. *Org. Chem.* **1996**, *61*, 9103.
- Thayer, A. M. *Chem. Eng. News* **1997**, 75(26), 10.

- **GOVERNMENT PUBLICATIONS**

- Author (may be an office) followed by the title (in italics), the agency, the printer, the date, and the government code for the document.
- Fish and Wildlife Service, *Impacts of Coal-Fired Power Plants on Fish, Wildlife, and their Habitats*. U.S.
- Department of the Interior, U.S. Government Printing Office: Washington, D.C. 1978; FWS/OBS-78/29.

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Achieving a Scientific Voice I

- Develop a precise vocabulary
 - As used in the field
 - Read the literature
- Be as precise as possible
 - Limit language
 - Once you define a word, keep using it
 - Define terms and assumptions
- Be honest about the evidence and limitations
 - Reader may come to yours or to different conclusions
 - Reader should be able to reproduce research

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Achieving a Scientific Voice II

- Do not include your feelings, opinions, impressions...
 - “perfect agreement”, “outstanding results”
- Label speculation as such
 - “We speculate that...”
- Proper reference format
 - Triple check!!
- Run a spell check and proofread

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The Science of Scientific Writing

- “If the reader is to grasp what the writer means, the writer must understand what the reader needs”
- Readers *interpret* based on structure

t (time)=15', T (temperature)=32°, t=0', T=25°;
t=6', T=29°; t=3', T=27°; t=12', T=32°; t=9';
T=31°

temperature (°C)	time (min)
25	0
27	3
29	6
31	9
32	12
32	15

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Example I

The smallest of the URF's (URFA6L), a 207-nucleotide (nt) reading frame overlapping out of phase the NH₂-terminal portion of the adenosinetriphosphatase (ATPase) subunit 6 gene has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene.

CQ: why is this sentence difficult to read?

- A. Requires specialized knowledge
- B. Technical vocabulary
- C. Sentence is too long
- D. Verb is too far from subject
- E. It is trying to do too many things

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Example II

Large earthquakes along a given fault segment do not occur at random intervals because it takes time to accumulate the strain energy for the rupture. **The rates at which tectonic plates move and accumulate strain at their boundaries are approximately uniform.** Therefore, in first approximation, one may expect that large ruptures of the same fault segment will occur at approximately constant time intervals. **If subsequent main shocks have different amounts of slip across the fault, then the recurrence time may vary, and the basic idea of periodic mainshocks must be modified.**

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CQ on Example II

- CQ: why is this passage difficult to read?
 - A. Technical vocabulary
 - B. No clear linkages between sentences
 - C. Sentences are too long
 - D. Verbs are too far from subject
 - E. It is trying to do too many things

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Discussion

- Readers expect the subject to be followed immediately by the verb
 - Need for resolution: without the verb, we don't know what the subject is doing
 - Anything in between S & V is treated as of lesser importance
- Readers expect every units of discourse (sentence, paragraph) to serve **ONLY** one purpose
- Interpretation is not fixed by writer, it is what the readers understand!
 - Have important writing proofread by colleagues or friends

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Discussion II

- The Stress Position (SP)
 - “Save the best for last”
 - Readers expect the important, exciting info to arrive at the end
 - A sentence is too long when it has more candidates for stress than SPs
- The Topic Position
 - “First things first”
 - Readers expect sentence to be a story about whoever shows up first
 - “Bees disperse pollen” vs. “Pollen is dispersed by bees”
 - Linkage (look back) and context (look forward)

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Improvements of Example I

- If material in the middle is not important:
 - The smallest of the URF's (URFA6L) has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene.
- Otherwise:
 - The smallest of the URF's is URFA6L, a 207-nucleotide (nt) reading frame overlapping out of phase the NH₂-terminal portion of the denosinetriphosphatase (ATPase) subunit 6 gene; it has been identified as the animal equivalent of the recently discovered yeast H⁺-ATPase subunit 8 gene.

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Improvements of Example II

Large earthquakes along a given fault segment do not occur at random intervals because it takes time to accumulate the strain energy for the rupture. The rates at which tectonic plates move and accumulate strain at their boundaries are roughly uniform. Therefore, nearly constant time intervals (at first approximation) would be expected between large ruptures of the same fault segment. [However?], the recurrence time may vary; the basic idea of periodic mainshocks may need to be modified if subsequent mainshocks have different amounts of slip across the fault.