

Metropolitan Preparatory Academy



Writing & Style Guide

Contents

INTRODUCTION

Academic Integrity & Plagiarism	Page 2
The Research Process	Page 3

WRITING THE ACADEMIC PAPER (LITERARY & ARGUMENTATIVE)

Characteristics of the Essay	Page 4
The Thesis	Page 5
Essay Outlines	Page 6-7
Essay Writing Rules	Page 8
Quotation Integration	Page 9

WRITING THE SCIENTIFIC RESEARCH PAPER

Structure & Format	Page 10
Figure / Table Integration	Page 10
Reference Integration	Page 11
Literature Cited Page	Page 12-14
Guidelines	Page 14

WRITING THE LAB REPORT

Structure and Format	Page 15-18
----------------------	------------

MLA (MODERN LANGUAGE ASSOCIATION) STYLE GUIDE

Embedded Citations	Page 18
Footnote / Endnote Citations	Page 19
Format & Examples for Footnotes & Endnotes	Page 20-21
MLA Reference List Page	Page 22

APA (AMERICAN PSYCHOLOGICAL ASSOCIATION) STYLE GUIDE

Embedded Citation	Page 25
APA Reference List Page	Page 26-27

APPENDIX A

Scientific Research Report Example	Page 28-41
------------------------------------	------------

APPENDIX B

Lab Report Example	Pages 42-48
--------------------	-------------

Academic Integrity & Plagiarism

Plagiarism Defined

Plagiarism is a deliberate deception. It is when you take the ideas, words, or works of others and claim they are your own without clearly acknowledging the source of that information.

Plagiarism in any paper that you hand in is the same thing as cheating and will lead to a mark of zero on the assignment.

You are plagiarizing if ...

- a) You copy another's work directly, only change around a few words or phrases, or change the order of the original's sentences.

AND / OR

- b) You fail to cite a source for the ideas or information you have included.

Forms of Plagiarism

- a) Direct copying of a published work verbatim.
- b) Presenting another person's work as your own.
- c) Un-credited paraphrasing (*when you adopt someone else's ideas but cannot put them into quotes because they are not verbatim*)
- d) Improper, inaccurate, or incomplete citation of your sources

Why is Plagiarism so bad?

Every teacher at Metro Prep assumes you will do honest work and that you will work with him or her to consistently improve upon work that is your own. The reality is that with the ease of getting work from other sources such as the Internet, you will be tempted.

However, your purpose in being in school is not to see how cleverly you can get away with not doing the work that is assigned to you. Your purpose is to train your mind and your selves to become more reliable and better thinkers. Presenting someone else's work as your own cheats you out of the ability to do this. It wastes yours and the teacher's time and it damages your reputation.

If you are ever unsure of whether or not to give credit to something – GIVE CREDIT!

The Research Process

Understanding the Assignment

Whenever you are given an assignment, always make sure you are entirely clear about what you are expected to do. Consider each of the following:

Expectations:

Length of the assignment

Marking criteria & how and where marks will be distributed

Precise format expected for the assignment

Due Dates:

Are stages of the assignment due at different times?

Set personal goals for how to manage your time to get the assignment done.

Record final due date

If any parts of the expectation or due dates are unclear or unmanageable, speak to your teacher as soon as possible.

Organization (Gathering & Recording Information)

While you are collecting information for your assignment, always make sure to record all the information about the sources you use. This will make it much easier to refer to this information in the assignment as well as in the reference lists of works cited. On a separate piece of paper, include the following information in your records:

Author's full name(s)

- Title of book or article
- Publication information (publisher, date of publication, place of publication)
- Page numbers
- Complete web address
- Date you visited the web site

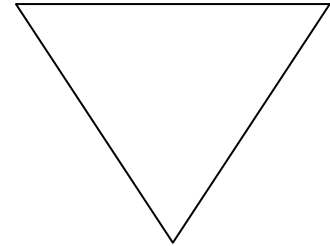
❖ **Further detail on proper referencing & citations can be found later in this guide.**

Writing the Academic Paper – Literary & Argumentative Essays

Characteristics of the Essay

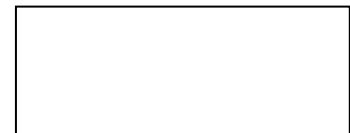
Introduction

- The introduction mirrors an inverted triangle, and follows the format of your ideas moving from general to specific.
- Your thesis is next – your arguable, academic opinion.
- Finally, you preview the three major ideas / arguments you will use to prove the stated thesis in the following THREE body paragraphs.



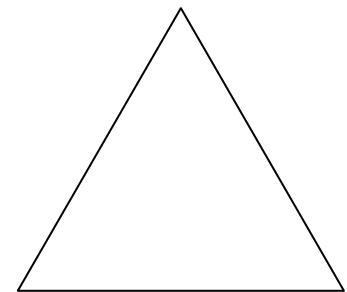
Body

- The following three body paragraphs mirror rectangles.
- Each paragraph should develop one of the arguments mentioned in the introduction that supports the thesis.
- Each paragraph must begin with a topic sentence that clearly states the topic the paragraph will discuss and how it is connected to your thesis.
- The rest of the paragraph supports the topic sentence with clear ideas, quotations from sources to support your argument, analysis of the evidence included to explain its significance in supporting your argument, transitions that move the argument smoothly within the paragraph, and a concluding sentence that returns to ideas in the topic sentence, your thesis, and leads to the next paragraph.
- There may be sub-paragraphs to support your main arguments.



Conclusion

- The concluding paragraph also mirrors a triangle and moves from specific to general in its format.
- Restate and rephrase the thesis (do not rewrite it word for word as it appears in the introduction).
- Review your three arguments again.
- Include a “statement of application” that attempts to suggest why it is important that your thesis is proved correct. How does your argument and your essay apply to our lives in general?



Newman, Garfield et al. Canada: A Nation Unfolding. Toronto: McGraw-Hill Ryerson, 2000.

The Thesis

What is a thesis?

The most essential element of a good essay is the thesis. The thesis tells the reader what your essay is trying to prove. It is a single, arguable sentence. A good thesis statement must be:

- Arguable and defensible
- Clearly stated, concise and specific
- An effective blueprint for the rest of the essay
- Not too general (“The novel explores the idea of life.”) or too specific (“The novel explores one character’s opinion about one note of one song”)

Developing a Thesis

Often, your thesis will be specifically dictated within the expectations of an assignment. Always make sure the thesis you have developed is acceptable with the teacher who has given the assignment.

In order to develop a good thesis, do the following:

- Brainstorm ideas about the topic.
- Write them down.
- Ask questions. Are there questions you have or ideas you’d like to explore further about the topic?
- Allow these questions lead you from obvious statements to arguable claims.
- Ask yourself, “So what?” Is the arguable claim you have developed interesting to yourself? To others?

Thesis Examples

EXAMPLE 1: “The main motivation for the exploration and sustained development of North America between the 16th and the 20th century has always been financial profit.”

EXAMPLE 2: “Shakespeare’s presentation of female characters in his play *The Taming of the Shrew* reveals more advanced notions of equality rather than sexism.”

Essay Outline

It is essential to plan your essay before you begin writing. It ensures the consistency throughout your essay and that your central thesis remains in focus throughout the paper. Use the following template to organize your essay.

Introduction Paragraph

Opening Sentence: _____
Thesis: _____ _____
Preview (The thesis will be proven through analysis of the following THREE arguments)
Argument 1: _____
Argument 2 : _____
Argument 3: _____

Body Paragraph 1

Topic Sentence: _____ (Highlight the link to the thesis and to the previewed topic in the sentence above)
<u>Specific Idea / Detail 1:</u>
Proof (quotation / citation):
Explanation of proof:
<u>Specific Idea / Detail 2:</u>
Proof (quotation / citation):
Explanation of proof:
<u>Specific Idea / Detail 3:</u>
Proof (quotation / citation):
Explanation of proof:
Concluding Sentence: _____ (Connect back to thesis & topic and lead to the next paragraph)

Body Paragraph 2

Topic Sentence: _____
(Highlight the link to the thesis and to the previewed topic in the sentence above)

Specific Idea / Detail 1:

Proof (quotation / citation):

Explanation of proof:

Specific Idea / Detail 2:

Proof (quotation / citation):

Explanation of proof:

Specific Idea / Detail 3:

Proof (quotation / citation):

Explanation of proof:

Concluding Sentence: _____
(Connect back to thesis & topic and lead to the next paragraph)

Body Paragraph 3

Topic Sentence: _____
(Highlight the link to the thesis and to the previewed topic in the sentence above)

Specific Idea / Detail 1:

Proof (quotation / citation):

Explanation of proof:

Specific Idea / Detail 2:

Proof (quotation / citation):

Explanation of proof:

Specific Idea / Detail 3:

Proof (quotation / citation):

Explanation of proof:

Concluding Sentence: _____
(Connect back to thesis & topic and lead to the next paragraph)

Conclusion Paragraph

General introduction of the conclusion:

Reworded /' restatement of thesis:

Summary of three arguments:

Statement of application:

Essay Writing Rules

Spacing

Essays should all be written in DOUBLE space. This leaves room for teacher's comments and distinguishes it from longer quotes in which you should use single space.

First Person

Be careful not to include any first person pronouns (I, me, my, we, us, our) in your essay. An academic essay requires you to objectify the positions and arguments you include. Rather than reducing your work to mere personal opinion, elevate it to objective truth.

Generalizations

Avoid broad statements or generalizations made without supporting evidence. They can easily be challenged, and they will weaken your overall argument.

Use of Tense

When you are discussing a story (literary text, play, or film) you always refer to events in the PRESENT tense. Events of a historical nature use the PAST tense. Avoid needless and confusing shifts in verb tense throughout the essay.

Emotion

Generally avoid overly emotional or judgemental statements. Maintaining a detached, universal perspective allows you to observe more clearly and argue more logically.

Formal Language

An academic essay requires formal language. In other words, avoid colloquial expressions (slang, idioms, swearing) and always refer to people either by their full names or by their last names.

Quotation Integration

The bulk of your paper should be your own thoughts and comments. Simply stringing a list of quotations together does not make a strong essay. You need to tell your reader what idea the quotation supports and why it is significant.

Short Quotations (3 lines or less)

Short quotations can be incorporated into your text in two ways:

1. Incorporated:

- Introduce the quotation with your own comments in a complete sentence.
- The quotation comes next, ending with your reference (embedded, footnote or endnote) and a period.
- After the quotation, explain the significance of the quotation in another full sentence.

2. Embedded:

- The quotation is part of your own sentence.
- Use a COMMA to introduce the quotation.
- The reference still occurs at the end of the sentence, before the period.

Long Quotations (4 lines or more)

- Introduce the quotation and its context with a full sentence, ending with a COLON.
- The quotation is indented 2 tabs on both sides of the page and single spaced.
- The quotation should end with a reference and a period.
- After the quotation, do not begin a new paragraph. Instead, in two or three sentences, explain the significance of the quotation you have introduced.

Paraphrase or Summary

- Explain the main points or claims of the idea you are summarizing in your own words. You may introduce your source as part of your sentence, but the reference still belongs at the end of the sentence before the period.

❖ **Do not end your paragraph with a quotation. The strongest statement is one made by you.**

Writing the Scientific Research Paper

Structure & Format Rules

- Your research paper should include a Title Page. The text of the paper, and references should appear on a separate page titled LITERATURE CITED. The pages should be stapled together, but do not put the paper in individual plastic cover sheets. They are a nuisance to the marker.
- Papers are to be TYPED and DOUBLE SPACED on 22½ X 28 cm paper. Margins – 3 cm left side; 2½ cm top, bottom, and right sides.
- The title page should contain the following information: the title of the paper, your name, the course, and the date (all centred on the page).

Figure / Table Integration

- Figures and tables should be placed in the text. Figures and tables should be referred to just before they appear and each should have a caption followed by the citation to credit the author. Each figure or table should be labeled separately (eg. Fig. 1, 2, etc. and Table 1, 2, etc.)

IN THE TEXT:

As illustrated in Figure 1, the tooth structure of ...

OR

Teeth are borne on dermal bone (Figure 1).

AT THE FIGURE:

When the figure is used exactly as shown in the reference work and the caption is the same OR modified, YOUR caption should read:

Fig. 1. Development of the tooth (Hyman 2009).

When you MODIFY the figure and the caption is the same OR modified YOUR caption should read:

Fig. 1. Development of the tooth (after Hyman 2009).

FIGURE CAPTIONS SHOULD BE PLACED BELOW THE FIGURE.

TABLE CAPTIONS SHOULD BE PLACED ABOVE THE TABLE.

Reference Integration

- In citing references, your goal should be to give your reader ALL the information he/she needs to trace the information you present to those sources in the literature which you yourself used.
- You are EXPECTED to use information obtained from the periodical literature (ie. journals, etc.) where new information is first reported, not only from textbook sources. These will likely be available on-line, but you may have to physically go to a reference library or university library (ie. like York or U of T campus). An important part of your grade depends on how well you research your topic and how well you use your references in the paper.
- You MUST cite the references you use as sources of information, whether you quote them or paraphrase them. This must be done both in the text of the paper at the point where you use it AND in the LITERATURE CITED. Only original ideas, observations, or data do not require citation.

If you do quote directly from a paper, it is imperative that you acknowledge the quote.

Lombard and Bolt (2010) state that “the standard view holds that a tympanic ear arose very early in tetrapod history...”

PLEASE NOTE: You should avoid direct quotation unless the issue is controversial and/or it is possible to misinterpret your source.

Embedded / In-Text Citations

- In the TEXT, when you cite a reference with only one author, use the following format:

Mayr (2012) has discussed the importance of geographic isolation on the evolution of new species.

OR

Geographic isolation is probably required to allow populations to differentiate into distinct species (Mayr 2012).

- If you wish to cite an author who has been cited by another author, the reference in the text should read:

Poston (in Ringrose 2008) postulates that ...

- HOWEVER, only the source article should appear in the LITERATURE CITED (ie. the article by Ringrose).

Literature Cited Page

- EVERY reference used must appear in the LITERATURE CITED. No journal articles or books should be cited which are not referred to either in the text or in the figures or tables.

Every citation should include:

A. – Author(s)

B. – Date

C. – Title

D. – Publisher and City (if a book) OR Journal title (abbreviated, if possible)

E. – Total number of pages (if a book) OR Volume number, Issue number (if given) and the first and last page numbers (if a journal).

- If you are unsure of how to abbreviate the journal you can look it up in the World List of Scientific Periodicals which you can simply google.
- References should be listed in alphabetical order according to the senior author's surname. When you use several papers by the same author(s), they should be listed according to date, oldest first. If there are several by the same author, published in the same year, they should be identified by subscript letters after the date both in the text and in the LITERATURE CITED.

❖ **References are not numbered and footnotes are not acceptable.**

BOOK CITATION

Nikolsky, G.V. 2011. The Ecology of Fishes. Transl. from Russian by L. Birkett. Academic Press, Inc., New York, N.Y. 352 pp.

JOURNAL CITATION

Mayr, E. 2012. Concepts of classification and nomenclature in higher organisms and microorganisms. *Ann. N.Y. Acad. Sci.* 56:391-7.

MULTIPLE AUTHOR CITATION

Regier, H.A., V.C. Applegate, and R.A. Ryder. 2007. The ecology and management of the walleye in western Lake Erie. *Great Lakes Fish. Comm. Tech. Rep.* 101 pp.

- PLEASE NOTE: In the text, the above multiple author citation (three or more) would have been cited as Regier et al. (2007) at the beginning of a sentence OR (Regier et al. 2007) at the end of a sentence. Et al is Latin for “and others”.

EDITED BOOKS WITH MULTIPLE AUTHORS

- If your information comes from an edited book where each chapter is by a different author(s), the citation in the text should be same as for single or multiple authors as shown above; however, the listing in the LITERATURE CITED section of your paper would be as follows:

Salt, G.W. and E. Zeuthen. 2009. The respiratory system. IN *Biology and Comparative Physiology of Birds*. Vol. 1. A.J. Marshall (ed.). Academic Press, New York, N.Y. 363-409.

INTERNET CITATION

Brown, I. E., 2011. The symptoms of Phenylketonuria. *J. Am. Genetics.* 40: 1-5.

- Internet source available at: <http://www.PKUsociety/clinpubs/html/fs.com>
- If there is no author available, use Anonymous in the author spot, for any citation (please limit yourself to only three (3) Anonymous sources).

PERSONAL INTERVIEW

- You may have an opportunity to interview an expert or other person; here is how you would cite them in your paper:

...there seems to be no geological evidence to suggest that the plains pocket gopher existed in Manitoba before the ice age (J. Dubois, pers. commun.)

- Then, later, after your LITERATURE CITED, provide this heading: PERSONAL COMMUNICATION and underneath it, list the person’s full name, occupation, title, city, and province, in this order, separated by commas.

PLEASE NOTE: Only the first word and any proper names occurring in the title of a journal article are capitalized. Book titles should have all principle words capitalized. Neither title should be underlined.

Guidelines

- ORGANIZE YOUR MATERIAL! Sub-headings are allowed to help with this.
- Write efficiently and concisely. Remember, your space is limited! Most of the grade will be based on the quality of the research and content of the paper, organization of content and efficiency of writing, originality of interpreting facts, and reaching conclusions.
- To a lesser, but still important extent, crediting your literature sources will enter into your grade.
- PROOFREAD YOUR PAPER! Read it over yourself several times and then try to get someone else to read it for you as well.
- If you are using special terminology, be sure you understand and use it correctly – provide a definition (in parentheses, immediately after the word) in the text.
- The Genus name of an organism is always capitalized and the species and subspecies names (if used) are ALWAYS lower case. Since you are typing, use italics for both.

Homo sapien sapien OR *Canis familiaris*

- ❖ **PLEASE NOTE:** The above is a commonly used method of handling citations in a formal scientific review paper. There are other styles that exist and you may encounter, but the format will be consistent within any given journal. Refer to the information on APA formatting later in this guide.
- ❖ See APPENDIX A at the end of this guide for an example of a well formatted Scientific Research Report

GUIDELINE FOR WRITING A LAB REPORT

The Purpose of a lab report is to communicate specific data that has been collected and to discuss what the data means.

The report should flow logically from the purpose to the conclusion.

The **layout of the report** will include the following

- Font size - 12
- Times New Roman or Calibri
- Double Spaced lines
- Headings are centred on the page
- Page number appear in the top right corner
- Material that was obtained from research must be referenced using APA format.
- NO COVER PAGE!!!

TITLE:

- Centred at the top of the first page using capital letters (Uppercase letters)
- The title should indicate exactly what was studied (including dependent and independent variables)
- In sentence case, centre your name, date submitted, course and teacher's name centred below the title.
E.g.)

DETERMINING THE PERCENTAGE COMPOSITION OF MAGNESIUM OXIDE

Jane Doe

November 10, 2009

[Chemistry 11 SCH3U- Debra McKelvey]

INTRODUCTION:

- Formal labs begin with an introduction. A good introduction should include all pertinent background information needed for a reader to understand the lab (e.g. definitions of terms used, pertinent scientific laws and theories, chemical equations, mathematical formulas, and so on).
- When appropriate, additional research must be cited using APA reference format.
- State clearly **the purpose** of the experiment (this is stated after the background information has been provided).
- You may also be required to include **a hypothesis** (a possible explanation for what you expect to observe, which can be adequately tested in the lab activity). If a hypothesis is required, include it immediately after the problem statement. A clear hypothesis statement is stated with an " IFTHEN..." sentence.

PROCEDURES

- The procedure must be written up in narrative style using **past tense passive**, describing “what was done” rather than “what you do.” For example, write “The apparatus was set up as directed” and appropriate observations were made.” Do not write statements such as “Set up the apparatus as directed” (present tense) or “We made appropriate observations” (active)
- Any equipment used must be mentioned as the procedure is written. (ie. 25.0 ml of hydrochloric acid was measured out using a graduated cylinder and poured into a 100 ml beaker.)
- **Do not list the materials**
- Any consumable materials used (including quantities) are mentioned as your narrative proceeds
- When a procedure requires a measurement to be make you must state this as well as where the data is to be recorded.
e.g.) The mass of the crucible, lid and magnesium oxide was determined and recorded in Table #1.
- A **FIGURE** many be included to show a set-up of the apparatus,
- The procedure should be detailed and should be written so that the experiment is reproducible.
- Remember safety precautions should be included in the procedures.

OBSERVATIONS

- If descriptive (**qualitative**) observations are required, they should be written up in proper sentences and should generally describe what was seen before (e.g. the reactants in a chemical reaction), during (changes that occurred during the experiment), and after (e.g. the chemical products) the experiment was completed.
- **Quantitative** data must be recorded in table form.
- Tables- formatted in chart-style format
- The **Table Title** is placed at the top of the table.

E.g.) **Table1: Measured Masses**

Objects	Mass (grams)
Clean empty crucible and lid	12.06
Crucible, lid and magnesium combined	17.06
Crucible, lid and magnesium oxide	20.35

DISCUSSION

- Write in past tense, narrative style.
- Restate the purpose of the experiment and then proceed to interpret the data explaining what it means.
- Calculations, when needed, are formatted as **FIGURES**. (e.g. if your experiment involved collecting data on mass and volume, and you are required to determine densities, you must show how you calculated the densities (using correct units and significant digits).
- A Figure is a text box.

Eg. The density of the unknown was calculated to be 2.47 g/ml as shown in Figure 1.

$\text{Density} = \text{mass (grams)} \div \text{volume (millilitres)}$ $\text{Density of the unknown} = 36.98 \text{ g} / 15.0 \text{ ml}$ $= 2.47 \text{ g/ml}$

Figure 1: Calculation of the Density of the Unknown

- Figures properly formatted and complete with necessary labels, units and graphics
- The **Figure Title** is placed at the bottom of the figure (see above)
- If you can best explain your results using a graph, you may also plot accurate graphs of quantitative data, whenever appropriate using a Figure format.
- Logical inclusion to answers to “Discussion Questions”/ “Analysis” are incorporated into your explanation as part of the narrative.
- When appropriate, refer to relevant outside research and use APA referencing style citations.
- Since no science activity is perfect, you must state the possible experimental errors that may have been made during your collection of data, and the impact that they had on your results and suggested improvements

CONCLUSION

- Restate the purpose of the experiment
- State all significant findings

References Cited

- A single list of all sources mentioned in the lab report
- Organized in alphabetical order by the first letter in the citation
- Use the APA format
- Resources must be appropriate to your grade-level or higher.

MLA (Modern Language Association) Style Guide

Academic papers in the arts and humanities (English, history, etc.) tend to follow MLA rules. Social and natural sciences tend to follow the rules of APA – to be discussed later in this guide.

Embedded Citations (used instead of footnotes or endnotes)

- Indicate the source for the quotation in brackets, in the text, before the period in the sentence.
- Footnote and endnote numbers are not used.

❖ **Remember that quotes should support what you say and not speak for you.**

Format and Examples

Source with an author and page number:

“As the sun became warmer, the snow vanished” (Shelly 132).

If no author is available, use the name or title which lists your source in the Reference List:

“Discussion can often detect bias” (Elements of English 107).

If no page number is available, list author only:

“Sorry, I made a liberal error” (McKelvey).

If you use two or more works by the same author, include the date in your reference:

“The table was still cluttered with the same cups” (Carver 1993 110).

For plays, list act, scene, and line numbers in numerals:

“To be or not to be, that is the question” (Shakespeare 3.3.67).

Footnote & Endnote Citation

- This system of documentation **does not** use parentheses embedded right in your text to cite sources.
- A number is placed at the end of the sentence before the period.
- The reader looks for that number at the bottom of the page (“footnote”) or at the end of the paper (“endnote”) to find complete documentation for that piece of information.

Footnotes

- When the information for a source is given at the bottom of the page it is called a “footnote.”
- Number notes consecutively, starting from 1, throughout your essay.
- Format note numbers as superscript numerals (i.e. raised slightly above the line like this¹) without periods, parentheses, or slashes.
- The numbers follow punctuation marks.

Endnotes

- When the information for a source is listed on a page at the end of the essay it is called an “endnote.”
- Number notes consecutively, starting from 1, throughout your essay.
- Follow the similar format as a footnote, but the entries are found on a separate page at the end of the essay.
- Your “Endnote” page is not the same thing as a “Works Cited” or “References” page. It is a separate page on which you must list every number used throughout the essay followed by a complete reference for it and the page the quotation was found on.
- Endnote page is the last page of your essay.
- On the endnote page, double space between entries, single space the entries themselves.
- Tab the first line in only.
- Entries ordered numerically by the order in which they appear in the essay.

Format and Examples for Footnotes and Endnotes

As footnotes, the following types of references should appear at the bottom of the page on which your references with superscript numerals appear. As endnotes, they should appear on a separate page at the end of the essay.

Books

For most purposes, the following elements must appear in the following order:

- i. Author's First Name
- ii. Author's Last Name
- iii. Title of Book
- iv. Place of Publication
- v. Publisher
- vi. Year of Publication
- vii. Page Reference is Found

Example

i. Michael ii. Okuda, iii. *Star Trek Chronology: The History of the Future*. (iv. New York: v. Pocket, vi. 1993.) vii. 208

Websites

Sources found on the web must include the following details:

- i. Author's First Name
- ii. Author's Last Name
- iii. Webpage / article Title
- iv. Website Title
- v. Date Article Published
- vi. Website Publisher (You may need to refer to the website's index or its footer. If you can't find this, leave it blank)
- vii. Date Website Visited
- viii. Complete Website Address / URL

Example

i. Alice ii. Park. iii. "Hope for Quitters." iv. Time Healthland. v. June 28 2010. vi. Time Incorporated. vii. April 15 2012. viii. <<http://healthland.time.com/2012/06/28/hope-for-quitters-scientists-devise-a-new-nicotine-vaccine/>>.

BOOK BY A SINGLE AUTHOR:

Michael Okuda. *Star Trek Chronology: The History of the Future*. (New York: Pocket, 1993.) 208

WEBSITE

Alice Park. "Hope for Quitters." Time Healthland. June 28 2012. Time Incorporated. April 15 2012. <<http://healthland.time.com/2012/06/28/hope-for-quitters-scientists-devise-a-new-nicotine-vaccine/>>.

BOOK BY TWO OR MORE AUTHORS:

Richard Baldwin et al. *Economic Geography and Public Policy*. (Princeton: Princeton UP, 2003.) 210

MAGAZINE, PERIODICAL, OR JOURNAL ARTICLE:

Alicia DiRado. "Trekking through College: Classes Explore Modern Society Using the World of Star Trek." *Los Angeles Times* 15 Mar. 1995: A3-A5.

FILM OR VIDEO:

Macbeth, Dir. Roman Polanski. Perf. Jon Finch, Francesca Annis, and Nicholas Selby. Columbia, 1971. DVD.

AN ARTICLE IN AN ONLINE PERIODICAL:

Athena Andreadis. "The Enterprise Finds Twin Earths Everywhere It Goes, But Future Colonizers of Distant Planets Won't Be So Lucky." *Astronomy* Jan. 1999: 64- . Academic Universe. Lexis-Nexis. B. Davis Schwartz Memorial Lib., Brookville, NY. 7 Feb. 1999 <<http://web.lexis-nexis.com/universe>>.

MLA Reference List Page

This is a list of all the sources you used in your research whether it is cited or not. You may want to distinguish work that you *did* cite from work that you *did not* by including works only consulted, (not cited) in a section called “Additional References”

The main characteristics of a works cited page are as follows:

- The list of Works Cited must be on a new page at the end of your text
- Entries are arranged alphabetically by the author's **last name** or by the title if there is no author
- Titles are *italicized* (not underlined) and all important words should be capitalized
- Single space each entry, but double space between entries
- Tab second and subsequent lines
- Include the type of source (Print, Web, Video, etc) at the end of the reference

❖ ***Punctuation is very important. Follow the examples exactly.***

Books

One Author

Mumford, Lewis. *The Culture of Cities*. New York: Harcourt, 1938. Print.

Two or Three Authors

Francis, R. Douglas, Richard Jones, and Donald B. Smith. *Destinies: Canadian History since Confederation*. Toronto: Harcourt, 2000. Print.

4 or more authors

Baldwin, Richard et al. *Economic Geography and Public Policy*. Princeton: Princeton UP, 2003. Print.

Anthology or Compilation

Abate, Corinne S., ed. *Privacy, Domesticity, and Women in Early Modern England*. Burlington, VT: Ashgate, 2003. Print.

Corporate Author

Organisation for Economic Co-operation and Development. *Action against Climate Change: The Kyoto Protocol and Beyond*. Paris: OECD, 1999. Print.

Electronic / Websites

Websites

Time Healthland. June 28 2010. Time Incorporated. April 15 2012.
<<http://healthland.time.com>>. Web.

Article on a Website

Park, Alice. "Hope for Quitters." Time Healthland. June 28 2012. Time Incorporated. April 15 2012. <<http://healthland.time.com/2012/06/28/hope-for-quitters-scientists-devise-a-new-nicotine-vaccine/>>. Web.

Articles / Periodicals

Article in a Newspaper or Magazine

Semenak, Susan. "Feeling Right at Home: Government Residence Eschews Traditional Rules." *Montreal Gazette* 28 Dec. 1995, Final Ed.: A4. Print.

Non Print Sources

Television or Radio Program

"Scandal of the Century." Narr. Linden MacIntyre. *The Fifth Estate*. CBC Television. 23 Jan. 2002. Television.

Sound Recording

Ellington, Duke. "Black and Tan Fantasy." *Music is My Mistress*. Musicmasters, 1989. CD.

Film, Video, DVD

The Shining. Dir. Stanley Kubrick. Perf. Jack Nicholson, Shelley Duvall. Warner Bros., 1980. Videocassette.

Work of Art / Photograph

Cassatt, Mary. *Mother and Child*. 1890. Wichita Art Museum, Wichita. *American Painting: 1560-1913*. By John Pearce. New York: McGraw, 1964. Slide 22.

Music / Sound Recording

Ellington, Duke. "Black and Tan Fantasy." *Music is My Mistress*. Musicmasters, 1989. CD.

[Reference examples found at <<http://library.concordia.ca/help/howto/mla.php>>]

APA (American Psychological Association) Style Guide

Embedded Citations (used instead of footnotes or endnotes)

- Indicate the source for the quotation in brackets, in the text, before the period in the sentence.
- Footnote and endnote numbers are not used.
- If no date of publication can be found, “n.d.” is placed in brackets

Format and Examples – Paraphrasing Information

Source with an author and page number:

Correct structure for an essay is fundamental (Collins, 2012).

According to Collins (2012), correct structure for an essay is fundamental.

Source from an organization or institution:

According to the Red Cross (2002)

Source from a website:

- The date included refers to when the page was last updated. DO NOT include the URL in embedded citation.

New technologies are now available (Crowe, 2012)

Format and Examples – Direct Quotations

Short Quotations:

- You need to include the author, year of publication, and the page number preceded by “p.”
“Correct Structure is fundamental,” (Collins, 2012, p. 18).

Long Quotations:

- Direct quotations that are longer than 40 words should be together in a single spaced text. Do not use quotation marks and indent the quote in 5 spaces.

Collins’ (2012) report discovered the following information:

Whereas ESL students found the lessons in grammar to be repetitive, native speakers were engaged and challenged by the material. The finding of the report suggest that future educational approached should be based on direct analysis of student needs. (p. 18, ¶ 5)

Electronic / Web Sources:

- On web sites that do not provide page numbers, refer to the paragraph number on the page that the quotation can be found. Use the paragraph symbol (¶) before the number. Also, include the date the site was updated.

Kady O'Mally (2012, ¶ 3) claims that the Canadian Cattlemen's Association attended the meeting.

APA Reference List Page

This is a list of all the sources you have referred to in the paper. Only references cited in the body of the paper should appear in this list. Regardless of format (film, print, sound recording, etc.) all sources are listed here ALPHABETICALLY.

The main characteristics of a works cited page are as follows:

- The list of Works Cited must be on a new page at the end of your text
- Entries are arranged alphabetically by the author's **last name** or by the title if there is no author
- Titles are *italicized* (not underlined) and all important words should be capitalized
- Year of publication is in parenthesis
- Single space each entry, but double space between entries
- First line is flush with left margin; Tab second and subsequent lines in 5 spaces.

❖ ***Punctuation is very important. Follow the examples exactly.***

Books

One Author

Bernstein, T. M. (1965). *The careful writer: A modern guide to English usage* (2nd ed.). New York, NY: Atheneum

Two Authors

Beck, C. A. J., & Sales, B. D. (2001). *Family mediation: Facts, myths, and future prospects*. Washington, DC: American Psychological Association.

Corporate Author

American Psychological Association. (1972). *Ethical standards of psychologists*. Washington, DC: American Psychological Association.

Anthology or Compilation

Gibbs, J. T., & Huang, L. N. (Eds.). (1991). *Children of color: Psychological interventions with minority youth*. San Francisco, CA: Jossey-Bass.

Electronic / Websites

Websites

Library and Archives Canada. (2008). *Celebrating women's achievements: Women artists in Canada*. Retrieved September 30, 2010, from <http://www.collectionscanada.gc.ca/women/002026-500-.html>

Article on a Website

Cooper, A., & Humphreys, K. (2008). The uncertainty is killing me: Self-triage decision making and information availability. *E-Journal of Applied Psychology*, 4(1). Retrieved from <http://ojs.lib.swin.edu.au/index.php/ejap/>

Articles / Periodicals

Article in a Newspaper or Magazine

Semenak, S. (1995, December 28). Feeling right at home: Government residence eschews traditional rules. *Montreal Gazette*, p. A4.

Non-Print Sources

Television or Radio Program

MacIntyre, L. (Reporter). (2002, January 23). Scandal of the Century [Television series episode]. In H. Cashore (Producer), *The fifth estate*. Toronto, Canada: Canadian Broadcasting Corporation.

Film, Video, DVD

Kubrick, S. (Director). (1980). *The Shining* [Motion picture]. United States: Warner Brothers.

- ❖ **Further current and changing resources on internet citation, refer to “Purdue Online Writing Lab”:** <<http://owl.english.purdue.edu/owl/resource/560/10/>>

[Reference examples found at < <http://library.concordia.ca/help/howto/apa.php>>]

An Investigation Into Multiple Sclerosis

Metropolitan Preparatory Academy

Thomas McKeown

Michael Oberpichler

May 25th 2012

SBI4U

Introduction:

Imagine an incurable disease that is very specific, but has abnormal characteristics. It likes to target developed countries, has a tendency to be race and gender specific when selecting its victim and this disease is so common that almost everyone knows its name (Millar 1977). Many fall victim to this tragic disease, 2.5 million to be exact (MS International 2012). This disease is known as Multiple Sclerosis and it is the most common disease of the nervous system. There is no cure, let alone the knowledge of its causes. The unknowns of this disease have produced this paper which explores the epidemiology of such a tragic disease through: its history, genetic, pathological and biochemical mechanisms, today's theories behind iodine, Calcitriol and sunlight deficiencies and today's treatments.

History:

Modern medicine did not take off until the 19th century. Before this time, many diseases were unknown. Nevertheless, symptoms of a specific disease were sometimes listed in literature. Multiple Sclerosis was no different, for it was first reported in medieval literature (Murray 2005, Rolak 2009). It was only until the late 1800s that scientist would accept Multiple Sclerosis as a specific disease (Rolak 2009). Moreover, it was not until the 20th century that scientists to have the knowledge and the technology to study Multiple Sclerosis in depth. However, at this time, scientists believed that Multiple Sclerosis was caused by a toxin because most damage was caused around blood vessels. A few years later, scientists found certain vaccines induced Multiple Sclerosis symptoms which caused the central question: was it due to a virus (Rolak 2009)? It was also suggested that bacteria were also the cause (Kuhn and Steiner 1917, Gay and Dick 1987). Then experiments proved blocked blood flow to the brain caused myelin to die, thus Multiple Sclerosis was thought to be a circulation problem (Rolak 2009).

The more “modern theories” came from the structure of DNA as proposed by Watson and Crick. For it caused Multiple Sclerosis to be seen in a new light: it is caused by a genetic problem since genes control the immune system. Then two more new theories emerged as a result: the first being white blood cells are attacking myelin and the second is altered antibodies are attacking myelin. Then in the 1990s, scientists made another new theory: genes (Rolak 2009). Today, the common thinking is the Multiple Sclerosis is an autoimmune based disease that makes the body’s immune cells (T-cells) attack myelin (Swank and Pullen 1977, MRSC 2002a, Foster 2006, NMSS 2012). However, the exact cause is still unknown (Foster 2006).

Background:

Myelin is a lipid and protein based substance that covers nerve fibres (see Figure 1). Nerve fibres carry signals to and from the brain and spinal cord. The nerve fibres need myelin in order to carry the signal across successfully the axon of the nerve. When myelin is damaged, the nerve impulses are inaccurate or broken (see Figure 2) (Foster 2006, Rolak 2009, NMSS 2012). Moreover, in the more severe cases, when the body attacks the myelin, the nerve fibres themselves could also be damaged in the process (NMSS 2012). This results in a variety of symptoms and severity that depend on the person (NMSS 2012). Multiple Sclerosis is broken up into many different kinds because the range of signs and severity of Multiple Sclerosis are so large (NMSS 2012). After the attacks (these attacks are formally known as ‘exacerbations’), the damaged myelin then forms scar tissues which are known as ‘sclerosis’ (hence giving its name) (Foster 2006).

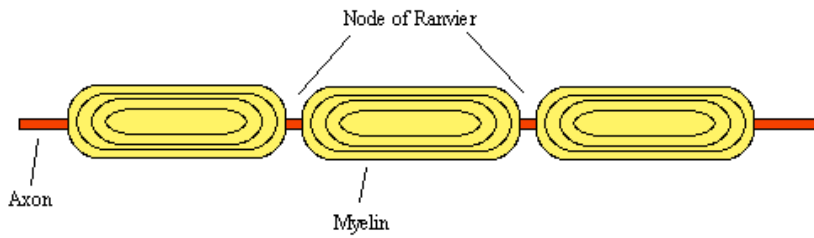
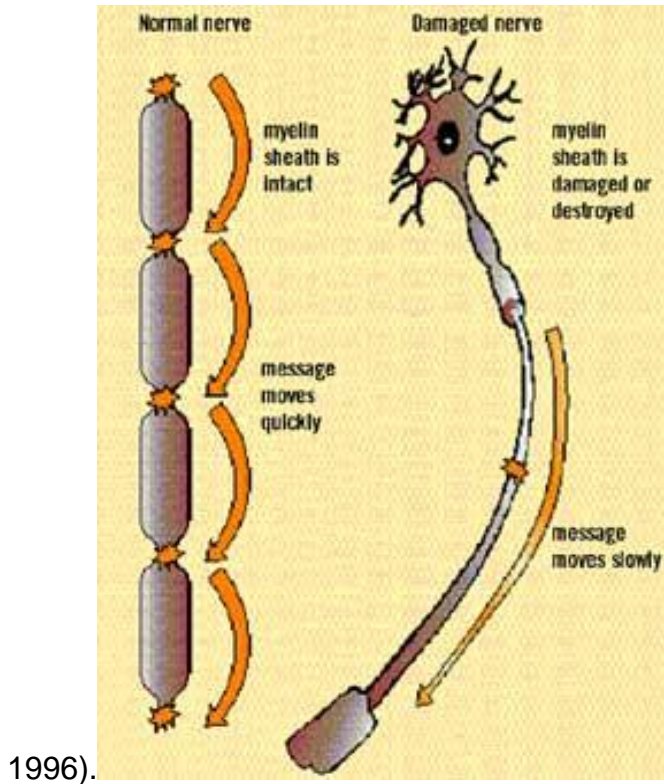


Figure 1: Part of a nerve cell (Chudler



1996).
 Figure 2: Comparing a healthy nerve (left) to one that has been affected by Multiple Sclerosis (right) (Mount Sinai 1997).

Causes:

Genetic Causes

As one can see, we do not know the exact cause and that is why there are many theories. For example, when we view Multiple Sclerosis as a genetic problem, there is strong evidence to support it: Chromosome 13's 19Q13 region has shown evidence of involvement (see Figure 3) (Schmidt et

al. 2002). When the scientific community crunched the data, they identified a total of eight regions based on their own scale that makes one susceptible to Multiple Sclerosis (TMSGC 2001).

Therefore, Multiple Sclerosis seems to be a multi-gene problem rather than a single dominant gene problem. However, if this was a solely genetic problem the following would have to occur: the defective genes would have to be widespread throughout the population due to its commonness.

There would be a global pattern and there cannot be rapid changes in the number of cases (Foster 2002). However, Multiple Sclerosis does not follow these three conditions. Therefore, it seems that genetics plays a role, but it is not the sole cause of the problem (Foster 2006).

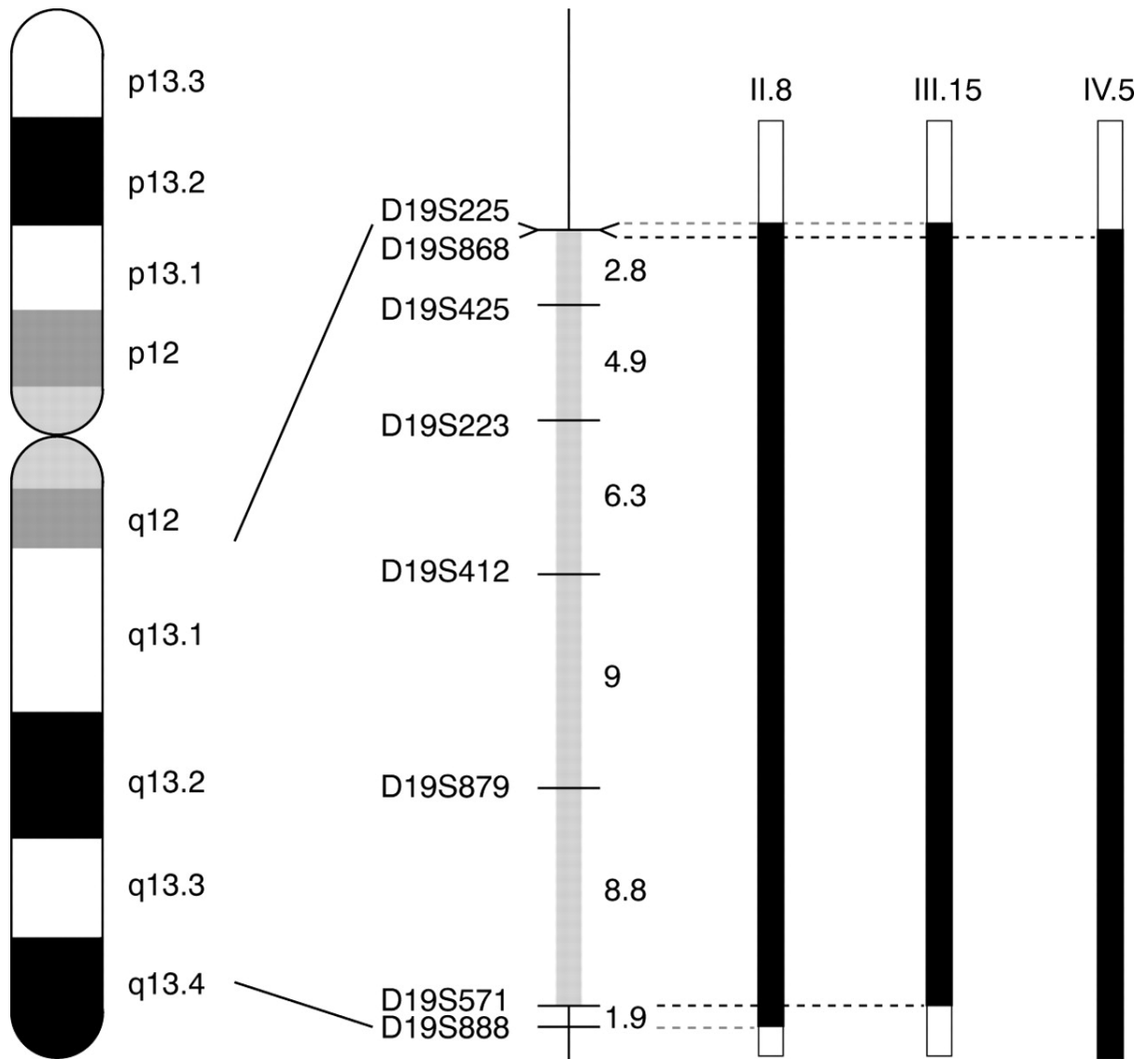


Figure 3: A picture of Chromosome 13 showing the 19Q13 region (Hul et al. 2000).

Microbial causes

If genetics is not the main culprit, could pathogens be? There is strong evidence: there have been rare epidemics of Multiple Sclerosis. For example, during world war two, when troops occupied location that did not have any cases of Multiple Sclerosis prior to occupation, there have been spontaneous outbreaks afterwards (Foster 2006). Moreover, Multiple Sclerosis patients have many of the same viruses and bacteria in them, such as rickettsia (McAlpine et al. 1972). Sadly, to be a pathogen, the statistics are too low for direct human to human transfer. (McAlpine et al. 1972) Yet there is a possibility of an animal to human transfer or even be subclinical transfer (Foster 2006). What we do know about Multiple Sclerosis' pathology is that it cannot be bacterial because it fails the Koch's postulate (Shevell and Evans 1994).

Iodine Deficiency

By analyzing geographical, medical and biochemical data, we currently believe iodine is the problem indirectly. Iodine is needed in the thyroid gland in order to produce thyroid hormones which are important for the growth and maintenance of nerves, especially myelin (Xue-Yi et al. 1994, Glinioer 1997, Oppenheimer and Schwartz 1997, Mitchell et al. 1998, Haddow et al. 1999, Foster 2006, Lazarus et al. 2012).

Also a lack of iodine means a lack of triiodothyronine (a thyroid hormone) which causes less oligodendrocyte cells to be made. These cells are used to repair damaged myelin. (Zychwardowska 2001) Moreover, a lack of thyroid hormones causes an abnormal need for

dopamine (Crocker et al. 1986). Dopamine is vulnerable to uncharged molecules that oxidise themselves which are not neutralised by antioxidants. When Dopamine breaks down, it forms toxins (e.g. dopachrome) that kill oligodendrocytes (Khorchid et al. 2002). Thus myelin cannot repair itself.

The reason why we believe iodine is indirectly the cause is because when the USA introduced iodised salt, the rates of Multiple Sclerosis did not change. However, since Multiple Sclerosis occurs in one's childhood, an infant could be fed iodine deficient breast milk (Foster 2006). Thus the risk is being exposed to bad milk before an intake of salt. Another theory states that the child could be deprived of certain vitamin(s) which needs thyroid hormones in order to be converted from their raw forms; such as Vitamin A (Warren 1984). Thus children were exposed to an iodine deficient diet before they were introduced to iodised salt. Moreover, there is a link between thyroid malfunctions and environment changes (Zycwardowska 2001). Since the global distribution of iodine varies by latitude, whereby the most concentrated areas are closer to the equator (Foster 2006), this seems extremely likely.

Sunlight and Calcitriol Deficiency

The last belief is the lack of sunlight because sunlight somehow protects oneself from Multiple Sclerosis (Kalafatova 1987, Laborde et al. 1988). Geographical evidence points to sunlight, as shown in Figure 4 (MRSC 2002b). This leads to the central question: is sunlight a direct or indirect cause? The answer to that question is still unknown and research has yet to discover the answer. However, the current wave of thinking is indirect. When the sun produces UVB light, it changes 7-dehydrocholesterol (a form of cholesterol which is found in the skin) into a raw form of

vitamin D3 which needs further processing in the liver. The liver processes it into 25-hydroxyvitamin D (“25(OH)D”) which is a prehormone that is then shipped to the kidney. The kidney then makes the final product called 1, 25-hydroxyvitamin D3 (“Calcitriol” or “1,25(OH)2D”) (Johnston 2005, Anthony et al. 2007). Calcitriol is the scientific term for vitamin D. Please Refer to Figure 5 for a visual representation.

What makes vitamin D so special is that it works directly with parathyroid hormones. It works with parathyroid hormones in order to regulate the body, such as calcium levels in the bloodstream. However, in recent years, Vitamin D on its own has been shown that it has many biological effects in a number of different areas (Foster 2006). Such examples include regulating T-cells’ function and its helpers: T-helper cells (called Th1) (Cantorna and Mahon 2004). Thus a lack of sunlight means a lack of vitamin D which means a lack of regulation of important cells, calcium levels, and other important biological functions. This notion is the current wave of thinking.

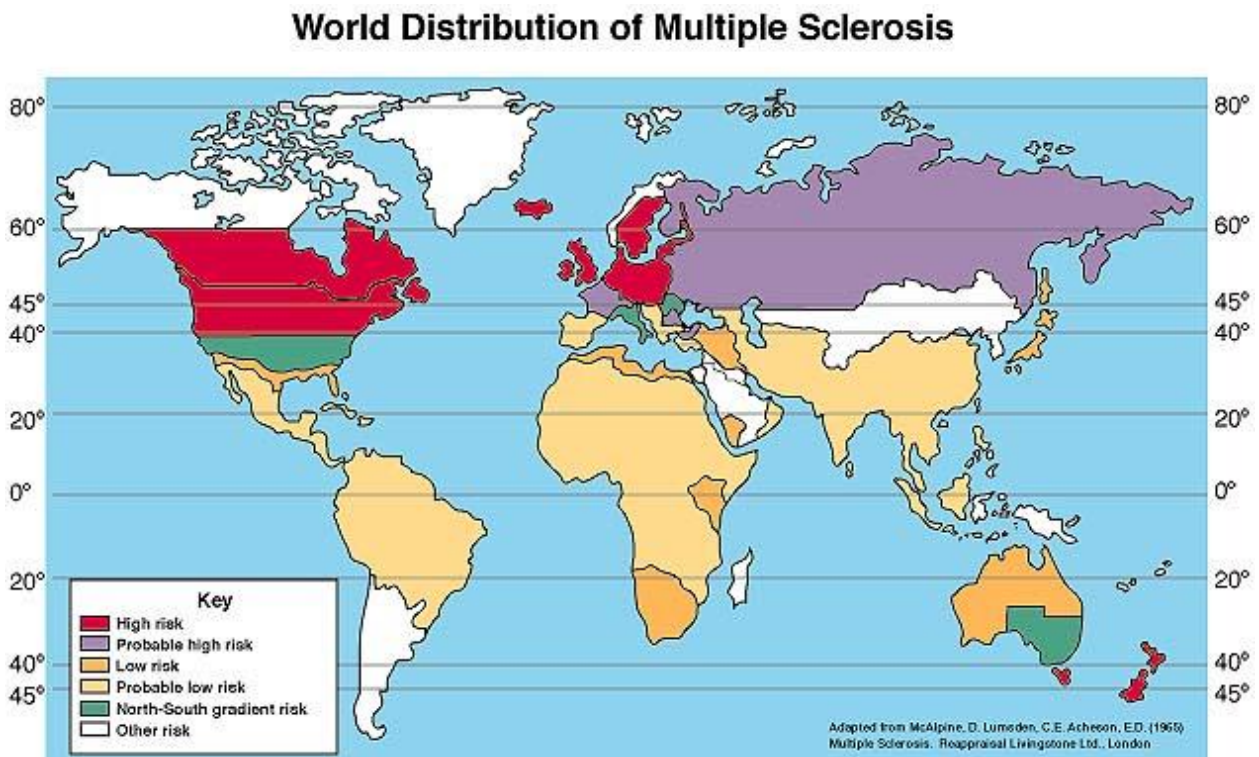


Figure 4: The Global distribution of Multiple Sclerosis (MRSC: Geography 2002).

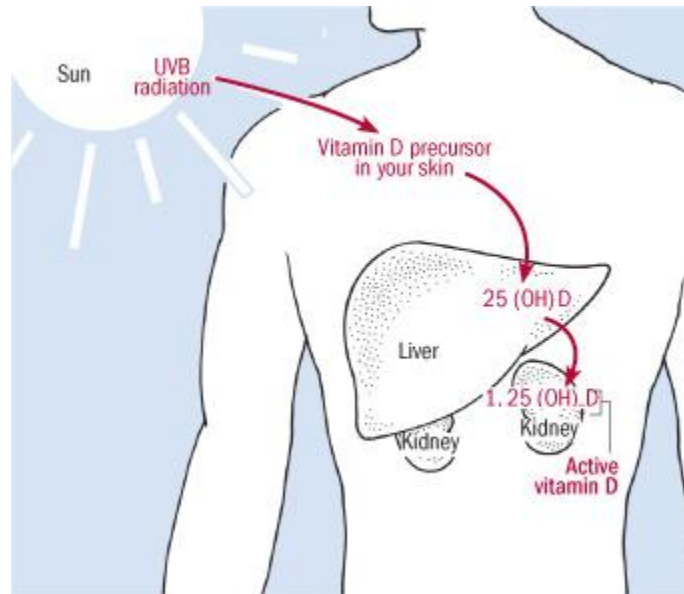


Figure 5: How UVB is turned into Vitamin D (Anthony et al. 2007).

Cures:

Currently, there is no cure to Multiple Sclerosis. However, one might not be able to prevent Multiple Sclerosis or fix the damage cause by the disease, but one can slow down its progression. Some drugs, such as Novantrone, restrain the immune system. It is interesting to note that its main use is in cancer treatment. Others such as Interferon beta-1b (e.g. Betaseron) reduce the number of attacks and the amount of damage caused. However, there are mild side effects. For example, in the case of Betaseron, roughly 25% of its users will develop antibodies towards this drug, making it useless. Some drugs mimic myelin proteins in order to act as a substitute, such as Copaxone (Nancy et al. 2007).

Conclusion:

As one can see, Multiple Sclerosis is intertwined into human history. Man has documented it since medieval times and has formally studied it for hundreds of years. The causes have yet to be determined and there is not a cure in sight. The reason being Multiple Sclerosis is a difficult disease to pinpoint because it has many variables, such as genetics, environment, etc.. Scientists are developing reasonable theories, such as a lack of iodine, sunlight or even vitamin D. But scientists are still uncertain of the exact cause. Therefore scientists are having a hard time finding a cure because they do not know what to target. With enough funding, willpower and time, Multiple Sclerosis will be a thing of the past. But until then, victims of such a tragic disease must accept their fate and use the temporary solutions available to them.

Literature Cited:

- Anthony, L.K, B.S. Harvey, K.S. Laing, P.T. O’Gara, G.H. Daniels, S.J. Rosenberg, C.M. Coley, S.E. Goldfinger, R.S. Phillips, M.B. Garnick, J.M. Siliski, G.W. Randolph, E.L. Giovannucci, G.L. Fricchione, W.U. Shipley, W.C. Dewolf, N.M. Heney and E.H. Coburn .2007. Vitamin D and your health: Breaking old rules, raising new hopes. Retrieved from <http://www.health.harvard.edu/newsweek/vitamin-d-and- your- health.htm>.
- Cantorna, M.T. and B.D. Mahon. 2004. Mounting evidence for vitamin D as an environmental factor affecting autoimmune disease prevalence. *Experimental Biology and Medicine*, 229(11), 1136-1142.
- Chudler, E.1996. Saltatory conduction. Retrieved from <http://faculty.washington.edu/chudler/salt.html>.
- Crocker, A.D., D.H. Overstreet, and J.M. Crocker.1986. Hypothyroidism leads to increased dopamine receptor sensitivity and concentration. *Pharmacology, Biochemistry and Behaviour*, 24(6), 1593-1597.
- Foster, H.D. 2002. Why the preeminent risk factors in sporadic Alzheimer’s disease cannot be genetic. *Medical Hypotheses*: 59(1): 57-61.
- Foster, H.D. 2006. What really causes multiple Sclerosis. Foster Foundation: 1-197
- Gay, D., and Dick, G.1987. Is Multiple Sclerosis caused by an oral spirochete? The evidence. In F.C. Rose and R. Jones (Eds.), *Multiple Sclerosis: Immunological, diagnostic and therapeutic aspects*. 72-77
- Glinoeer, D.1997. The regulation of thyroid function in pregnancy: pathways of endocrine adaptation from physiology to pathology. *Endocrine Reviews*. 18:404.
- Haddow J.E, G.E. Palomaki, W.C. Allan, J.R. Williams, G. J. Knight, J. Gagnon, C.E. O’Heir, M.L. Mitchell, R.J. Hermos, S.E. Waisbren, J. D. Faix and R. Z.Klein. 1999. Maternal thyroid deficiency during pregnancy and subsequent neuropsychological development of the child. *New England Journal of Medicine*. 341:549-555.
- Hul, V.W., K. Janssenset, R. Gershoni-Baruch, E. V. Hul, R. Brik, N. Guanabens, N. Migone, L.A. Verbruggen, S. H. Ralston, M. Bonduelle, L. V. Maldergem and F. Vanhoenacker. 2000. Localisation of the gene causing diaphyseal dysplasia Camurati-Engelmann to chromosome 19q13, *Journal of Medical genetics*. (volume 37 Issue 4). Retrieved from <http://jmg.highwire.org/content/37/4/245.full>.
- Johnston, L. 2005. Sunlight, vitamin D and health. Retrieved from <http://www.healingtherapies.info/Sunlight&VitaminD.htm>

- Kalafatova, O. 1987. Geographical and climate factors and Multiple Sclerosis in some districts of Bulgaria. *Neuroepidemiology*. 6(3): 116-119.
- Khorchid, A., G. Frago, G. Shore and G. Almazan. 2002. Catecholamine-induced oligodendrocyte cell death in culture is developmentally regulated and involves free radical generation and differential activation of caspase-3. 40(3): 283-299.
- Kuhn, P., and Steiner, G. 1917. Über die Ursache der multiplen Sklerose. *Med. Klin.* 13:1007.
- Laborde, J.M., W.A. Dando and M.L. Teetzen. 1988. Climate, diffused solar radiation and Multiple Sclerosis. *Social Science and Medicine*. 27(3): 231-238.
- Lazarus, J.H., J.P. Bestwick, S. Channon, D. Clin, R. Paradise, A. Mania, R. Rees, E. Chiusano, R. John, V. Guaraldo, M.S. Chem, L.M. George, M. Perona, D. Dall'amico, B. Parkes, M. Joomum and N. J. Wald. 2012. Antenatal thyroid screening and childhood cognitive function. *New England Journal of Medicine*. 366:493-498.
- McAlpine, D., C.E. Lumsden and E.D. Acheson. 1972. Multiple Sclerosis: A reappraisal. 65-399
- Millar, J.H.D. 1977. Multiple Sclerosis: Introduction. *British Medical Bulletin*. 33(1): 1-3.
- Mitchell, J.H., F. Nicol, G.J. Beckett and J.R. Arthur. 1998. Selenoprotein expression and brain development in preweanling selenium- and iodine-deficient rats. *Journal of Molecular Endocrinology*, 20(2), 203-210.
- Mount Sinai. 1997. Multiple Sclerosis. Retrieved from <http://www.mountsinai.on.ca/care/ebffrc/ms>.
- Multiple Sclerosis Resource Centre (MSRC). 2002a. About MS. Retrieved from <http://www.msrc.co.uk/index.cfm/fuseaction/show/pageid/6>
- Multiple Sclerosis Resource Centre (MSRC). 2002b. The Geography Of Multiple Sclerosis. Retrieved from <http://www.msrc.co.uk/index.cfm/fuseaction/show/pageid/2325>. Data generate from McAlpine, D., C.E. Lumsden and E.D. Acheson. 1965. Multiple sclerosis: a reappraisal.
- MS International Federation. 2012. Quick Facts. Retrieved from <http://www.msif.org/print.rm?id=40>.
- Murray, T.J. 2005. Multiple Sclerosis: The history of a disease. 89-91
- Nancy, J.H, T.J. Murray, J. Holland and S.C. Reingold. 2007. Multiple Sclerosis: A Guide for the Newly Diagnosed. 18-21

- National Multiple Sclerosis Society (NMSS).2012. retrieved from <http://www.nationalmssociety.org/about-multiple-sclerosis/what-we-know-about- ms/what-is-ms/index.aspx> .
- Oppenheimer J.H and Schwartz H.L. 1997. Molecular basis of thyroid hormone-dependent brain development. *Endocrine Review* 18:462-475.
- Rolak, L.A. 2009. The history of Multiple Sclerosis. Retrieved from <http://www.nationalmssociety.org/multimedialibrary/brochures/general-information/index.aspx>.
- Schmidt, S., L. F. Barcellos and K. DeSombre, J.B. Rimmmler, R.R. Lincoln, P. Bucher, A. M. Saunders, E. Lai, E. R. Martin, J. M. Vance, J. R. Oksenberg, S. L. Hauser, M. A Pericak-Vance and J. L. Haines.2002. Association of polymorphisms in the apolipoprotein E region with susceptibility to and progression of Multiple Sclerosis. *American Journal of Human Genetics*, 70(3), 708-717.
- Shevell, M. and B.K. Evans. 1994. The “Schaltenbrand experiment,” Würzburg, 1940: Scientific, historical and ethical perspectives. *Neurology*. 44: 350-356.
- Swank, R.L. and Pullen, M.H. 1977. *The Multiple Sclerosis diet book*. 81-105
- Transatlantic Multiple Sclerosis Genetics Cooperative (TMSGC).2001. A metaanalysis of genomic screens in Multiple Sclerosis. *Multiple Sclerosis*. 7(1): 3-11.
- Warren, T.R. 1984. The increased prevalence of Multiple Sclerosis among people who were born and bred in areas where goitre is endemic. *Medical Hypotheses*. 14:111-114.
- Xue-Yi, C., J. Xin-Min, D. Zhi-Hong, M. A. Rakeman, M. Zhang, K. O’Donnel, T. Ma, K. Amette, N. DeLong and G. R. DeLong. 1994. Timing of vulnerability of the brain to iodine deficiency in endemic cretinism. *New England Journal of Medicine*. 221:1739-1744
- Zychwardowska, E. 2001. Blood levels of selected hormones in patients with Multiple Sclerosis. *Medical Science Monitor*. 7(5): 1005-1012.

Appendix B:

THE EXPERIMENTAL DETERMINATION OF THE PERCENTAGE COMPOSITION OF MAGNESIUM OXIDE

Jane Doe

November 15, 2011

{Chemistry 11 – SCH3U- Debra McKelvey}

INTRODUCTION

Magnesium oxide is an ionic compound that is produced when magnesium metal reacts with oxygen as shown in the balanced equation $2 \text{Mg} (s) + \text{O}_2 (g) \rightarrow 2 \text{MgO} (s)$. This reaction, which is a high temperature process, is both a synthesis and combustion reaction. Magnesium is an alkaline earth metal that when heated to a high temperature will ignite giving off a bright light. Once ignited it is difficult to extinguish. In the past magnesium flames have been used in photography flash bulbs and are presently used in fireworks and pyrotechnics (Winter, n.d., ¶ 1). The flame is so bright that looking directly at the flame, without protective glasses, is harmful for the eyes. The purpose of performing this laboratory experiment was to experimentally determine the percentage composition of magnesium oxide. Percentage composition is the percent by mass of each element in a compound. If there were no experiential error then the percentage composition of the magnesium should be 60% and the oxygen 40% by mass as calculated in Figure 6.

PROCEDURES

Due to the nature of the bright light given off by burning magnesium, special goggles that block ultraviolet light were used instead of original goggles. A lab apron was also worn and all loose clothing and long hair was tied back due to the use of an open flame.

A retort stand, iron ring, clay triangle and burner were assembled as shown in Figure 1.

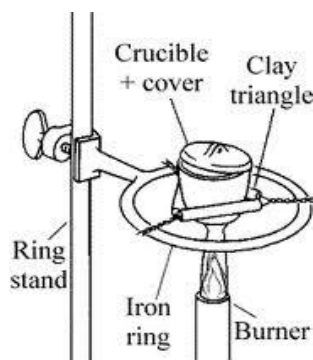


Figure 1:

The mass of an empty crucible and lid was determined using a centigram balance and the mass was recorded in Table I. An 8 cm strip of magnesium, which had been previously brushed with sandpaper to remove any possible oxide coating and rubbed with a dry paper towel to remove any residue, was obtained. The magnesium strip was placed inside the crucible and again the centigram was used to measure the mass of the crucible, lid and magnesium. This mass was also recorded in Table 1. With the lid off the crucible containing the magnesium was placed on the clay triangle. The burner was lit and the crucible was heated with a hot flame. Using crucible tongs, the lid was held close by and was placed on the crucible as soon as the magnesium strip ignited. The lid was left on the crucible for one minute. Using the crucible tongs the lid was slightly and briefly lifted to allow more oxygen into the crucible so the magnesium strip would reignite. Caution was taken not to allow smoke to escape the crucible. Once the magnesium reignited the lid was placed over the crucible for another minute. The process of heating the magnesium, reigniting the magnesium, lifting and closing the lid continued until the magnesium no longer ignited. At this point, the crucible, with the lid off, was heated for 4 to 5 more minutes. The burner was then extinguished. The crucible was transferred, using the crucible tongs, to a ceramic pad where the lid was again placed on top and the lid and crucible were allowed to cool for fifteen minutes.

When the crucible and lid had cooled enough to be touched, they were transferred to the centigram where their mass was measured. This mass was recorded in Table 1.

The product magnesium oxide was disposed of in the appropriate container.

OBSERVATIONS

Table 1: Measured Masses

Materials Massed	Mass (grams)
Mass of clean empty crucible and lid	22.30
Mass of crucible, lid, and magnesium (Mg)	22.40
Mass of crucible, lid, and magnesium oxide (MgO)	22.45

The magnesium strip was silvery-grey in appearance. When ignited the flame was very white and bright. The resultant product was a greyish white powder.

DISCUSSION

The purpose of the experiment was to determine the percentage composition of magnesium oxide. The mass of magnesium, Mg, used was 0.10 grams as calculated in Figure 2.

$$\begin{aligned}\text{Mass of Mg} &= (\text{Mass of Mg, crucible and lid}) - (\text{Mass of crucible and lid}) \\ &= 22.40 \text{ grams} - 22.30 \text{ grams} \\ &= 0.10 \text{ grams}\end{aligned}$$

Figure 2: Calculation of Amount of Magnesium Used

The amount of magnesium oxide, MgO, produced was 0.15 grams as calculated in Figure 3.

$$\begin{aligned}\text{Mass of Magnesium oxide} &= (\text{Mass of MgO, crucible and lid}) - (\text{Mass of crucible and lid}) \\ &= 22.45 \text{ grams} - 22.30 \text{ grams} \\ &= 0.15 \text{ grams}\end{aligned}$$

Figure 3: Calculation of Amount of Magnesium Oxide produced

The mass of oxygen that reacted with the magnesium was 0.05 g as calculated in Figure 4.

$$\begin{aligned}\text{Mass of oxygen} &= \text{Mass of Magnesium Oxide} - \text{Mass of Magnesium} \\ &= 0.15 \text{ grams} - .10 \text{ grams} \\ &= 0.05 \text{ grams}\end{aligned}$$

Figure 4: Calculation of Amount of Oxygen within the Magnesium Oxide

The experimental percent composition of magnesium oxide from the masses calculated above

indicates that the magnesium oxide is composed of 67% magnesium and 33% oxygen by mass as shown in Figure 5.

$$\begin{aligned}\text{Percentage Mg} &= \frac{\text{Mass of Mg}}{\text{Mass of MgO}} \times 100\% \\ &= \frac{0.10 \text{ grams}}{0.15 \text{ grams}} \times 100\% \\ &= 67\% \\ \text{Percentage O} &= 100\% - \text{Percentage Mg} \\ &= 100\% - 67\% \\ &= 33\%\end{aligned}$$

Figure 5: Calculation of Experimental Percentage Composition of Magnesium Oxide

The theoretical percent composition of magnesium oxide is 60.0% magnesium and 40.0 % oxygen by mass as shown in Figure 6.

$$\begin{aligned}\text{Percentage Mg} &= \frac{\text{Mass of Mg}}{\text{Mass of MgO}} \times 100\% \\ &= \frac{24.31 \text{ grams}}{40.31 \text{ grams}} \times 100\% \\ &= 60.00\% \\ \text{Percentage O} &= 100\% - \text{Percentage Mg} \\ &= 100\% - 60.00\% \\ &= 40.00\%\end{aligned}$$

Figure 6: Calculation of Theoretical Percentage Composition of Magnesium Oxide

The percentage error in the mass percent of magnesium was 12% as calculated in Figure 7.

$$\begin{aligned} \text{Percent Error} &= \frac{\text{Experimental Percentage Mg} - \text{Theoretical Percentage Mg}}{\text{Theoretical Percentage Mg}} \times 100\% \\ &= \frac{.67 - .60}{.60} \times 100\% \\ &= 12\% \end{aligned}$$

Figure 7: Calculation of percent error for percentage magnesium by mass

The percent error can be attributed to experimental errors such as some of the magnesium oxide may have escaped when the lid was lifted to allow for more oxygen to get inside the crucible. The loss of magnesium oxide in the smoke resulted in the mass of the magnesium oxide to be less than it should have been. By simply adding up to 0.016 grams to the mass of the magnesium oxide the experimental percentage composition approaches that of the theoretical composition, as shown in Figure 8.

$$\begin{aligned} &\text{Increase Mass of Magnesium Oxide from 0.15 g to 0.166 grams} \\ \text{Percentage Mg} &= \frac{\text{Mass of Mg}}{\text{Mass of MgO}} \times 100\% \\ &= \frac{0.10 \text{ grams}}{0.166 \text{ grams}} \times 100\% \\ &= 60\% \end{aligned}$$

Figure 8: Calculation of Percentage Magnesium by mass with Correction for Product Loss

Another possibility for the percent error was that not all the magnesium actually reacted. If a number of the magnesium atoms did not form bonds with oxygen atoms then the final mass of the content of the crucible would be less as illustrated in Figure 9.

If 1 mole of Magnesium completely reacted with oxygen 1 mole of magnesium oxide will be formed with a mass of 40.31g.
 If you start with 1 mole of Magnesium and only half reacts then you will form 0.5 mole of magnesium oxide and still have 0.5 mole of Mg. left. This content will weigh 20.16 grams of MgO and 12.16 grams of Magnesium with a total mass of 32.32 grams.
 With only half of the magnesium reacting there is a loss of approximately 8.00 grams.

Figure 9: Illustration of loss of mass due to incomplete reaction.

These two possible areas of error could be corrected by adjusting the lid slightly to prevent the escape of magnesium oxide and the final contents could be crushed and reignited to ensure all the magnesium reacted.

CONCLUSION

The purpose of the experiment was to determine the percentage composition of magnesium oxide. It was determined experimentally that magnesium oxide was 67% magnesium and 33% oxygen by mass. This represented a 12% error since the theoretical percentage composition of magnesium oxide is 60% magnesium and 40% oxygen by mass.

Literature Cited:

Winter, M. (n.d.). *Magnesium:Web Elements: The Periodic Table on the Web* . Retrieved November 10, 2011, from <http://www.webelements.com/magnesium/uses.html>