There's no time to teach *that*: Integrating the immune system, autoimmunity, literacy, and research into an over-crowded curriculum.

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Teacher Guide

I. Overview

Because of various curricular mandates, teachers are faced with covering an ever-expanding range of topics with little room for more interesting aspects of biology. Adding to this problem is the need for many teachers to incorporate literacy strategies to remediate student deficits. In addition, assigning independent research often results in plagiarized reports based on unreliable

In-Depth Study

Individual Autoimmune Research and Presentation

Assessment

Making Connections

Curriculum Integration: This unit is probably best placed into pre-existing units on viruses or on the immune system. The unit is designed to be implemented in either pieces or as a whole. The literacy/research strategies can be applied to many other topics.

Student Activities: Students will learn about the basics of the immune system and specifics about autoimmunity. Utilizing Internet resources, such as YouTube, news sites, and organizational websites, students will engage in a variety of literacy and research activities.

Relevance for Students: The functioning of the immune system, and especially autoimmunity, are often overlooked by teachers because of curricular mandates and complexity, yet many students have direct experience with various autoimmune conditions – diabetes, multiple sclerosis, arthritis, etc. Using “Best Practices” to explore

discussions. As the unit progresses, students and teachers should fill out the “L” column with correct concepts that they have learned.

While 7 words may be too few (or too many) in some cases, the goal is for the students to fully interact with the text and only record what is important. This task becomes easier, especially if students have annotated the text first.

Rationale

- Note-taking is an essential study strategy that should be explicitly taught to students as it allows students to generate understandings and reflect on ideas.
- Students who take brief notes of the most essential details outperform students who take detailed notes of the same materials.
- Short, efficient notes reflect deeper understanding of the information.
- It is essential that students organize and reflect on their notes. Notes should only reflect the significant components of the text. The act of separating main ideas from details strengthens the understanding and memory of the content area.

Implementation

Though some students may need scaffolds (writing notes in the left-hand column, filling in portions of the details for students prior to reading, chunking text, and so on), these scaffolds should be removed over time so that students can complete the strategy independently.

1. When teaching 2-Column Notes to students, first explain the purpose of the notes:
   - 2-Column Notes help students record the significant details of the text, and this helps students generate a deeper understanding.
   - 2-Column Notes help students understand the relationship between ideas when they summarize and meta-cognitively reflect on their learning.
   - 2-Column Notes serve as a study aid.

2. Guide students through 2-Column notes by modeling the strategy. It is helpful for students to see you complete the entire 2-Column Note process:

   - Review notes from the previous lecture [reading, demonstration, chapter, etc.].
   - Record important ideas in the right-hand column.
   - Review/reread the notes.
   - Determine the main idea of the notes.
   - Record the main ideas in the left-hand column.
   - Summarize the notes on the bottom of each page.

Modifications/Variations

- Teachers put questions for students to answer in the left-hand column.
- Teachers complete sections of the text or insert visuals for students.
- Teachers or students create a “look for” in the left column and use the right to include the information. Some examples are attached.

Synthesis Journal

A Synthesis Journal is another type of graphic organizer which allows the students to put together information from disparate sources. It can be structured in a variety of formats, but generally relies on developing an answer to a "Guiding Question" – in this case, "What is the immune system, and what does it do for you?" Having students reorganize their information is an additional strategy that forces them to interact with the information and improve their cognition of the material.

Burrell, K.I., & McAlexander, P.J. (1998). Ideas in practice: The synthesis journal. Journal of Developmental Education, 22 (1), 20-22, 24, 26, 28, 30.

Think/Pair/Share

Think/Pair/Share is a cooperative learning strategy that allows the students to both individually and in small groups work with content. Students are given a question, a section of a worksheet/graphic organizer, or other format which requires them to access prior information. Students should be instructed to "think" about the answer for a few minutes and individually record their thoughts. Then, students should "pair" with another student and compare their answers with their partner. Both students should be encouraged to discuss the information, correct any misconceptions, and add additional information to their own answer. Then, students should "share" the information with the class in a structured format, again adding/highlighting specific details at the teacher's direction.

Lyman, F. T. (1981). The responsive classroom discussion: The inclusion of all students. In A. Anderson (Ed.), Mainstreaming digest (pp. 109-113). College Park: University of Maryland Press.

News Article / Text Annotation

Text annotation is a **meta-cognitive literacy strategy** that involves noting important ideas and examples in the margins and is a widely practiced writing-to-learn strategy. The purpose of annotation is to isolate key ideas in the text to study them later, but the ultimate goal is for students to be able to synthesize and rephrase ideas as this is the only way a teacher can ensure the student understands the text. Annotation provides students with an opportunity to **hold their thinking** while engaging with a **text** and facilitates their learning of the **content.** The thought of annotating a text might conjure up images of coloring a **text** to eradicate white space. To circumvent the coloring concept, researchers suggest teachers should tell students to avoid using a highlighter for the following reasons:

- Kids have to own their annotations; it's just too easy to highlight an entire page without being thoughtful.
- It's cumbersome to move between highlighter and pen when working with a **text**.
- Pens are just as easy to underline with as a highlighter!
- Prevents "over-marking" of a text (aka meaningless marking of said **text**!).

Rationale for teaching annotating skills:

- If you don't teach students how to annotate in a manner that is specific to the **processes** in your discipline, who will?
- When a reader isolates information, he or she is more likely to remember it and add it to his or her **schema** for the discipline.
- Students utilize cognitive strategies and skills when they are underlining, including: activating prior knowledge, making connections, asking questions, summarizing a chunk of a text, making predictions, analyzing the author's craft, making inferences, and so on. These are some of the **best practices in literacy** instruction.
- Annotation is **transparent** through teacher **modeling** and can be easily **transported** to other disciplines and **texts.**

Steps to teach annotation:

1. The teacher must **model** and provide direct instruction as he or she would any other strategy.
2. Provide the students with a purpose for reading and annotating the text.
3. **Model** annotating a text using the purpose you would like the student to use.
4. Allow students practice.
5. Provide students with both oral and written feedback.
6. Re-teach and remodel as necessary.
7. Have students use their annotations through extending activities: studying, summarizing, discussion, and writing.

Suggested annotation steps for students:

1. Check off information you understand.

2.

Standardized Test Practice – ACT Format

Standardized testing is a “necessary evil” in the field of education. While there are many different tests and formats, one of the most challenging for students seems to be the Science Reasoning section of the ACT (American College Test). During this test, students are presented with 7 passages, involving a variety of text, graphs, figures, and tables. Students are not expected to be familiar with the content. In fact, many of the passages are designed to be unfamiliar, have highly tchni3(a)4(ne)4(ou6(an)--6(h)-)-6(uen of)3(t)-22d mou6(d)-6(a)4((e)4(e)4(t)-2c-6(a), f)3(ia(e)r)3(e)4(4)

Engaging in a role-playing exercise allows students to practice being both physician and patient and provides them with a direct peer-feedback format of sharing information in a less-threatening method than a whole-class presentation.

III. Student Outcomes and Learning Objectives

Students will be able to:

- Assess what they know about the functioning of the immune system.
- Develop questions about what they need to learn about the immune system.
- Take notes and summarize information from a variety of sources, including text, video, websites, lecture, etc.
- Collaboratively synthesize scientific information.
- Hypothesize what happens when the immune system does not function properly.
- Annotate and summarize current news articles.
- Practice standardized test questions on an autoimmune topic.
- Analyze the appropriateness of web resources.
- Synthesize web-based information into a creative format.
- Present research information to peers.
- Assess the effectiveness of their own and other's work.

IV. Time Requirements

1-14 Days (45 minute class periods) – depending on level of implementation

Introduction – 1 day
Background Information – 2-3 days
Building Connections – 1-4 days
In-Depth Study – 3-5 days
Assessment – 1 day

V. Advance Preparation

Equipment and Materials

- Access to the Internet for multiple class periods
- Copies of Student Worksheets:
  - KWL – The Immune System
  - YouTube Graphic Organizer – Immune System Animation
  - 2-Column Notes - Understanding the Immune System
  - Immune System – Synthesis Journal
  - YouTube Graphic Organizer – Autoimmune Disease
  - "Findings Suggest…" Current Event News Article
  - "Findings Suggest …" – Annotation Example
  - Standardized Test Practice – EAE

Student Section

I. Overview

The following pages contain teacher master copies of the student worksheets. Each worksheet contains applicable instructions.

KWL: The Immune System

Follow your teacher's instructions to fill out the "K" and "W" sections of the KWL chart about the Immune System

Know: This is what I know.	Want: This is what I want to know.	Learn: This is what I learned.

Understanding the Immune System

Understanding the Immune System—NIAID Science Education Brochure

http://www.niaid.nih.gov/topics/immunesystem/documents/theimmunesystem.pdf

Understanding the Immune System—NIAID Science Education Brochure

http://www.niaid.nih.gov/topics/immunesystem/documents/theimmunesystem.pdf

As you read the brochure, take notes (in your own words) about each of the sections. Be concise!

Immune System Synthesis Journal

Fill in each of the sections using information from each of the sources.
Then, summarize the information in your own words to answer the central question.

What is the prior knowledge of the class?

What does the teacher say?

What is the immune system, and what does it do for you?

What does you-tube say?

What does the text say?

YouTube Graphic Organizer – What is an Autoimmune Disease Name_____

http://www.youtube.com/watch?v=0mz33fLJGwQ

After watching the YouTube video above, fill out the following: P._____

Facts I learned about autoimmune diseases

1.

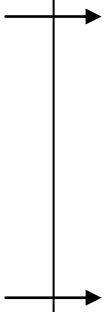
2.

3.

4.

5.

Personal Stories: What was the problem?



Watching this made me feel:

I can go here for more information:

Questions I have about autoimmune diseases

?

?

?

?

As you read about Multiple Sclerosis, annotate the article. For each paragraph:

1. Check off information that you understand

r TJ 0.006 Tc -0.011 Tw 0 -1.213 TD [(B)12(a)7(s)7(ic)7

the environmental pollutant acrolein may damage nerve insulation called myelin in multiple scle rosis. "A " represents the normal structure of nerve fibers and myelin; "B " represents how...

Click here for more information.

was writte n by doctoral students Gary Leung, Wenjing Sun and Lingxing Zheng; graduate research assistant Melissa Tully, who is an MD -Ph.D. student at Purdue and the Indiana University School of Medicine; postdoctoral researcher Sarah Brookes; and Shi.

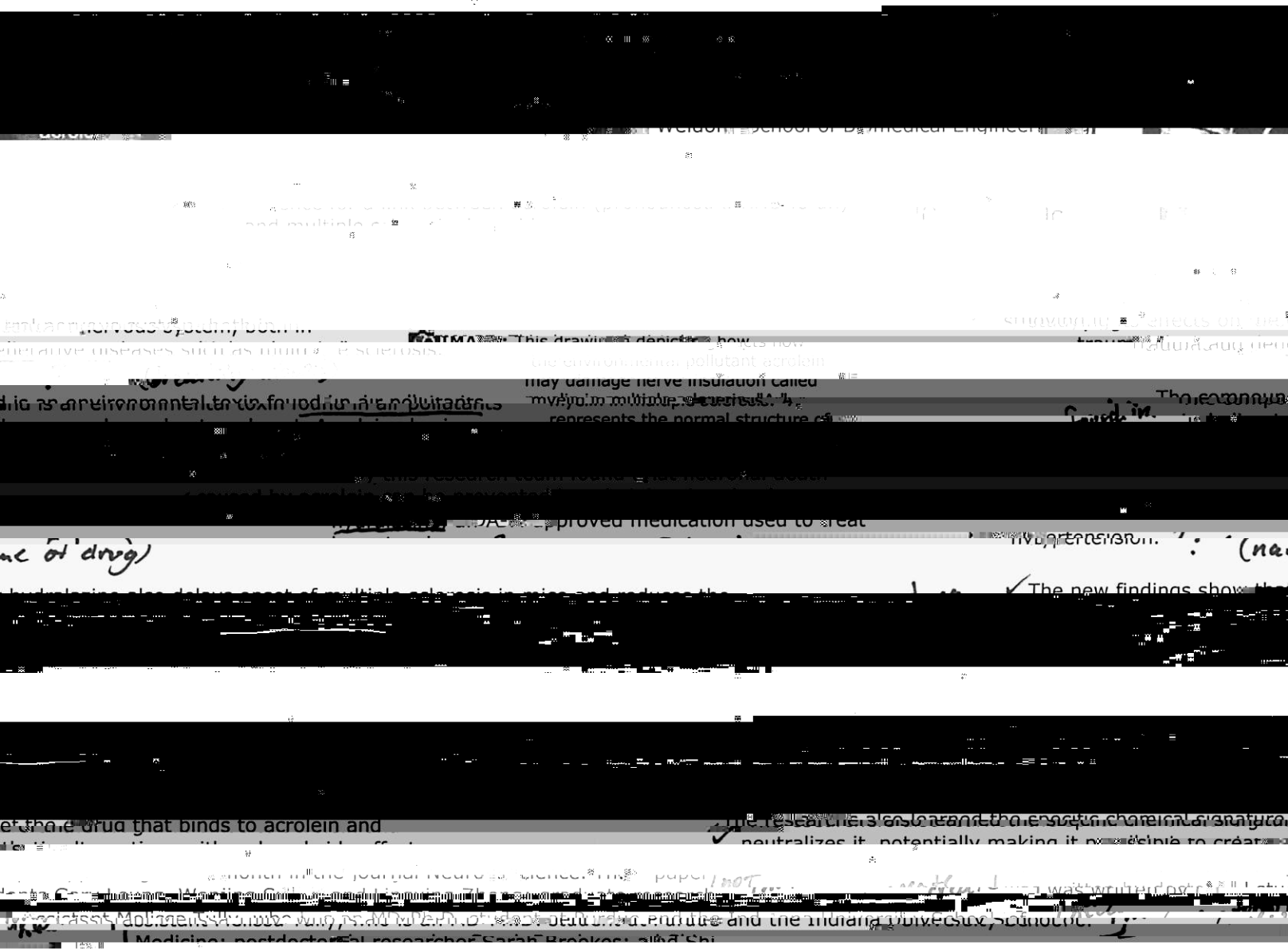
In multiple sc lerosis, the myelin insulation surrounding nerve cells is destroyed and the nerve fibers themselves are damaged.

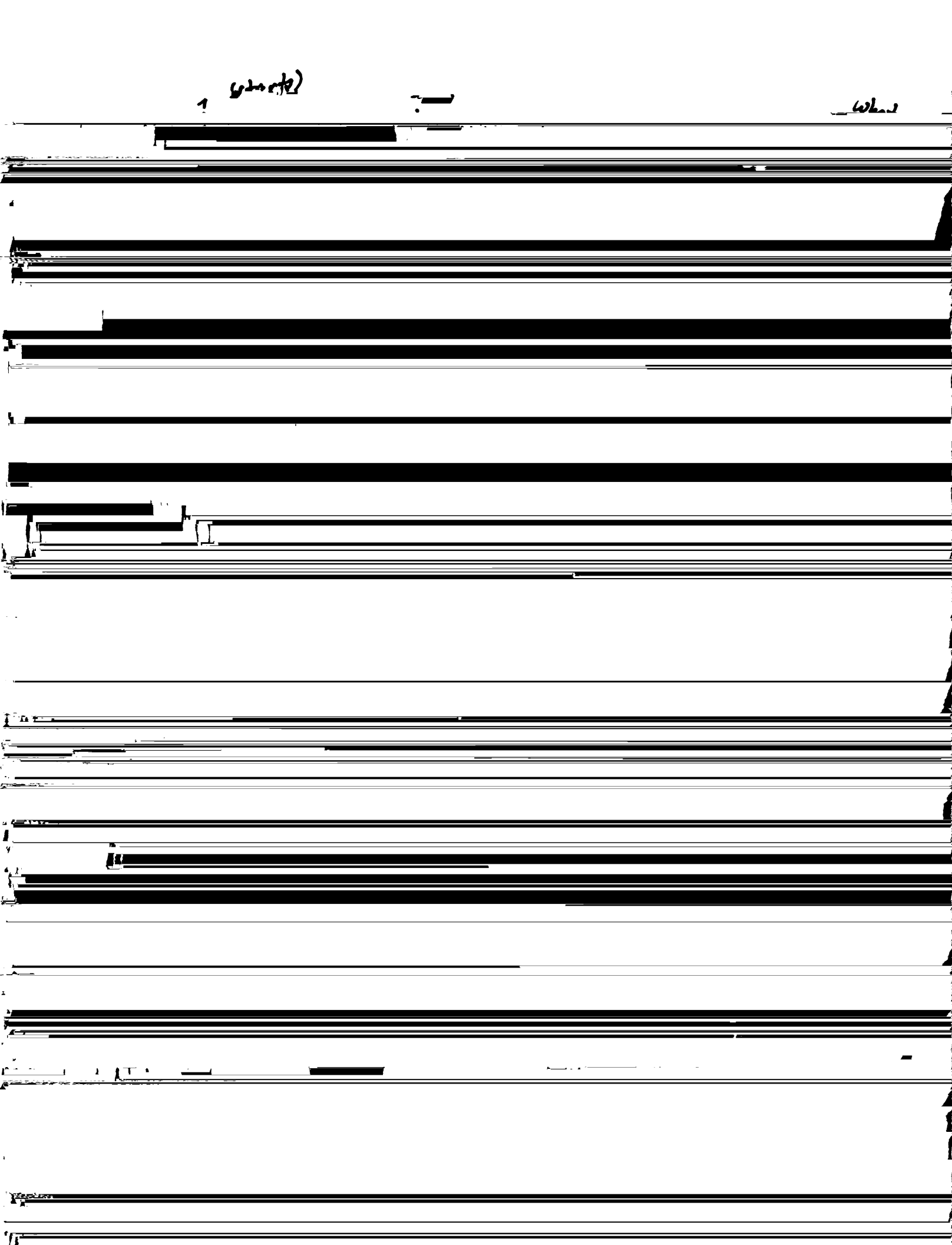
"We think that acrolein is what degrades myelin, so if we can block that effect then we can delay the onset of MS and l( )]TJ 0" Sh

e13(8(o)-assi)-74(,)"esa iaei.

th 7emc vr2(c)uent inaely vhentratithyralainch-9 s(;)7(a)s(;)7(a)7(n)12(e)7(u)12(r)otoxivin7(-)11(M)9(S)10(a

Findings suggest new drug may help treat multiple sclerosis





EAE – The Mouse Model of Multiple Sclerosis

Standardized Test Practice

EAE (Experimental Autoimmune Encephalomyelitis) is the animal model of the disease multiple sclerosis. In EAE, mice are given central nervous system proteins (from the brain and spinal cord) to stimulate an autoimmune response. The foreign proteins (antigens) cause the immune system to break down the myelin sheath (fatty covering) around the nerves. This may happen in one of several ways: B cells (a type of white blood cells) may be producing antibodies (proteins that attack foreign proteins) to its own central nervous system. Or, T cells (a different type of white blood cells) may be attacking the spinal cord directly. The result is that the spinal cord is damaged and the mice have trouble walking, and may even become completely paralyzed. To complicate the subject, other T cells (T regulator cells) may be effective in stopping the autoimmune response of either B or T cells.

Experiment 1

Two strains of mice, SJL and C57B, were given separate injections of two specific central nervous system protein, PLP and MOG. The progression of the disease was measured by rating the mouse's gait (walking movement) on an EAE scale of 0-5 over the course of 50 days.

0 – normal gait
1 – waddling gait
2 – severe waddling gait
3 – impaired righting reflex – ability to turn over when placed on back
4 – hind limb paralysis
5 - death

Average EAE Score		
Mouse Strain + Protein		
Day	SJL + PLP	SJL + MOG
0	0	0
10	0.7	0.2
20	4.2	0.1
30	1.2	0.1
40	3.1	0.2

		0
10	1	0.9
20	4.2	3.6
30	1.2	4.4
40	0.5	4.5
50	0.3	4.6

Table 1

1. Which of the following changes in Experiment 2 would permit a test of the hypothesis that depleting T cells with a protein (called Anti-CD8) would reduce the effects of the disease?
   A. Repeat the experiment using the same concentration of Anti-CD8 protein that depletes the T cells.
   B. Repeat the experiment without injecting the mice at Day 0.
   C. Repeat the experiment using both Anti-CD8 and Anti-CD20 proteins.
   D. Repeat the experiment without using additional proteins.

2. The results in Experiments 2 and 3 demonstrate that blocking the actions of specific immune cells
   F. has an immediate effect on EAE scores.
   G. has a delayed effect on EAE scores.
   H. has no effect on EAE scores.
   J. has a negative effect on EAE scores.

3. Based on the information in Table 1, which statement is correct?
   A. The mice with an EAE score of 0 received no injections.
   B. The average score of C57BL + PLP mice is lower on Day 40 than the SJL + MOG mice on Day 40.
   C. The MOG protein has a significant effect on SJL mice.
   D. C57BL + PLP mice become paralyzed and then recover.

4. Which of the following graphs best represents the data presented in Table 1 for SJL mice injected with PLP protein?

F.

G.

H.

J.

EAE – The Mouse Model of Multiple Sclerosis

3. Based on the information in Table 1, which statement is correct?
   A. The mice with an EAE score of 0 received no injections.
   B. The average score of C57BL + PLP mice is lower on Day 40 than the SJL + MOG mice on Day 40.
   C. The MOG protein has a significant effect on SJL mice.
   D. C57BL + PLP mice become paralyzed and then recover.

Correct: D On Day 20, these mice show paralysis and then return to an almost normal gait.

Wrong: A. All mice received injections. B. C57BL + PLP – Day 40 = 0.5; SJL + MOG – Day 40 = 0.2. C SJL mice injected with MOG showed few signs of EAE.

4. Which of the following graphs best represents the data presented in Table 1 for SJL mice injected with PLP protein?

F.

G.

H.

J.

Correct: H This matches the increase, decrease, and increase of the data.

Wrong: F. This would be the graph for C57BL + MOG mice. G. This would be the graph for SJL + MOG mice. J. This would be the graph for C57BL + PLP mice.

5. Based on the results of Experiment 3, what strain of mice was most likely used?
   A. C57BL only
   B. SJL only
   C. Both C57 and SJL
   D. Neither C57 nor SJL

Correct: D The data for PBS/PLP139 (the top line) needs to be compared to the data in Table 1. In Figure 2, the EAE scores peak, then stay elevated. In Table 1, neither group of mice shows this pattern in the same time period.

Wrong: A. C57BL + PLP mice EAE scores increase and then decrease almost to normal. This looks like C57BL + MOG results, but the experiment used the PLP protein, not the MOG protein. B SJL mice EAE scores show a different pattern over the same time period. C. Contradicts the results.

Note: This is a very difficult question. It is the type that most students on standardized tests would miss, due to the complexity and the "trickiness" of the answer.

6. Multiple Sclerosis and EAE diseases come in two forms: a. relapsing/remitting - the disease symptoms get worse, then better, then worse, etc. and b. chronic – the symptoms get worse and do not get better. Rituximab is a drug developed to control the relapsing/remitting form of the disease and has shown to be most effective in mice at 50 days after initially being exposed to nervous system antigens. What is the most likely effect of Rituximab?

F. Depletes B cells
G. Blocks MOG proteins
H. Increases T regulator cells
J. Removes PLP proteins from the body

Correct: F MS and EAE are diseases caused by the immune system "overreacting" to the body's normal proteins, so the drug must work to block the immune system, not the proteins. Figure 1 shows data most representing the relapsing/remitting form of the disease, so Rituximab would most likely deplete the B cells.

Wrong: G. MOG is a protein and not the target of the drug. In H Figure 2, the data resembles a more chronic form of the disease. By Day 50, the drug is not at its most effective point. J. PLP is a protein and is not the target of the drug.

Autoimmune Disease Project

Your assignment will be to help understand the question:

"What happens when your own immune system attacks you?"

Hypothesis: If my own immune system attacks me, then _____

_____

_____

_____

Assignment:

1. Research an autoimmune disease – go to the American Autoimmune Related Disease Association - www.aarda.org

Evaluating Internet Websites

Before doing research, use the Chart below to analyze an Internet Website and to make sure that the website provides a reliable source of information.

Authority	Is there an author(s) or sponsor(s)? What are their qualifications? Can you verify? • Address • Phone number • E-mail Check the header (top) or footer (bottom) of the page.
Accuracy	Are sources listed? Who is responsible? Any errors? • Grammatical • Technical Can you verify the information?
Objectivity	What is the purpose of the site? • Is there a bias? Are they selling? Are they trying to persuade? Look for "About us/Mission/ Purpose" links.
Currency	Is the website dated? • When was it put on the web? When was it updated? • Is the information current?
Coverage	What is the depth of the information? • Summary •

Name of Author or sponsor _____
_____
_____

Their Qualifications _____
_____
_____

Sources Errors Verified Information _____
_____
_____
_____

Explain the purpose of the site _____
_____
_____
_____
_____

When was the site published & updated? _____
_____
_____
_____
_____

edu/Wolfgram-Memorial-Library/webevaluation/webeval.htm. 26 October 2001.

Compare your site to an encyclopedia article. Compare the amount of information provided. Are there any differences in information between the two sources? Explain why there might be differences. _____
_____
_____
_____
_____
_____
_____

Northrup, Mary. "Web Site Evaluation Checklist." The Book Report September/October, 2001: 48.
University of Wisconsin, InternetWorkshop Working Group. "Checklist for Evaluating Web Sites" September 5, 2001[last update]. Online. University of Wisconsin. Available: http://www.library.wisc.edu/libraries/ Instruction/instmat/webeval.htm. 26 October 2001.

2 Column Notes- Autoimmune Disease
As you read information, take notes (in your own words) about each of the sections. Be concise!

Disease:

Topic	Summary – Recommended 5-7 words (your own)
General Info Explain autoimmunity	
Explain your specific disease:	

2 Column Notes- Autoimmune Disease
As you read information, take notes (in your own words) about each of the sections. Be concise!

Topic	Summary – Recommended 5-7 words (your own)
Major Symptoms (How doyou know you have it?) What body parts does it affect? How? Are there preventions? (tests, early treatments,…)	
Questions I need answered:	

2 Column Notes- Autoimmune Disease
As you read information, take notes (in your own words) about each of the sections. Be concise!

Topic	Summary – Recommended 5-7 words (your own)
Treatments/Cures Is the disease curable, (goes away completely), treatable (live with it), or uncurable?	
What treatments are available?	
Is treatment effective?	

2 Column Notes- Autoimmune Disease
As you read information, take notes (in your own words) about each of the sections. Be concise!

Assignment: Create a pamphlet that clearly explains the disease. The pamphlet should include the components presented below and should be in your own words. It is designed to be used during a consultation with a patient who has just been diagnosed with the disease.

Name _____

Autoimmune Disease Pamphlet
Grading Rubric

Excellent = clearly explained in your own words; correct information; appropriate scientific vocabulary
Good = clearly explained in your own words; correct information; some appropriate scientific vocabulary
Average = primarily clear explanation in your own words; primarily correct information; some appropriate scientific vocabulary
Fair = somewhat clear explanation; lacking your own words, correctness, and/or appropriate scientific vocabulary
Poor = unclear explanation; copied or incorrect information; little/no scientific vocabulary

	Excellent 5	Good 4	Average 3	Fair 2	Poor 1
Pamphlet Components					
1. General autoimmunity	_____	_____	_____	_____	_____
2. Specific disease	_____	_____	_____	_____	_____
3. Role of immune system	_____	_____	_____	_____	_____
4. Causes (if known)	_____	_____	_____	_____	_____
5. Risk factors	_____	_____	_____	_____	_____
6. Symptoms	_____	_____	_____	_____	_____
7. Preventions	_____	_____	_____	_____	_____
8.					

PatientConsultation Evaluation

The purpose of this activity is for the patient to evaluate the experi of a consultation. The student (patient)who is evaluating should use the following form to critique the doctor (another student) and the pamphlet.

Pamphlet & Consultation	Your comments
1. Based on the	