## Scoring Criteria

<table>
<thead>
<tr>
<th>PERFORMANCE INDICATOR</th>
<th>BEGINNING</th>
<th>DEVELOPING</th>
<th>PROFICIENT</th>
<th>EXPANDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3 Life Sciences-Structure, Function, and Information Processing: B</td>
<td>Identify the components of the model.</td>
<td>Describe the relationships between components of the model.</td>
<td>Develop and use a model to explain the relationship among its components.</td>
<td>Distinguish between the accuracy of the model and the actual body system/function it represents by identifying limitations of the model.</td>
</tr>
<tr>
<td></td>
<td>Identify systems in multicellular organisms.</td>
<td>Explain the function(s) of the systems in multicellular organisms.</td>
<td>Illustrate how the hierarchical organization of systems interact to provide specific functions in multicellular organisms.</td>
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</tr>
<tr>
<td>#3 Life Sciences-Structure, Function, and Information Processing: C</td>
<td>Plan an investigation to collect data about how feedback mechanisms maintain homeostasis.</td>
<td>Plan and conduct an investigation to collect data that demonstrates that feedback mechanisms maintain homeostasis.</td>
<td>Plan and conduct an investigation that identifies and measures internal and external environmental conditions and explain why the evidence demonstrates that feedback maintains homeostasis.</td>
<td>Plan another investigation that identifies and measures internal and external environmental conditions to collect evidence of how feedback maintains homeostasis in a different living system in a real-world scenario.</td>
</tr>
<tr>
<td>Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.</td>
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<td>Plan another investigation that identifies and measures internal and external environmental conditions to collect evidence of how feedback maintains homeostasis in a different living system in a real-world scenario.</td>
</tr>
<tr>
<td>Communication: 3</td>
<td>Identify audience and purpose of communication.</td>
<td>Use some appropriate aspects of style, tone and language to partially address the needs of the audience and purpose.</td>
<td>Use appropriate style, tone, and language to address intended audience and purpose.</td>
<td>Use strategic, engaging, and creative style, tone, and language to effectively address the intended audience and purpose.</td>
</tr>
<tr>
<td>Choose and apply an appropriate communication strategy according to audience and purpose.</td>
<td>Use a method of communication (e.g., written, oral, visual, graphic, audio,</td>
<td>Select and use a method of communication</td>
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<td>Select and use a method of communication</td>
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<tr>
<td>and/or interactive) to present ideas.</td>
<td>Select and use a method of communication (e.g., written, oral, visual, graphic, audio, and/or interactive) to present ideas.</td>
<td>(e.g., written, oral, visual, graphic, audio, and/or interactive) that fits the audience and purpose.</td>
<td>Select and use a strategic method of communication (e.g., written, oral, visual, graphic, audio, and/or interactive) that effectively addresses the audience and purpose.</td>
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</tbody>
</table>
| **Research: 1**  
Analyze the relevance, bias, and usefulness of information. | Locate information that pertains to the topic researched. | Select and categorize information according to relevance and usefulness. | Analyze information and sources to determine the relevance, bias and usefulness of information. | Seek out additional information to ensure a comprehensive representation of the topic. |
Systemic Lupus Erythematosus (SLE)
What is Lupus?

- Systemic Lupus is an autoimmune disorder that can be passed down by genetics or potentially developed from another form of lupus. The immune system attacks its own tissues mistakenly.
- Because it is systemic, any type of tissue can be affected, but the most common ones include:
  - Loose areolar connective tissue (Skin)
  - Dense regular connective tissue (Tendons and Ligaments)
  - Smooth muscle (Organs)
  - Fibrocartilage (Joints)
- In essence, tissue damage in lupus is caused by rapid cell damage and death. Immune cells (B cells) mistakenly identify apoptotic debris from dead cells as antigens from foreign bodies, and create antibodies targeting healthy cells. This can either lead to antibodies clinging to cells directly (Hypersensitivity 2), or antibodies forming complexes with the antigens and becoming deposited in tissues (Hypersensitivity 3).
- Both responses result in chronic inflammation, the main characteristic of SLE.
Feedback loop

Healthy tissues damaged

Stimulant

Control center calls immune system

Immune system
To generally explain what happens in the terms of a feedback loop, genes need to effect two aspects of a normal, unaffected loop to cause inflammation- these genes need to affect clearance and B-cells.

The cycle starts when cells die. They break apart after death, releasing their nuclei contents. Poor clearance (genes) means the debris in blood builds up to abnormally high levels. Then, an affected B cell (also genes) mistake this debris for foreign antigens. They create antibodies from these, of which can either combine with the dead cell part and travel through the blood as an immune complex or attach themselves to cells directly. Both of which end in more cells dying, restarting the loop and resulting in chronic inflammation.
Lupus occurs in periods called flare ups and remissions.

Symptoms vary on where the flare up occurs.

All symptoms can occur in other diseases as well, so having some of these symptoms is not a correct test for lupus.

Symptoms:

1. Fatigue
2. Fever
3. Joint pain, stiffness and swelling
4. Malar rash on face
5. Skin lesions
6. Fingers & toes turn white or blue when stressed
7. Shortness of breath
8. Chest pain
9. Dry eyes
10. Headaches, confusion and memory loss
Potential Tests

- Test if ANA is in the blood
- Test if urinalysis, positive - high level of protein (usually attacks kidneys)
- A DSDNA test, if it’s positive
- Test for Antiphospholipid Antibodies, an antibody directed against phospholipids
- Typically if a test comes back positive, more tests will then be conducted
**Materials**

- A blood sample
- Specific test for Lupus
- Preferred collection container: 3.5 mL
- Gold-top (serum separator)
- Tube
- Alternate Collection Container: 6 mL red-top (plain, non-serum separator)

**IF) ANA test**

**Procedure**

1. Patients blood is placed on a slide with fixed cells. Some time elapses.
2. The blood is washed away.
3. A new solution is added, containing anti-antibodies. Bonded with these are immunofluorescent molecules.
4. A light is shined on the slide, and causes the ANA's to light up.

After the test:

Chest x-rays & echocardiograms may be necessary to investigate fluid around the lungs & the heart.

If doctors suspect nephritis is present, the patient may need to have a kidney biopsy.
Data

The following is a diagram of the process during an IF ANA test. If no ANA’s are present, the stuck cells have no antibodies sticking to them, and thus nothing happens. However, because ANA’s can be present in a healthy person’s blood, usually doctors examine the number and pattern of ANAs rather than just the presence.
Data analysis

Depending on the presence of light from the anti-antibodies, the test will show if there are any ANAs present as well as an approximate take on the density of the ANAs.

A further step in analyzing data from an Indirect Immunofluorescence ANA test is the pattern within the present ANAs, if there are any. There are a few recognizable patterns that are visible that can help determine the potential disease. By examining these, doctors can rule out certain options.
Conclusion

Lupus in itself is a difficult condition to diagnose, and is otherwise called *The Great Imitator* for the variety of symptoms it shares with other diseases. It’s an autoimmune disease that affects mostly young women and is passed down via genetics and is characterized by the inflammation of bodily tissues brought on by damage done to said tissues by the carriers’ immune system. Of the 4 types of lupus (Neonatal, Discoid, Drug induced, and Erythematous), SLE is the most common. Although this disorder has the potential to be very serious, the help of modern medicine does an efficient job in combatting its most lethal side effects.
#3 Life Sciences - Structure, Function, and Information Processing: B - Proficient - All components of the model are clearly explained and how the different components affect different tissues of the body.

**Communication: 3 - Expanding** - Students used a Google Slide Presentation. Graphic chosen are easy to follow and some are self-created. Information is organized and appropriate. Graphics chosen to accompany information are appropriate and enhance the information. Color scheme and font are pleasing and easy to read. Presentation has a natural flow.

**Research: 1 - Expanding** - Students used more than the number of required sources for their presentation. They performed a CRAAP test on all of the sources to analyze the information. Information is properly formatted.
Polymyositis
What is Polymyositis?

The meaning:
- Poly- many
- Myo- muscle
- Itis- Inflammation

Symptoms:
- Muscle pain and stiffness.
- Muscle weakness, particularly in the belly (abdomen), shoulders, upper arms, and hips.
- Joint pain and stiffness.
- Trouble catching your breath.
- Problems with swallowing.
Which body system does the disease affect?

- It affects the skeletal muscles
- The exact cause of polymyositis is unknown
- The disease shares many characteristics with *autoimmune disorders*
  - When the immune system mistakenly attacks healthy body tissues
- In some cases, the disease may be associated:
  - viral infections, connective tissue disorders, or an increased risk for cancer
Materials:

- Safety goggles
- Lab coat
- Gloves
- Test tubes
- Test tube rack
- Lab cart
- Patients muscle tissue
- Patients blood
Safety Concerns

➤ Safety Procedures:
  ○ Sterile needles
  ○ Gloves
  ○ Clean working area
  ○ Biohazard container for sharp objects
Procedure

1. An EMG measures the electrical activity in the muscles. The pattern of the electrical activity in the muscles can demonstrate if the muscle weakness is due to polymyositis.

2. A biopsy is where a sample of muscle tissue is collected during a minor surgical procedure under a local anaesthetic. The muscle tissue sample is sent to a lab for further investigation. Characteristics changes in muscle tissue can be a strong indicator of polymyositis.

3. Other tests that can be performed including blood tests
Healthy Skeletal Muscle

- Normal muscles (when viewed under microscope) look like puzzle pieces fit together perfectly
- Normal muscle fibers

Muscle with Polymyositis

- Has inflammatory cells
- Fibers are being invaded by inflammatory cells

vs.
Polymyositis

**Muscle biopsy of polymyositis**

- Focal and endomysial infiltration of T cell, esp. CD8, with small number of macrophage
- Muscle fiber degeneration and atrophy

**Healthy Muscle vs.**

Student Work Sample #2 (page 8 of 13)
Blood Test Results:

- Safety Procedures:
  - Sterile needles
  - Gloves
  - Clean working area
  - Biohazard container for sharps

- Shows high levels of:
  - Muscle Enzymes
  - Inflammatory markers
  - Autoantibodies.
Table 2. Comparison of demographic and laboratory variables in polymyositis (PM) patient and inactive disease.

<table>
<thead>
<tr>
<th></th>
<th>Active PM patients (n=44)</th>
<th>Inactive PM patients (n=48)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (male/female; n)</td>
<td>14/30</td>
<td>16/32</td>
</tr>
<tr>
<td>Age (years)</td>
<td>45.6 ± 10.12</td>
<td>41.9 ± 11.28</td>
</tr>
<tr>
<td>C-reactive protein (mg/L)</td>
<td>13.9 ± 24.68</td>
<td>3.9 ± 2.74</td>
</tr>
<tr>
<td>Erythrocyte sedimentation rate (mm/h)</td>
<td>33.5 ± 16.38</td>
<td>20.4 ± 12.71</td>
</tr>
<tr>
<td>Hemoglobin (g/L)</td>
<td>128.3 ± 18.99</td>
<td>129.9 ± 19.22</td>
</tr>
<tr>
<td>Lymphocyte count (10^9/L)</td>
<td>1.5 ± 0.81</td>
<td>1.6 ± 0.76</td>
</tr>
<tr>
<td>Neutrophil count (10^9/L)</td>
<td>5.6 ± 2.40</td>
<td>5.2 ± 2.35</td>
</tr>
<tr>
<td>Platelet count (10^9/L)</td>
<td>234.8 ± 80.81</td>
<td>210.9 ± 66.20</td>
</tr>
<tr>
<td>Mean platelet volume (fL)</td>
<td>9.9 ± 1.39</td>
<td>10.6 ± 0.92</td>
</tr>
<tr>
<td>MMT score</td>
<td>21.3 ± 6.27</td>
<td>34.8 ± 6.17</td>
</tr>
</tbody>
</table>
Polymyositis Feedback Loop
Conclusion:

- Positively diagnose a patient with Polymyositis by:
  - Muscle biopsy
  - Blood tests
  - EMG results
- Overall
  - Skeletal muscles are invaded by inflammatory cells and healthy muscles become rounded
#3 Life Sciences - Structure, Function, and Information Processing: B - Proficient - Illustrates how the hierarchical organization of systems interact to provide specific functions.

**Communication:** 3 - Proficient - The method of presentation is suitable for the audience and purpose.

**Research:** 1 - Proficient - Student provided information about the reliability of resources used.

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**Works Cited:**

- [https://www.webmd.com/arthritis/polymyositis#1](https://www.webmd.com/arthritis/polymyositis#1)
- [https://understandingmyositis.org/myositis/polymyositis/](https://understandingmyositis.org/myositis/polymyositis/)
- [https://rarediseases.info.nih.gov/diseases/7425/polymyositis](https://rarediseases.info.nih.gov/diseases/7425/polymyositis)
Vasculitis
Purpose and Hypothesis

Purpose: The purpose is to show how someone would be diagnosed with vasculitis and what it would actually look like.

Hypothesis: If the patient has vasculitis, the tests results will show signs of inflammation in the blood vessels.
Signs & Symptoms

- Shortness of breath and cough
- Nerve problems; numbness or weakness in hands or feet
- Rash
- Fever
- Headache
- Fatigue
- General aches and pains
- Weight loss
Materials

- X-rays
- Blood tests
- Biopsy
- Urine tests
- Image tests (PET scan, CT scan)
X-Rays of Blood Vessels (Angiography)

During this procedure, a flexible catheter, resembling a thin straw, is inserted into a large artery or vein. A special dye (contrast medium) is then injected into the catheter, and x-rays are taken as the dye fills the artery or veins. The outlines of your blood vessels are visible on the resulting x-rays.

- Shows which blood cells and organs are affected
- Shows whether you are responding to treatment or not
X-Rays Data
Urine Test

This test may reveal whether your urine contains red blood cells or has too much protein, which can signal a medical problem.
Blood Test

These tests look for signs of inflammation. A complete blood cell count can tell whether you have enough red blood cells in your body.

- Shows a high level of C-reactive protein cells
Biopsy

The doctors take a small sample of tissue from the affected area of your body. The doctor then sends it down to pathology where people look at the tissue under a microscope to look for signs of vasculitis.
Imaging Test

Noninvasive imaging techniques can help determine what blood vessels and organs are affected. They can also help the doctor monitor whether you are responding to treatment. Imaging tests for vasculitis include X-rays, ultrasound, computerized tomography (CT), magnetic resonance imaging (MRI) and positron emission tomography (PET).
Feedback Loop

[Diagram with labels and arrows showing the interactions between the complement system, neutrophil priming, and endothelial injury.]
#3 Life Sciences - Structure, Function, and Information Processing: B - *Beginning. Provided a model.*

**Communication:** 3 - *Developing* - Includes some of the necessary information for the intended audience.

**Research:** 1 - *Proficient* - Student provided information about the reliability of resources used.

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**Work Cited Sources**


Tissue Issues: Fibroma
What is Fibroma?

Fibroma is tumor-like growth made up mostly of connective tissue. Tumor-like growths such as fibroma develop when uncontrolled cell growth occurs for an unknown reason, or as a result of injury or local irritation. Fibroma can form anywhere in the body and usually do not require treatment or removal. Fibroma can form in any gender and at any age.
A photograph of Fibroma
Feedback loop
Symptoms of Fibroma:

The main symptom of plantar fibroma is a lump in the arch of the foot that is firm to the touch and may or may not be painful. Pain is usually caused by pressure from shoes, although walking and standing while barefoot can also cause pain, depending on the size and location of the mass.
Treatment procedure

One kind of treatment is physical therapy. Physical therapy helps break tissue accumulation in the foot. Your physical therapist will help you develop a routine of strength training and stretching exercises that can help increase blood circulation and stimulate cell growth. Increased circulation can also reduce inflammation and relieve pain caused by a plantar fibroma. There are no published studies that show that physical therapy has a significant beneficial effect in the treatment of plantar fibromas.
#3 Life Sciences - Structure, Function, and Information Processing: B - Beginning - Student included a model.

Communication: 3 - Beginning - Slides are somewhat difficult to read and information is incomplete.

Research: 1 - Proficient - Student provided information about the reliability of resources used.

Sources:

https://www.healthline.com/health/plantar-fibroma


https://www.brighamandwomens.org/obgyn/resources/fibroma