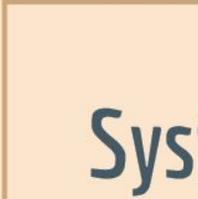


Annotated 9 - 12 (Anatomy) Science Work Samples

Scoring Criteria

PERFORMANCE INDICATOR	BEGINNING	DEVELOPING	PROFICIENT	EXPANDING
<p>#3 Life Sciences-Structure, Function, and Information Processing: B</p> <p>Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.</p>	<p>Identify the components of the model.</p> <p>Identify systems in multicellular organisms.</p>	<p>Describe the relationships between components of the model.</p> <p>Explain the function(s) of the systems in multicellular organisms.</p>	<p>Develop and use a model to explain the relationship among its components.</p> <p>Illustrate how the hierarchical organization of systems interact to provide specific functions in multicellular organisms.</p>	<p>Distinguish between the accuracy of the model and the actual body system/function it represents by identifying limitations of the model.</p>
<p>#3 Life Sciences-Structure, Function, and Information Processing: C</p> <p>Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.</p>	<p>Plan an investigation to collect data about how feedback mechanisms maintain homeostasis.</p>	<p>Plan and conduct an investigation to collect data that demonstrates that feedback mechanisms maintain homeostasis.</p>	<p>Plan and conduct an investigation that identifies and measures internal and external environmental conditions and explain why the evidence demonstrates that feedback maintains homeostasis.</p>	<p>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.</p>
<p>Communication: 3</p> <p>Choose and apply an appropriate communication strategy according to audience and purpose.</p>	<p>Identify audience and purpose of communication.</p> <p>Use a method of communication (e.g., written, oral, visual, graphic, audio,</p>	<p>Use some appropriate aspects of style, tone and language to partially address the needs of the audience and purpose.</p>	<p>Use appropriate style, tone, and language to address intended audience and purpose.</p> <p>Select and use a method of communication</p>	<p>Use strategic, engaging, and creative style, tone, and language to effectively address the intended audience and purpose.</p>

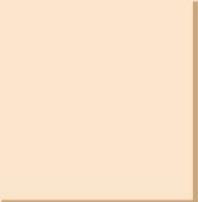
	and/or interactive) to present ideas.	Select and use a method of communication (e.g., written, oral, visual, graphic, audio, and/or interactive) to present ideas.	(e.g., written, oral, visual, graphic, audio, and/or interactive) that fits the audience and purpose.	Select and use a strategic method of communication (e.g., written, oral, visual, graphic, audio, and/or interactive) that effectively addresses the audience and purpose.
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)

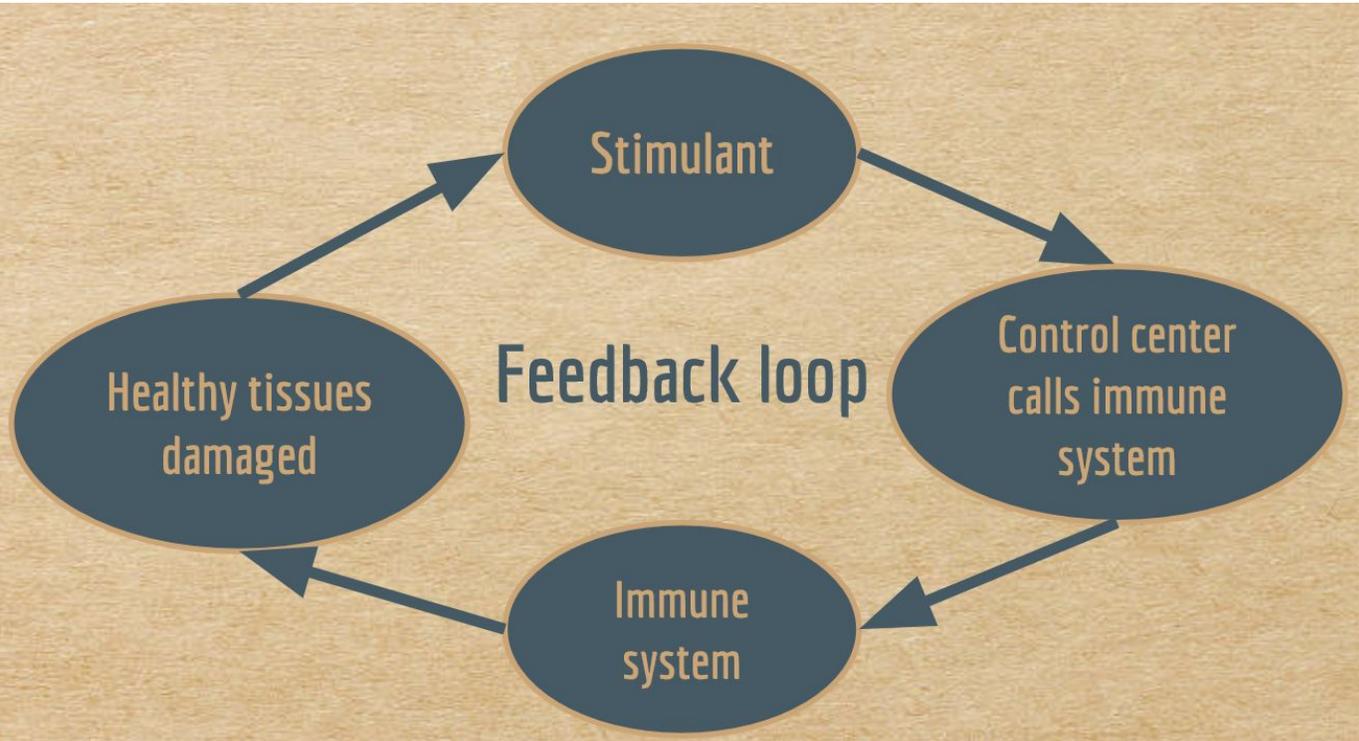


Student Work Sample #1 (page 2 of 12)

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.

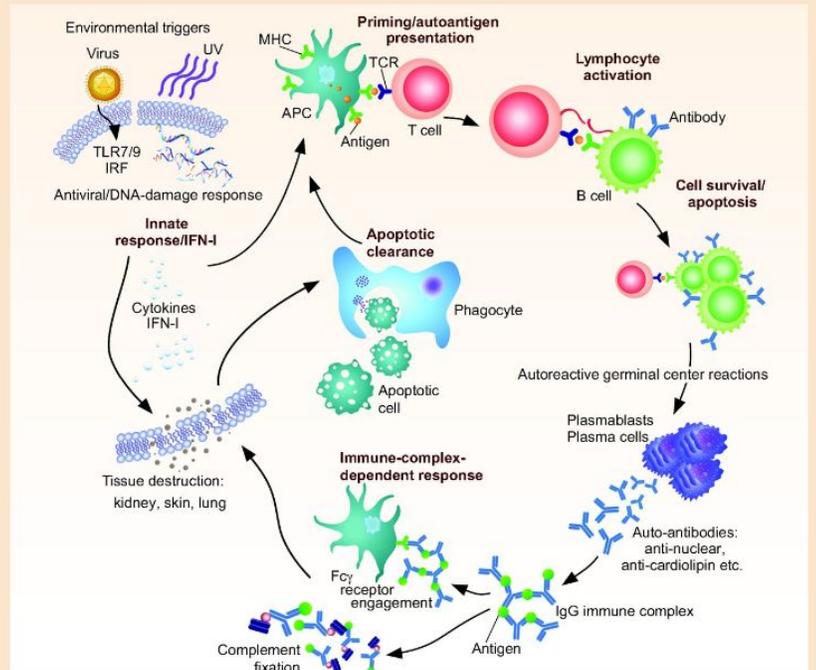
Student Work Sample #1 (page 3 of 12)



Student Work Sample #1 (page 4 of 12)

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.



Student Work Sample #1 (page 5 of 12)

- ❑ 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.

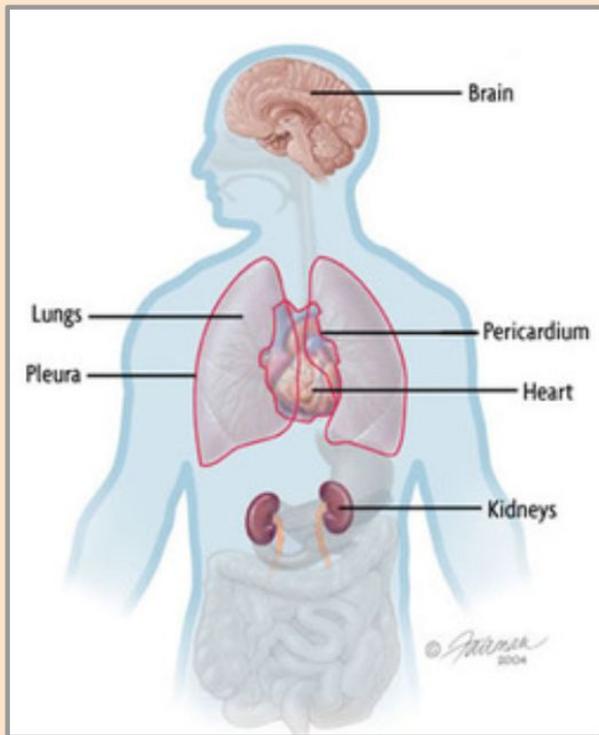


Symptoms:



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

Student Work Sample #1 (page 6 of 12)



SOME COMMON SYMPTOMS OF LUPUS

The infographic features a central silhouette of a human body with callouts to various systems and symptoms:

- Central Nervous System**: Headaches, dizziness, depression, memory disturbances, vision problems, seizures, stroke, or changes in behavior.
- Lungs**: Pleuritis, inflammation, or pneumonia.
- Blood**: Anemia, decreased white cells, increased risk of blood clots.
- Heart**: Chest pains, Heart murmurs.
- Joints**: Painful, swollen joints.
- Kidneys**: Inflammation.

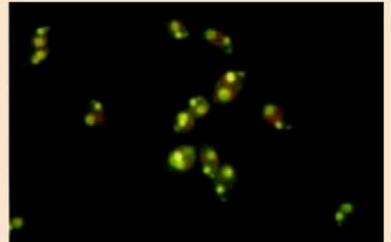
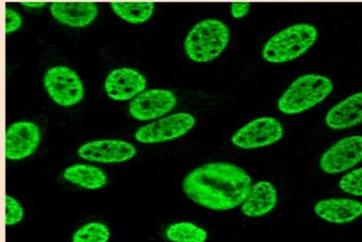
*It's recommended to review any information from searching the Internet with a health care professional—the primary resource to meet individual medical needs.

LUPUS RESEARCH ALLIANCE
Breaking through

LUPUSRESEARCH.ORG

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

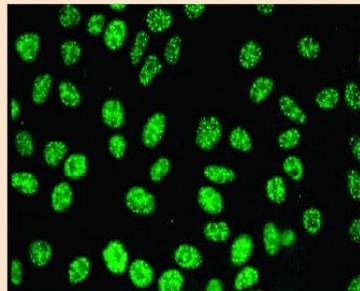
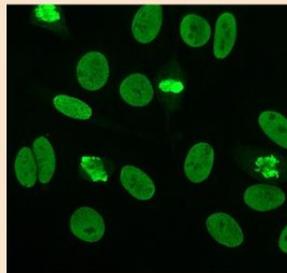


Student Work Sample #1 (page 8 of 12)

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. Patient's 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:

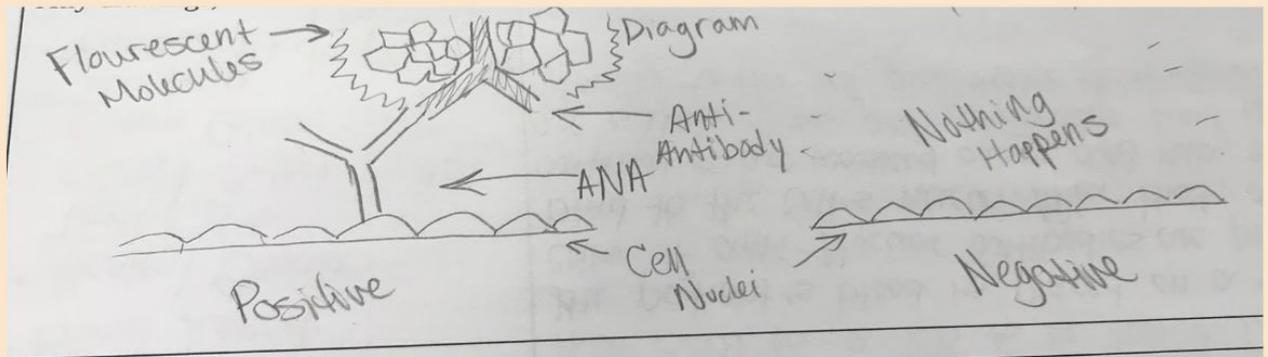
Chest x-rays & echocardiograms may be necessary to investigate fluid around the lungs & the heart

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

Student Work Sample #1 (page 9 of 12)

Data

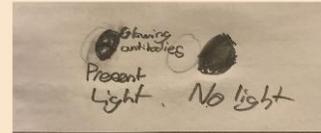
The following is a diagram of the process during an IF ANA test. If no ANA's are present, the stuck cells have no antibodies sticking to them, and thus nothing happens. However, because ANA's can be present in a healthy person's blood, usually doctors examine the number and pattern of ANAs rather than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



Student Work Sample #1 (page 10 of 12)

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.



Peripheral (rim)		anti-DNA (not seen on HEp-2)	SLE
Homogeneous (diffuse)		anti-DNA anti-histone anti-DNP (nucleosomes)	RA & SLE Misc. Disorders (anti-ssDNA)
Speckled		anti-Sm & RNP anti-Ro & La anti-Jo-1 & Mi-2 anti-Scl-70	SLE & SS PM/DM PSS (Systemic)
Centromere		anti-centromere	PSS (CREST)
Nucleolar		anti-nucleolar	SLE & PSS

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 Erythematosus), 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.

Student Work Sample #1 (page 12 of 12)

Works cited

Munoz, L E, et al. "Apoptosis in the Pathogenesis of Systemic Lupus Erythematosus." *Lupus*, U.S. National Library of Medicine, May 2008, www.ncbi.nlm.nih.gov/pubmed/18490410.

OpenStax. "Anatomy and Physiology." *18.4 Leukocytes and Platelets - Anatomy and Physiology*, OpenStax, 6 Mar. 2013, opentextbc.ca/anatomyandphysiology/chapter/18-4-leukocytes-and-platelets/.

"Systemic Lupus Erythematosus (Lupus)." *Systemic Lupus Erythematosus (Lupus) | Johns Hopkins Medicine Health Library*, www.hopkinsmedicine.org/healthlibrary/conditions/arthritis_and_other_rheumatic_diseases/systemic_lupus_erythematosus_lupus_85,P00058.

Boundless. "Boundless Anatomy and Physiology." *Lumen*, courses.lumenlearning.com/boundless-ap/chapter/blood-vessel-structure-and-function/.

"Antinuclear Antibodies (ANA)." *Rheumatology.org*, www.rheumatology.org/I-Am-A/Patient-Caregiver/Diseases-Conditions/Antinuclear-Antibodies-ANA.

"Lab Tests for Lupus." *WebMD*, WebMD, www.webmd.com/lupus/laboratory-tests-used-diagnose-evaluate-sle#4.

#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.

Student Work Sample #2 (page 1 of 13)

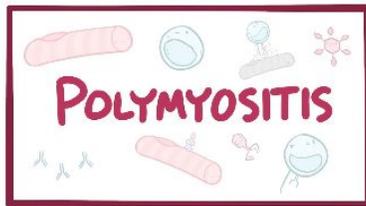
Polymyositis



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:**

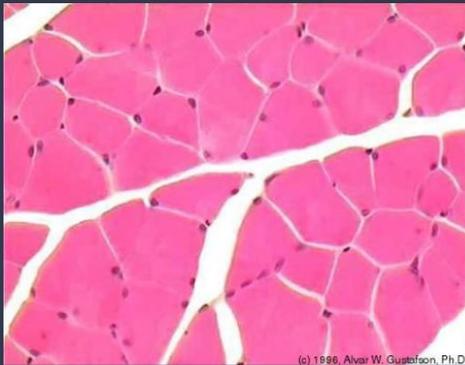
- Sterile needles
- Gloves
- Clean working area
- Biohazard container for sharp objects



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

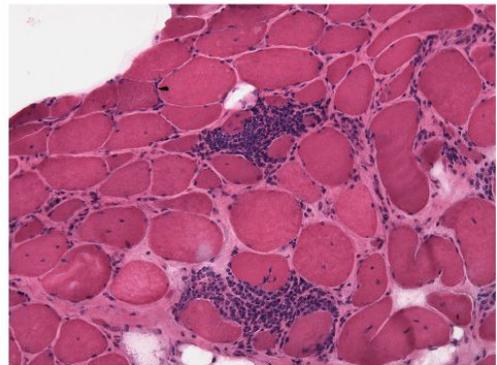
Healthy Skeletal Muscle



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

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

Muscle with Polymyositis



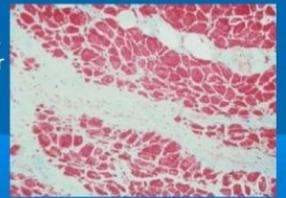
vs.



Polymyositis

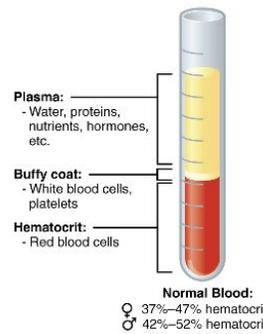
Muscle biopsy of polymyositis

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



Blood Test Results:

- Safety Procedures:
 - Sterile needles
 - Gloves
 - Clean working area
 - Biohazard container for sharps
- Shows high levels of:
 - Muscle Enzymes
 - Inflammatory markers
 - Autoantibodies.



Normal

VS.

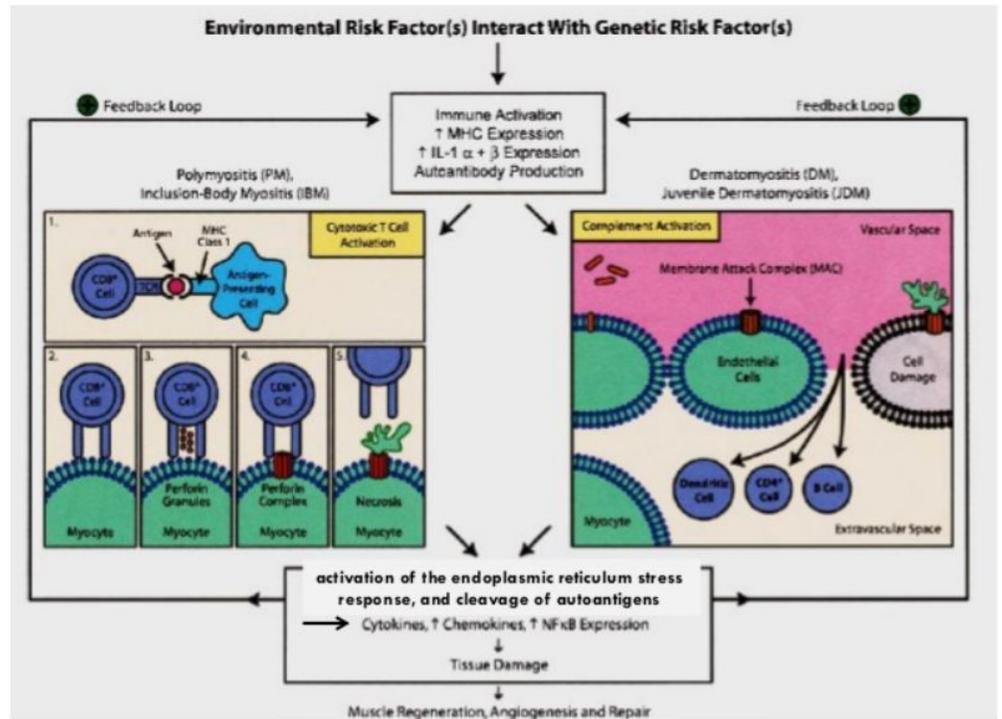
Polymyositis



Table 2. Comparison of demographic and laboratory variables in polymyositis (PM) patient and inactive disease.

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

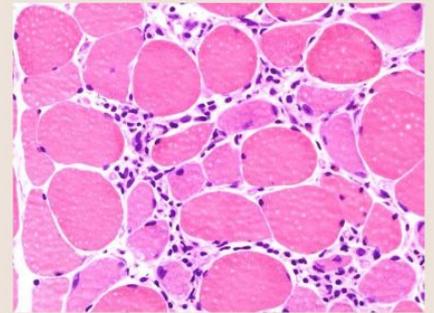
Student Work Sample #2 (page 11 of 13)



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



Works Cited:

[-https://www.webmd.com/arthritis/polymyositis#1](https://www.webmd.com/arthritis/polymyositis#1)

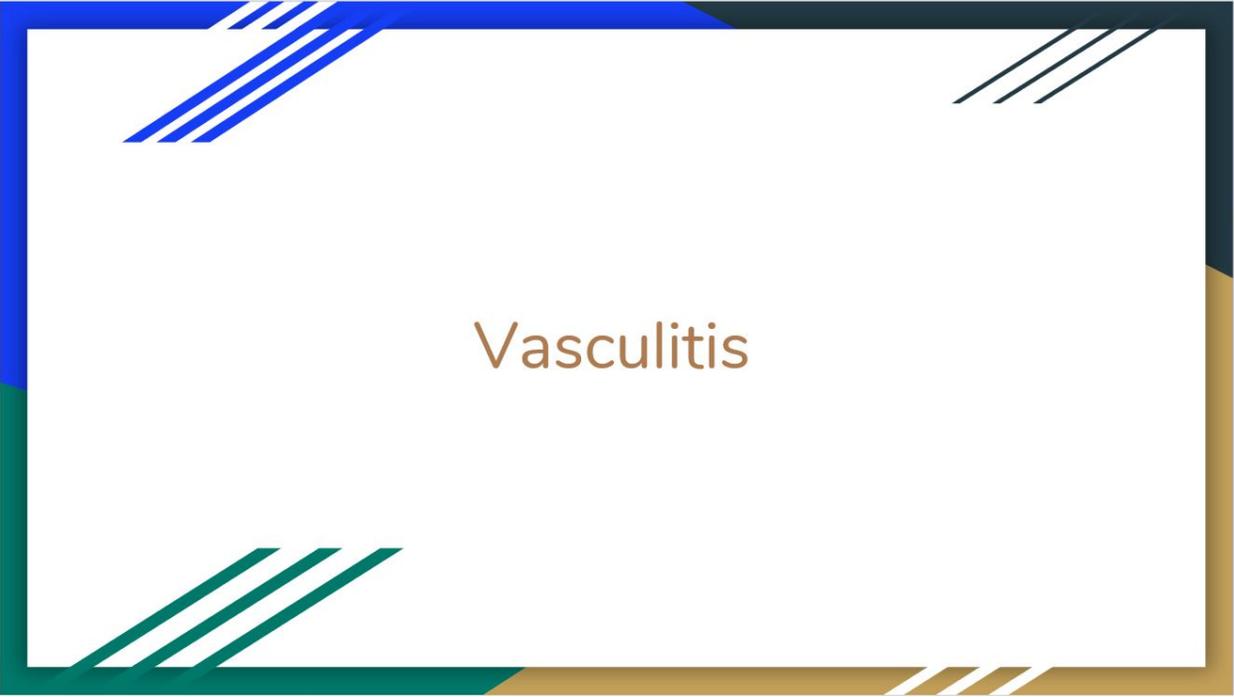
[-https://understandingmyositis.org/myositis/polymyositis/](https://understandingmyositis.org/myositis/polymyositis/)

[-https://rarediseases.info.nih.gov/diseases/7425/polymyositis](https://rarediseases.info.nih.gov/diseases/7425/polymyositis)

#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.



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

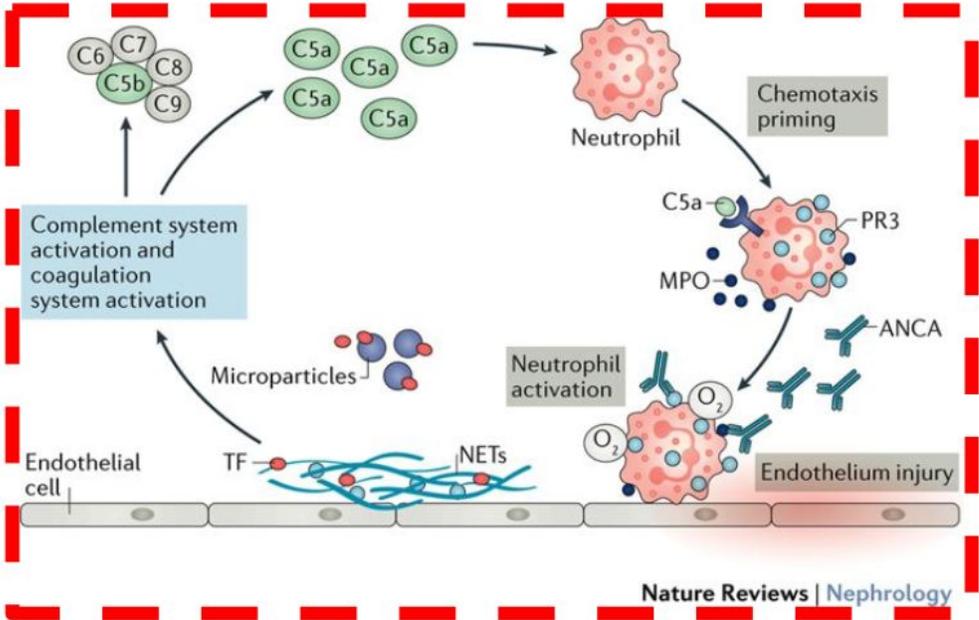
Biopsy

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



Student Work Sample #3 (page 12 of 12)

Work Cited Sources

Vasculitis." *Mayo Clinic*, Mayo Foundation for Medical Education and Research, 18 Oct. 2017, www.mayoclinic.org/diseases-conditions/vasculitis/symptoms-causes/syc-20363435. Accessed 19 Nov. 2018.

"Diagnosing Vasculitis • Johns Hopkins Vasculitis Center." *Johns Hopkins Vasculitis Center*, 2018, www.hopkinsvasculitis.org/vasculitis/diagnosing-vasculitis/#abdomin.

"Vasculitis." *National Heart Lung and Blood Institute*, U.S. Department of Health and Human Services, 2017, www.nhlbi.nih.gov/health-topics/vasculitis.

#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.

Student Work Sample #4 (page 1 of 7)

Tissue Issues: Fibroma

Student Work Sample #4 (page 2 of 7)

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.

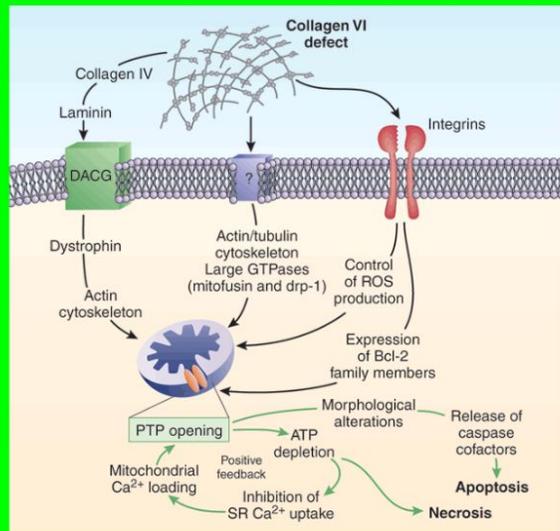
Student Work Sample #4 (page 3 of 7)

A photograph of Fibroma



Student Work Sample #4 (page 4 of 7)

Feedback loop



Student Work Sample #4 (page 5 of 7)

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.

Student Work Sample #4 (page 6 of 7)

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.

Student Work Sample #4 (page 7 of 7)

Sources:

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

<https://www.healthgrades.com/right-care/skin-hair-and-nails/fibroma--symptoms>

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

#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.