PULSE EXPERIENTIAL TEAM ASSIGNMENT

Team #: Group 35

1. Title of your PULSE experiential assignment. *Provide a creative and informative title.*
Systemic Lupus Erythematosus: An Immune System's Mutiny
2. Please summarize your PULSE experiential assignment (max 300 words). *Provide a non-technical (lay) summary of your PULSE assignment. Prompts to think about: What is the topic? What is the format? Why did you choose this topic and format? The summary for lay audience is a brief and accessible summary of the assignment that is used to explain complex ideas, technical writing and scientific terms to people who do not have prior knowledge of the subject (e.g., high school science level). This summary should include the importance, impact, and content of your assignment to a broader audience.* *[Team 23 is an example of an informative lay summary.]*
Our PULSE assignment is about Systemic Lupus Erythematosus (SLE), or lupus, which is an autoimmune disease where the immune system starts attacking the body's own healthy tissues instead of protecting them. Because of this, lupus can affect many different organs and systems in the body, including the skin, joints, kidneys, lungs, heart, and brain. It can also look very different from person to person, which is part of what makes it hard to understand and sometimes difficult to diagnose. We chose this topic because lupus is a condition that many people have heard of, but may not actually know much about. We wanted to make it easier to understand by breaking down what it is, what can trigger it, how it affects the body, and how it is treated. Since it is such a broad and complex disease, we felt it was important to present the information in a way that would be easier for a general audience to follow. We chose to use an interactive infographic as our project's format because it allowed us to organize the extensive SLE information into short sections, combining video, images, audio, and written explanations. This helped make the assignment more captivating and accessible compared to a long and text-heavy explanation. Our project covers the causes and risk factors of lupus, its signs and symptoms, how it is diagnosed, and the treatments used to help manage it. Overall, the goal of our assignment was to make this complicated autoimmune disease more understandable while remaining informative and useful for people without a strong science background.

3. Provide up to 6 keywords relevant to your PULSE experiential assignment.

3-6 keywords are ideal.

Systemic Lupus Erythematosus, Autoimmune Disease, Infographic

4. Identify the course topic with which your PULSE assignment most aligns.

Refer to the various topics outlined under 'Course content and Schedule' in the syllabus (e.g. Inflammation).

Immunity and Immune Disorders

5. What are the learning outcomes?

There should be a minimum of 2 learning outcomes for your assignments. For further information on learning outcomes, the Centre for Teaching and Learning offers information: https://teaching.uwo.ca/curriculum/coursedesign/learning-outcomes.html

After interacting with this infographic, viewers should be able to:

- Describe common clinical representations of SLE along with diagnostic techniques used to confirm diagnosis
- List common causes of SLE and understand the differences in genetic and environmental contributions
- Describe how the immune system goes awry in SLE, including the cell involvement and immune hypersensitivity contribution to disease progression
- Explain who falls into the most at-risk populations for SLE
- List common treatment methods in SLE while understanding the goal of treatment (prevention, symptom relief, or cure)

6. Why did the team select the chosen topic and the medium? How will the topic and medium of choice help learners?

Our group chose lupus because it is a classic autoimmune disorder that integrates multiple core concepts from PATHOLOGY 3500, including hypersensitivity reactions, autoantibody formation, immune complex deposition, tissue injury, and chronic inflammation. Lupus provides a great opportunity to connect molecular mechanisms with clinical features, helping others understand how immunopathology translates into real diseases. We decided that an interactive infographic is a great choice of medium for turning the heavy information into clear visuals that people can understand at a

glance. The interactive digital version allows people to click through different sections and learn in a more engaging way. This would hopefully help make lupus more clearly recognized and understood.

7. Did the team use an artificial intelligence (AI) technology tool? If so, which AI technology tool(s) did the team use? What other technology tools did the team use? Is the technology tool novel? Is the team using this technology tool in a novel fashion? If the team did not use technology tool, why did the team decide against using the technology tool(s)?

Please include details (e.g., for what purpose was the tool used for? Why was the tool the best tool to use for your assignment? Are there alternative tools that were considered?)

Our team used artificial intelligence for video creation, image creation, and quiz development. Pika was used for video creation because it offered a lot of prompts in the free package when you sign up. Creative Fabrica was considered for AI video generation, but it required too much prompting to get a finished video that was correct, and the free sign-up would not cover the number of prompts needed. ChatGPT was used to help develop detailed prompts for the video creator. Image creation for basic graphics was done with Canva AI image generator, as the base of the infographic was completed in Canva. Used Solvely.AI to help generate some false answers for the test your knowledge quiz, but we did not like the look of the quiz generation itself, so we made the final quiz with flexiquiz.com, which could be embedded in the Canva infographic. Video generation and image generation were often post-edited as the results were often partly inaccurate. Videos were edited in Microsoft Clipchamp, and images were manually corrected in Canva. The use of AI video generation in an interactive infographic as a pop-up to explain disease diagnosis techniques is fairly novel

8. How is your PULSE experiential assignment innovative and/or novel?
Describe what about the PULSE assignment is innovative/novel. Is there a particular component or content that is innovative/novel? How is it different from other content that already exists?

Our Pulse assignment is an infographic that presents a complex systemic disease in an interactive way, bringing in videos, verbal presentations, image gallery widgets, and a knowledge testing quiz. This infographic allows the viewer to interact with it on their own time and navigate back to parts they may want to review, while also being inclusive of those who have hearing impairments, as videos and auditory presentations include closed captions. This presents SLE knowledge in an engaging way that is not an overwhelming amount of information on a single page, like a basic static infographic. This is especially important in this disease because of its complex systemic presentation.

9. If you used an AI tool, please copy and paste the prompt(s)/question(s) used along with the output(s)/answer(s) from the AI tool.

The response here is to allow others to replicate the team's work. If the prompts/outputs are lengthy (over 1 page), please attach it as a separate document and note below [Please see attached document].

AI used for image, video, and quiz false answers. Please see the attached document for AI prompts and responses.

10. If you did not use an AI tool, please attach a copy of the team's notes to the assignment.

The response here is to allow others to observe the 'behind the scenes' team's work.

Information for the assignment was gathered without AI, and below are the teams' organized notes.

• Diagnosis:

Diagnosing lupus could be hard as symptoms vary from one person to another and may change over time, what also makes it more difficult is there is no "one test" for lupus and many lab tests must preformed such as:

CBC (complete blood count):

Measures the number of red/white blood cells and the amount of hemoglobin in grams per deciliter (g/dL). Results show the signs of anemia which is common in lupus

2. Erythrocyte sedimentation rate (ESR):

ESR blood test shows the amount of inflammation present in the body as it measures the rate at which the RBC settles to the bottom of a tube in an hour. A faster rate indicates higher levels of inflammatory response which may be linked with lupus

3. Chest X-ray:

Images may show shadows that might indicate fluids or inflammation in the lungs

4. MRI:

MRI can confirm pleuritis in SLE-associated shrinkage lung syndrome. A dynamic MRI sequences on forced voluntary ventilation technique can confirm the physiological movements of the diaphragm and all auxiliary respiratory muscles, as this evaluation of the diaphragm motion might be useful as a second-line tool to reinforce the clinical suspicion of the SLE-associated shrinkage lung syndrome.

5. Antinuclear antibody (ANA) test:

A test to evaluate the amount of autoantibodies, which are antibodies that attack self cells and tissues, present in the body. (It's not a clear indication of having lupus since other illnesses would have autoantibodies present, therefore more testing is needed

6. Biopsy:

Which is a test performed on a small piece extracted from an organ

• Renal: performed if urine protein-to-creatinine ratio exceeding 500mg/24h, or persistent renal dysfunction. This biopsy has classification based on glomerular morphological changes observed under light microscopy, immune deposits (IgG,IgA, IgM) identified through immunofluorescence.

Class I: Glumeruli appears normal under light microscopy, immunofluorescence shows immune complex deposit in the mesangial space

Class II: light microscopy shows mesangial proliferation. Immunofluorescences shows immune complex deposit in the mesangial space similar to class I

Class III: immune complex deposit may be visualized in the mesangial, sub-endothelial, or subepithelial space using immunofluorescence imaging

Class IV: similar to Class III in addition to lesions that may be segmental involving less or more than 50% of the glomeruli
Class V: Immune complex deposit are present in the mesangial and subepithelial spaces. Capillary loop appears thickened due to the subepithelial immune complex deposit. Nephrotic-range Proteinuria (excretion of proteins) occurs in this class.
Class VI: Most of the glomeruli is sclerosed (hardened, stiffened or scarred tissue). Immune complex deposits are not visualized on immunofluorescence as more than 90% if the glomeruli is scarred.

- Skin: Skin biopsies are infrequently performed in the evaluation of a rash in patients with SLE as skin manifestations of SLE can vary widely and may mimic other conditions
- Lung:

In patients with pleural involvement, fibrosis, lymphocytic and plasma cell infiltration, and fibrinous pleuritis were detected. Under immunofluorescence imaging, anti-IgG, anti-IgM, and anti-C3 nuclear patterns were seen.
Acute lupus Pneumonitis (ALP): In the case of ALP, it shows alveolar wall damage, necrosis, inflammatory cell infiltration, edema, hemorrhage, and hyaline membranes
Diffuse Alveolar Hemorrhage(DAH): The predominant findings of DAH is hemorrhage, capillaritis (inflammation of capillaries in the skin), immune complex deposition, and neutrophils in the alveolar walls
Bronchoalveolar Lavage (BAL): it is a diagnosis procedure where a flexible bronchoscope is inserted through the nose or mouth to reach the gas exchange zone of the lung then suction some fluid to take it and test it. Mainly used to exclude other causes of respiratory compromise as it can be used to rule out infection as an underlying cause of ALP or DAH.
Treatment:

1. Nonsteroidal anti-inflammatory drugs (NSAIDs)

They are drugs that target COX 1 and 2 enzymes , which are isoforms of the enzyme cycleoxygenase, COX is an enzyme that converts arachidonic acid into prostaglandin, which then go and bind to GPCR to have their effects (including inflammation, pain, haemostasis, protection of gastric mucosa, cell proliferation, and many more). NSAIDs will inhibit COX 1 and 2 preventing the conversion of archidonic acid into prostaglandin to stop the transduction of pain and inflammation signaling. There are 2 types of NSAIDs:
non-selective NSAIDs: These NSAIDs bind to both COX 1 and 2 and examples of these are: Diclofenac (Voltaren), Ibuporfen (Advil), and Naproxen (Aleve).
COX2- selective NSAIDs: Specifically bind to COX 2 and they include Celecoxib (Celebrex) and Rofecoxib

2. Immunosuppressives

Drugs that help to stop the immune system from attacking the body's healthy tissues such as: Methotrexate (Rheumatrex), Mycophenolate mofetil (Cellcept),, Azathioprine (Imuran) and Cyclophosphamide (Cytoxan). These drugs work differently and treat different lupus symptoms.
Symptoms: what the person is feeling; subjective
Source: Manifestations of Systemic Lupus Erythematosus - PMC
Musculoskeletal:
Joint pain (arthralgia)
Muscle pain (myalgia)
Morning stiffness (usually brief)
Migratory joint pain
Skin-related:
Sensitivity to sunlight (photosensitivity)
Itchy or painful rashes

Hair loss (alopecia)
Renal:
Swelling (edema)
Weight gain from fluid retention
Neurological:
Headaches
Mood changes (depression, anxiety)
Cognitive difficulties (memory, thinking)
Pulmonary/Cardiac:
Chest pain (especially with breathing or position changes)
Shortness of breath
Gastrointestinal:
Abdominal pain
Nausea
Indigestion (dyspepsia)
Vascular:
Cold sensitivity in fingers/toes (Raynaud's phenomenon)
Obstetric (in pregnancy):
History of miscarriages
Signs: objective evidence
Source: Manifestations of Systemic Lupus Erythematosus - PMC
Skin findings:
Malar (butterfly) rash across cheeks and nose
Source: Malar Rash - an overview | ScienceDirect Topics
Livedo reticularis (purple net-like rash)
Bluish discoloration of digits (Raynaud's)
Non-deforming arthritis
Renal:
Proteinuria (protein in urine)
Hematuria (blood in urine)
Hypertension
Signs of nephrotic syndrome (edema, hyperlipidemia)
Neurological:
Seizures
Stroke or transient ischemic attack (TIA)
Neuropathy
Pulmonary:
Pleural effusion
Source: stritch.luc.edu/lumen/meded/radio/curriculum/medicine/pleural_effusion1.htm
Pulmonary hypertension
Hemoptysis (in severe cases)
Cardiac:
Pericarditis (inflammation around heart)
Signs of heart failure
Endocarditis (Libman-Sacks)
Gastrointestinal:
Oral ulcers
Jaundice (in some cases)
Anemia
Leukopenia / lymphopenia
Thrombocytopenia
Elevated ESR
Immunologic/lab findings:

Positive ANA (antinuclear antibodies)
Anti-dsDNA, anti-Smith antibodies
Source: Anti-Sm antibodies in the classification criteria of systemic lupus erythematosus - ScienceDirect
Antiphospholipid antibodies
Ocular:
Dry eyes (keratoconjunctivitis sicca)
Retinal changes (cotton-wool spots)
Multiple Choice question
A patient with Systemic Lupus Erythematosus presents with swelling, weight gain, and laboratory findings of proteinuria. Which organ system is most likely affected?
INTRO: What is Lupus?
Source: An Overview of Systemic Lupus Erythematosus (SLE) Pathogenesis, Classification, and Management
Systemic lupus erythematosus (SLE) is a chronic autoimmune disease with multisystem involvement, meaning it can affect many organs in the body. It occurs due to abnormal activation of the immune system, leading to the production of autoantibodies and the formation of immune complexes that deposit in tissues, trigger inflammation, and can cause damage in organs such as the skin, kidneys, joints, and brain.
ETIOLOGY: What Causes Lupus?
Source: An Overview of Systemic Lupus Erythematosus (SLE) Pathogenesis, Classification, and Management
Genetic Factors:
Lupus is influenced by genetic susceptibility, including genes involved in immune regulation and clearance of cellular debris. When these processes are impaired, self-antigens accumulate and trigger autoimmune responses.
Environmental Factors:
Environmental exposures contribute to lupus by activating the immune system and interacting with genetic risk factors. These triggers promote inflammation and increase the likelihood of autoantibody production.
Infections:
Infections can trigger lupus by activating immune responses and promoting autoantibody formation. They may expose self-antigens or stimulate immune pathways that lead to chronic inflammation and tissue damage.
Supporting Source: Advances in the Pathogenesis and Treatment of Systemic Lupus Erythematosus
Sunlight / UV Exposure:
UV exposure contributes to lupus by causing skin cell damage and releasing intracellular antigens. These antigens stimulate immune responses, leading to immune complex formation and inflammation, which can trigger disease flares.
Supporting Source: Systemic Lupus Erythematosus
Multiple Choice question
Which of the following best explains how environmental factors contribute to the development of systemic lupus erythematosus (SLE)?
A. They directly destroy tissues without involving the immune system
B. They reduce autoantibody production
C. They trigger immune activation and expose self-antigens, leading to autoimmunity
D. They only affect a single organ
Dai, X., Fan, Y., & Zhao, X. (2025). Systemic lupus erythematosus: Updated insights on the pathogenesis, diagnosis, prevention and therapeutics. Signal Transduction and Targeted Therapy, 10(1). https://doi.org/10.1038/s41392-025-02168-0
The immune system attacks the body

Inflammation throughout the body damages organs, skin, joints, brain, and blood vessels
Women, especially between puberty and menopause more likely to develop lupus than men
Develops from a combination of genetics, hormones, and environmental triggers
Normally, the immune system protects the body from viruses and bacteria immune system is confused and attacks itself by producing auto antibodies that attack the body's own DNA and proteins, for example, anti-DS DNA antibodies, anti-Smith antibodies form immune complexes that travel in the bloodstream, get stuck in organs, and cause inflammation and damage
Inflammatory helper T cells become too active and attack the body more aggressively
Clean up system doesn't work in lupus; dead cell debris builds up, and the immune system sees it as dangerous
Lupus risk has internal and external factors; more than 100 genes have been linked to lupus
Environmental triggers such as UV light by damaging skin cells, infections, and lifestyle risks like smoking, stress, and poor diet.
Due to the variability of lupus, diagnosing is difficult using symptoms and blood tests to check for antibodies
Because genetic risks cannot be changed, prevention is focused on environmental factors
No cure for lupus, drug suppress the immune system, like corticosteroids, and treatments that target immune signals and B cells
Siegel, C. H., & Sammaritano, L. R. (2024). Systemic lupus erythematosus. JAMA, 331(17), 1480. doi: 10.1001/jama.2024.2315
It's a chronic autoimmune disease that attacks the body's own tissues, causing inflammation and damage in multiple organs
Women are more likely to get lupus, with black and Hispanic women occurring more than Caucasian women, and in more severe cases
A combination of mental factors, including UV light, cigarette smoking, and viral infections
The immune system produces autoantibodies that attack parts of the body's own cells, targeting nuclear materials, anti-nuclear antibodies, anti-double-stranded DNA antibodies, anti-smith antibodies
Skin involvement is very common in lupus, butterfly rash, sensitive to sunlight, discoid rash
May also have joint pain and arthritis
Blood disorders such as low white blood cells, anemia, and thrombocytopenia
Heart and lung problems such as pericarditis inflammation of the heart, Pleuritis inflammation of the lining of the lungs, kidney disease, and brain and nervous system problems
No single test to confirm lupus relies on a combination of symptoms blood tests, physical examinations, and sometimes biopsies
Ana test is not specific for lupus
Often measure anti-dsDNA antibodies and anti-Smith antibodies
Doctors aim to keep the disease in remission or low activity
Immunosuppressive drugs are often used to reduce immune system activity
Hydroxychloroquine commonly used medication that reduces inflammation, lowers flare risks, and protects organs
Ghodke-Puranik, Y. & Niewold, T. B. Genetics of the type I interferon pathway in systemic lupus erythematosus. Int. J. Clin. Rheumatol. 8, 657–669 (2013). doi: 10.2217/ijr.13.58
SLE is a chronic systemic autoimmune disease.

It involves multiple organ systems: the skin, musculoskeletal, renal, and hematologic systems.
much more common in women than in men, with the review snippet giving an incidence ratio of about 9:1, especially during the reproductive years.
Autoantibody production is a main feature, and mentions circulating anti-dsDNA autoantibodies.
mainly about genetics and interferon biology, it also highlights that circulating type I interferon levels are elevated in SLE and that this pathway activation is heritable in families with SLE.
genes IRF5 and stat4 = dysregulate inflammatory signals
Textbook
The immune system is responsible for recognizing danger and removing it
Helper T cells coordinate the immune response by releasing chemical messengers called cytokines- help B cells make antibodies
MHC class one protein on all cells lets T cells know not foreign
MHC class two on antigen-presenting cells for body defense
HLA in humans is MHC gene
B cells can bind directly to many targets when activated, and become plasma cells(antibody factories)
Antigen-presenting cells capture antigens and travel to lymph nodes, mostly dendritic cells
B-cell follicles form germinal centers when active in lymph node T cell areas, and dendritic cells show antigens to T cells
Type two hypersensitivity reaction body attacks cells and tissues
Type three hypersensitivity reaction, immune complexes deposit in the blood and tissues complement system turns on, and inflammation classic type in SLE
The immune system usually has self-tolerance, where self-reactive cells can be forced to die, but in an autoimmune disease, genetics plus the environment can cause tolerance to fail
In lupus, antibodies are made to attack parts of your own cell nuclei, DNA, histones, and nuclear proteins
Lupus may have type two hypersensitivity problems with antibodies attacking red blood cells, white cells, platelets, and Antiphospholipid antibodies
It's a loop of cell death, releasing nuclear material that isn't cleared well. Then, the immune system makes antibodies. The antibodies form complexes with the nuclear antigen, and the complexes stimulate more immune activation via inflammation and cell death
Most lesions caused by immune complex type three hypersensitivity
Most hematological signs are caused by type two hypersensitivity
4 symptoms + positive blood test for antinuclear antibodies to diagnose
Complement pathway genes implicated cause poor clearance of debris
Inhibitory FC receptor FcyRII = poor regulation of B cell activity

11. How did the team ensure the veracity of the information presented in the PULSE assignment?

The response should highlight how the team has ensured that the information presented in the assignment is evidence-based and not spreading misinformation. You should specifically mention which databases (if any) or textbook materials you used, and how you kept track of the sources/references for each claim. If AI provided you with false information, please describe how the team has fact-checked the AI response and the legitimate (scientific) sources you used. A reference document should be provided in the reference section (15. References) below. Please ensure to include in-text citations in your assignment where applicable.

Information was gathered from peer-reviewed articles from known journals and the Robbin & Kumar Basic Pathology textbook. Also checked a government site the CDC to make sure epidemiological statistics from sources were up to date. After reading and taking notes on a resource, the article's link was embedded under or above the information provided in a shared Google document and referenced in the assignment. AI provided some anatomically and diagnostically inaccurate images and videos, which were either re-prompted or edited by hand. Basic anatomical knowledge and knowledge of the procedures were used to check for the AI generation's correctness.

12. Write a meaningful team reflection about the PULSE session (max 250 words).

Prompts to help your team write the reflection: Were there any team/individual biases that surfaced when creating content for the assignment? Did the team implement any practices to ensure the content was equitable, diverse, and/or inclusive? How has the PULSE assignment helped with the team's learning? If the team had to estimate, how long did the assignment take? What worked well for your team? What would the team do differently next time? What were the opportunities and challenges with creating the PULSE assignment to help others' learning? Were there any barriers or limitations?

Reflection: Our team aimed to make this interactive infographic engaging for people who may not be experts in this area, while including different styles of learning and providing accessibility for people with hearing impairments. A bias that came up was our own familiarity with the topic, since it can be easy to assume certain terms or concepts are simpler than they actually are for a wider audience. To address this, we worked to simplify complex ideas, use clear visuals, and explain things that others may not know. This assignment gave us a much better understanding of how the immune system is supposed to function and the different ways it can go wrong, because teaching something really forces you to understand it on a deeper level. If we had to estimate, the assignment probably took about two weeks of nonstop work, spread throughout the year. What worked well for our team was dividing the project into sections so we could work on it separately, since we had conflicting schedules and were working at a distance. Using Canva, Google Docs, and WhatsApp made remote collaboration much easier. One challenge was finding the right balance between being interactive and informative for a general audience. We also found some limitations in Canva, since it could not support things like pop-ups or hover text, so we had to work around that by embedding widgets and linking images. If we were to do a project like this again, we would like to explore other platforms with more design flexibility.

13. Write the contributions of individual team members using unique initials.

Example: All team members contributed to the design of the prompts used in the technology tool, ChatGPT (GPT-3.5). T.K and T.K2 fact checked the information presented by ChatGPT using published literature on PubMed (PMID 29211319, 32477271). Y.Z finalized and formatted the final infographic and compiled the prompts and outputs. P.E was involved in…

All team members annotated and formatted their own references. All team members provided a multiple-choice style question related to their respective subtopics. G.C. provided information for the introduction and etiology, and formatted the respective

Canva pages. A.C. provided information on signs and symptoms and formatted the respective Canva pages. D.S. provided information on pathology and formatted the respective Canva pages. A.M. provided information on diagnosis and treatment and formatted the respective Canva pages. D.S. configured Canva linking and embedded widgets made in ElfSight. All team members worked together on the final pulse assignment write-up and approved the finished bibliography/infographic.
14. Other comments (Optional) *Any comments the team would like to let the coordinator and/or TAs know.*

15. References

1. Ameer, M. A. *et al.* An overview of systemic lupus erythematosus (SLE): pathogenesis, classification, and management. *Cureus* **14**, e30330 (2022). Available from: https://pubmed.ncbi.nlm.nih.gov/36407159/
2. Samir, M. *et al.* Molecular mechanisms and immunopathogenesis of systemic lupus erythematosus. *Int J Mol Sci* **24**, 6578 (2023). Available from: https://doi.org/10.3390/ijms24076578
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16. Annotated Bibliography

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   This article gives a full picture of systemic lupus erythematosus (SLE), including how it starts, how it is classified, its symptoms, and how to treat it. The authors elucidate that systemic lupus erythematosus (SLE) is a chronic autoimmune disease characterized by the generation of autoantibodies and the accumulation of immune complexes, resulting in inflammation and damage to multiple organs. The paper defines the multifactorial etiology of lupus, emphasizing the contributions of genetic predisposition, environmental stimuli, and immune dysregulation. This source is from a peer-reviewed medical journal, which adds to its trustworthiness and credibility. One of the best things about this article is that it clearly and logically explains both the basic and clinical aspects of lupus, making it a great resource for us. But as a general review, it doesn't go into great detail about how certain mechanisms work. This source is very helpful for our project because it backs up the introduction and etiology parts of our infographic. It helps us accurately define lupus as an autoimmune disease that affects more than one organ and shows how environmental and genetic factors can cause the disease.

2. Samir, M. *et al.* Molecular mechanisms and immunopathogenesis of systemic lupus erythematosus. *International Journal of Molecular Sciences* **24**, 6578 (2023). Available from: https://doi.org/10.3390/ijms24076578

   This article talks about the molecular and immunological processes that cause systemic lupus erythematosus. It talks about how an immune system that isn't working right can make autoantibodies, cause long-term inflammation, and hurt tissues. The authors elucidate critical processes, including the aberrant activation of B cells, impaired clearance of apoptotic cells, and the function of cytokines in perpetuating autoimmune responses. The article also talks about how environmental factors, like infections, can lead to disease by turning on immune pathways and making people more likely to come into contact with their own antigens. This source is very trustworthy because it was published in a well-known, peer-reviewed journal and gives detailed, up-to-date scientific information. One of its best features is that it focuses on mechanistic explanations, which help link molecular events to disease outcomes. But some parts are more advanced and might be hard for students to understand. This source is helpful for our assignment because it backs up the parts about the causes and effects of lupus, especially when it talks about how infections and problems with the immune system can lead to lupus.

3. Vaillant, A. A. J., Goyal, A. & Varacallo, M. A. Systemic Lupus Erythematosus. *Dermatology: Volume 1-2, Fifth Edition* **1**, 670–688 (2023). Available from: https://www.ncbi.nlm.nih.gov/books/NBK535405/

This source gives a clinical overview of systemic lupus erythematosus, covering its epidemiology, pathophysiology, clinical presentation, and triggers. It makes it clear that things like ultraviolet (UV) light and infections are important causes of lupus flares and the disease getting worse. The article says that UV light kills skin cells, which releases nuclear antigens and starts autoimmune responses. In the same way, infections are said to help activate the immune system and make autoantibodies. StatPearls is a well-known medical resource that healthcare professionals have written and reviewed, so it is a trustworthy and reliable source. One good thing about this source is that it clearly explains clinical and environmental triggers, which are important for understanding how diseases start. However, it doesn't go into as much detail about molecular mechanisms as primary research articles do. This source is very helpful for our project because it backs up the etiology section by explaining how sunlight and infections can trigger lupus in the environment.

4. Kumar, V., Abbas, A. K., Aster, J. C. & Deyrup, A. T. Robbins & Kumar Basic Pathology 11th edn (Elsevier, Philadelphia, PA, 2023).

   This is a textbook on introductory human pathology, which is used in medical education, and it is valuable for providing the foundational disease mechanisms. Although this is not a lupus-specific textbook, it covers the main principles needed to understand the immune system and autoimmune diseases, including hypersensitivity reactions, immune complex deposition, complement activation, inflammation, and tissue injury. It also contains a portion that is focused directly on SLE, making it helpful for explaining why SLE can involve multiple organs and how mechanisms such as type II and type III hypersensitivity contribute to clinical findings. A strength of this source is that it was written for teaching the basics of pathology in an easy-to-understand format. Though its information is broader and less current than some more recent review articles focused solely on lupus. For this assignment, it is used as a foundation in understanding the disease occurrence, for basic concepts and definitions, and information on some genetic predispositions for lupus.

5. Ghodke-Puranik, Y. & Niewold, T. B. Genetics of the type I interferon pathway in systemic lupus erythematosus. *Int J Clin Rheumtol* **8**, 657–669 (2013). doi: 10.2217/ijr.13.58

   This article focuses on the genetics of the type I interferon pathway in SLE. The authors give an overview of evidence that SLE-associated risk alleles can alter interferon production and signaling, which helps explain why some patients develop a strong interferon signal with a lasting immune activation. That focus makes this paper more specialized than just a general lupus review article and useful for explaining the connection between genetic susceptibility and immune dysregulation. A major strength of this source is how it clarifies the interferon molecular pathway in SLE. The article was published in 2013, so it is a bit older of an article with newer understandings that have come out more recently; it remains valuable as a foundational source for the genetic predisposition that was witnessed in SLE patients related to the interferon pathway. For this assignment,

it was useful in the etiology section discussing genetic risk factors, interferon signaling, loss of self-tolerance, and the basis of chronic inflammation in lupus.

6. Cojocaru, M., Cojocaru, I. M., Silosi, I. & Vrabie, C. D. Manifestations of Systemic Lupus Erythematosus. *Mædica* **6**, 330 (2011). Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC3391953/

   This article summarizes the many different ways systemic lupus erythematosus can show up in the body. Its main purpose is to explain that lupus is not limited to one organ system, but can affect the skin, joints, kidneys, lungs, heart, blood, nervous system, and gastrointestinal system. This was useful because our assignment also focused on showing lupus as a systemic disease, meaning it can impact multiple areas of the body. The source is credible because it is a peer-reviewed medical article and has been cited often, but one weakness is that it is from 2011, so it is not the most up-to-date source for current treatment or newer research. However, it was still helpful for describing signs and symptoms. We used this article to support the signs and sections of the infographic assignment, explaining how lupus can present and look different from person to person.

7. Musa, R., Rout, P. & Qurie, A. Lupus Nephritis. *StatPearls* (2025). Available from: https://www.ncbi.nlm.nih.gov/books/NBK499817/

   This article is on lupus nephritis, which is when lupus affects the kidneys. It explains that lupus nephritis is a serious manifestation of SLE and that early monitoring of kidney function, such as urine testing and creatinine levels, is important to prevent worsening kidney damage. It also discusses how renal biopsy is used to classify lupus nephritis and guide treatment. This is a credible and recent source; it is from StatPearls through NCBI Bookshelf, and it was updated in January 2025. A strength is that it gives clear clinical information about pathophysiology, diagnosis, and treatment. A limitation is that it is written more for healthcare professionals, so some parts are technical. We used this article for our diagnosis and treatment section, as it explains proteinuria, hematuria, biopsy, immune complex damage, and why kidney involvement in lupus is important to detect early.

8. Hobayan, C. G. P., Korman, A. & Lin, J. Utility of skin biopsy in patients with systemic lupus erythematosus. *Lupus Sci Med* **11**, e001280 (2024). Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC11423714/.

   This article looks at how useful skin biopsies can be for patients with rashes that may be related to lupus. The main purpose is to see whether biopsy results matched the clinical diagnosis and whether they changed patient management.

This is helpful because skin symptoms in lupus can vary widely and can also look like other skin conditions, so it is not always simple to diagnose based only on appearance. It is a recent 2024 article published in Lupus Science & Medicine journal, which is focused on lupus research. A strength is that it directly studies a practical diagnostic question. A weakness is that the study was limited in size and setting, so it may not be very representative of every patient. We used this article to provide information for the diagnosis and treatment section of our infographic, and to state that a skin biopsy is not always done, but it can be useful when the rash is unclear or could be another condition

9. Dai, X., Fan, Y. & Zhao, X. Systemic lupus erythematosus: updated insights on the pathogenesis, diagnosis, prevention and therapeutics. *Signal Transduction and Targeted Therapy* **10**, 102- (2025). doi: 10.1038/s41392-025-02168-0

   This is a recent review article that gives a broad understanding of systemic lupus erythematosus (SLE), covering things like epidemiology, disease mechanisms, diagnosis, prevention, and treatment. The authors organize SLE pathogenesis around three major processes: overactive immune responses, cytokine imbalance, and impaired clearance of cellular debris, while also talking about genetic, epigenetic, hormonal, and environmental contributions. The article is useful in our infographic because it discusses the pathogenesis, diagnostics, and treatment strategies. It was mainly used for understanding the pathogenesis of SLE. Its limitation is that, because it is so comprehensive, it cannot examine every treatment study in the same depth as a focused paper, but for this assignment, it was useful as a background source because it helps explain how SLE develops and how that informs diagnosis, prevention, and treatment.

10. Siegel, C. H. & Sammaritano, L. R. Systemic Lupus Erythematosus: A Review. *JAMA* **331**, 1480–1491 (2024). doi: 10.1001/jama.2024.2315

    This article is a clinically oriented review of SLE, which is valuable for understanding how the disease presents itself and how it is classified. This review article summarizes the major organ systems impacted by SLE. It brings attention to the role of the EULAR/ACR classification criteria, and describes treatment goals like remission, preventing flare-ups, and reducing organ damage. It also clearly identifies hydroxychloroquine as standard therapy and outlines when additional immunosuppressive or biologic agents are used. This source is reliable for a clinical overview and popular treatment recommendations. Although it was less detailed on the pathophysiology of SLE, it still had usable recent information for the pathology section in developing an understanding of how the disease comes to be. It was also useful for this assignment as it supported sections on symptoms, diagnosis, lupus nephritis, and disease management.

11. ScienceDirect Topics. *Malar rash*. Available from: https://www.sciencedirect.com/topics/medicine-and-dentistry/malar-rash

    This is an overview of malar rash, which is one of the common skin signs associated with lupus. We used it for the image and to help represent the facial

rash seen in SLE in a visual way in the signs and symptoms section of our infographic.

12. Primary Care Dermatology Society. *Livedo reticularis*. Available from: https://www.pcds.org.uk/clinical-guidance/livedo-reticularis

    This clinical web page explains livedo reticularis, which is a skin finding that can be seen in some lupus patients. We used it for the image as a visual example of one of the skin-related signs included in our infographic project.

13. Steffes, M. J. *Raynaud's syndrome*. Orthobullets Available from: https://www.orthobullets.com/hand/6098/raynauds-syndrome (updated 10 February 2025).

    This webpage gives information and visuals related to Raynaud's syndrome, which can happen in people with lupus. We used it for only the image to help show what this condition can look like and to support the signs section of our infographic assignment.

14. Chandrasekhar, A. J. *Pleural effusion*. Available from: https://www.stritch.luc.edu/lumen/meded/radio/curriculum/medicine/pleural_effusion1.htm

    This website provides information and imaging related to pleural effusion, which can occur as a pulmonary complication in lupus. We used it for only the image to visually represent lung involvement and fluid around the lungs.

15. Klatt, E. C. *Cardiovascular pathology*.Available from: https://webpath.med.utah.edu/CVHTML/CV122.html

    This medical site contains pathology images and information related to cardiovascular conditions. We used it for visual support in the signs section of our project, with a photo of endocarditis to help show how lupus can also affect the heart.

16. *Mouth ulcer*. Wikipedia. Available from: https://en.wikipedia.org/wiki/Mouth_ulcer

    This source gives an image of mouth ulcers, which are a possible sign of lupus. We used it for the image to help show one of the more common oral findings in our signs and symptoms section.

17. Worth, T. *Jaundice: why it happens in adults*. WebMD (2015). Available from: https://www.webmd.com/hepatitis/jaundice-why-happens-adults

    This widely used clinical website describes jaundice and what it can look like in adults. We only used it for the image to support the section on possible gastrointestinal signs that may appear in some lupus cases.

18. van Beers, J. J. B. C. & Schreurs, M. W. J. Anti-Sm antibodies in the classification criteria of systemic lupus erythematosus. *J. Transl. Autoimmun.* **5**, 100155 (2022). doi:10.1016/j.jtauto.2022.100155.

    This is a journal article about Anti-Sm antibodies and their importance in lupus classification. We only used it in our infographic for its immunological staining image of anti smith antibodies to support our signs and symptoms section of our infographic on SLE.

19. Cleveland Clinic. *Cotton wool spots: causes & treatment*. https://my.clevelandclinic.org/health/symptoms/cotton-wool-spots (updated 10 February 2025).

    This clinical webpage talks about cotton wool spots and includes information about what they are and why they happen (lupus). We only used it for the image, to support the ocular findings in the signs and symptoms section by showing one of the ocular changes that can be seen in lupus.

20. FlexiQuiz. *Login*. Available from: https://www.flexiquiz.com/Account/Login?ReturnUrl=%2fPublish%2fEdit%2f5c561a78-a0a0-426c-9b6e-22b6d83e4592

    This is the platform we used to create and organize the quiz portion of our project. It was useful for turning some of our content into an interactive format so users could test their understanding of the information presented on SLE.

21. Solvely. *Convert text to quiz - Best AI Quiz Generator*. Available from: https://solvely.ai/quiz-generator?adjust_referrer=adjust_external_click_id%3D4f55cc8ef2a31fe7d3e5a549d6ba2268

    This is an AI quiz-generating platform that helps turn written content into quiz questions. We used it to help build false multiple choice answers for our test your knowledge quiz on SLE material presented in our infographic.

22. Kobe, H. *et al.* Acute onset systemic lupus erythematosus interstitial lung disease: a case report. *Respir. Med. Case Rep.* **32**, 101329 (2021).

    This is a medical case report showing a real example of lung involvement in lupus. We used it to support our section on pulmonary complications with its pathological lung histology photo.

23. Pika. Available from: https://pika.art/

    This source is an AI design and media generation platform. It was used to help create diagnostic videos on blood samples, biopsy, x-rays, urine sample and bronchioalveolar lavage. It was also used in SLE pathology for a video depicting antibodies in the bloodstream.

24. Elfsight. *The best free widgets and plugins for your website* (2025). Available from: https://elfsight.com/widgets/

This is a widget and plugin platform that provides interactive website features. We used it to add image gallery widgets with hover capabilities that show writing, as Canva did not have these features built in.

25. OpenAI. *ChatGPT*. Available from: https://chatgpt.com/

    This is an AI language platform that helps with generating and organizing written content. We used it to help build prompts for video creation so as not to waste prompting credits in the AI video creator pika.

26. Canva. *Visual Suite for Everyone*. Available from: https://www.canva.com/

    This is the main design platform we used to build our interactive infographic. It was useful for putting together visuals, text, and layout in one place and allowed us to use AI-generated graphics when stock images would not suffice, so we could make the project clear and appealing.

27. Centers for Disease Control and Prevention. People with Lupus. *CDC* https://www.cdc.gov/lupus/data-research/index.html (2024). Accessed 3 Apr 2026.

    This is a public health resource from the CDC that provides general information and research-based data about people living with lupus. We used it to support the prevalence of SLE stated in some of our articles, which was used on the introductory homepage section in our infographic, as this information helped show the real-world importance and impact of lupus on different populations.