**PULSE EXPERIENTIAL TEAM ASSIGNMENT**

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| **1. Title of your PULSE experiential assignment.**<br><br>*Provide a creative and informative title.* |
| Fix the Body!<br><br>A Sarcoidosis Case Study |
| **2. Please summarize your PULSE experiential assignment (max 300 words).**<br><br>*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.*<br><br>*[Team 23 is an example of an informative lay summary.]* |

Our PULSE experiential assignment is an interactive slideshow game that follows a case study to explore the various connections between sarcoidosis and course content. Instead of a traditional paper or presentation, the diagnosis game challenges users to work through a patient case step-by-step, making decisions and actively learning throughout the process. The user can click on different levels to deepen their understanding of each system, and go back and forth when selecting “Test Your Knowledge” answers.

The game follows a 34-year-old woman who presents with initial symptoms such as fatigue, cough, and shortness of breath. User moves through four levels, representing different body systems: 1) Immune Disorders, 2) Respiratory System, 3) Nutritional and Metabolic Diseases, and 4) Hepatobiliary Diseases. At each stage, they learn background information and apply the knowledge to diagnose the patient.

We picked sarcoidosis as our topic, a complex inflammatory disease that can affect multiple organs in the body, because it connects to four lecture systems we have explored in Pathology 3500. Sarcoidosis has a wide range of symptoms and an unclear cause, making it a great example of how diseases can affect the whole body. Since the target audience is people with a high school level of scientific understanding, this game format makes learning more engaging and accessible. By turning complex pathology concepts into interactive questions and real-life scenarios, the assignment helps users actively learn rather than passively read.

On a broader scale, the impact of this project focuses on health education. Our goal is to simplify complicated medical concepts for clearer scientific communication among the general population. This approach improves public awareness of chronic diseases and makes science more approachable.

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

*3-6 keywords are ideal.*

Immune Disorders, Respiratory System, Nutritional and Metabolic Diseases, Hepatobiliary Diseases, Diagnostic Tools, Interactive Learning

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

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| *Refer to the various topics outlined under 'Course content and Schedule' in the syllabus (e.g. Inflammation).* |
| Immunity and Immune Disorders (Section B, Topic 7) |
| **5. What are the learning outcomes?**<br><br>*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* |

By the end of level 1, students will be able to:

- Describe the immunopathogenesis of sarcoidosis, including the role of antigen-presenting cells, $CD4^+$ T helper (Th1) cells, and macrophages in granuloma formation.
- Explain how cytokines (e.g., IL-2, IFN-γ, TNF-α) contribute to immune activation and chronic inflammation.
- Identify the key cellular components involved in granuloma structure.
- Explain the concept of immune dysregulation, including the paradox of local immune activation and systemic hyporesponsiveness.
- Explain the immunologic basis of treatment strategies.

By the end of level 2, students will be able to:

- Describe the effects of sarcoidosis on the respiratory system, including granuloma formation, airflow obstruction, impaired gas exchange, and pulmonary fibrosis.
- Explain how structural changes in the lungs contribute to clinical symptoms such as dyspnea, cough, and hypoxemia.
- Interpret the functional consequences of pulmonary sarcoidosis, including reduced DLCO and its impact on gas exchange, exercise capacity, and disease severity.
- Identify key diagnostic and treatment approaches for pulmonary sarcoidosis, including imaging findings, biopsy, and the role of corticosteroids and immunosuppressive therapies.

By the end of level 3, students will be able to:

- Understand the connection between sarcoidosis and obesity.
- Explain how vitamin D deficiency, hypercalcemia, and vitamin B12 deficiency can arise.
- List complications that can result from metabolic deficiencies and explain how the deficiencies can cause them.
- Identify several long-term complications of untreated sarcoidosis.
- Describe how diet can impact corticosteroid effectiveness and other symptoms of sarcoidosis.
- Recommend an appropriate diet for sarcoidosis patients.

By the end of level 4, students will be able to:

- Describe liver anatomy, including the structure and components of the portal triad.
- Summarize liver functions (metabolic, synthetic, storage, and excretory) and relate them to the patient's clinical symptoms.

- Analyze clinical findings (e.g., jaundice, hepatomegaly, laboratory abnormalities) to infer the presence of hepatic involvement.
- Evaluate treatment strategies (e.g., corticosteroids, immunosuppressants) and their effects on disease progression and liver function.

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

Our team selected sarcoidosis as the focus of our project because it provides a comprehensive and integrative model for applying multiple core concepts from the course. As a systemic, immune-mediated disease, sarcoidosis spans a broad range of topics, including immune cell interactions, granuloma formation, hypersensitivity mechanisms, immune dysregulation, and organ-specific pathology, particularly within the respiratory system. This made it an ideal cumulative topic, allowing us to connect and apply knowledge from different topics of the course to a single condition. By exploring one disease in depth, learners are encouraged to connect concepts rather than study them in isolation, reinforcing deeper understanding.

We chose an interactive video game format as our medium because active learning strategies have been shown to improve engagement, retention, and application of knowledge compared to passive learning. Rather than simply presenting information, the interactive format requires learners to answer questions and apply concepts in real time. Incorporating multiple-choice questions throughout the game allows users to test their understanding, receive immediate feedback, and reinforce key concepts through practice.

Additionally, our approach was inspired by interactive, game-based learning tools introduced in class (e.g., AI-supported study games), which demonstrated how engagement and interactivity can enhance the learning experience. We aimed to build on this idea by creating a resource that is both educational and engaging, helping learners stay motivated while working through complex material.

The combination of a conceptually rich topic like sarcoidosis and an interactive medium allows future students to actively engage with the material, apply course knowledge in a meaningful context, and retain information more effectively.

**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 an artificial intelligence (AI) technology tool in the development of this project. Specifically, we used ChatGPT to support brainstorming, refine explanations of complex concepts, and improve clarity and flow in our written content. The tool was used primarily as an assistive resource to enhance understanding and communication, rather than to generate original ideas or replace critical thinking.

In addition to AI, we used several other technology tools to support our workflow. These included Google Slides for creating the interactive presentation and Google Docs for drafting and editing content collaboratively.

The use of AI tools such as ChatGPT is not novel. However, our team used it in a thoughtful and targeted way to support learning and improve scientific communication. Rather than relying on it passively, we critically evaluated and refined all AI-assisted outputs to ensure accuracy, relevance, and alignment with course material. This approach reflects a responsible and academically appropriate use of AI as a supplementary tool.

**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 innovative because it goes beyond recalling lecture content to apply knowledge in a clinical case-based scenario. Instead of focusing on a prominent topic from lectures, we took a disease that was briefly introduced in class and used it as a foundation to connect multiple concepts across the course. This type of content requires students to think critically to apply concepts and relate them to a real-world novel disease. Furthermore, instead of a traditional presentation, we used an interactive format that relies on multiple-choice questions and case studies tailored to each course concept. This ensures students are not passively receiving information but are actively participating and reflecting on their learning. Overall, both the format and topic of our assignment are innovative because they encourage active learning and a deeper understanding of multiple course concepts.

**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].*

Note: Please see attached document.

**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.*

Note: Please see attached document.

**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.*

To ensure the veracity of the information, our team relied on peer-reviewed literature, the course textbook, and verified information from ChatGPT. We used reputable medical databases such as PubMed (National Library of Medicine), StatPearls, and peer-reviewed journals (*Journal of Clinical Medicine*, *Chest*, *Diagnostics*, and *International Journal of Chronic Diseases*). Most of our information that connects to the course content was retrieved from the Robbins Basic Pathology (11th edition) textbook and official course lecture materials from Pathology 3500.

To keep track of our references, we used Zotero to organize our sources and create folders for each topic. This also allowed us to annotate each article and highlight key information. The use of this reference manager ensured all information in our final presentation was traceable to a credible source and properly cited with in-text citations.

AI-generated content was fact-checked. ChatGPT responses for case studies were cross-referenced with scientific papers. Any symptoms that did not match the papers were removed. In addition, when prompting AI, we provided our own course notes to ensure that outputs aligned with course content. All of these careful considerations reduced the risk of misinformation.

**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?*

All members of the group contributed significantly to the end result of the assignment. Each person chose a level of the game to work on, and the group met regularly to discuss goals and progress. Throughout the project, group members reviewed lecture content and observed different learning strategies employed by one another, increasing the team's learning.

In total, the assignment took around 20-30 hours per person to complete, in addition to group meetings. Our regular discussions worked well to keep track of progress and ensure that each member was working efficiently. In addition, we set internal deadlines to outline deliverables that each member should have finished at certain checkpoints. In the next meeting, the team would thoroughly review each other's work to ensure there is no overlap of topics and that there is no missing content.

One challenge we faced was how we should approach detailed information that was not covered in class. On one hand, it would not be helpful for future students to learn technical details on sarcoidosis that is not covered in the course. On the other hand, some details were relevant to fully understand and apply course connections. Overall, our group worked well together to produce a novel case study that outlines an in-depth case of sarcoidosis, helping future students learn about key features in the context of Pathology 3500.

**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…*

Each member chose a level of the game to work on, where they conducted research, made notes, generated case studies and multiple-choice questions using AI, and created the slides while ensuring coherence. Each member was responsible for fact-checking of the information presented by ChatGPT using published literature sources or the course textbook.

- TA wrote level 1
- CM wrote level 2
- GL wrote level 3
- DL wrote level 4
- Every member completed their own slide design
- CM and DL added the interactive buttons
- Everyone's section was peer-reviewed to reduce redundancy and ensure coherence
- Every contributed to their own section of the annotated bibliography and worked together to compose the PDFs for the ChatGPT prompts (#9) and the team notes (#10)

We also divided up this document

- TA contributed to prompt 5, 7, 9, 13
- CM contributed to prompt 5, 6, 8, 9
- GL contributed to 5, 9, 11, 12
- DL contributed to prompt 1-5, 9, 1

## 15. References

Please provide a numbered reference list with Nature citation style. [Please feel free to use citation management software (i.e., free citation manager, e.g., Zotero and Mendeley)]


1. Bokhari SRA, Zulfiqar H, Mansur A. Sarcoidosis. 2023 Jun 25. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan -.
2. Loke WS, Herbert C, Thomas PS. Sarcoidosis: Immunopathogenesis and Immunological Markers. Int J Chronic Dis. 2013;2013:928601. doi: 10.1155/2013/928601. Epub 2013 Jul 25.
3. Kumar V, Abbas AK, Aster JC. Diseases of the Immune System. In: Kumar V, Abbas AK, Aster JC, editors. Robbins basic pathology. 11th ed. Philadelphia (PA): Elsevier Saunders; 2022. p. 130-185.
4. Li Y, Liang Z, Zheng Y, Qiao J, Wang P. Pulmonary sarcoidosis: from clinical features to pathology – narrative review. Ann Palliat Med. 2021 Mar 25;10(3):3438-44. doi:10.21037/apm-21-344.
5. Baughman RP, Lower EE, Gibson K. Pulmonary manifestations of sarcoidosis. La Presse Med. 2012 May 10;41(6):e289–302. doi:10.1016/j.lpm.2012.03.019.
6. Bernardinello N, Petrarulo S, Balestro E, Cocconcelli E, Veltkamp M, Spagnolo P. Pulmonary sarcoidosis: diagnosis and differential diagnosis. Diagnostics. 2021 Aug 28;11(9):1558. doi:10.3390/diagnostics11091558.
7. Kumar V, Abbas AK, Aster JC. Lungs. In: Kumar V, Abbas AK, Aster JC, editors. Robbins basic pathology. 11th ed. Philadelphia (PA): Elsevier Saunders; 2022. p. 400-448.
8. Lamberto C, Nunes H, Le Toumelin P, Duperron F, Valeyre D, Clerici C. Membrane and capillary blood components of diffusion capacity of the lung for carbon monoxide in pulmonary sarcoidosis. Chest. 2004 Jun;125(6):2061-8.
9. Judson MA. The symptoms of pulmonary sarcoidosis. J Clin Med. 2023 Sep 20;12(18):6088. doi:10.3390/jcm12186088.
10. Baughman RP. Pulmonary hypertension associated with sarcoidosis. Arthritis Res Ther. 2007 Aug 15;9(Suppl 2):S8.
11. Gianella F, Hsia CC, Sakhaee K. The role of vitamin D in sarcoidosis. Fac Rev. 2020 Nov 18;9:14. doi: 10.12703/b/9-14. PMID: 33659946; PMCID: PMC7886067.
12. Sweiss NJ, Lower EE, Korsten P, Niewold TB, Favus MJ, Baughman RP. Bone health issues in sarcoidosis. Curr Rheumatol Rep. 2011 Jun;13(3):265-72. doi: 10.1007/s11926-011-0170-1. PMID: 21327743; PMCID: PMC3311464.
13. Burke RR, Rybicki BA, Rao DS. Calcium and vitamin D in sarcoidosis: how to assess and manage. Semin Respir Crit Care Med. 2010 Aug;31(4):474-84. doi: 10.1055/s-0030-1262215. Epub 2010 Jul 27. PMID: 20665397; PMCID: PMC4876288.

14. Yildiz Gulhan P, Gulec Balbay E, Ercelik M, Yildiz S, Yilmaz MA. Is sarcoidosis related to metabolic syndrome and insulin resistance? Aging Male. 2020;23(1):53-58. doi: 10.1080/13685538.2019.1631272.
15. Vronsky D, Finkelstein A, Shiber S, Heching M, Eliakim-Raz N, Ayalon-Dangur I. A Profound Vitamin B12 Deficiency in a Patient with Lofgren's Syndrome. Int Med Case Rep J. 2023 Oct 10;16:655-658. doi: 10.2147/IMCRJ.S404956. PMID: 37840969; PMCID: PMC10576453.
16. Bast A, Semen KO, Drent M. Nutrition and corticosteroids in the treatment of sarcoidosis. Curr Opin Pulm Med. 2018 Sep;24(5):479-486. doi: 10.1097/MCP.0000000000000501.
17. Zia A. Topic 16: Hepatobiliary Pathology [unpublished lecture notes]. London (ON): University of Western Ontario; 2026 Jan 26.
18. Graf C, Arncken J, Lange CM, Willuweit K, Schattenberg JM, Seessle J, et al. Hepatic sarcoidosis: clinical characteristics and outcome. *JHEP Rep*. 2021;3(6):100360. doi:10.1016/j.jhepr.2021.100360.
19. Ryland KL. Hepatic sarcoidosis: incidence, monitoring, and treatment. *Clin Liver Dis (Hoboken)*. 2020;16(5):208–211. doi:10.1002/cld.1002.
20. Tadros M, Forouhar F, Wu GY. Hepatic sarcoidosis. *J Clin Transl Hepatol*. 2013;1(2):87–93. doi:10.14218/JCTH.2013.00016.
21. Ferral H, Behrens G, Lopera J. Budd-Chiari syndrome. *AJR Am J Roentgenol*. 2012;199(4):737–745. doi:10.2214/AJR.12.9098.
22. Bosch J, Groszmann RJ, Shah VH. Portal hypertension: concepts in diagnosis and
23. Bari K, et al. Disseminated sarcoidosis resulting in portal hypertension and gastrointestinal bleeding: a rare presentation. *Case Rep Med*. 2012;2012:326357. doi:10.1155/2012/326357.

**16. Annotated Bibliography**

*An annotated bibliography is a list of sources (books, articles, websites, etc.) that you used for your project. Each entry has two parts:*

1. *Citation – written in the required citation style (same formatting and order as the Nature citation style in your list of references).*
2. *Annotation – a short paragraph that summarizes, evaluates, and explains how the source is useful for your assignment.*

*Why do this?*

- *Helps you keep track of your research.*
- *Shows your instructor you read and understood your sources.*
- *Develops critical thinking by requiring you to evaluate the quality and relevance of each source.*

*Write the annotation (about 150–200 words each)*

- *Summary: Briefly describe the main argument or purpose of the source.*
- *Evaluation: Comment on the credibility, strengths, or weaknesses of the source.*
- *Relevance: Explain how you will use this source in your assignment.*

**Level 1**

1. Bokhari SRA, Zulfiqar H, Mansur A. Sarcoidosis. 2023 Jun 25. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan -.

This source provides a comprehensive clinical overview of sarcoidosis, a multisystem inflammatory disease characterized by noncaseating granulomas. It covers key aspects including epidemiology, pathophysiology, clinical presentation, diagnosis, and management. The article emphasizes that sarcoidosis most commonly affects the lungs and lymph nodes, often presenting with bilateral hilar lymphadenopathy and respiratory symptoms, while also

highlighting its potential to involve other organ systems such as the skin, eyes, heart, and nervous system.

This source is credible as it is published in StatPearls, a peer-reviewed medical database widely used for clinical reference. A key strength is its clear and organized synthesis of both clinical and immunological information, making complex concepts accessible. However, a limitation is that it is more clinically focused and may lack the depth of mechanistic detail found in specialized immunology review articles.

This article was used to enrich the section on immunopathogenesis of sarcoidosis in the assignment, particularly in describing its systemic nature and the role of immune dysregulation, particularly the role of cell-mediated immunity, T-helper cell activation, and macrophage-driven granuloma formation in disease development.

2. Loke WS, Herbert C, Thomas PS. Sarcoidosis: Immunopathogenesis and Immunological Markers. Int J Chronic Dis. 2013;2013:928601. doi: 10.1155/2013/928601. Epub 2013 Jul 25.

This review article examines the immunopathogenesis of sarcoidosis, focusing on the cellular and molecular mechanisms that drive granuloma formation and the identification of immunological biomarkers. It explains that sarcoidosis is mediated by an exaggerated cell-mediated immune response, particularly involving $CD4^+$ T-helper (Th1) cells and activated macrophages. These immune cells release pro-inflammatory cytokines such as interferon-γ and tumor necrosis factor-α, which promote the formation and persistence of noncaseating granulomas and contribute to disease progression.

This source is credible as it is a peer-reviewed article published in the International Journal of Chronic Diseases. A key strength is its detailed and well-integrated explanation of immunological mechanisms alongside clinical implications, allowing for a deeper understanding of disease processes. However, a limitation is that it was published in 2013, meaning some biomarker research or emerging pathways may not reflect the most recent developments.

This article was used to support the immunology section of the assignment, particularly in explaining the mechanisms of disease initiation and progression, including antigen-presenting cell activation, Th1 responses, cytokine signaling, and granuloma formation.

3. Kumar V, Abbas AK, Aster JC. Diseases of the Immune System. In: Kumar V, Abbas AK, Aster JC, editors. Robbins Basic Pathology. 11th ed. Philadelphia (PA): Elsevier Saunders; 2022. p. 130-185.

This textbook chapter provides a comprehensive overview of immune system disorders, outlining key mechanisms of innate and adaptive immunity, antigen presentation, T-cell activation, cytokine signaling, and immune-mediated tissue injury. It explains how

dysregulated immune responses can lead to chronic inflammation and granuloma formation, processes that are central to diseases such as sarcoidosis. The content offers a strong conceptual foundation for understanding how immune pathways contribute to disease development.

This source is highly credible as it is drawn from Robbins Basic Pathology, a widely used and authoritative textbook in medical education. A major strength is its clear, structured explanation of core immunological concepts, making complex mechanisms accessible and reliable. However, a limitation is that it is not disease-specific and does not focus in depth on sarcoidosis itself.

This source was used to build foundational immunology knowledge and to connect course concepts to the assignment, particularly in explaining antigen-presenting cell function, T-helper cell activation, and granuloma formation. It also helped reinforce course material, allowing the assignment to function as a useful study tool for future Path 3500 students.

**Level 2**

4. Li Y, Liang Z, Zheng Y, Qiao J, Wang P. Pulmonary sarcoidosis: from clinical features to pathology – narrative review. Ann Palliat Med. 2021 Mar 25;10(3):3438-44. doi:10.21037/apm-21-344.

This article reviewed the clinical features of pulmonary sarcoidosis and the underlying pathological mechanisms. The authors discussed symptom presentation, stages, granuloma formation, and immune dysregulation that drives disease progression. The disruption of lung architecture and impaired respiratory function by granulomas were highlighted.

The article is credible because it was recently published in a medical journal. A strength of the article was the clear connection between pathology and observable clinical outcomes, as the paper integrates symptoms with mechanisms effectively.

This source was useful for explaining disease mechanisms, particularly to help bridge clinical findings presented in the AI case study to the underlying pathology. It allowed me to create effective explanatory slides to understand why symptoms and pulmonary function changes occur. Additionally, it was used as a basis of information given to AI to create mechanism-based multiple-choice questions, as well as for fact-checking. This information was also important to connect overlapping mechanisms to other respiratory diseases.

5. Baughman RP, Lower EE, Gibson K. Pulmonary manifestations of sarcoidosis. La Presse Med. 2012 May 10;41(6):e289–302. doi:10.1016/j.lpm.2012.03.019.

This article focused on a range of pulmonary manifestations in sarcoidosis, reinforcing that lung involvement is the most common and significant feature of the disease. The authors outlined hallmark respiratory symptoms, radiographic patterns, abnormalities in pulmonary function tests, and disease progression. The effect of granulomatous inflammation on the airways, lung parenchyma, and gas exchange was discussed along with the general symptoms of dyspnea, cough, and chest discomfort.

This source is credible because it was written by researchers specializing in sarcoidosis and published in a peer-reviewed medical journal. A strength of the paper was the comprehensive clinical overview of the disease. Detailed information on physiology and symptom presentation was provided while integrating diagnostic images.

This source was useful for providing a basic description of the respiratory dysfunctions in many anatomical areas, including the alveoli, parenchyma, and bronchi. The article connected granuloma formation to both progressive and initial respiratory symptoms, along with functional impairments. The article was also useful for fact-checking symptoms from the ChatGPT-generated respiratory case study.

6. Bernardinello N, Petrarulo S, Balestro E, Cocconcelli E, Veltkamp M, Spagnolo P. Pulmonary sarcoidosis: diagnosis and differential diagnosis. Diagnostics. 2021 Aug 28;11(9):1558. doi:10.3390/diagnostics11091558.

This article provided a detailed overview of the diagnostic tests for pulmonary sarcoidosis, highlighting differences from other lung diseases and granulomatous conditions. The authors outlined clinical features, image findings, histologic confirmation, and laboratory tests used for diagnosis. This included the role of biopsy and the criteria to exclude infections or cancer.

The article is credible because it's recent and published in a peer-reviewed journal, allowing it to reflect current diagnostic standards. A strength of the article was its comparison of sarcoidosis with similar pulmonary diseases. This allowed for clarity on diagnostics. A limitation of the paper was its focus on diagnosis rather than long-term outcomes, mechanisms, or treatment.

This source was useful for information on relevant diagnostic tests, particularly to explain that sarcoidosis is diagnosed by exclusion of other conditions. The article also supported evidence-based diagnostic criteria and the manifestation of mechanisms as symptoms. This was important when connecting pathogenesis to the symptoms patients experience, and for comparing this condition to other respiratory diseases.

7. Kumar V, Abbas AK, Aster JC. Lungs. In: Kumar V, Abbas AK, Aster JC, editors. Robbins basic pathology. 11th ed. Philadelphia (PA): Elsevier Saunders; 2022. p. 400-448.

This textbook chapter summarizes general information on a variety of lung diseases and pathology. For sarcoidosis, it explained granuloma formation, macrophage activation, tissue remodelling, and immune-mediated pathology. Other respiratory diseases, such as tuberculosis, asthma, COPD, pneumonia, and emphysema, were described in detail. This included the pathogenesis, histological indicators, and mechanisms of each disease.

This source is very credible, as it's a widely used medical pathology textbook. The textbook was also a reliable source chosen by the professors in Pathology 3500. A strength is the clear explanation of core pathology concepts. However, it doesn't provide a lot of information on sarcoidosis itself, just an overview.

This source was useful to relate sarcoidosis to the lecture content. I was able to connect external sources to mechanisms described in the lecture, as well as compare and contrast sarcoidosis with high-yield diseases discussed in class. This allowed for a greater understanding of the respiratory system as a whole and enhanced understanding of key diseases like asthma, COPD, and pneumonia.

8. Lamberto C, Nunes H, Le Toumelin P, Duperron F, Valeyre D, Clerici C. Membrane and capillary blood components of diffusion capacity of the lung for carbon monoxide in pulmonary sarcoidosis. Chest. 2004 Jun;125(6):2061-8.

This article investigated how pulmonary sarcoidosis affects the diffuse capacity (DLCO) by separating the membrane and capillary blood components of gas exchange. The authors showed how granuloma involvement impairs diffusion through membrane thickening and vascular changes.

This article is credible since it was published in a well-known respiratory journal, and the study provides a rigorous outline of its methodology. A limitation of the article is the complexity of the language, methodology, and mechanisms discussed. This was challenging for me to understand and may be difficult for the general public.

This source was useful for explaining pulmonary function changes, specifically related to gas exchange. It supported the changes of reduced oxygen diffusion from altered gas exchange and informed changes in signs and symptoms, like reduced oxygen saturation and exercise intolerance. Overall, the findings of this paper strengthened the explanation of respiratory symptoms that are presented in the case study.

9. Judson MA. The symptoms of pulmonary sarcoidosis. J Clin Med. 2023 Sep 20;12(18):6088. doi:10.3390/jcm12186088.

This article focused on the symptoms presented in pulmonary sarcoidosis. A wide range of respiratory symptoms was discussed, such as shortness of breath, cough, fatigue, and chest tightness. The characteristics of each symptom were described, along with prevalence,

causes, and diagnosis. The article also examined the variability in symptom severity and correlation to imaging findings on X-rays and Ultrasounds.

This article is credible because it was published recently in a well-known peer-reviewed medical journal. The author is also a well-known sarcoidosis clinician, giving the author reliable credentials. A strength of the paper was the patient-centred approach that explained subjective experiences along with objective measurements of diagnosis.

This source was useful in providing information on the clinical presentation of sarcoidosis, including the signs and symptoms. This allowed for a connection between other respiratory disease symptoms to describe similarities and differences. It was also important for fact-checking the multiple-choice questions and case study generated by ChatGPT.

10. Baughman RP. Pulmonary hypertension associated with sarcoidosis. Arthritis Res Ther. 2007 Aug 15;9(Suppl 2):S8.

This article investigated pulmonary hypertension as a complication of sarcoidosis. The authors discussed the prevalence, mechanisms, and consequences of hypertension leading to fibrosis. Moreover, they discussed how vascular involvement contributes to vascular resistance and heart strain.

Although it was published in 2007, the article is credible because it was peer-reviewed and written by a recognized expert in sarcoidosis. A strength of the article was its discussion of significant (but less common) complications. A limitation is that newer diagnostic and treatment approaches are not discussed, making some of the information outdated.

This source was useful for addressing progressive complications in pulmonary sarcoidosis and understanding disease progression. Particularly, it was used to explain how pulmonary vessels and oxygenation are altered and to describe long-term outcomes. Additionally, the article provided background information on the pathophysiology of sarcoidosis that was important for providing a general overview of the disease pathology and what parts of the respiratory system it affects, specifically when referencing the pulmonary vessels.

**Level 3**

11. Gianella F, Hsia CC, Sakhaee K. The role of vitamin D in sarcoidosis. Fac Rev. 2020 Nov 18;9:14. doi: 10.12703/b/9-14. PMID: 33659946; PMCID: PMC7886067.

This review article discusses the physiological and pathological production of vitamin D in the body. It also goes over some of the uses of vitamin D in the body, such as in the immune system and bone formation. The differences in the conversion of 25-hydroxyvitamin D to 1,25-dihydroxyvitamin D in the renal cells and immune cells are of particular interest.

The article is credible due to its recent publication in a peer-reviewed journal. It has also been cited over 20 times in recent years and is used in modern research. A strength of the article was its broad yet in-depth overview of several key topics of sarcoidosis.

The source was useful in determining the pathways of vitamin D conversion and some potential outcomes of both low vitamin D and hypercalcemia. It was used to determine some of the symptoms in the case study and to develop engaging questions.

12. Sweiss NJ, Lower EE, Korsten P, Niewold TB, Favus MJ, Baughman RP. Bone health issues in sarcoidosis. Curr Rheumatol Rep. 2011 Jun;13(3):265-72. doi: 10.1007/s11926-011-0170-1. PMID: 21327743; PMCID: PMC3311464.

This review article discusses the relationship between sarcoidosis and bone health, specifically focusing on calcium metabolism and bone marrow involvement. It also reviews mechanisms of hypercalcemia and hypercalciuria, which are driven by the extra-renal production of calcitrol by sarcoid macrophages. The article also examines how chronic inflammation and the long-term use of corticosteroids in sarcoidosis patients significantly increase the risk of osteoporosis and fragility fractures.

The article is a highly credible source, as it was published in a well-regarded, peer-reviewed journal. Although it was published in 2011, it remains a foundational reference and has been cited over 50 times, demonstrating its lasting impact on clinical research. A major strength of the paper is its practical clinical focus, providing clear guidance on monitoring and managing bone density in affected patients.

This source was useful for understanding the secondary skeletal complications that arise from both the disease process and its primary treatments. It helped explain the link between granulomatous inflammation and bone loss, which was essential for connecting the clinical symptoms of the case study to broader systemic effects. This made it ideal as the basis of a question in the case study as well.

13. Burke RR, Rybicki BA, Rao DS. Calcium and vitamin D in sarcoidosis: how to assess and manage. Semin Respir Crit Care Med. 2010 Aug;31(4):474-84. doi: 10.1055/s-0030-1262215. Epub 2010 Jul 27. PMID: 20665397; PMCID: PMC4876288.

This review article discusses the management of calcium metabolism disorders in sarcoidosis. It also goes over the diagnostic challenges of managing vitamin D deficiency in these patients without triggering hypercalcemia or hypercalciuria. The mechanisms of dysregulated calcium homeostasis are also discussed.

The article is credible as it was published in a respected, peer-reviewed medical journal and authored by established specialists in respiratory and bone health. However, the article is relatively old, as it was published in 2010, which may indicate that some information is outdated. Despite its age, it remains an important article that gives a deep look into two crucial parts of sarcoidosis treatment, and is useful in both research and clinical application.

This source was useful in determining the specific laboratory tests needed to safely assess vitamin D levels in sarcoidosis patients. It helped explain why standard vitamin D supplementation can be dangerous in patients, which can be a vital component in connecting a patient's metabolic data to potentially dangerous complications. Additionally, it helped reinforce other sources in this section to ensure that multiple credible sources provide accurate information.

14. Yildiz Gulhan P, Gulec Balbay E, Ercelik M, Yildiz S, Yilmaz MA. Is sarcoidosis related to metabolic syndrome and insulin resistance? Aging Male. 2020;23(1):53-58. doi: 10.1080/13685538.2019.1631272.

This article goes over the relationship between sarcoidosis, metabolic syndrome, and insulin resistance. Its findings show increased risk of insulin resistance and metabolic syndrome in sarcoidosis patients, which suggests that certain inflammatory environments may be associated with their development. It also discusses the impact of cytokines on inflammation and their relations to the above conditions.

Its recent publication in a peer-reviewed journal indicates that it is a reliable source. It has also been cited in other research 14 times. However, the article focuses a lot of its attention on metabolic syndrome and insulin resistance, reducing the focus on sarcoidosis.

This article was useful as the main resource for information on how sarcoidosis and inflammation could lead to metabolic syndrome and insulin resistance. It helped explain how some long-term consequences could arise from sarcoidosis and related some more complex topics back to course content.

15. Vronsky D, Finkelstein A, Shiber S, Heching M, Eliakim-Raz N, Ayalon-Dangur I. A Profound Vitamin B12 Deficiency in a Patient with Lofgren's Syndrome. Int Med Case Rep J. 2023 Oct 10;16:655-658. doi: 10.2147/IMCRJ.S404956. PMID: 37840969; PMCID: PMC10576453.

This article provides a case study on a patient presenting with vitamin B12 deficiency and other similar symptoms. It covers several possibilities before concluding that a rare form of sarcoidosis in the GI tract is a likely cause of the deficiency. It also discusses treatment options and supplementation with vitamins.

Published recently in a highly regarded journal, this source is a reliable account of a rare case of sarcoidosis. One weakness is the lack of citations to other articles, although this may be expected from a case review. Additionally, it only discusses a singular case, which is a more severe limitation. However, the article does go into extreme detail regarding the process of diagnosis and potential other explanations, which strengthens the source.

This source was useful in better understanding the scope and details of potential GI tract sarcoidosis and how it could lead to reduced nutrient intake. In the case study, this source

provided the information on how vitamin B12 could be disrupted in our patient and helped give a guideline on some diagnostic measures.

16. Bast A, Semen KO, Drent M. Nutrition and corticosteroids in the treatment of sarcoidosis. Curr Opin Pulm Med. 2018 Sep;24(5):479-486. doi: 10.1097/MCP.0000000000000501.

This article details the nutritional management of sarcoidosis and the potential metabolic impacts of long-term corticosteroid usage. A key detail is the emphasis on dietary antioxidants and vitamins to attenuate chronic inflammation and ensure drug efficacy.

The article is credible due to its publication in a peer-reviewed medical journal and its authorship by prominent researchers. It has been cited in recent years and remains a relevant resource for understanding the management of sarcoidosis patients. A strength of the article was its combination of both nutrition and pharmaceuticals in treatment, an approach not often discussed in papers.

The source was useful in determining the nutritional needs of patients undergoing steroid therapy and identifying dietary strategies to mitigate inflammation. It helped explain the metabolic complications of sarcoidosis treatment and was used to refine the dietary recommendations within the case study.

**Level 4**

17. Zia A. Topic 16: Hepatobiliary Pathology [unpublished lecture notes]. London (ON): University of Western Ontario; 2026 Jan 26.

The purpose of this lecture is to describe the gross anatomy of the liver, list the normal functions of the liver, and describe cirrhosis, including its pathophysiology, causes, and complications.

This lecture is credible as it was delivered by Dr. Zia A. Khan, a professor at the Department of Pathology and Laboratory Medicine and Schulich School of Medicine & Dentistry at Western University. He is also the Vice Chair in Pathology and Laboratory Medicine. A key strength of the lecture notes is their use of a diversity of visual elements, such as anatomy diagrams and histology slides, to accompany learning.

This source was the main one used throughout Level 4 of the slideshow game. It was referred to for the section “Background Information on the Hepatic System,” such as for describing liver anatomy, blood supply, bile ducts, hepatic lobules, and the function of the liver. This was a prominent source as it connected game content to course content, which will help future generations of Pathology 3500 students learn about several course topics in an interactive manner.

18. Graf C, Arncken J, Lange CM, Willuweit K, Schattenberg JM, Seessle J, et al. Hepatic sarcoidosis: clinical characteristics and outcome. *JHEP Rep*. 2021;3(6):100360. doi:10.1016/j.jhepr.2021.100360.

The purpose of this source is to evaluate the clinical characteristics of hepatic sarcoidosis, including its presentation, progression, and patient outcomes. The study analyzes a cohort of patients who have been diagnosed with the disease and identifies symptoms, biochemical abnormalities, and possible complications.

This paper is credible as it was published in the National Library of Medicine and includes contributions from 15 authors. It has been cited by five papers and references 21 sources, indicating strong integration within existing research. As a primary research article, it follows proper scientific structure, including detailed methodology and statistical analysis. A key strength of this paper is its use of real patient data, which increases the reliability and clinical relevance of its findings. On the other hand, a limitation is its small sample size, which could make the results less generalizable.

In the assignment, this paper was used to describe the epidemiology of hepatic sarcoidosis under "Sarcoidosis Effects on the Hepatic System" and four complications under "Complications." In addition, the information retrieved from the paper was used to generate multiple-choice questions and answers using ChatGPT.

19. Ryland KL. Hepatic sarcoidosis: incidence, monitoring, and treatment. *Clin Liver Dis (Hoboken)*. 2020;16(5):208–211. doi:10.1002/cld.1002.

This source provides an overview of hepatic sarcoidosis, which focuses on its incidence, diagnostic challenges, monitoring strategies, and treatment options. The authors discuss common laboratory findings, imaging techniques, and the role of liver biopsy as the most definitive diagnostic tool. The paper also highlights treatment approaches, such as observation, corticosteroids, and immunosuppressive medications.

This paper is published in the National Library of Medicine, a peer-reviewed medical journal, making it a credible source. It is a review article that covers findings from multiple studies, strengthening its reliability. A strength of this paper was its clear explanations of diagnostic and management strategies in clinical practice, accompanied by labeled diagnostic images.

This source was used in multiple sections describing the hepatic involvement of sarcoidosis. It was referenced in the sections "Sarcoidosis Effects on the Hepatic System," "Diagnosis," "Treatment," and "Complications," more specifically for cirrhosis. The figures explaining diagnostic techniques were used to develop visuals for the game and help the user understand the applications of the knowledge learned in clinical practice. Finally, the information was used to generate multiple-choice questions and answers.

20. Tadros M, Forouhar F, Wu GY. Hepatic sarcoidosis. *J Clin Transl Hepatol*. 2013;1(2):87–93. doi:10.14218/JCTH.2013.00016.

The purpose of this source is to give a comprehensive review of hepatic sarcoidosis, such as its epidemiology, pathophysiology, clinical presentation, and management. The article explains that a significant number of sarcoidosis patients experience liver involvement, despite remaining asymptomatic. The authors also describe the formation of non-caseating granulomas, diagnostic approaches, and potential complications, such as portal hypertension and cirrhosis.

This paper is credible because it is published in the National Library of Medicine, a peer-reviewed journal. It includes 62 references and presents detailed explanations of disease mechanisms and clinical features. A strength of this paper is that it covers in-depth basic scientific background while exploring clinical aspects, making it a well-rounded resource. In contrast, a weakness is that it was published in 2013, meaning some information may be outdated.

In the assignment, this paper was used to evaluate treatment options for symptomatic patients who experience inflammation. It recommends the use of corticosteroids or ursodeoxycholic acid as a first-line treatment, and immunosuppressant medications as second-line agents.

21. Ferral H, Behrens G, Lopera J. Budd-Chiari syndrome. *AJR Am J Roentgenol*. 2012;199(4):737–745. doi:10.2214/AJR.12.9098.

This paper is unique from the rest as it examines Budd-Chiari syndrome, a condition involving obstruction of hepatic venous outflow, a potential complication of hepatic sarcoidosis. It expands the causes of disease, imaging findings, and clinical management. The article focuses on radiological diagnosis using CT and MRI, and teaches about how venous obstruction can lead to liver damage alongside other complications.

This paper has high credibility as it is published in the American Journal of Roentgenology, a well-known radiology journal. It shows imaging evidence with clinical correlations, making it a reliable read. The paper is easy to follow along with various labeled images, offering clear explanations of how the condition is identified in clinical practice.

Under “Complications,” this paper was used to teach the user about Budd-Chiari syndrome, the second complication listed for hepatic sarcoidosis. It informs them of a brief description, a couple of possible causes, medical management, and treatment options.

22. Bosch J, Groszmann RJ, Shah VH. Portal hypertension: concepts in diagnosis and management. *J Radiol Nurs*. 2013;32(2):77–86. doi:10.1016/j.jradnu.2012.10.003.

The purpose of this source is to explain portal hypertension, including its pathophysiology, diagnosis, and management strategies. The authors describe how increased pressure in the portal venous system can result from liver disease and lead to complications such as variceal bleeding and ascites.

This paper is credible as it is based on established research and published by Elsevier, a well-known academic publishing company. It integrates clinical knowledge with practical management techniques, making it a foundational education resource. A couple of weaknesses are that it may be outdated since it was published in 1989, and it is not specific to sarcoidosis. A minor inconvenience is that the article is not available in text format, as are newer articles; thus, finding specific information on the PDF was a tedious process.

The game uses this source to explain portal hypertension as a complication of hepatic sarcoidosis. It offers a concise description of the chronic disease, causes, and treatment options.

23. Bari K, et al. Disseminated sarcoidosis resulting in portal hypertension and gastrointestinal bleeding: a rare presentation. *Case Rep Med*. 2012;2012:326357. doi:10.1155/2012/326357.

    The purpose of this source is to present a case study of disseminated sarcoidosis that leads to portal hypertension and gastrointestinal bleeding. This highlights a rare but serious complication of the disease. The authors describe the patient's symptoms, diagnostic process, and treatment, demonstrating how sarcoidosis can progress to severe liver involvement.

This paper was published in the National Library of Medicine, making it a credible source that follows a structured case report format. A strength and uniqueness of this source is its detailed real-world example, helping the reader understand in a story-like manner how complications can develop in individual patients. This is different from most other papers, which examine a disease at the population level. This could also be a limitation because it may not be representative of all patients with hepatic sarcoidosis.

In the assignment, this paper was used to explain portal hypertension as a complication of hepatic sarcoidosis. It recommends β-blockers for patients with small varices and high risk of bleeding, and either β-blockers or esophageal band ligation for those with medium/large varices.