PULSE EXPERIENTIAL TEAM ASSIGNMENT

Team #: 9

1. Title of your PULSE experiential assignment. *Provide a creative and informative title.*
T Cell Life
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.]*
T-lymphocytes are components of adaptive immunity that allow for stronger immune responses and immunological memory. Knowing the life cycle of T cells is essential because these stages determine how the immune system recognizes threats, mounts effective responses, forms immune memory, and develops diseases when regulation fails. T-lymphocytes that have not previously encountered an antigen (a foreign substance that triggers an immune response) differentiate into specialized functional types after the antigen is presented to them. A T-cell can bind directly to antigens and then mature into having supportive or toxic effects. To accurately represent these various pathways, our experimental assignment explores the T cell's life cycle, functions, and pathological states within immunity and immune disorders in the form of a "choose your own adventure" video game. This format is chosen to give players a clear chronological sequence of key events during T cell life cycles in a way that is interactive, engaging, and clear. Using both graphics and text to deliver information reflects different learning styles, and the addition of practice questions (presented as "What Would You Do" scenarios (WWYD)) helps students apply their knowledge through active recall.
3. Provide up to 6 keywords relevant to your PULSE experiential assignment. *3-6 keywords are ideal.*
LYMPHOCYTE **T-CELL** **CELL DIFFERENTIATION** **IMMUNE SYSTEM** **AUTOIMMUNE**
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

1. Students can compare/contrast the life cycles of different types of T cells.
2. Students can explain the physiological functions of T lymphocytes and their roles in the immune system
3. Students can break down the pathological consequences of T lymphocyte dysregulation and how it can progress into disease.

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

The lymphocyte pathways can feel like a daunting, convoluted topic to learn. However, knowing the life cycles of T cells is essential because these stages determine how the immune system recognizes threats, mounts effective responses, forms immune memory, and develops diseases when regulation fails.

Our “choose your own adventure” video game allows players to gain a bigger picture around the different pathways within T cell development, helping learners to understand the many paths immune cells can take during maturation and infection.

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 AI tools such as ChatGPT and Grammarly to check grammar mistakes, reword information to suit our target audience, and to find research papers relevant to our project. Our team has avoided using AI to generate content to ensure that our content remains accurate directly. These tools were the best for our assignment because they can effectively check grammar as we write and/or support rephrasing information we believe is too complex for high school students. No other tools were considered.

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 interactive and procedural “choose your own adventure” video game provides in-depth explanations of immunity concepts in a user-friendly manner, so that regardless of the player’s background knowledge, anyone can use this tool to learn about the fate of immune cells. Our game is informative enough for students studying the topic to use as a reliable review tool, but descriptions are broken down in simple terms to build user knowledge of foundational concepts and cellular relationships.

While some previously published books and papers use this “choose your own adventure” format to explain concepts in pathology, our team has not come across an interactive online game that takes users through the life cycles and responses associated with lymphocyte cells in particular. We hope to create an informative, accessible product that assists in the learning of the immune system.

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].

Prompt: “Can you clean this up and make it more concise without removing any important info?”

Output: “Here is a clean, concise version that does not remove any important info. Early thymocytes express the T-cell receptor (TCR)–CD3 complex along with both CD4 and CD8 co-receptors. These cells are called double-positive thymocytes. The TCR at this stage is tested for its ability to recognize antigens presented on major histocompatibility complex (MHC) molecules on thymic epithelial cells.”

Prompt: “Can you clean this up and make it more concise without removing any important info?”

Output: “Here is a clean, concise version that does not remove any important info. $CD4^+$ T cells recognize antigens presented on MHC class II molecules on antigen-presenting cells (APCs). The TCR binds the antigen–MHC II complex, and the CD4 co-receptor binds MHC II, stabilizing the interaction and allowing CD3 to transmit the activation signal. $CD8^+$ T cells recognize antigen presented on MHC class I molecules on all nucleated cells. The TCR binds the antigen–MHC I complex, while CD8 binds MHC I, strengthening the interaction and triggering CD3 signaling, which activates cytotoxic killing.”

Prompt: “I have some notes about a source I choose to include into my final project. Please turn this into a cohesive paragraph of ~150 word length.

- Comprehensive overview of ADA deficiency (pathophysiology + clinical outcomes)
- Explains buildup of toxic metabolites (e.g., deoxyadenosine) → impaired lymphocyte development
- Links biochemical defect to severe immune dysfunction (SCID)
- Highly detailed + clearly organized explanations of pathways Some content exceeded assignment scope → selectively used
- Helped reinforce and clarify class concepts Highly reliable source (NIH, reputable government publication)
- Used to verify accuracy of disorder mechanisms + biochemical pathways
- Also outlines key risk factors and broader clinical implications

Output: "This source provides a comprehensive overview of Adenosine Deaminase (ADA) Deficiency, outlining both its underlying pathophysiology and associated clinical consequences. It clearly explains how the accumulation of toxic metabolites, particularly deoxyadenosine, leads to impaired lymphocyte development and severe immune dysfunction. The content is highly detailed and well organized, offering in-depth explanations of the biochemical pathways involved. However, much of the information extended beyond the scope of our assignment, so only selected portions were incorporated into our final work. Despite this, the source proved valuable for reinforcing our understanding of key concepts discussed in class. Its reliability is strong, as it is published by the National Institutes of Health, a reputable and authoritative government organization. It was primarily used to verify the accuracy of the disorder's mechanisms and related biochemical pathways. Additionally, the source highlights various risk factors and broader clinical implications associated with ADA deficiency."

Prompt: "I have some notes about a source I'm using for my project's annotated bibliography. Please turn this into a cohesive paragraph of ~150-200 word length.

- Explains T-cell development in the thymus, where immature progenitor cells differentiate into functional, self-tolerant T cells
- Describes key stages: double negative (DN), double positive (DP), and single positive (SP)
- Includes processes such as TCR rearrangement and thymic selection
- Positive selection ensures recognition of self-MHC; negative selection eliminates self-reactive cells (prevents autoimmunity)
- Source is highly credible (British Society for Immunology)
- Strengths: clear, well-organized, accessible for learning complex concepts
- Limitation: lacks depth and detailed primary research evidence
- Relevant for assignment: provides foundational knowledge on thymic maturation and selection
- Supports content used in first two stages of the game and explains how T cells become functional and self-tolerant

Output: Shah (2021) explains the process of T-cell development in the thymus, focusing on how immature progenitor cells differentiate into functional, self-tolerant T lymphocytes. The source outlines key stages—double negative, double positive, and single positive—along with important processes such as T-cell receptor (TCR)

rearrangement and thymic selection. Positive selection ensures T cells can recognize self-MHC molecules, while negative selection eliminates strongly self-reactive cells, preventing autoimmunity. This source is credible because it is published by the British Society for Immunology, a well-established and authoritative organization. Its strengths include clear organization and accessible explanations of complex immunological concepts, making it ideal for student learning. However, it is somewhat limited in depth, as it simplifies mechanisms and does not include detailed experimental evidence or primary research data. This source is highly relevant to our assignment because it provides foundational knowledge on thymic maturation and selection, which are described in the first two stages of our game. We will use it to explain how T cells become both functional and self-tolerant, particularly when describing developmental stages and the importance of selection processes in maintaining immune system balance.

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.

N/A

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 presented, we made sure to only source our information from reputable sources such as the *Robbins Basic Pathology* textbook. We also ensured we had a workflow that allowed us to both track and manage our sources; Everytime a claim/statement/fact was presented we made sure to cite where the information was pulled from, all information written is then checked by another verifier (another team member that did not write that section) to check for the validity of both the source and if the information matches that of the source. AI-generated content was not used to generate any research or facts used in our project. AI was only used to help us reword sentences, find research papers, and check grammar.

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?

Throughout the PULSE assignment, our team became more aware of potential biases, particularly our tendency to assume a baseline level of scientific knowledge when designing content. Initially, we used terminology that may not have been accessible to all learners. To address this, we made a conscious effort to simplify complex immunology concepts, incorporate clear explanations, and design scenarios that were inclusive of different learning styles. We highlighted any words that we felt required definitions and created a glossary to provide context.

This assignment significantly enhanced our understanding of T-cell development by requiring us to translate detailed biological processes into an interactive, engaging format. Teaching the material through a "choose your own adventure" approach deepened our comprehension and reinforced key concepts and pathways. As a team, we estimate the assignment took approximately 40 hours, including planning, research, content creation, and troubleshooting.

Our team worked well collaboratively, with strong communication and a clear division of tasks. One strength was our ability to build on each other's ideas to improve clarity and engagement. However, if we were to do this again, we would begin simplifying content earlier in the process rather than revising later.

A key opportunity was making complex science more accessible, while a challenge was balancing accuracy with simplicity. Limitations included time constraints and ensuring consistency across sections. Overall, this project strengthened both our teamwork and science communication skills.

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 contributed to the generation of our content creation idea: a choose your own adventure game surrounding immune system cells.
L.X found the online platform we used to create the game: Figma
All members learned from scratch the online platform built to make this game.
K.G researched and created choose your own adventure scenarios for T cell origin and maturation, as well as the pathological DiGeorge Syndrome state.
L.Z researched and created choose your own adventure scenarios for T cell differentiation and antigen-recognition, as well as pathological X-linked SCID.
L.X researched and created choose your own adventure scenarios for T cell peripheral function and activation, as well as pathological ADA deficiency.
All team members designed their own slides on Canva with a general theme in mind.

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. Adu-Berchie K, Obuseh FO, Mooney DJ. T cell development and function. Rejuvenation Research [Internet]. 2023 May 8 [cited 2026 Mar 13];26(4):126–38. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC10460695/

2. Shah DK. T-cell development in thymus | British Society for Immunology [Internet]. Immunology.org. 2021 [cited 2026 Mar 13]. Available from: https://www.immunology.org/public-information/bitesized-immunology/immune-development/t-cell-development-thymus?utm

3. Sun L, Su Y, Jiao A, Wang X, Zhang B. T cells in health and disease. Signal Transduction and Targeted Therapy [Internet]. 2023 Jun 19 [cited 2026 Mar 13];8(1). Available from: https://www.nature.com/articles/s41392-023-01471-y

4. Kumar BV, Connors T, Farber DL. Human T cell development, localization, and function throughout life. Immunity [Internet]. 2018 Feb 20 [cited 2026 Mar 13];48(2):202–13. Available from: https://www.cell.com/immunity/fulltext/S1074-7613(18)30028-1?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS1074761318300281%3Fshowall%3Dtrue

5. Kumar V, Abbas AK, Aster JC, Deyrup AT. Robbins & Kumar basic pathology. 11th ed. Elsevier Health Sciences; 2022.

6. Mayo Clinic. *DiGeorge syndrome (22q11.2 deletion syndrome): Symptoms and causes.* https://www.mayoclinic.org/diseases-conditions/digeorge-syndrome/symptoms-causes/syc-20353543

7. Hershfield M. Adenosine Deaminase Deficiency [Internet]. Nih.gov. University of Washington, Seattle; 2017. Available from: https://www.ncbi.nlm.nih.gov/books/NBK1483/

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.*

1. Adu-Berchie K, Obuseh FO, Mooney DJ. T cell development and function. Rejuvenation Research [Internet]. 2023 May 8 [cited 2026 Mar 13];26(4):126–38. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC10460695/

This article provides a comprehensive overview of T cell development, differentiation, and functional roles within the adaptive immune system. It outlines key stages of T cell maturation, beginning in the thymus and progressing through peripheral activation, while emphasizing the molecular mechanisms underlying T cell receptor signaling, antigen recognition, and the formation of effector and memory T cells. The authors also discuss how dysregulation in these processes can contribute to immune-related diseases, including autoimmunity and immunodeficiency. The source is highly credible, as it is published in a peer-reviewed immunology journal and written by experts in the field. Its strength lies in its clear organization and detailed explanation of both fundamental and advanced concepts, making it suitable for building a strong conceptual foundation. However, some sections are dense and may require prior knowledge of immunological terminology to fully understand. This source is directly relevant to our project, as it informs the structure of our “choose your own adventure” game by outlining the chronological stages of the T cell life cycle. It also supports the development of accurate

WWYD scenarios by providing insight into both normal T cell function and pathological outcomes when these processes fail.

3. Shah DK. T-cell development in thymus | British Society for Immunology [Internet]. Immunology.org. 2021 [cited 2026 Mar 13]. Available from: https://www.immunology.org/public-information/bitesized-immunology/immune-development/t-cell-development-thymus?utm

Shah (2021) explains the process of T-cell development in the thymus, focusing on how immature progenitor cells differentiate into functional, self-tolerant T lymphocytes. The source outlines key stages—double negative, double positive, and single positive—along with important processes such as T-cell receptor (TCR) rearrangement and thymic selection. Positive selection ensures T cells can recognize self-MHC molecules, while negative selection eliminates strongly self-reactive cells, preventing autoimmunity. This source is credible because it is published by the British Society for Immunology, a well-established and authoritative organization. Its strengths include clear organization and accessible explanations of complex immunological concepts, making it ideal for student learning. However, it is somewhat limited in depth, as it simplifies mechanisms and does not include detailed experimental evidence or primary research data. This source is highly relevant to our assignment because it provides foundational knowledge on thymic maturation and selection, which are described in the first two stages of our game. We will use it to explain how T cells become both functional and self-tolerant, particularly when describing developmental stages and the importance of selection processes in maintaining immune system balance.

2. Sun L, Su Y, Jiao A, Wang X, Zhang B. T cells in health and disease. Signal Transduction and Targeted Therapy [Internet]. 2023 Jun 19 [cited 2026 Mar 13];8(1). Available from: https://www.nature.com/articles/s41392-023-01471-y

This review examines the role of T cells across a wide range of physiological and pathological contexts, focusing on how different T cell subsets contribute to immune homeostasis and disease progression. It describes the processes of T cell activation, specialization into functional subsets, and the establishment of long-term immune memory, while also addressing how disruptions in these processes are linked to conditions such as autoimmunity, infection, and cancer. The article emphasizes the dynamic balance T cells maintain between protective immunity and harmful overactivation. As a peer-reviewed publication in a high-impact journal, this source is reliable and well-supported by current research. Its strength lies in connecting immunological mechanisms to real-world disease outcomes, making complex concepts more applicable. However, because it covers a broad range of topics, some sections lack detailed mechanistic depth.This source is useful for our project because it helps expand beyond the normal T cell life cycle to include disease-related pathways. It supports the development of interactive decision points in our “choose your own

adventure” game by providing examples of what can go wrong when T cell regulation is altered, allowing players to explore both functional and dysfunctional immune responses.

4. Kumar BV, Connors T, Farber DL. Human T cell development, localization, and function throughout life. Immunity [Internet]. 2018 Feb 20 [cited 2026 Mar 13];48(2):202–13. Available from: https://www.cell.com/immunity/fulltext/S1074-7613(18)30028-1?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS1074761318300281%3Fshowall%3Dtrue

Kumar, Connors, and Farber (2018) provide a comprehensive review of human T-cell development, emphasizing how T cells not only mature in the thymus but also change in distribution, function, and composition across different tissues and stages of life. The authors highlight that T cells play a central role in coordinating adaptive immunity against pathogens, tumors, and allergens, while maintaining immune homeostasis over decades. A key argument is that T-cell function is shaped by both age and tissue localization, with distinct subsets residing in different anatomical compartments and adapting over time. This source is highly credible because it is a peer-reviewed review article published in *Immunity*, a leading journal in immunology. The authors are established researchers, and the paper synthesizes a large body of primary research. Its strength lies in its depth and broad perspective across the human lifespan. However, as a review, it does not present original experimental data and may be dense for beginners. This source is relevant to our assignment because it expands on basic thymic development by incorporating how T cells function and adapt throughout life. We will use it to support explanations of T-cell roles beyond maturation, particularly in discussing immune function, tissue specialization, and long-term immune regulation.

5. Kumar V, Abbas AK, Aster JC, Deyrup AT. Robbins & Kumar basic pathology. 11th ed. Elsevier Health Sciences; 2022.

This textbook provides a foundational overview of disease mechanisms, including key concepts in immunology such as immune cell development, function, and pathological dysfunction. It outlines the principles of adaptive immunity, with particular emphasis on how T-lymphocytes recognize antigens, become activated, and contribute to immune responses. The text also connects these processes to clinical conditions, including autoimmune diseases, immunodeficiencies, and lymphoid malignancies, offering a broader pathological context. As a widely used and authoritative medical textbook, this source is highly credible and written by leading experts in pathology. Its strength lies in its clear explanations and strong integration of basic science with clinical relevance, making complex concepts more accessible. However, as a general textbook, it may not provide the same level of detail or up-to-date research as primary journal articles. This source is highly relevant to our project as it supports the foundational understanding of T cell function and disease. It helps ensure that the biological concepts presented in our “choose your own adventure” game are accurate and clinically grounded, particularly when designing scenarios that involve immune dysfunction and pathological outcomes.

6. Mayo Clinic. *DiGeorge syndrome (22q11.2 deletion syndrome): Symptoms and causes.*
https://www.mayoclinic.org/diseases-conditions/digeorge-syndrome/symptoms-causes/syc-20353543

This source explains that DiGeorge syndrome is a genetic disorder caused by a deletion on chromosome 22, leading to abnormal development of multiple body systems. Key features include congenital heart defects, immune deficiency due to thymic hypoplasia, cleft palate, and low calcium levels. The condition varies widely in severity, but a central concept is impaired T-cell development, which increases susceptibility to infections. This source is highly credible because it is published by the Mayo Clinic, a well-known and trusted medical institution. It is medically reviewed and provides accurate, up-to-date clinical information. A major strength is its clarity and organization, making complex genetic and immunological concepts easy to understand. However, it is designed for a general audience, so it lacks detailed molecular or mechanistic depth. This source is relevant to our assignment because it clearly links thymic dysfunction to impaired T-cell maturation, which directly connects to my topic on T-cell development. We will use it to explain how defects in the thymus can lead to immunodeficiency and illustrate real-world clinical implications of disrupted T-cell development.

7. Hershfield M. Adenosine Deaminase Deficiency [Internet]. Nih.gov. University of Washington, Seattle; 2017. Available from:
https://www.ncbi.nlm.nih.gov/books/NBK1483/

This source provides a comprehensive overview of Adenosine Deaminase (ADA) Deficiency, outlining both its underlying pathophysiology and associated clinical consequences. It clearly explains how the accumulation of toxic metabolites, particularly deoxyadenosine, leads to impaired lymphocyte development and severe immune dysfunction. The content is highly detailed and well organized, offering in-depth explanations of the biochemical pathways involved. However, much of the information extended beyond the scope of our assignment, so only selected portions were incorporated into our final work. Despite this, the source proved valuable for reinforcing our understanding of key concepts discussed in class. Its reliability is strong, as it is published by the National Institutes of Health, a reputable and authoritative government organization. It was primarily used to verify the accuracy of the disorder's mechanisms and related biochemical pathways. Additionally, the source highlights various risk factors and broader clinical implications associated with ADA deficiency.