PULSE EXPERIENTIAL TEAM ASSIGNMENT

Team #: 12

1. Title of your PULSE experiential assignment.
Provide a creative and informative title.

Bite to Brain : An Interactive Map of Rabies

Title Rationale: The phrase "An Interactive Map" signals to a high school reader that this is a narrative-driven resource, not a dense academic paper. The subtitle "Bite to Brain" introduces tension and stakes. It communicates that rabies is one of the deadliest pathogens ever studied while ending on a note of optimism that points toward prevention and modern vaccine science. It also intentionally provocative because it prompts the reader to ask why and how, which is exactly the intellectual curiosity this assignment is designed to generate. The title is also scientifically accurate: untreated rabies has a case fatality rate approaching 100 percent, making the phrase scientifically defensible rather than exaggerated.

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.]

Imagine a virus so precise in its strategy that it can travel from a bite wound all the way to your brain over the course of several weeks without your immune system detecting it even once. That virus is rabies, and it holds the grim distinction of being the most consistently fatal viral infection ever documented in human medicine. Once neurological symptoms appear, fewer than 20 people in all of recorded medical history have survived.

Rabies is caused by the Rabies Virus (RABV), a bullet-shaped pathogen belonging to the Rhabdoviridae family. What sets RABV apart from virtually every other virus is that it completely avoids the bloodstream. Instead of spreading systemically like influenza or SARS-CoV-2, RABV slips directly into the nerve endings embedded in the muscle tissue surrounding a bite wound. From there it hijacks the nerve cell's own internal transport system, using a motor protein called dynein to carry itself up the nerve fiber toward the spinal cord and brain. This journey can take anywhere from two weeks to three months, during which the infected person feels completely healthy. No fever, no pain, no warning.

By the time symptoms begin, RABV has already infected the hippocampus, brainstem, and cerebellum, scrambling how neurons communicate and triggering either violent agitation and a severe fear of water, or progressive muscle paralysis, depending on

which form of the disease develops. Both end in coma and death within two to ten days of symptom onset.

The critical insight is that rabies is entirely preventable. A vaccine given promptly after a bite stops the virus before it reaches the nervous system. This is called post-exposure prophylaxis and it saves an estimated 250,000 lives every year. Yet 59,000 people still die annually, almost all in rural Asia and Africa where vaccines remain inaccessible.

This PULSE assignment uses an interactive concept map to walk learners through the complete biology of rabies, from the structure of the virus, through its silent journey, through what it does in the brain, and finally to how medicine intervenes.

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

Rabies Virus (RABV), Viral Encephalitis, Retrograde Axonal Transport, Negri Bodies, Glycoprotein G Protein, Post-Exposure Prophylaxis (PEP)

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).

Infectious Disease (Nov 26 / Dec 1): The foundational biology of RABV as a zoonotic pathogen, its transmission through animal bites, the global reservoir ecology (dogs in Asia and Africa, bats in North America), and the mechanism and schedule of post-exposure prophylaxis all fall directly under the Infectious Disease lecture block. The concept map's Section 6 (Prevention and the Race Against Time) is mapped entirely to this unit.

CNS Disease (March 18 to April 1): The neuropathological consequences of RABV brain infection are a textbook case study for viral encephalitis. The formation of Negri bodies inside infected neurons is one of the most recognizable pathognomonic findings in all of neuropathology and is directly addressed in this lecture block. The clinical distinction between furious and paralytic rabies also maps to this unit. Sections 3 and 5 of the concept map align here.

Immunity: Innate and Adaptive Response (Oct 22 to 27): The P protein-mediated suppression of STAT1 and STAT2 interferon signalling, the exploitation of immunologically privileged nerve tissue, and the role of neutralising antibodies in vaccine-mediated protection all connect directly to the Immunity unit. Section 4 of the concept map (The Body Tries to Fight Back) is mapped here.

Cell Injury and Cell Death (Sept 10 to 15): RABV entry through receptor-mediated endocytosis, binding of the G protein to nicotinic acetylcholine receptors on peripheral nerve terminals, and the disruption of normal neuronal function without immediate lytic cell death all connect to the Cell Injury unit. Section 1 (Virus Structure) and Section 2 (The Journey to the Brain) draw on this content.

Inflammation (Sept 24 to 29): The role of the blood-brain barrier in both protecting and being exploited during RABV infection, the neuroinflammatory response to viral

encephalitis, and the pathological consequences of delayed immune activation in the CNS all connect to the Inflammation unit. This content appears across Sections 3 and 4 of the concept map.

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

Learning Outcome 1: Identify the five structural proteins of RABV (G protein, N protein, L protein, M protein, and P protein) and explain the specific biological function of each protein in the viral life cycle, including receptor binding and cell entry, RNA encapsidation and genome protection, RNA-dependent RNA polymerase activity, structural integrity of the virion, and suppression of the host interferon response. Learners will also be able to locate each protein in a labelled cross-section diagram of the virion using the colour-coded 3D model embedded in the concept map.

Learning Outcome 2: Describe in sequential order the complete journey of RABV from the site of inoculation at a bite wound to the central nervous system, including the initial infection of peripheral nerve terminals in muscle tissue, the binding of the G protein to nicotinic acetylcholine receptors, the process of receptor-mediated endocytosis, the loading of the ribonucleoprotein complex onto dynein motor proteins, retrograde axonal transport at approximately 250 mm per day toward the spinal cord, and the final spread across brain regions including the hippocampus, brainstem, and cerebellum.

Learning Outcome 3: Explain the neuropathological consequences of RABV infection in the central nervous system, including the mechanism of neuronal dysfunction through disrupted synaptic signalling rather than immediate lytic cell death, the formation of Negri bodies as intraneuronal protein inclusions and their significance as the pathognomonic diagnostic finding for rabies, the clinical and pathological distinction between furious rabies (80 percent of cases: agitation, hydrophobia, aerophobia, lucid intervals) and paralytic rabies (20 percent of cases: ascending weakness, frequent misdiagnosis as Guillain-Barre syndrome), and the terminal progression to coma and death from respiratory failure within 2 to 10 days of symptom onset.

Learning Outcome 4: Analyse the mechanisms by which RABV evades the host immune system, including P protein-mediated inhibition of the STAT1 and STAT2 transcription factors that are required for interferon signalling, the strategic use of peripheral nerve cells as a transit vehicle through immunologically privileged tissue, the preservation of the blood-brain barrier during infection which limits access of circulating immune cells to the site of viral replication, and the inhibition of neuronal apoptosis to maintain host cell viability as a replication platform. Learners will connect these mechanisms to the concepts of viral immune evasion and innate immunity covered in the PATHOL 3500 Immunity unit.

Learning Outcome 5: Evaluate the mechanism and timing of post-exposure prophylaxis (PEP), including the biological rationale for why a four-dose vaccine schedule combined with rabies immunoglobulin (RIG) is effective when administered before viral entry into the central nervous system but universally ineffective after neurological symptoms appear, the role of neutralising antibodies directed against the G protein in preventing cell entry, the standard PEP schedule and timing requirements, and the global public health challenge of delivering PEP to the 59,000 people who die annually in resource-limited settings in Asia and Africa. Learners will also identify the major animal reservoirs of rabies by geographic region and explain why humans are accidental dead-end hosts in the transmission chain.

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

Rabies was selected as the topic for this PULSE assignment after reviewing the PATHOL 3500 course syllabus for a pathogen that could simultaneously illustrate the greatest number of core course themes while remaining genuinely engaging and accessible to a high school audience. No other single pathogen maps as cleanly across Cell Injury, Immunity, Inflammation, Infectious Disease, and CNS Disease all at once. Rabies is the only virus in which a student can trace a single molecular event, the G protein binding to a peripheral nerve receptor, through every level of the PATHOL 3500 curriculum: from cell entry and injury, through immune evasion, through neuroinflammation, through clinical CNS disease, and finally to infectious disease prevention. This makes it unusually efficient as a teaching tool.

Beyond its curriculum utility, rabies has genuine narrative power that most pathogens lack. Its biology unfolds as a story with a clear beginning, middle, and end. There is a moment of exposure (the bite), a prolonged silent phase during which the virus travels undetected through the nervous system (the incubation period), a dramatic clinical crisis in the brain (the encephalitic phase), and two possible outcomes depending entirely on whether the patient received timely intervention. This story structure maps naturally onto how human beings process and retain information. Students who might struggle to memorize a list of viral pathogenesis facts are far more likely to remember a sequence of events they experienced as a narrative.

Rabies also has direct and urgent global health relevance that is rarely present in undergraduate pathology content. Approximately 59,000 people die from rabies every year. The overwhelming majority of these deaths occur in rural communities in South Asia and sub-Saharan Africa where domestic dog vaccination programmes are incomplete and post-exposure prophylaxis is financially or geographically inaccessible. These deaths are not inevitable and not acceptable: rabies is one of the few infectious diseases for which a reliable, inexpensive prevention exists but still causes tens of thousands of deaths annually due to structural barriers. Introducing students to this reality connects the molecular biology content to health equity and global medicine in a way that is rarely achieved in a preclinical pathology course.

The topic also benefits from a particularly striking visual profile. The bullet-shaped RABV virion is immediately recognizable and distinctive, the cross-section of the virus showing five colour-coded proteins is visually compelling even to a non-specialist, and the diagrams of the nerve highway journey and the interferon-blocking mechanism

lend themselves naturally to illustration. Rabies is a topic that can be shown as well as explained, which is ideal for a concept map format.

Why a Concept Map?

The concept map was selected as the medium after considering and ruling out several alternatives including a poster, an infographic, a short video documentary, and a written case study. Each of these alternatives has a fundamental structural limitation for rabies: they are linear. Rabies biology is not linear. It spans virology, neuroscience, immunology, and epidemiology, and these areas are not simply sequential chapters in a story. They are interconnected systems. The immune evasion mechanism directly determines why the incubation period is so long. The incubation period length directly determines whether PEP will be effective. The neuroinflammatory response directly determines the clinical presentation. A linear format forces these connections into a sequence where they appear independent, when they are in fact deeply linked.

A concept map solves this structural problem by representing information as a network rather than a sequence. Learners can see immediately that the G protein connects the virus structure section to the immune response section and the prevention section simultaneously. They can navigate from any entry point in the map to any other, following the connections that are most relevant to their learning goals at that moment. This non-linear navigation is particularly valuable for a resource aimed at two distinct audiences, high school learners and pre-medical students, who will naturally navigate the same map at different levels of depth.

The concept map also supports active and self-directed learning in ways that a static document cannot. Each subsection of the map contains at least one embedded interactive element: a colour-identification protein quiz using the 3D virus diagram, a clinical case scenario presenting a real patient presentation for learners to assess, a comparison table for furious versus paralytic rabies, and a PEP timing activity that challenges learners to decide whether to vaccinate based on time elapsed and bite location. These elements require the learner to engage with the content rather than simply read it, which research consistently shows improves retention and understanding for complex scientific material.

Finally, the concept map format is highly scalable. A high school student encounters the plain-language core concept, the analogy, and the fast fact in the outer bubble of each section. A pre-medical student pushes deeper into the mechanistic subsections, the clinical cases, and the PATHOL 3500 course connections. Both learners use the same resource and both receive content calibrated to their level. This dual-depth design was a central goal of the assignment from the beginning and the concept map is the only format that achieves it without feeling simultaneously too simple for one audience and too complex for the other.

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?)

Two AI tools were used in the development of this assignment. Claude (Anthropic), accessed through the Cowork desktop application, served as the primary research assistant, writing partner, content structuring tool, and editorial collaborator throughout the project. Adobe Firefly (Adobe's generative AI image and video platform) was used to produce the scientific visualisations embedded in the concept map, including a photorealistic 3D cross-section of the RABV virion with all five proteins labelled by colour, an anatomically accurate diagram of the P protein interferon-blocking mechanism inside a neuron, and a video flythrough of the virus structure used as a visual introduction to Section 1 of the concept map.

How Claude Was Used in Detail:

Claude was not used as a simple answer generator. The team used it as an iterative thinking and drafting partner across eight distinct stages of the project, with each stage involving a prompt, a critical evaluation of the output against primary sources and rubric criteria, and a targeted follow-up prompt to refine the result. This back-and-forth process is closer to how professional science communicators work with editors and subject matter reviewers than it is to asking a chatbot for information. The team maintained full responsibility for factual accuracy at every stage, and no AI-generated claim was included in the final assignment without independent verification.

Stage 1 involved using Claude to build the foundational content for Section 1 (virus structure), prompting it to explain each of the five RABV proteins using accessible analogies appropriate for a Grade 10 to 12 reader. The output was then checked against Schnell et al. (2010) and Jackson (2016) before inclusion.

Stage 2 involved using Claude to draft the nerve transport explanation for Section 2, specifically requesting a concrete physical analogy for dynein-mediated retrograde axonal transport and an explanation of why the immune system fails to detect the virus during transit. The team refined the resulting "hijacked delivery truck" and "underground tunnel" analogies through multiple prompt iterations before settling on the final version.

Stage 3 involved generating the CNS pathology content for Section 3, including Negri body formation, the furious versus paralytic distinction, and the connection to the PATHOL 3500 CNS Disease unit. This output required significant editing to remove overly technical language and to simplify the clinical descriptions for the high school audience.

Stage 4 was a complete content revision prompted by feedback that the initial draft was too dense for the intended audience. The team gave Claude explicit instructions to rewrite every section at a lower reading level, add fast facts, shorten paragraphs, use more analogies, and preserve the course connections. The revised output was then

compared section by section with the original draft to ensure no accuracy was sacrificed in the simplification.

Stage 5 involved using Claude to generate the detailed Adobe Firefly prompt for the 3D virus cross-section, including specific colour assignments for each protein, the correct anatomical proportions for the bullet-shaped virion, and the cross-section perspective that would allow all five proteins to be visible simultaneously.

Stage 6 involved generating all six topic alignment entries connecting each concept map section to its corresponding PATHOL 3500 lecture dates, using the course syllabus as a reference document fed into the prompt.

Stage 7 involved drafting and refining the learning outcomes, ensuring they used correct Bloom's Taxonomy action verbs and were measurable and specific enough to satisfy the PULSE rubric criteria.

Stage 8 involved structural drafting of the rubric document itself, with the team providing all factual content and using Claude primarily to organise it into coherent paragraphs and check for internal consistency.

How Adobe Firefly Was Used:

Adobe Firefly was used to generate three scientific visuals that do not exist in any existing educational resource on rabies. The primary output was a photorealistic 3D cross-section of the RABV virion showing all five structural proteins simultaneously, with each protein assigned a distinct colour matching the colour scheme used in the concept map (deep blue for G protein spikes, sage green for M protein matrix layer, warm orange for N protein nucleoprotein coils, cobalt blue for L protein polymerase spheres, and golden yellow for P protein connectors), and an ivory cream helical RNA genome strand visible at both ends. A custom prompt describing the exact anatomical features, protein positions, cross-section angle, lighting conditions, colour palette, and scientific accuracy standards required was developed over several iterations before the final image was accepted. The second output was an anatomical diagram of the interferon evasion mechanism showing P protein blocking the interferon signalling cascade inside a neuron on one side, and replicated RABV particles travelling toward the salivary gland on the other side, with a real histological image of inflamed brain tissue in the corner as a contrast. The third output was a short video flythrough of the virus surface and interior, used as a visual opener for Section 1 of the concept map.

Is This Novel?

Yes, on multiple levels. The use of Claude as a multi-stage editorial partner with structured feedback loops between stages, rather than as a single-use answer tool, represents a more sophisticated and more responsible approach to AI-assisted academic work than is typically seen in undergraduate assignments. The team's practice of verifying every AI output against primary sources before inclusion, and their documented correction of AI inaccuracies found during this process, demonstrates a

critical and responsible relationship with AI-generated content that goes beyond simple acceptance and submission.

The use of Adobe Firefly to produce labelled, anatomically accurate 3D scientific diagrams at the level of detail shown in the concept map is also genuinely novel in the context of an undergraduate assignment. The level of scientific visualisation quality achieved would previously have required either a professional medical illustrator working over several days or access to expensive 3D molecular modelling software with significant training. Making this quality of scientific communication accessible through generative AI represents a meaningful advancement in what undergraduate learners can produce and share.

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?

Innovation 1: AI-Generated Scientific Visualisation at Professional Quality

The most immediately visible innovation in this assignment is the use of Adobe Firefly to generate photorealistic 3D scientific visualisations of a quality that has previously been exclusive to professional medical illustrators and molecular modelling software. The 3D cross-section of the RABV virion showing all five structural proteins simultaneously in anatomically correct positions, with distinct colours, accurate proportions, and a cross-section perspective that makes the internal architecture visible, is not a resource that currently exists in any publicly available undergraduate educational material on rabies. Existing diagrams of RABV structure in textbooks and online resources are either schematic 2D line drawings, low-resolution electron microscope images, or simplified cartoons. None of them achieve the combination of visual realism and structural accuracy that the Firefly-generated model provides.

The same applies to the interferon evasion diagram. A split-screen cross-section of a human neuron showing the P protein actively blocking interferon signal molecules on one side, RABV particles replicating freely and travelling toward the salivary gland on the other, with a real histological contrast image of inflamed brain tissue in the corner, does not exist as a unified teaching diagram anywhere in the current educational literature. This diagram was designed specifically for this assignment from a custom scientific prompt developed by the team, and represents original scientific communication content rather than a reproduction or adaptation of existing material.

The use of generative AI to produce this level of scientific illustration within an undergraduate assignment is genuinely novel. It represents a meaningful advancement in what students can create and share as educational resources without access to professional illustration services or expensive 3D modelling software.

Innovation 2: Dual-Depth Architecture for Two Simultaneous Audiences

Most undergraduate educational resources are designed for a single target audience at a single level of expertise. This assignment was deliberately architected to serve two fundamentally different audiences simultaneously without compromising the experience for either. Every section of the concept map operates at two distinct depth levels that are structurally embedded into the map design rather than presented as separate versions of the same content.

The outer bubble of each section presents a plain-language core concept written at a Grade 10 to 12 reading level, accompanied by a physical analogy, a set of fast facts, and a visual element. A high school learner can engage with the entire concept map at this level and walk away with a genuine understanding of rabies biology that goes significantly beyond what any existing high school biology resource provides.

The subsections within each bubble contain mechanistic explanations, clinical case studies, PATHOL 3500 course connection boxes, and connections to the Robbins Basic Pathology textbook. A pre-medical student navigating the same concept map can push into this layer and find content that directly prepares them for course assessments, written at a level of biological and clinical detail appropriate for their training.

This dual-depth design is structurally different from simply writing some sections as "introductory" and others as "advanced." Both audiences navigate the same six primary sections of the map. The depth they encounter is determined by how far they click into each section, not by which sections they are directed to. This is a design innovation that has not been applied in any PULSE assignment the team reviewed during the background research phase.

Innovation 3: Narrative-First Chronological Structure

The overwhelming majority of existing educational resources on rabies, including those found on the WHO website, the CDC website, public health agency fact sheets, and undergraduate microbiology course notes, organise content by topic category. They typically present sections in an order such as: What is rabies, Epidemiology, Symptoms, Treatment, Prevention. This is a logical organisational structure for a reference document but it is a poor structure for learning, because it presents the biology of infection out of chronological order and separates causally linked events into separate unconnected sections.

This assignment organises all content around the chronological story of what happens when the rabies virus enters a human body, from the moment of exposure to the moment of resolution. Section 1 introduces the virus itself. Section 2 follows the virus from the bite site to the nervous system. Section 3 documents what the virus does when it reaches the brain. Section 4 examines how the body responds and why that response fails. Section 5 covers diagnosis. Section 6 covers prevention and why timing is everything. Each section is causally connected to the one that precedes it, and learners

can follow the biological logic of the disease as a sequence of events rather than a collection of unrelated facts.

This narrative structure mirrors how the human brain naturally processes and retains complex information. Research in cognitive science consistently shows that information presented as a coherent narrative with causal connections between events is retained significantly better than the same information presented as a categorised list. Applying this insight to the design of a pathology educational resource is an innovation in format rather than content, and one that is not present in any existing rabies educational material the team identified.

Innovation 4: Responsible and Documented AI Integration Methodology

The way this assignment integrates AI is itself innovative. Rather than using Claude as a one-shot answer generator where a prompt is submitted and the output is accepted and submitted, the team used Claude as an iterative editorial partner across eight distinct stages of the project, each involving a structured prompt, a critical evaluation of the output against primary sources and the target audience, a fact-checking step against peer-reviewed literature, and a targeted follow-up prompt designed to address specific deficiencies found in the previous output.

This iterative human-AI collaboration model is closer to the relationship between a science writer and a subject matter editor than it is to the way AI is typically used in undergraduate academic work. It treats the AI as a capable but fallible drafting tool rather than an authoritative source, which is the epistemically correct stance. The team's correction log, which documents the two specific factual errors found in Claude's output during fact-checking and describes how they were corrected, provides a transparent and replicable account of the AI integration process that other students, instructors, and future PULSE teams can learn from.

The complete prompt log in Q9 provides enough detail for any reader to independently replicate the team's AI-assisted content development process. This level of documentation transparency is not common in undergraduate assignments that use AI tools, and it represents a model for responsible AI use in academic science communication that could serve as a template for future PULSE teams.

Innovation 5: Embedded Interactive Learning Activities Designed as Diagnostic Tools

Each subsection of the concept map contains at least one interactive element that requires the learner to actively apply the content they have just encountered rather than passively receive it. These elements were not designed as decorative additions to make the map visually interesting. They were each designed to serve a specific diagnostic

function: to reveal whether the learner has understood a particular concept well enough to use it.

The protein colour-identification quiz uses the 3D RABV virion diagram and asks learners to match each colour to the correct protein and function. This requires not just recalling that the G protein exists but knowing where it is, what colour represents it, and why its position on the outer surface is functionally significant. A learner who can answer this correctly has genuinely understood the virus structure section.

The clinical case scenario in Section 3 presents a real patient presentation including bite history, incubation period, initial symptoms, and progression, and asks learners to identify which form of rabies is developing and explain why, based on the specific symptom pattern. This requires applying the furious versus paralytic distinction to a concrete case rather than simply reciting the difference.

The PEP timing activity in Section 6 presents learners with three different exposure scenarios varying in bite location, time elapsed since exposure, and availability of medical care, and asks them to assess the likelihood that PEP will be effective in each case. This requires integrating knowledge from multiple sections of the map: the speed of nerve transport from Section 2, the meaning of symptom onset from Section 3, and the mechanism and timing requirements of PEP from Section 6.

None of these interactive elements exist in any other publicly available educational resource on rabies. They were created specifically for this assignment and represent original contributions to the available educational material on this topic.

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 Prompts Attached

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.

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.

Ensuring the accuracy of all content in this assignment was treated as a non-negotiable requirement from the beginning of the project, particularly given that AI tools were

used extensively in content drafting. The team implemented a three-stage verification process for every factual claim included in the concept map and rubric document.

Stage 1: Source identification before drafting. Before asking Claude to draft any section of the concept map, the team first identified which primary sources contained the relevant factual information for that section. This meant the team had a pre-verified foundation of accurate information before any AI output was generated, which made it significantly easier to identify when Claude produced a claim that was incorrect or unsupported.

Stage 2: Claim-by-claim verification against primary sources. Every specific factual claim in the concept map was traced back to a primary source before inclusion. The databases used for this process were PubMed (for peer-reviewed journal articles), the Schulich Library catalogue (for textbook access), the WHO website (for epidemiological statistics), and the CDC website (for prophylaxis protocols). Where a claim could not be verified against a primary or authoritative secondary source, it was removed from the assignment.

Stage 3: AI output correction log. The team maintained a written log of every instance where Claude produced a claim that was found to be inaccurate or unsupported during verification. Two specific errors were identified and corrected. In the first instance, Claude cited the annual global rabies mortality as "approximately 55,000 deaths" when the current WHO figure is 59,000. In the second instance, Claude described the incubation period as "typically 1 to 3 months" without acknowledging documented cases of incubation periods exceeding one year, which are described in Jackson (2016). Both figures were corrected to match the verified source material.

The concept map includes in-text reference numbers corresponding to the numbered reference list in Q15. Every claim supported by a specific source is numbered accordingly, allowing any reader to identify the source for any piece of information presented.

Databases and materials used: PubMed for primary literature searching and access. Schulich Medicine Library for full-text access to journal articles and the Robbins Basic Pathology textbook. WHO Fact Sheets and CDC MMWR publications for epidemiological and clinical guideline data. Google Scholar was used as a secondary tool to identify citation counts and assess the relative impact of candidate sources before selecting the final seven references.

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:

Before beginning this project, every member of the team had heard of rabies but none of us had studied it at a mechanistic level. The most significant thing we learned was not a specific fact but a concept: that the route a pathogen uses to travel through the body fundamentally determines how the immune system can or cannot respond to it. Rabies is not unusually aggressive or fast-replicating compared to other viruses. It is lethal because of where it goes and how it gets there. That insight changed how we thought about pathogen-host interactions generally and gave us a much more nuanced way of thinking about what makes a disease dangerous.

Writing for a high school audience turned out to be significantly harder than writing for a university audience. It forced us to confront which concepts we genuinely understood at a level deep enough to explain simply, and which ones we had only surface-level familiarity with. Analogy development was particularly challenging because a good analogy has to be both accessible and accurate: it cannot introduce misconceptions while trying to simplify. The "dynein as a hijacked delivery truck" analogy required three iterations before the team felt it was both understandable and scientifically fair.

The experience of fact-checking AI output was also genuinely educational. Finding two specific errors in Claude's output early in the project shifted the whole team's relationship with AI from trust to critical engagement, which we believe is the correct stance. The assignment took approximately 14 hours across the team. Next time we would establish a formal fact-checking checklist at the start rather than developing it reactively mid-project.

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…

R.A served as the lead researcher and primary content writer. R.A conducted the PubMed literature search, selected and performed full-text review of all seven sources used in the reference list, developed the initial content drafts for all six concept map sections in collaboration with Claude, performed all primary source fact-checking for AI-generated content, wrote the lay summary, learning outcomes, topic alignment, topic and medium justification, team reflection, and all annotated bibliography entries, and completed the final proofreading and editing pass on all rubric components.

AF served as the visual design lead and concept map architect. AF designed the overall structure, layout, and navigation logic of the concept map, developed all Adobe Firefly prompts for the scientific diagrams across multiple iteration rounds, produced the final 3D RABV virion cross-section and the interferon evasion neuron diagram, oversaw the colour palette and visual hierarchy decisions throughout the concept map, and created the video flythrough used in the Section 1 introduction.

OS served as the curriculum alignment specialist and bibliography coordinator. OS reviewed the full PATHOL 3500 syllabus and lecture outlines to produce the five-unit course alignment documented in Q4, cross-referenced all concept map content with the relevant chapters of Robbins Basic Pathology to verify textbook accuracy, compiled the complete reference list in Nature format, and contributed to early drafts of the Q6 topic justification.

All three team members participated equally in all major conceptual decisions including topic selection, section structure, depth-level calibration, and the decision to use a concept map format. All team members reviewed each other's sections before finalisation.

14. Other comments (Optional)

Any comments the team would like to let the coordinator and/or TAs know.

All sections (1-3, 3-4, 5-6) are specifically designed for each different person, to represent our own creative processes. That’s why each section is different colors and designed differently then others.

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. Schnell, M. J., McGettigan, J. P., Wirblich, C. & Papaneri, A. The cell biology of rabies virus: using stealth to reach the brain. *Nature Reviews Microbiology* **8**, 51-61 (2010).
2. Fooks, A. R. et al. Current status of rabies and prospects for elimination. *The Lancet* **384**, 1389-1399 (2014).
3. Jackson, A. C. *Rabies: Scientific Basis of the Disease and its Management*. 3rd ed. (Academic Press, 2016).
4. Hemachudha, T., Laothamatas, J. & Rupprecht, C. E. Human rabies: a disease of complex neuropathological mechanisms. *The Lancet Neurology* **1**, 101-109 (2002).
5. Kumar, V., Abbas, A. K. & Aster, J. C. *Robbins Basic Pathology*. 11th ed. (Elsevier, 2022).
6. Rupprecht, C. E. et al. Use of a reduced (4-dose) vaccine schedule for postexposure prophylaxis to prevent human rabies. *MMWR Recommendations and Reports* **59**, 1-9 (2010).
7. World Health Organization. Rabies Fact Sheet. https://www.who.int/news-room/fact-sheets/detail/rabies (2023).

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.

- **Schnell, M. J., McGettigan, J. P., Wirblich, C. & Papaneri, A.** The cell biology of rabies virus: using stealth to reach the brain. *Nature Reviews Microbiology* 8, 51–61 (2010).
- **Annotation:**
  This review explains the molecular mechanisms of rabies virus infection, including receptor binding, axonal transport, and immune evasion. Published in a high-impact journal, it is highly credible and widely cited, with expert authors in virology. While some structural details may be updated, its core mechanisms remain valid. This source was essential for the concept map's mechanistic sections, supporting explanations of viral entry, intracellular transport, and interferon suppression, ensuring accuracy in describing how rabies spreads and avoids immune detection.

- **2.**
- **Fooks, A. R. et al.** Current status of rabies and prospects for elimination. *The Lancet* 384, 1389–1399 (2014).
- **Annotation:**
  This article provides a global overview of rabies epidemiology, including transmission, mortality, and elimination strategies. Published in *The Lancet*, it is highly credible and based on WHO data. Its international authorship strengthens reliability. It was important for providing statistics such as global deaths and dog transmission rates. This source supported the global health section of the concept map, particularly discussions on prevention, geographic distribution, and

public health challenges, though it required supplementation for non-dog reservoirs.

- **3.**
- **Jackson, A. C.** *Rabies: Scientific Basis of the Disease and its Management.* 3rd ed. (Academic Press, 2016).
- **Annotation:**
  This textbook offers a comprehensive overview of rabies, including clinical features, neuropathology, and treatment. Written by an expert neurologist, it is a highly authoritative source, though limited to research up to 2015. It was useful for explaining brain pathology, including Negri bodies, and distinguishing forms of rabies. The source supported clinical accuracy in the concept map, including disease progression, symptoms, and post-exposure prophylaxis, making it key for understanding how rabies affects the brain and patients.

- **4.**
- **Hemachudha, T., Laothamatas, J. & Rupprecht, C. E.** Human rabies: a disease of complex neuropathological mechanisms. *The Lancet Neurology* 1, 101–109 (2002).
- **Annotation:**
  This article explains how rabies causes severe neurological symptoms without widespread neuron death, focusing on functional disruption. Published in a leading neurology journal, it is highly cited and written by experts in clinical and public health fields. Despite its age, its findings remain widely accepted. It contributed to understanding how rabies differs from other brain infections, supporting explanations of neuronal dysfunction, axonal transport speed, and blood-brain barrier integrity in the concept map.

- **5.**
- **Kumar, V., Abbas, A. K. & Aster, J. C.** *Robbins Basic Pathology.* 11th ed. (Elsevier, 2022).
- **Annotation:**
  This textbook is a widely used and authoritative resource in medical education, written by leading experts. It provides broad coverage of pathology concepts but less mechanistic detail. As the course textbook, it was essential for ensuring alignment with PATHOL 3500 content. It was used to verify terminology, definitions, and key concepts throughout the concept map, ensuring consistency with course expectations and improving clarity and accuracy in all scientific explanations.

- **6.**
- **Rupprecht, C. E. et al.** Use of a reduced (4-dose) vaccine schedule for postexposure prophylaxis to prevent human rabies. *MMWR Recommendations and Reports* 59, 1–9 (2010).
- **Annotation:**
  This CDC guideline outlines the standard rabies post-exposure prophylaxis protocol, including vaccine timing and immunoglobulin use. As an official public health recommendation, it is highly authoritative and evidence-based. It was crucial for explaining prevention strategies in the concept map. The source clarified why treatment is effective before symptoms but not after, supporting key public health concepts and ensuring clinical accuracy in describing rabies prevention and response.

- **7.**
- **World Health Organization.** Rabies Fact Sheet. https://www.who.int/news-room/fact-sheets/detail/rabies (2023).
- **Annotation:**
  This WHO fact sheet provides current global data on rabies, including transmission, mortality, and prevention efforts. As an official international health source, it is highly credible and regularly updated. While not detailed mechanistically, it is the most reliable source for global statistics. It was used to support all epidemiological data in the concept map, including death rates, geographic distribution, and elimination goals, ensuring all public health information is accurate and up to date.