PULSE EXPERIENTIAL TEAM ASSIGNMENT

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

A look at Retinoblastoma

2. Please summarize your PULSE experiential assignment (max 300 words).
Provide a non-technical (lay) summary of your PULSE assignment. Prompts to think about: What is the topic? What is the format? Why did you choose this topic and format? The summary for lay audience is a brief and accessible summary of the assignment that is used to explain complex ideas, technical writing and scientific terms to people who do not have prior knowledge of the subject (e.g., high school science level). This summary should include the importance, impact, and content of your assignment to a broader audience.
[Team 23 is an example of an informative lay summary.]

Our PULSE experiential assignment is about **retinoblastoma**, which is a rare eye cancer that mostly affects babies and very young children. We chose this topic because it connects well to what we learned in class about how cancer begins and grows. It is also a topic that feels important in real life, because catching it early can make a huge difference for a child's health, vision, and chance of survival.

We decided to present our project as an **infographic poster**. We chose this format because it is easier for people to read and understand than a long paper full of hard words. A poster lets us organize the information into clear sections, use visuals, and highlight the most important points in a way that feels quick, engaging, and accessible. We wanted to make sure someone without a science background could still learn from it and come away from understanding why this disease matters. Our poster explains what retinoblastoma is, who it affects, and why it is different from many other cancers. It also looks at the causes of the disease, how it can affect one or both eyes, what warning signs people should look for, and how doctors find and treat it. We included information about common signs such as a white glow in the eye, crossed eyes, and vision problems, as well as the importance of family history and early testing in some cases. The poster also covers treatment options and the balance between saving the child's life and protecting vision whenever possible. We chose this topic and format because we wanted to take something serious and complex and turn it into something clear, useful, and meaningful for a broader audience. Overall, our goal is to help people better understand this childhood cancer and why early attention and care are so important.

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

- Retinoblastoma
- RB1 gene
- Two-hit hypothesis

- Leukocoria
- Pediatric cancer
- Early detection

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).

Neoplasia

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. **Understand the pathophysiology of retinoblastoma**
   Explain how mutations in the RB1 gene lead to loss of cell cycle control and tumour development, including Knudson's two-hit hypothesis.
2. **Identify key clinical features and warning signs**
   Recognize common presentations such as leukocoria, strabismus, and red flags that require urgent medical evaluation.
3. **Describe diagnostic and screening methods**
   Outline how retinoblastoma is diagnosed using ophthalmologic exams and imaging techniques like MRI.
4. **Compare treatment options and outcomes**
   Differentiate between treatment strategies (e.g., enucleation, chemotherapy, focal therapies) based on disease stage and severity.
5. **Understand global and epidemiological differences**
   Discuss how outcomes vary by income level and access to healthcare, emphasizing the importance of early detection.

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 retinoblastoma as our topic because it is a serious but often under-recognized childhood cancer where early detection can significantly improve outcomes. We wanted to focus on a condition that combines genetics, pathophysiology, and real-world clinical relevance, while also highlighting important warning signs like leukocoria that non-specialists can learn to identify. Additionally, the topic allowed us to incorporate both scientific concepts (e.g., RB1 gene, two-hit hypothesis) and global health perspectives, making it meaningful and impactful. We chose a poster format as our medium because it allows complex medical information to be presented in a clear, visually engaging, and accessible way. Posters help break down dense content into organized sections, visuals, and key points, which support quick understanding and retention. This format is especially useful for learners who benefit from visual learning and structured summaries rather than long text.

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 several AI tools, including ChatGPT, Claude, and Gemini, during the development of our infographic. These tools were primarily used to experiment with image generation and to gather inspiration for layout and visual design. In addition, a small portion of the factual content (specifically in the top-left and bottom-right sections of the infographic) was supported by AI-generated suggestions, which were then verified and refined. However, the core research for this project was conducted independently using research articles. All key scientific information, analysis, and conclusions were derived directly from the articles we selected, ensuring accuracy and academic integrity. The AI tools were mainly used to enhance the visual presentation and organization of the infographic rather than to generate information. We used AI to support the creative and design aspects of our assignment. We chose these tools because they are efficient for generating visual ideas and exploring different design options quickly. Alternative tools, such as traditional design software or manual sketching, were considered, but AI tools allowed for faster iteration and refinement of visual concepts, and it helped to keep images in the same artstyle.

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 experiential assignment is innovative because it transforms a complex medical topic into a clear, visually structured, and learner-focused format that integrates multiple layers of understanding in one place. Unlike traditional resources that often separate genetics, clinical features, and treatment into different sections or use dense, technical language, our poster connects the molecular basis of retinoblastoma (RB1 mutation and Knudson's two-hit hypothesis) directly to real clinical signs, diagnosis, and treatment decisions. A particularly novel component is the inclusion of clinical "red flags" and visual cues, which makes the content not only informative but also practical for early recognition. Additionally, by incorporating global health perspectives, our assignment goes beyond standard lecture content to highlight real-world disparities in outcomes. Overall, what makes our work different is its ability to simplify complex science while maintaining depth, using visuals and organization to improve understanding, retention, and real-life application for learners.

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].

Me: "Suggest a clean and appealing color scheme for a medical infographic about retinoblastoma. The design should feel scientific, minimalistic, and visually clear. Avoid overly bright or distracting colors"

AI: “Yes! The first part we'll tackle is:

- **The header/title bar** (name of the disease, authors)
- **The overall color palette** we'll use consistently throughout the whole poster

For the color palette, I want to suggest something that fits the retina/eye theme. Let me ask one quick thing:

Q: Which color direction feels right for a retinoblastoma poster? A: Surprise me — just make it look great

Love the energy — leaving it in my hands! Let me read the design skill first to make sure I build this to a high standard.”

Me: “Suggest a clear and visually appealing layout for a medical infographic about retinoblastoma. The infographic should include sections for definition, genetic mechanism, tumor types, symptoms, and treatment. Leave the sections blank though”

AI: “**The section order** is now logical and numbered — it tells a story from "what is this" all the way to "how do we treat it."

What do you think? A few things I'd love your input on:

- Are you happy with the **dark theme**, or would you prefer a lighter version?
- Does the section order feel right, or do you want to swap anything?

Once you sign off on this, we'll move to **Section 01 — Introduction**! ◎”

Me: “Give ideas for organizing a scientific infographic so that it looks minimalistic but still visually engaging.”

AI: “Use clear section divisions with consistent spacing and alignment. Incorporate icons or simple diagrams instead of large blocks of text. Maintain a limited color palette and use whitespace effectively to improve readability. Highlight key points using bold text or small callout boxes.”

Me: “Generate a few concise and interesting facts about retinoblastoma that would work well in small side sections of an infographic.”

AI: “Here are 2 good ones based on the data:

Box 1 — Survival

> **95%** survival rate in high-income countries with early treatment — drops to **~30%** in low-income countries without access

Box 2 — Globe salvage

~90% globe (eye) salvage rate with modern IAC — meaning most children keep their eye when treated early

Want me to add these two to the stats sidebar alongside the existing ones, matching that dark crimson bubble style you've got going? 🔘"

Me: "Create a clean, minimalistic medical-style illustration of an eye showing retinoblastoma tumor growth (*** or insert image idea here ***). The style should be simple, scientific, and suitable for an infographic."

- Other image prompts:
  - a simple visual diagram representing the two-hit hypothesis for RB1 gene mutation in retinoblastoma
  - showing different tumor growth patterns (focal, diffuse, and invasive

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.

https://docs.google.com/document/d/1exd8q-ZjCL71JVDfoHbTTjnwykou3G3qnBSRCFJKefA/edit?usp=sharing

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 in our PULSE assignment, our team relied exclusively on peer-reviewed scientific literature and reputable medical journals. We used databases such as PubMed and Google Scholar to locate high-quality sources, including foundational studies (e.g., Knudson's two-hit hypothesis) and more recent clinical research on retinoblastoma. Each claim included in the poster was cross-checked across multiple sources to confirm accuracy and consistency. We also ensured that key concepts, such as RB1 gene function, clinical presentation, and treatment options, aligned with established medical knowledge. All references were carefully tracked and organized using Vancouver-style citations, allowing us to clearly link each piece of information back to its original source (as shown in our reference document). When using AI tools to support drafting or clarification, we verified all generated information against primary scientific articles and review papers to avoid misinformation. This process ensured that our final assignment is evidence-based, accurate, and reliable for learners.

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

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

Reflection: Our team had a very collaborative and balanced experience completing the PULSE assignment. Everyone contributed equally to the work, which helped ensure that the final product reflected a range of perspectives and ideas. While no major biases surfaced during the process, we were mindful of presenting the information in an inclusive and accessible way. We focused on simplifying complex concepts and avoiding overly technical language so that the content could be understood by a broader audience, regardless of their background. This assignment significantly supported our learning by requiring us to teach the material. Breaking down concepts for others helped deepen our own understanding and made us more aware of areas we needed to clarify. Overall, the assignment took several hours spread across a few days, including time for research, discussion, and final edits. One of the main challenges we faced was coordinating times to meet and discuss ideas, as everyone had different schedules. Despite this, we maintained strong communication and ensured all voices were heard. What worked well was our equal division of tasks and our shared responsibility for reviewing and refining the final content. If we were to complete this assignment again, we would plan meetings earlier to avoid scheduling conflicts. Overall, this experience strengthened our teamwork and communication skills while giving us the opportunity to create meaningful, educational content for others.

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 members contributed equally to researching and putting on poster

- R.J: Did intro and clinical presentation section
- W.W: Did treatment and pathophysiology
- J.S: Did Etiology and Diagnosis

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. Lee WH, Bookstein R, Hong FD, Young LJ, Shew JY, Lee EY. Human retinoblastoma susceptibility gene: cloning, identification, and sequence. Science. 1987;235(4794):1394-9. doi:10.1126/science.3823889.
2. Lee WH, Shew JY, Hong FD, Sery TW, Donoso LA, Young LJ, et al. The retinoblastoma susceptibility gene encodes a nuclear phosphoprotein associated with DNA binding activity. Nature [Internet]. 1987 Oct 1;329(6140):642–5. Available from: https://doi.org/10.1038/329642a0
3. Knudson AG. Mutation and Cancer: Statistical study of retinoblastoma. Proceedings of the National Academy of Sciences [Internet]. 1971 Apr 1;68(4):820–3. Available from: https://doi.org/10.1073/pnas.68.4.820
4. Group GRS, Fabian ID, Abdallah E, Abdullahi SU, Abdulqader RA, Boubacar SA, et al. Global Retinoblastoma presentation and Analysis by national income level. JAMA Oncology [Internet]. 2020 Feb 27;6(5):685. Available from: https://doi.org/10.1001/jamaoncol.2019.6716
5. Knudsen ES, Nambiar R, Rosario SR, Smiraglia DJ, Goodrich DW, Witkiewicz AK. Pan-cancer molecular analysis of the RB tumor suppressor pathway. Communications Biology. 2020 Apr 2;3(1).
6. Caselli R, Speciale C, Pescucci C, Uliana V, Sampieri K, Bruttini M, et al. Retinoblastoma and mental retardation microdeletion syndrome: clinical characterization and molecular dissection using array CGH. Journal of Human Genetics [Internet]. 2007 Jun 1;52(6):535–42.
7. Knudson AG. Two genetic hits (more or less) to cancer. Nature Reviews Cancer. 2001 Nov;1(2):157–62.
8. Jagadeesan M, Khetan V, Mallipatna A. Genetic perspective of retinoblastoma: From present to future. Indian Journal of Ophthalmology [Internet]. 2016;64(5):332.
9. Kumari A, Singh SP, Kumar P, Suresh Babu Kondaveeti, Garg VK, Kaur R, et al. A Comprehensive Review of the Epidemiology, Pathophysiology, Risk Factors, and Treatment Strategies for Retinoblastoma. Diseases [Internet]. 2025 Sep 19;13(9):307–7.
10. Ortiz MV, Ira J. Dunkel. Retinoblastoma. J Child Neurol. 2016;31(2):227–236. doi:10.1177/0883073815587943
11. Kapatai G, Brundler MA, Jenkinson H, et al. Gene expression profiling identifies different sub-types of retinoblastoma. Br J Cancer. 2013;109(2):512–525. doi:10.1038/bjc.2013.283

12. Zhang Y, et al. Exploration of retinoblastoma pathogenesis with bioinformatics. Transl Cancer Res. 2021;10(7):3527–3537. doi:10.21037/tcr-21-1034
13. Moll AC, et al. Three histopathological types of retinoblastoma and their relation to heredity and age of enucleation. *J Med Genet.* 1996;33(11):923–927. doi:10.1136/jmg.33.11.923
14. Abramson DH, Frank CM, Susman M, Whalen MP, Dunkel IJ, Boyd NW. Presenting signs of retinoblastoma. The Journal of Pediatrics [Internet]. 1998 Mar 1;132(3):505–8. Available from: https://doi.org/10.1016/s0022-3476(98)70028-9
15. De Aguirre Neto JC, Antoneli CBG, Ribeiro KB, Castilho MS, Novaes PERS, Chojniak MMM, et al. Retinoblastoma in children older than 5 years of age. Pediatric Blood & Cancer [Internet]. 2006 Jul 17;48(3):292–5. Available from: https://pubmed.ncbi.nlm.nih.gov/16847922/
16. Ishaq H, Patel BC. Cancer, Retinoblastoma [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2020. Available from: https://www.ncbi.nlm.nih.gov/books/NBK545276/
17. Skalet AH, Gombos DS, Gallie BL, Kim JW, Shields CL, Marr BP, et al. Screening Children at Risk for Retinoblastoma. Ophthalmology. 2018 Mar;125(3):453–8.
18. Gündüz K, et al. Metastatic retinoblastoma: clinical features, treatment, and prognosis. *Ophthalmology.* 2006;113(9):1558–1566. doi:10.1016/j.ophtha.2006.03.039
19. Ancona-Lezama D, Dalvin LA, Shields CL. Modern treatment of retinoblastoma: A 2020 review. Indian J Ophthalmol. 2020;68(11):2356–2365. doi:10.4103/ijo.IJO_721_20

16. Annotated Bibliography

1. Lee WH, Bookstein R, Hong FD, Young LJ, Shew JY, Lee EY. Human retinoblastoma susceptibility gene: cloning, identification, and sequence. Science. 1987;235(4794):1394-9. doi:10.1126/science.3823889.

   This large international clinical study analyzes retinoblastoma presentation and outcomes across different national income levels. The researchers collected data from retinoblastoma treatment centers in 153 countries, examining patient characteristics, stage at diagnosis, treatment approaches, and survival outcomes. The study found that children in low-income countries are significantly more likely to present with advanced disease and experience higher mortality rates compared to children in high-income nations. The authors highlight the importance of early detection, improved screening programs, and increased access to specialized care to reduce global disparities in survival. This source is valuable

for providing current epidemiological data and global patterns of disease presentation, making it particularly useful for discussions about incidence, diagnosis, and the importance of early detection.

2. Lee WH, Shew JY, Hong FD, Sery TW, Donoso LA, Young LJ, et al. The retinoblastoma susceptibility gene encodes a nuclear phosphoprotein associated with DNA binding activity. Nature [Internet]. 1987 Oct 1;329(6140):642–5. Available from: https://doi.org/10.1038/329642a0

   Knudson's landmark study introduced the two-hit hypothesis, one of the most influential concepts in cancer genetics. Using statistical analysis of retinoblastoma cases, Knudson demonstrated that tumor development requires two mutational events affecting both copies of a tumor suppressor gene. The paper also distinguished between hereditary and sporadic forms of retinoblastoma, explaining why hereditary cases tend to occur earlier and often involve tumors in both eyes. This research laid the foundation for understanding how genetic mutations drive cancer development and was later confirmed by the identification of the RB1 gene. The study is an essential primary source because it established the genetic model explaining retinoblastoma tumor formation and significantly influenced modern cancer biology.

3. Knudson AG. Mutation and Cancer: Statistical study of retinoblastoma. Proceedings of the National Academy of Sciences [Internet]. 1971 Apr 1;68(4):820–3. Available from: https://doi.org/10.1073/pnas.68.4.820

This study reports the cloning and identification of the RB1 gene, the tumor-suppressor gene responsible for retinoblastoma. Using molecular genetic techniques, the researchers isolated and sequenced the gene located on chromosome 13 and demonstrated that alterations in this gene are associated with retinoblastoma development. The identification of RB1 provided strong molecular evidence supporting Knudson's earlier two-hit hypothesis. This paper represents a major breakthrough in cancer genetics because it was among the first to identify a tumor suppressor gene linked to a specific cancer. The source is highly relevant for explaining the genetic mechanisms underlying retinoblastoma.

4. Group GRS, Fabian ID, Abdallah E, Abdullahi SU, Abdulqader RA, Boubacar SA, et al. Global Retinoblastoma presentation and Analysis by national income level. JAMA Oncology [Internet]. 2020 Feb 27;6(5):685. Available from: https://doi.org/10.1001/jamaoncol.2019.6716

In this follow-up study, Lee and colleagues investigated the biological function of the RB1 gene product, known as the retinoblastoma protein (pRb). Through molecular and biochemical analyses, the researchers demonstrated that the RB1 gene encodes a nuclear phosphoprotein involved in regulating DNA binding and cell cycle control. Their findings showed that pRb plays a critical role in controlling cell proliferation, and loss of this regulatory function can lead to uncontrolled cell growth and tumor formation. This study helped establish the molecular mechanism through which RB1 mutations contribute to cancer development. The article is important because it explains how the RB1 protein functions as a tumor suppressor, deepening the understanding of retinoblastoma biology.

5. Knudsen ES, Nambiar R, Rosario SR, Smiraglia DJ, Goodrich DW, Witkiewicz AK. Pan-cancer molecular analysis of the RB tumor suppressor pathway. Communications Biology. 2020 Apr 2;3(1).

   This source explains how gene-mediated tumour suppression in retinoblastoma is controlled by the RB1 gene, which encodes the retinoblastoma protein (pRB), a key regulator of the cell cycle. pRB inhibits E2F transcription factors, preventing activation of genes required for DNA replication and blocking progression from the G1 to S phase, ensuring that cells divide only under appropriate conditions while maintaining genomic stability. When both RB1 alleles are lost or mutated, pRB can no longer restrain E2F activity, leading to uncontrolled proliferation in retinal cells and the development of retinoblastoma. The source is credible as it presents well-established concepts in cell cycle regulation and tumour suppression, and its strength lies in clearly explaining the RB1–pRB–E2F pathway in a concise and logical way; however, it focuses primarily on molecular mechanisms and lacks clinical context, such as differences between hereditary and sporadic cases. This source directly supports my infographic by explaining the RB1 mechanism shown in the first section, reinforcing key concepts such as G1–S checkpoint regulation and E2F inhibition, and providing the biological foundation for understanding retinoblastoma development.

6. Caselli R, Speciale C, Pescucci C, Uliana V, Sampieri K, Bruttini M, et al. Retinoblastoma and mental retardation microdeletion syndrome: clinical characterization and molecular dissection using array CGH. Journal of Human Genetics [Internet]. 2007 Jun 1;52(6):535–42.

   This source explains how a 13q14 chromosomal deletion contributes to the development of retinoblastoma by removing one copy of the RB1 tumour-suppressor gene located on chromosome 13. With only a single functional RB1 allele remaining, cells become vulnerable to tumorigenesis. According to the two-hit model, retinoblastoma develops when the second RB1 allele is inactivated by

mutation or other mechanisms, resulting in complete loss of RB1 function and uncontrolled proliferation of retinal cells. The source also highlights that 13q14 deletions may lead to additional clinical features, such as developmental delay or distinct facial characteristics, due to the loss of neighboring genes within the same chromosomal region. This source is credible as it aligns with established genetic models of cancer, particularly the two-hit hypothesis, and effectively links chromosomal abnormalities to disease outcomes; however, it provides limited detail on molecular mechanisms compared to sources focused on pRB function. This source supports my infographic by explaining the genetic deletion component of retinoblastoma, reinforcing how loss of RB1 contributes to tumor development and adding clinical context to the genetic mechanisms illustrated.

7. Knudson AG. Two genetic hits (more or less) to cancer. Nature Reviews Cancer. 2001 Nov;1(2):157–62.

   This source explains the two-hit model of retinoblastoma, first proposed by Alfred Knudson, which states that tumour formation occurs only after both copies of the RB1 tumour-suppressor gene are inactivated. In hereditary retinoblastoma, individuals inherit one mutated RB1 allele (the first “hit”) in all cells, and tumour development occurs when a second mutation affects the remaining normal allele in a retinal cell. In contrast, sporadic cases require both mutations to occur somatically within the same retinal cell, which explains why these cases tend to present later and are often unilateral. Once both RB1 alleles are lost, normal regulation of the cell cycle is disrupted, allowing uncontrolled proliferation and tumour formation. This source is credible as it describes a well-established and widely accepted genetic model in cancer biology, and its strength lies in clearly distinguishing between hereditary and sporadic forms; however, it focuses more on genetic theory and provides less detail on downstream molecular mechanisms. This source directly supports my infographic by explaining the “two-hit” mechanism illustrated, reinforcing how sequential RB1 inactivation leads to retinoblastoma development.

8. Jagadeesan M, Khetan V, Mallipatna A. Genetic perspective of retinoblastoma: From present to future. Indian Journal of Ophthalmology [Internet]. 2016;64(5):332.

   This source explains the differences between hereditary and non-hereditary forms of retinoblastoma, both of which involve loss of function of the RB1 tumour-suppressor gene. In hereditary retinoblastoma, a germline mutation results in one defective RB1 allele being present in all body cells, and tumour formation occurs when a second mutation arises in a retinal cell. This form accounts for

approximately 25–35% of cases, typically presents earlier in life, and is often associated with bilateral or multifocal tumours, as well as an increased risk of secondary cancers such as osteosarcoma or pineal tumours. In contrast, non-hereditary retinoblastoma occurs when both RB1 mutations arise somatically within a single retinal cell, meaning the mutation is not inherited or passed to offspring; these cases usually present later, are unilateral, and represent the majority of cases. This source is credible as it reflects well-established clinical and genetic distinctions in retinoblastoma, and its strength lies in clearly comparing the two forms; however, it provides limited detail on underlying molecular mechanisms. This source supports my infographic by reinforcing the differences between hereditary and sporadic pathways, particularly in timing, inheritance, and tumour presentation.

9. Kumari A, Singh SP, Kumar P, Suresh Babu Kondaveeti, Garg VK, Kaur R, et al. A Comprehensive Review of the Epidemiology, Pathophysiology, Risk Factors, and Treatment Strategies for Retinoblastoma. Diseases [Internet]. 2025 Sep 19;13(9):307–7.

   This source explains how hereditary retinoblastoma is associated with an increased risk of systemic cancers due to a germline mutation in the RB1 tumour-suppressor gene. Because this mutation is present in all cells of the body, individuals have a heightened susceptibility to developing additional malignancies beyond the retina, including osteosarcoma, melanoma, and pineal tumours. This contrasts with non-hereditary cases, where RB1 mutations are limited to retinal cells and cancer risk remains localized to the eye. The source emphasizes that the widespread presence of the mutation, rather than just the loss of RB1 in a single tissue, underlies the increased risk of secondary cancers. This source is credible as it aligns with established clinical observations of hereditary cancer syndromes; however, it simplifies the range of modifying factors, such as environmental influences or additional genetic mutations, that may affect cancer risk. It also provides limited detail on the molecular mechanisms driving secondary tumour formation. This source supports my infographic by reinforcing the systemic implications of germline RB1 mutations and highlighting the broader cancer risks associated with hereditary retinoblastoma.

10. Ortiz MV, Ira J. Dunkel. Retinoblastoma. J Child Neurol. 2016;31(2):227–236. doi:10.1177/0883073815587943

    This article gives a general overview of retinoblastoma, touching on all concepts including genetics, clinical presentations, and treatments. The authors explain how mutations in the RB1 gene lead to uncontrolled cell proliferation in retinal cells, emphasizing the role of this gene in regulating the cell cycle. The paper also outlines

diagnostic methods and discusses both hereditary and non-hereditary forms of the disease, along with common treatment strategies such as chemotherapy, enucleation, and focal therapies. A major strength of this source is its comprehensive and accessible overview, making it useful for understanding the disease as a whole. However, because it is broad in scope, it does not go into significant depth on any single topic, particularly at the molecular level. This source is relevant to my assignment because it provides foundational knowledge of retinoblastoma. I will specifically use it to support my explanation of the genetic mechanisms underlying the disease, particularly the role of RB1 mutations in tumor development.

11. Kapatai G, Brundler MA, Jenkinson H, et al. Gene expression profiling identifies different sub-types of retinoblastoma. Br J Cancer. 2013;109(2):512–525. doi:10.1038/bjc.2013.283

    This study investigates molecular differences in Retinoblastoma using gene expression profiling. The authors analyze patterns of gene activity across tumor samples and identify distinct subtypes of retinoblastoma based on differences in gene expression. These findings suggest that retinoblastoma is not a single uniform disease, but rather consists of biologically different groups that may vary in development and progression. The study also highlights specific genes and pathways that may be involved in tumor growth, providing deeper insight into the molecular mechanisms underlying the disease. A major strength of this source is its use of experimental data and advanced molecular techniques, making it a strong example of primary research. It provides detailed and specific insights into how genes function in retinoblastoma. One limitation is that the study is highly technical, which may make it more difficult to interpret and apply broadly compared to review articles. This source is relevant to my assignment because it helps explain how gene expression contributes to differences in retinoblastoma development. I will use it to support more detailed discussion of the genetic and molecular mechanisms involved in tumor formation.

12. Zhang Y, et al. Exploration of retinoblastoma pathogenesis with bioinformatics. Transl Cancer Res. 2021;10(7):3527–3537. doi:10.21037/tcr-21-1034

    This study explores the pathogenesis of Retinoblastoma using bioinformatics analysis. The authors analyze large datasets of gene expression and identify key genes and signaling pathways that may contribute to tumor development. By using computational methods, the study highlights potential molecular mechanisms involved in retinoblastoma, including genes related to cell cycle regulation and proliferation. The findings help identify possible biomarkers and therapeutic targets, offering insight into how the disease develops at a systems level. A major strength of this source is its use of bioinformatics to analyze large-scale data, allowing for the identification of patterns that may not be visible in smaller experimental studies. This makes the findings valuable for understanding broader molecular trends. However, a limitation is that bioinformatics studies rely on existing datasets and predictive analysis, meaning the results may require further experimental validation to confirm their biological significance. This source is

relevant to my assignment because it provides insight into the molecular pathways involved in retinoblastoma development. I will use it to support my discussion of disease pathogenesis and to highlight how multiple genes and pathways interact in tumor formation.

13. Moll AC, et al. Three histopathological types of retinoblastoma and their relation to heredity and age of enucleation. *J Med Genet.* 1996;33(11):923–927. doi:10.1136/jmg.33.11.923

    This study examines different histopathological forms of Retinoblastoma and how they relate to factors such as heredity and the age at which the eye is removed (enucleation). The authors identify three distinct tumor types based on their microscopic structure and analyze how these variations correlate with whether the disease is hereditary or non-hereditary. The study suggests that tumor characteristics may differ depending on genetic background and timing of disease progression, providing insight into how retinoblastoma develops and presents in different patients. A major strength of this source is its focus on histopathology, offering detailed information about tumor structure that complements genetic and molecular studies. However, a limitation is that the study is relatively older, which means some of its findings may not reflect more recent advances in molecular classification or treatment. This source is relevant to my assignment because it helps explain the different types of retinoblastoma and how they vary based on heredity and development. I will use it to support my discussion of tumor classification and to show that retinoblastoma is not a single uniform disease.

14. Abramson DH, Frank CM, Susman M, Whalen MP, Dunkel IJ, Boyd NW. Presenting signs of retinoblastoma. The Journal of Pediatrics [Internet]. 1998 Mar 1;132(3):505–8. Available from: https://doi.org/10.1016/s0022-3476(98)70028-9

    This retrospective review examined over 1,800 retinoblastoma cases and evaluated the symptoms present at diagnosis. The study confirmed that leukocoria and strabismus are the two most common presenting signs. It also found that children diagnosed through screening programs had earlier detection and better visual outcomes. The study is widely cited and provides strong clinical evidence on how retinoblastoma is typically first identified.

15. De Aguirre Neto JC, Antoneli CBG, Ribeiro KB, Castilho MS, Novaes PERS, Chojniak MMM, et al. Retinoblastoma in children older than 5 years of age. Pediatric Blood & Cancer [Internet]. 2006 Jul 17;48(3):292–5. Available from: https://pubmed.ncbi.nlm.nih.gov/16847922/

    This study focused on the rare occurrence of retinoblastoma in children older than five years. The authors found that these patients often presented with vision loss or inflammatory symptoms rather than classic signs such as leukocoria. Many

cases were initially misdiagnosed as uveitis or infection before correct diagnosis. This research highlights how retinoblastoma can present differently in older children and underscores the importance of considering the disease even in atypical cases.

16. Ishaq H, Patel BC. Cancer, Retinoblastoma [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2020. Available from: https://www.ncbi.nlm.nih.gov/books/NBK545276/

    This source outlines the primary methods used in the diagnosis of retinoblastoma, emphasizing the importance of ophthalmologic examination under anesthesia, where a fundoscopy lamp is used to directly visualize retinal tumours. It explains that imaging techniques such as MRI, CT, ultrasound, and optical coherence tomography (OCT) are used as supportive tools to assess tumour size, spread, and potential metastasis. MRI is particularly useful for evaluating optic nerve and brain involvement without exposing the patient to radiation, contributing to its preference over CT. Ultrasound is highlighted for its ability to detect intraocular masses and calcifications, while OCT provides high-resolution imaging for smaller lesions and monitoring. The source also discusses genetic (RB1) testing through blood and tumour analysis to determine whether cases are hereditary or sporadic, which is important for assessing family risk. This source is credible as it reflects standard clinical diagnostic approaches; however, it may simplify decision-making processes and does not fully address limitations such as accessibility, cost, or variability in imaging sensitivity. This source supports my infographic by reinforcing the diagnostic approaches illustrated, linking clinical evaluation with imaging and genetic testing in retinoblastoma detection.

17. Skalet AH, Gombos DS, Gallie BL, Kim JW, Shields CL, Marr BP, et al. Screening Children at Risk for Retinoblastoma. Ophthalmology. 2018 Mar;125(3):453–8.

    This source explains the role of screening in retinoblastoma, particularly for children with a known family history of the disease. It emphasizes that individuals at higher genetic risk are routinely monitored to detect tumour development at an early stage, often through regular dilated eye examinations that allow for detailed visualization of the retina. Early screening is critical in hereditary cases, where a germline RB1 mutation increases the likelihood of tumour formation, as it enables prompt diagnosis and intervention before significant progression occurs. The source highlights that screening is a preventative strategy aimed at reducing morbidity and improving clinical outcomes through early detection. This source is credible as it reflects standard clinical practices for managing hereditary cancer

risk; however, it provides limited detail on screening frequency, age-specific guidelines, or potential barriers such as access to specialized care. It also does not address the psychological or logistical implications of repeated screening in young patients. This source supports my infographic by reinforcing the importance of early detection in at-risk populations and complementing the genetic and diagnostic concepts illustrated.

18. Gündüz K, et al. Metastatic retinoblastoma: clinical features, treatment, and prognosis. *Ophthalmology.* 2006;113(9):1558–1566. doi:10.1016/j.ophtha.2006.03.039

    This article examines metastatic forms of Retinoblastoma, with a particular focus on clinical features, treatment strategies, and patient outcomes. The authors describe how the disease spreads beyond the eye and outline treatment approaches used in advanced cases, including systemic chemotherapy, radiation therapy, and more aggressive interventions. The study highlights the challenges of treating metastatic retinoblastoma and emphasizes that prognosis is significantly worse once the cancer has spread, making early detection and intervention critical. A major strength of this source is its focus on advanced-stage disease, providing insight into treatment strategies for more severe cases that are not always covered in general overviews. However, a limitation is that the study is somewhat older, and treatment approaches may have evolved with more recent medical advancements. This source is relevant to my assignment because it provides detailed information about treatment options in advanced retinoblastoma. I will use it to support discussion of how treatment varies depending on disease progression and to highlight the importance of early diagnosis.

19. Ancona-Lezama D, Dalvin LA, Shields CL. Modern treatment of retinoblastoma: A 2020 review. *Indian J Ophthalmol*. 2020;68(11):2356–2365. doi:10.4103/ijo.IJO_721_20.

    This article provides a comprehensive review of modern treatment approaches for Retinoblastoma. The authors discuss current therapeutic strategies, including chemotherapy, focal therapies (such as laser therapy and cryotherapy), radiation therapy, and enucleation. The paper also highlights advances in targeted and localized treatments, which aim to preserve vision while effectively controlling tumor growth. In addition, it emphasizes the importance of a multidisciplinary approach, combining different treatment methods depending on the stage and severity of the disease. A major strength of this source is that it is recent and reflects current clinical practices, making it highly relevant for understanding how retinoblastoma is treated today. However, as a review article, it summarizes existing research rather than presenting new experimental findings. This source is relevant to my assignment because it provides up-to-date information on treatment strategies. I will use it to support my discussion of how retinoblastoma is managed in modern medicine and to contrast current approaches with older treatment methods.