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| **Team #:** 18 | |

**1. Title of your PULSE experiential assignment.**
Adaptations in Cancer Cells
https://view.genially.com/69837a5ca280074876ad4e81

**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.]*
Cellular adaptations are ways that our body's cells respond to stress or harmful conditions. While these changes can initially be a protection mechanism for the body, if the stress is persistent they sometimes can lead to pathological issues. For example, a process called metaplasia can occur when one cell type changes to another that is better suited to handle the stress. For a short period of time this is normal but if the stress continues these cells can acquire abnormal features that can cause them to divide and grow uncontrollably. This can eventually lead to cancer.
This topic was chosen as it is a very relevant issue in the population and it provides some insight as to how cancer develops at the cellular level. This can help to raise awareness about prevention and avoiding the common risk factors.
Our assignment is presented as an interactive infographic that explains all the relevant information related to cellular changes, progression of cancer, and an example of cancer that connects these ideas. This format was chosen as it gives a clear, visual, and easy-to-understand way to communicate the information. After working through all interactive aspects of the infographic to learn all the details of this topic, there are practice questions to help reinforce understanding after learning the material.

**3. Provide up to 6 keywords relevant to your PULSE experiential assignment.**
*3-6 keywords are ideal.*
Metaplasia
Dysplasia
Carcinoma
Neoplasia
Carcinogen

**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?**
Identify and describe the hallmarks of cancer
Describe what metaplasia, dysplasia, and neoplasia are.
Describe how metaplasia can eventually lead to neoplasia.
Define carcinoma and give examples
Identify four examples of carcinoma and their clinical features, main risk factors, and treatment option
Define carcinogen and provide some examples
Describe how smoking can lead to development of squamous cell carcinoma.
Describe the two main cell types in the lungs involved in metaplasia.

**6. Why did the team select the chosen topic and the medium? How will the topic and medium of choice help learners?**
We selected this topic because cancer is a highly relevant disease to the population. By focusing on cellular adaptations and how they can lead to cancer this helps people to understand early changes in the body and how they may progress to disease. This knowledge is important because it highlights prevention and helps individuals understand consequences of long term exposure to harmful factors.
We chose to use an interactive infographic as our medium because it presents the scientific content in an engaging way that is easy to follow. Cellular processes can be challenging to understand by text alone so providing images and interactive elements can help simplify them and can be helpful for those learning about this topic for the first time. The format encourages active engagement with the content and allows for reinforcement of the topic through practice questions.

**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?)*
AI (chatgpt) was used to generate the lung images in the An Example: Lung Cancer Section. Genially was used to generate the infographic. This was new to our group and allowed us to make the infographic more interactive.
**8. How is your PULSE experiential assignment innovative and/or novel?**
*Describe what about the PULSE assignment is innovative/novel. Is there a particular component or content that is innovative/novel? How is it different from other content that already exists?*
Our pulse assignment is innovative because it simplifies scientific content in an interactive and visually engaging way. Rather than presenting the information through text alone, our infographic allows users to explore concepts at their own pace, with each section building on the previous. This helps with understanding how normal cellular changes can progress to

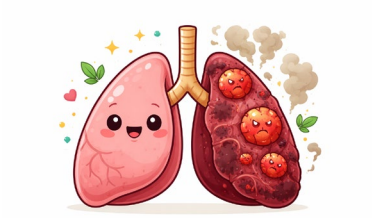
cancer. The inclusion of practice questions also promotes self-testing and more active engagement with the material.
It is novel as it uses these key concepts to connect to a real-life example such as lung cancer. All of the terms and processes explained in the infographic are directly related to this disease which allows learners to clearly see how foundational knowledge applies in a real world example.
This resource is different from other content as it integrates all the key ideas while simplifying them and allowing for support of various learning styles. By combining visuals, interactivity, and applied examples, this complex topic is more accessible to a broader audience.

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

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

AI used to generate images.
Prompt: Generate cartoon image of lungs

Output:
Input: one half lung one half cancer



Output:

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

https://docs.google.com/document/d/1LRynZnXtARRwGz0NEuPD3p-HT5bjBhnY9FLur7q_yHI/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.*

Our team ensured veracity of information presented in the PULSE assignment by using credible, peer-reviewed sources. We incorporated foundational information that was presented in class and expanded on these concepts by consulting primary research articles. Multiple reliable sources were used to verify accuracy.
Each team member kept track of their sources by keeping an organized list underneath the source being used. This allowed for accurate creation of the annotated bibliography as it was known what information came from what source. AI was not used to gather scientific information on this assignment. It was only used to generate cartoon images to add to the visuals of the infographic.

**12. Write a meaningful team reflection about the PULSE session (max 250 words).**
The PULSE assignment has helped with our teams learning as it has allowed us to dive deeper into the concepts around neoplasia in order to create our media. By doing further research and re-organizing ideas in our own way to present them, we strongly reinforced our understanding of the concepts presented. Further, by creating our own questions relevant to our respective sections we gained a more critical understanding through pairing correct question and answer responses and creating wrong answer choices through anticipating possible misconceptions to make for a valuable learning experience. If we had to estimate, our assignment took us 27 hours to complete. What worked well for us was to space out time to work together on it, keep on track and communicate ideas. One thing we could have done differently is to set checkpoints on what we want to have completed at certain times to avoid overwhelming work later on. One of the challenges with creating this media to help others' learning was to unpack the dense, jargon filled articles to then present main ideas in an easy to digest manner. The opportunity we had with creating this media was expanding the depth of our understanding of neoplasia, as well as using a new platform to create something interactive and appealing.

**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…*

E.G. wrote the lay summary, and answered the questions about how it was novel and why we chose this platform. E.G. also created the section about lung cancer.

M.D. completed the sections hallmarks of cancer, what is carcinoma, and what is a carcinogen. M.D. wrote the team reflection with input from team members.

C.G. did the section on cellular adaptations and neoplasia and edited references to make sure they fit Vancouver style.

Each team member wrote at least 2 questions for the quiz, and wrote the annotations for their sources.

**14. Other comments (Optional)**
N/A

**15. References**


1. Cell injury, cell death, and adaptations. In: Kumar V, Abbas AK, Aster JC, Deyrup AT, editors. Robbins & Kumar basic pathology. 11th ed. Philadelphia (PA): Elsevier - Health Sciences Division; c2024. p. 18.

2. Haig A. Cell injury, adaptation, and cell death [Internet]. London (ON): [date unknown] [cited 2026 April 10]. Available from: https://westernu.brightspace.com/d2l/home

3. Cecchini M. Neoplasia [Internet]. London (ON): [date unknown] [cited 2026 April 10]. Available from: https://westernu.brightspace.com/d2l/home

4. Hanahan D, Weinberg RA. Hallmarks of Cancer: The next generation. Cell. 2011 March 4;144(5):646–74. Available from: https://doi.org/10.1016/j.cell.2011.02.013

5. Carcinoma [Internet]. Cleveland Clinic. [date unknown] [updated 2022 May 31; cited 2026 April 10]. Available from: https://my.clevelandclinic.org/health/diseases/23180-carcinoma

6. Wong CSM, Strange RC, Lear JT. Basal cell carcinoma. BMJ. 2003 Oct 2;327(7418):794–8. Available from: https://doi.org/10.1136/bmj.327.7418.794

7. Adenocarcinoma cancers. Cleveland Clinic. [date unknown] [updated 2024 June 25; cited 2026 April 10]. Available from: https://my.clevelandclinic.org/health/diseases/21652-adenocarcinoma-cancers#symptoms-and-causes

8. Sabbula BR, Gasalberti DP, Mukkamalla SR, Anjum F. Squamous cell lung cancer [Internet]. Treasure Island (FL): StatPearls; [date unknown] [updated 2024 February 14; cited 2026 April 10]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK564510/

9. Bane A. Ductal Carcinoma In situ: What the Pathologist needs to know and why. Int J of Breast Cancer. 2013 Jan 1;2013:1–7. Available from: https://doi.org/10.1155/2013/914053

10. Professional CCM. Carcinogens [Internet]. Cleveland Clinic. [date unknown]. [updated 2023 June 19; cited 2026 April 10]. Available from: https://my.clevelandclinic.org/health/articles/25081-carcinogens

11. Juan LS, Freije A, Sanz-Gómez N, Jiménez-Matías B, Pleguezuelos-Manzano C, Sanz JR, et al. DNA damage triggers squamous metaplasia in human lung and mammary cells via mitotic checkpoints. Cell Death Discov. 2023 Jan 21;9(1):21.

12. Rigden HM, Alias A, Havelock T, O'Donnell R, Djukanovic R, Davies DE, et al. Squamous metaplasia is increased in the bronchial epithelium of smokers with chronic obstructive pulmonary disease. PLoS One. 2016 May 26;11(5):e0156009.

**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. Cell injury, cell death, and adaptations. In: Kumar V, Abbas AK, Aster JC, Deyrup AT, editors. Robbins & Kumar basic pathology. 11th ed. Philadelphia (PA): Elsevier - Health Sciences Division; c2024. p. 18.

This textbook gives a clear overview of how cells respond to stress through adaptation, injury, and death. It explains relevant key concepts such as metaplasia and cell adaptation, showing how these changes can be either physiologic responses to normal stimuli, like hormones, or pathologic in response to persistent stress. A major strength of this source is that it presents these ideas in a simple and organized way, making it easier to understand both the basic definitions and their pathological significance. As a source written by experts in pathology, it is reliable and useful for building a strong foundational understanding of cellular adaptation. It is helpful for the assignment because it provides core definitions needed to explain reversible cellular changes, explain how metaplasia fits within the broader concept of cell adaptation, and how to distinguish adaptation from more serious cell injury. Overall, it is a strong background source for understanding how cells adjust to stress and how adaptation can shape tissue response.

2. Haig A. Cell injury, adaptation, and cell death [Internet]. London (ON): [date unknown] [cited 2026 April 10]. Available from: https://westernu.brightspace.com/d2l/home

This lecture source provides a focused overview of how cells respond to stress through adaptation, reversible injury, and irreversible cell death. It is useful for understanding metaplasia as one of the forms of cellular adaptation, while also placing it within the broader sequence of cellular responses to harmful stimuli. The lecture clearly distinguishes reversible injury from irreversible injury by describing structural and functional changes such as cellular swelling, fatty change, necrosis, and apoptosis. One of the main strengths of this source is its direct and organized presentation, which makes difficult pathology concepts easier to follow and apply. Rather than only listing definitions, it connects mechanisms of injury to the actual visible changes that occur in cells and tissues. This makes the material useful not just for memorizing terminology, but for understanding how pathology develops step by step. For this assignment, the source is useful because it helps explain how metaplasia relates to adaptation more generally and how adaptive changes can be separated from more severe forms of injury and cell death. Overall, it serves as a strong lecture based foundation for core pathology concepts.

3. Cecchini M. Neoplasia [Internet]. London (ON): [date unknown] [cited 2026 April 10]. Available from: https://westernu.brightspace.com/d2l/home

This source provides an overview of neoplasia by explaining the definitions, mechanisms, and progression of tumour development. It introduces key terms such as benign and malignant and helps clarify how these categories differ in behaviour and significance. One of the main strengths of this source is that it organizes complex cancer biology concepts into a clear and structured format, which makes the material easier to understand. It is especially helpful for showing how changes in normal cellular processes can contribute to the development of uncontrolled growth. As a lecture based source, it is useful for building a strong foundational understanding of tumour biology before moving into more detailed concepts. For this assignment, the source is useful because it connects basic pathology knowledge to the development and clinical behaviour of tumours, helping explain how abnormal cellular changes relate to disease progression. Overall, it serves as a clear and relevant academic source for understanding the basics of neoplasia.

4. Hanahan D, Weinberg RA. Hallmarks of Cancer: The next generation. Cell [Internet]. 2011 Mar 1;144(5):646–74. Available from: https://doi.org/10.1016/j.cell.2011.02.013

This article gives a detailed explanation of the different hallmarks of cancer, as well as the additional pathways to cancer through genetic instability. This source comments on the future research of cancers and aims to condense what we know about cancer through these hallmarks to a logical science to increase our understanding of cancer. This article shows strengths in its detailed compilation of the intricate mechanisms of cancer development. This article appears credible from its numerous references, and has been cited over 50 thousand times. It is also published in the Cell Press Journal, meaning it has been peer-reviewed. We plan to use this source to identify and briefly explain the hallmarks of cancer. This article

went into detail with cellular mechanisms, so we plan to condense and pick out the important information to present it in an easy to understand manner.

5. Carcinoma [Internet]. Cleveland Clinic. [date unknown]. [updated 2022 May 31; cited 2026 April 10]. Available from: https://my.clevelandclinic.org/health/diseases/23180-carcinoma

This article offers general, introductory knowledge about carcinomas. It outlines where they come from, classifications, symptoms and causes, diagnostic details, as well as treatment. It also describes in lay terms some key words involved in classifying cancers. Additionally, it expands on other names of cancers from other origins. This article shows strengths in its simple and organized breakdown of the concepts with detailed explanations where required. This article is credible as it is medically reviewed. We plan to use this article to deliver a simple definition and facts around carcinomas in an easy to digest manner. We plan to take notes and include relevant information and facts in our project. This article gave examples of more specific types of carcinoma and we plan to expand on these examples with the help of other sources to provide a more in depth analysis.

6. Wong CSM, Strange RC, Lear JT. Basal cell carcinoma. BMJ [Internet]. 2003 Oct 2;327(7418):794–8. Available from: https://doi.org/10.1136/bmj.327.7418.794

This article provides a comprehensive overview of basal cell carcinoma. It goes over epidemiology, risk factors, clinical features, and treatment options. It goes into detail about the clinical presentation of basal cell carcinoma accompanied by images for visual aid. It also goes into detail about the molecular genetics involved in this cancer. This article shows strengths in how it breaks down information, and its many references. This is a credible article as it is published in a journal, meaning it has gone through extensive peer-reviews and editing. We plan to use this source to highlight key features of basal cell carcinoma in our outline of examples of specific carcinomas. Specifically, drawing from clinical features, key risk factors, and treatments options. Outlining these areas is meant to deliver the important facts about this disease to help others learn about basal cell carcinoma.

7. Adenocarcinoma cancers. Cleveland Clinic. [date unknown]. [updated 2024 June 25; cited 2026 April 10]. Available from: https://my.clevelandclinic.org/health/diseases/21652-adenocarcinoma-cancers#symptoms-and-causes

This article provides a summary in lay terms of adenocarcinomas. It provides a section with common questions and detailed answers. It then goes on to summarize symptoms, diagnosis, treatment and prognosis. Additionally, the article addresses concerns about living with the disease and information patients should seek out from a healthcare provider. This article also highlights some key examples of adenocarcinomas and places they are likely to arise in. For each example, specific symptoms are provided. This article shows strengths in its organization of information and simple terms used to describe complex mechanisms. This is a credible source as it is medically reviewed to ensure accuracy and reliability. We will use this

source to collect information on clinical features, main risks, and treatment options to present them in an organized layout. By condensing the information and organizing it into our chosen sub headings, we can provide an easy to digest learning material for students.

8. Sabbula BR, Gasalberti DP, Mukkamalla SR, Anjum F. Squamous cell lung cancer [Internet]. Treasure Island (FL): StatPearls; [date unknown]. [updated 2024 February 14; cited 2026 April 10]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK564510/

This article provides an in depth review of squamous cell carcinoma in the lungs. It describes the etiology, epidemiology, pathophysiology, histopathology, diagnosis and treatment of this disease. This article also identifies the most relevant risk associated with squamous cell carcinoma in the lungs. There are extensive details provided for treatment and surgery. This article also highlights the importance of patient education for prevention. This article shows strengths in its detail and through making it clear why smoking is so hazardous. This article is credible as it is peer-reviewed and published. We plan to use this article by collecting information surrounding the clinical features, main risks, and treatment options for this disease. After collecting this information, we will organize and present it in a way that is concise and easy to understand to enhance student learning.

9. Bane A. Ductal CarcinomaIn situ: What the Pathologist needs to know and why. International Journal of Breast Cancer [Internet]. 2013 Jan 1;2013:1–7. Available from: https://doi.org/10.1155/2013/914053

This article outlines the pathology of ductal carcinoma in situ. It does this through many approaches including providing a definition, epidemiology, classifications and grading, prognosis, disease management, and molecular genetics. The goal of this article is to provide a framework of what pathologists need to consider when dealing with this disease. Classifications are reinforced with images to contrast differences. This article shows strengths specifically with the abstract, where the importance of this information is highlighted. The article introduces here the problem of overtreatment of this condition and advocates for more clear parameters to be reported on by pathologists. This article is credible as it is published in a journal which requires editing, accuracy of information, and peer-review. We plan to use this article to highlight key aspects of ductal carcinoma in situ including its clinical features, unique risk factors, and treatments.

10. Professional CCM. Carcinogens [Internet]. Cleveland Clinic. [date unknown]. [updated 2023 June 19; cited 2026 April 10]. Available from: https://my.clevelandclinic.org/health/articles/25081-carcinogens

This article offers a lay summary of the types of carcinogens and their corresponding mechanism of action. It also provides a background on molecular genetics to supplement understanding of the mechanism of action of common carcinogens. The article then goes on by anticipating questions and providing detailed answers. It describes common carcinogens, and what specific cancer they are likely to lead to. This article shows strengths in its

simplistic description of these common carcinogens as well as the realistic outcomes. This article offers credibility as it is medically reviewed. We plan to use this article to give a simple overview of the main sources of carcinogens: physical, chemical and infectious with high yield examples of each. We will also include where applicable the specific cancer that the carcinogen is likely to induce. This organization of information will provide a high yield overview of carcinogens and their relevance to specific cancers.

11. Juan LS, Freije A, Sanz-Gómez N, Jiménez-Matías B, Pleguezuelos-Manzano C, Sanz JR, et al. DNA damage triggers squamous metaplasia in human lung and mammary cells via mitotic checkpoints. Cell Death Discov. 2023 Jan 21;9(1):21.

This article examines the mechanisms that can lead to squamous cell metaplasia. It studies some carcinogens that can lead to cellular changes in the lung which if the person is chronically exposed can lead to progression to lung carcinoma. It studies how these carcinogens can induce DNA damage that can cause the initial squamous cell metaplasmic state. Then by accumulation of DNA damage this can drive the cells through the cell cycle checkpoints without repair which ultimately can lead to cancer.
This source is credible because it is published in a reviewed journal (Cell Death Discovery) with multiple authors with expertise in this field. A strength of this article is it provides recent (2023) and relevant information on how DNA damage can trigger squamous metaplasia. A limitation to this article was it is highly focused on cellular mechanisms which required simplification for our project.
This source was used for some of the main ideas presented in the An Example: Lung Cancer section of our infographic. It supports the idea of metaplastic changes leading to cancerous changes.

12. Rigden HM, Alias A, Havelock T, O'Donnell R, Djukanovic R, Davies DE, et al. Squamous metaplasia is increased in the bronchial epithelium of smokers with chronic obstructive pulmonary disease. PLoS One. 2016 May 26;11(5):e0156009.

This source explores the effects of smoking on the lungs specifically in people suffering from chronic obstructive pulmonary disease (COPD). It specifically talks about squamous metaplasia being a pre-neoplastic change of the bronchial epithelium that is observed in the lungs. This is observed when the lungs are chronically exposed to cigarette smoke.
This source is credible as it is published in a reviewed journal with multiple authors with expertise in this field. A major strength of this article is it provides clinical evidence linking smoking with increased metaplastic changes in the lung. A limitation is this study is performed on individuals with COPD which may limit its applicability to the general population.
This source was used to determine the specific cell types affected in the lungs. Specifically, the pseudostratified epithelium that undergo metaplastic change to squamous cells. This supports the idea of DNA damage causing these metaplastic cells to re-enter the cell cycle and lead to hyperproliferation.