PULSE EXPERIENTIAL TEAM ASSIGNMENT

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

Celiac Disease: When Your Body Declares War on Bread

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.]

Celiac disease (CD) is an autoimmune disease, where the consumption of gluten, a protein found in many grain products, causes an immune reaction damaging the gastrointestinal tract. CD is a hereditary disease, meaning only those with a genetic predisposition acquire the disease.

CD is a quite common autoimmune disorder, as it affects 1 in 100 people worldwide, thus understanding the pathogenesis and its implications is important, as the disease is significantly underdiagnosed and misunderstood.

For our assignment, we choose to use an interactive learning module that takes the learner through what CD is, its pathogenesis, common symptoms & risk factors, how it is diagnosed, prognosis of the disease, and treatments for the learner to apply their knowledge gained throughout the module. We felt that a learning module was the ideal method of presenting this disease as it is a more engaging learning mechanism that allows the user to learn the material at their own pace. There are added questions in the module that allow the learner to directly apply what they have learned throughout the module further reinforcing their understanding of the topic, as well as plenty of images to help the learner visualise the topic at hand.

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

- Celiac disease
- Gluten
- Gastrointestinal Pathology
- Antibody
- Autoimmune
- Hypersensitivity

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).

Gastrointestinal Pathology, Autoimmune Disorders

5. What are the learning outcomes?

There should be a minimum of 2 learning outcomes for your assignments. For further information on learning outcomes, the Centre for Teaching and Learning offers information: https://teaching.uwo.ca/curriculum/coursedesign/learning-outcomes.html

After completing the learning module, the user should be able to:

1. Describe Celiac Disease (CD)
2. Describe the pathogenesis of CD
3. List common symptoms and risk factors of CD
4. Recall common diagnostic tools used to diagnose CD
5. Explain the prognosis of CD
6. Identify the main treatment method of CD

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

We chose Celiac Disease as the topic for this assignment as it involves a combination of 2 topics discussed in class: gastrointestinal pathology and autoimmune disorders. Furthermore, since CD is a condition that is often undiagnosed or mistaken for other GI disorders, we feel that creating educational content about celiac disease to share with future students is a valuable way to apply what we have learned in this course. We chose to do a learning module as the medium of choice to present this information as many of the courses we have taken use learning modules to present pre-lecture material which we found to be very useful in deepening our understanding of topics and relatively engaging to use which helped to reinforce the understanding we had of the topic. Through a learning module, we can easily embed interactive elements, such as questions, images and videos which help present the material in several ways that further consolidate the topic for the learner.

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?)

The team did not use artificial intelligence for the creation of this assignment. We chose against using these tools because they are known to hallucinate information and provide nonexistent sources. We also wanted the experience of doing the research without artificial intelligence.

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 assignment provides an interactive self-learning experience for students that is

not present in a traditional presentation, infographic, or podcast.
There have not been many comprehensive resources and explanations of Celiac disease provided online, and no interactive learning resources.
Finally, this assignment was designed through the lens of undergraduate students, offering a view and explanation tailored to undergraduate students on an intricate clinical condition.
The technology used for this module has not been explored very much at UWO for educational purposes and has been used very sparingly. This is one of the few examples of it being used for a learning module**.**

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].

N/A

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.

Submitted as a separate PDF

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 that our assignment contained accurate and evidence-based information, our team relied on peer-reviewed articles and reputable academic sources. We primarily searched databases such as PubMed, Google Scholar, Science Direct etc; and also consulted course lecture slides and notes to confirm key concepts. Each team member verified the accuracy of the information they contributed, and we cross-checked each others' sections to ensure validity across the module.

We kept track of sources in a shared Google document, where references were organized alongside the research we did for each of our sections. This allowed us to easily add in-text citations and ensure that all statements were supported by scientific evidence. We compared multiple sources to avoid relying on a single article and selected the most consistent and recent information.This process ensured that the information presented in our PULSE assignment was accurate, credible, and not spreading misinformation.

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

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

Reflection:

Our team did not experience significant biases when creating content for the PULSE assignment. Instead, each member brought their own ideas about slide design, organization, and the overall flow of the module. We approached these differences through open discussion and collectively decided on the final structure by considering everyone's suggestions. This collaborative approach ensured that the module was made in the best way possible.

This assignment helped us develop teamwork skills and encouraged us to be more open-minded and compassionate toward others' perspectives. We also deepened our understanding of the topic by reading multiple articles in depth. We spent time after midterms conducting research, compiling information, and tracking references. Once the content was finalized, we worked together over the course of about a week to create the learning module.

What worked well for our team was dividing tasks and setting internal deadlines to stay on track. Using a shared Google document allowed everyone to remain updated on progress. Team members were also willing to support one another when certain sections were challenging. One thing we would do differently next time is schedule more in-person discussions as most of our communication occurred online via text.

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…

AG did research on what Celiac Disease is as well as treatments and therapies used to treat the disease. WB researched the risk factors and pathogenesis of celiac disease. APW researched on the ways in which celiac disease is diagnosed and its prognosis and CH researched on the signs and symptoms of the disease.

AG, APW, CH, and WB made the slides corresponding to their research topics in the learning module by adding texts, images, and making fun interactive questions.

15. References

1 Fasano A, Catassi C. Celiac Disease. *New England Journal of Medicine* 2012; **367**: 2419–2426.

2 What's the big deal with gluten? [Internet]. - William D. Chey - YouTube. https://www.youtube.com/watch?v=uEM2iDT-VAk (accessed 12 Apr2026).

3 What Is Gluten and What Does It Do? | Johns Hopkins Medicine. https://www.hopkinsmedicine.org/health/wellness-and-prevention/what-is-gluten-and-what-does-it-do (accessed 12 Apr2026).

4 Celiac disease - Symptoms and causes - Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/celiac-disease/symptoms-causes/syc-20352220 (accessed 10 Apr 2026).

5 Gujral N, Freeman HJ, Thomson ABR. Celiac disease: Prevalence, diagnosis, pathogenesis and treatment. *World Journal of Gastroenterology : WJG* 2012; **18**: 6036.

6 Therrien A, Kelly CP, Silvester JA. Celiac Disease: Extraintestinal Manifestations and Associated Conditions. *J Clin Gastroenterol* 2020; **54**: 8.

7 Catassi C, Verdu EF, Bai JC, Lionetti E. Coeliac disease. *The Lancet* 2022; **399**: 2413–2426.

8 Caio G, Volta U, Sapone A, Leffler DA, De Giorgio R, Catassi C *et al.* Celiac disease: a comprehensive current review. *BMC Med* 2019; **17**: 142.

9 Nunes-Silva JG, Nunes VS, Schwartz RP, Mlss Trecco S, Evazian D, Correa-Giannella ML *et al.* Impact of type 1 diabetes mellitus and celiac disease on nutrition and quality of life. *Nutr Diabetes* 2017; **7**: e239.

10 Szałowska-Woźniak DA, Bąk-Romaniszyn L, Cywińska-Bernas A, Zeman K. Evaluation of HLA-DQ2/DQ8 genotype in patients with celiac disease hospitalised in 2012 at the Department of Paediatrics. *Prz Gastroenterol* 2014; **9**: 32.

11 Mårild K, Stephansson O, Grahnquist L, Cnattingius S, Söderman G, Ludvigsson JF. Down Syndrome Is Associated with Elevated Risk of Celiac Disease: A Nationwide Case-Control Study. *J Pediatr* 2013; **163**: 237–242.

12 Kumar V, Jarzabek-Chorzelska M, Sulej J, Karnewska K, Farrell T, Jablonska S. Celiac Disease and Immunoglobulin A Deficiency: How Effective Are the Serological Methods of Diagnosis? *Clin Diagn Lab Immunol* 2002; **9**: 1295.

13 Diagnosis of Celiac Disease - NIDDK. https://www.niddk.nih.gov/health-information/digestive-diseases/celiac-disease/diagnosis (accessed 8 Apr2026).

14 Lebwohl B, Sanders DS, Green PHR. Coeliac disease. *The Lancet* 2018; **391**: 70–81.

15 Rubio-Tapia A, Hill ID, Kelly CP, Calderwood AH, Murray JA. ACG clinical guidelines: Diagnosis and management of celiac disease. *Am J Gastroenterol* 2013; **108**: 656–676.

16 Daley SF, Haseeb M. Celiac Disease. *StatPearls* 2025.https://www.ncbi.nlm.nih.gov/books/NBK441900/ (accessed 8 Apr2026).

17 Ludvigsson JF, Card T, Ciclitira PJ, Swift GL, Nasr I, Sanders DS *et al.* Support for patients with celiac disease: A literature review. *United European Gastroenterol J* 2015; **3**: 146–159.

18 Future Therapies | Celiac Disease Foundation. https://celiac.org/about-celiac-disease/future-therapies-for-celiac-disease/ (accessed 10 Apr2026).

19 Jouanin A, Gilissen LJWJ, Schaart JG, Leigh FJ, Cockram J, Wallington EJ *et al.* CRISPR/Cas9 Gene Editing of Gluten in Wheat to Reduce Gluten Content and Exposure—Reviewing Methods to Screen for Coeliac Safety. *Front Nutr* 2020; **7**: 51.

16. Annotated Bibliography

1 Fasano A, Catassi C. Celiac Disease. *New England Journal of Medicine* 2012; **367**: 2419–2426.

- This article provides a detailed insight into the pathogenesis, staging, diagnostic methods, treatments and clinical presentation of celiac disease. The authors emphasize the strong genetic link of the disease to the HLA-DQ2 gene, as individuals homozygous for this gene are more likely to present with celiac disease. The authors particularly highlight the diagnostic methods used in the identification of individuals with celiac disease, specifically the measurement of IgA anti-tissue transglutaminase antibodies. The article highlights the treatment of celiac disease, i.e. a gluten-free diet, as well as areas of uncertainty presented when diagnosing individuals with celiac disease.
- This article was published in the The New England Journal of Medicine as a peer-reviewed article, and as such is considered highly credible.The authors of the article are highly esteemed practicing physicians, and are recognized experts in mucosal immunology and biological research. Although this article is from 2012, it remains a foundational text for understanding the pathophysiology and treatment protocols for celiac disease.
- Due to its significant credibility, this source is suitable for the learning module, as we can use the information provided in this article to accurately provide a general introduction to the learners about celiac disease.

2 What's the big deal with gluten? [Internet]. - William D. Chey - YouTube. https://www.youtube.com/watch?v=uEM2iDT-VAk (accessed 12 Apr2026).

- This video provides a brief synopsis about gluten sensitivity and celiac disease. The narrator, Dr. William D. Chey, is a gastroenterologist with an expertise in celiac disease. Dr. Chey provides an excellent overview of gluten and its accompanying issues, with simple and deliberate animations that allow the viewer to easily understand the concept. This source was exceptionally useful to include in the 'Overview of Celiac Disease' section of the learning module, as it establishes a general understanding of the importance of gluten.

3 What Is Gluten and What Does It Do? | Johns Hopkins Medicine. https://www.hopkinsmedicine.org/health/wellness-and-prevention/what-is-gluten-and-what-does-it-do (accessed 12 Apr2026).

- This article supplies a general understanding of what gluten is and its relevance in the body. The author, Dr. Selvi Rajagopal, provides a straightforward review of what gluten is, where it comes from, what it does to the body, and what to do if one is concerned they have a gluten problem. The article was published on the John Hopkins Medicine website, so it may not be considered highly credible, however due to the author being renowned in the field of gastroenterology, this source was sufficient in providing general information on gluten required for the creation of this learning module.

4 Celiac disease - Symptoms and causes - Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/celiac-disease/symptoms-causes/syc-20352220 (accessed 10 Apr 2026).

- This source provides a comprehensive overview of celiac disease. The entry details the physiological mechanism of the disease and explains how the autoimmune response alters the villi of the small intestine, resulting in malabsorption of nutrients. The authors categorize common symptoms caused by celiac disease over different age groups. Additionally the page outlines risk factors, including genetic predispositions and associated autoimmune disorders, and emphasizes that a strict lifelong gluten-free diet is the only effective treatment in the prevention of long-term complications such as malnutrition and certain cancers.
- Since the article was published by Mayo Clinic, a world-renowned academic medical center, it is considered a highly reliable source. While the website does not list a specific individual author, the information on the site is regularly updated and peer-reviewed by medical professionals to ensure accuracy. Mayo Clinic is a great source, as it provides a “lay summary” of complex medical concepts, making the understanding of the disease more accessible to individuals with low medical knowledge.
- This source was particularly effective in supplying a clear summary of celiac disease for a general audience. It was helpful for summarizing the impact of celiac disease on the small intestine.

5 Gujral N, Freeman HJ, Thomson ABR. Celiac disease: Prevalence, diagnosis, pathogenesis and treatment. *World Journal of Gastroenterology : WJG* 2012; **18**: 6036.

- This comprehensive review article examines the global epidemiology and biological mechanism of celiac disease. The authors describe the complex interactions between genetic factors and environmental triggers that lead to the intestinal damage presented in celiac disease. The authors illustrate how many cases of celiac disease remain undiagnosed due to asymptomatic or atypical presentations. The text also compares the efficacy of diagnostic protocols, and concludes with an analysis of current and emerging therapeutic strategies that extend beyond the standard gluten free diet.
- This article is a highly reliable, peer-reviewed source that provides a significantly more in-depth understanding of celiac disease. The authors are associated with major research institutions (University of British Columbia and University of Western Ontario), and the journal (World Journal of Gastroenterology) are well-regarded in the field of gastroenterology. The article lists over 150 citations, providing a rigorous synthesis of medical literature. Although the article was published in 2012, it provides an excellent explanation of the genetic and immunological foundations of the disease, making it highly relevant for clinical research.
- This source was particularly useful in providing statistics on the prevalence of celiac disease in populations across the world.

6 Therrien A, Kelly CP, Silvester JA. Celiac Disease: Extraintestinal Manifestations and Associated Conditions. *J Clin Gastroenterol* 2020; **54**: 8.

- This comprehensive review examines the “non-classic” manifestations of celiac disease, noting that a large majority (62%) of adults exhibit extraintestinal manifestations at the time of diagnosis. The authors categorize these manifestations into those resulting from nutrient malabsorption compared to those driven by immune-mediated pathways. The article focuses on a critical diagnostic gap, where patients that exhibit gastrointestinal symptoms are typically diagnosed within 2 months, whereas those presenting with only extraintestinal symptoms face an average diagnostic delay over 2 years. The authors argue that recognizing the diversity of extraintestinal manifestations of celiac disease are essential in the prevention of irreversible neurological and intestinal damage to improve long-term patient outcomes.

- This is a highly reliable source from researchers at the Harvard Medical School published in a specialized gastroenterology journal (Journal of Clinical Gastroenterology). It serves as a modern update to the current understanding of celiac disease, as it emphasizes that the disease is a multi-systemic disorder rather than just a digestive one.

- This source was useful in providing uncommon and widely unknown extraintestinal manifestations of celiac disease for the learning module.

7 Catassi C, Verdu EF, Bai JC, Lionetti E. Coeliac disease. *The Lancet* 2022; **399**: 2413–2426.

- This seminar provides a comprehensive overview of Celiac Disease including the etiology, pathophysiology, signs and symptoms, prognosis, diagnosis and treatment of the diagnosis. It extensively details the pathophysiology of Celiac Disease including the genetic factors such as HLA-DQ2 and HLA-DQ8 haplotypes and how that leads to the physiological defects in the intestines. This seminar also details the wide range of clinical presentation of the disease, describing the three categories of the disease and the wide range of signs and symptoms that come with them. It explains the cause of some of the signs and symptoms along with the many differential diagnoses that must be made before we are sure that it is Celiac Disease. Additionally, this seminar also provided the diagnostic methods and current methods of treatment used to manage Celiac Disease.
- This article was published in *The Lancet*, one of the leading peer-reviewed medical journals in the world. The four researchers credited with this seminar are all doctors from various respected institutions around the world such as Harvard Medical School in the USA and McMaster School of Family Medicine in Canada. This supports this paper’s credibility and verifiability in addition to its applicability as this paper was published relatively recently in 2022.
- This paper provided the wealth of signs and symptoms that different patients with Celiac Disease exhibit along with the differential diagnoses that must be made to ensure that the disease is Celiac Disease.

8 Caio G, Volta U, Sapone A, Leffler DA, De Giorgio R, Catassi C *et al.* Celiac disease: a comprehensive current review. *BMC Med* 2019; **17**: 142.

- This review provides a thorough introduction to celiac disease, including epidemiology, pathophysiology, methods of diagnosis, subtype classification, complications, and treatments. It mentions risk factors for celiac disease, including Down syndrome, IgA deficiency, and type I diabetes mellitus. It also explains the immunological pathways that cause gut inflammation, as well as the results of that inflammation, such as villous atrophy. It emphasizes the role of both innate and adaptive immunity in triggering a dysregulated immune response, and further describes the possible associations between celiac disease and the gut microbiome, though it is careful to note that, as of the time of publication, there was no evidence of a causative relationship between the two.
- This review was published in BMC Medicine, an established, peer-reviewed and open-access journal, and thus is credible. One of its strengths is its clear, thorough, and well-organized overview of celiac disease. However, as a review article, it does not touch on every topic with equal amounts of depth, and including detailed experimental results is beyond its scope.
- This source was used for much of the section on pathogenesis, and for outlining the basic risk factors of celiac disease, supplemented with additional papers for further depth and verification.

9 Nunes-Silva JG, Nunes VS, Schwartz RP, Mlss Trecco S, Evazian D, Correa-Giannella ML *et al.* Impact of type 1 diabetes mellitus and celiac disease on nutrition and quality of life. *Nutr Diabetes* 2017; **7**: e239.

- This paper describes a study that aimed to assess the quality of life of individuals with both type 1 diabetes mellitus and celiac disease, compared to healthy controls and individuals with only 1 of the 2 diseases. This was done on the basis that both conditions are autoimmune diseases linked to the same alleles (HLA-DQ2 and HLA-DQ8) and that involve dietary management as part of treatment.
- This paper was published in Nutrition and Diabetes, a peer-reviewed journal that is associated with Nature, a highly prestigious scientific publication. Thus, it is likely credible.
- This paper was used to confirm the assertion in Caio et al. (2019) that type I diabetes mellitus and celiac disease have similar genetic risk factors.

10 Szałowska-Woźniak DA, Bąk-Romaniszyn L, Cywińska-Bernas A, Zeman K. Evaluation of HLA-DQ2/DQ8 genotype in patients with celiac disease hospitalised in 2012 at the Department of Paediatrics. *Prz Gastroenterol* 2014; **9**: 32.

- This paper describes a study evaluating the prevalence of HLA-DQ2 and HLA-DQ8 alleles in children with previously diagnosed celiac disease in one hospital. Blood testing found that 68% of participants were HLA-DQ2+, 21% were HLA-DQ8+, and 11% had both alleles. The proportion of patients with HLA-DQ2 was

noticeably lower than the generally established figure reported in the introduction (90-95%), which may be explained by a small sample size.
- This paper was published in Przeglad Gastroenterologiczny (Gastroenterology Review), a peer-reviewed journal based in Poland. Due to its status as a peer-reviewed journal included in the NCBI PubMed database, the paper is considered credible.
- This source was used to confirm the prevalence of HLA-DQ2 and HLA-DQ8 alleles in patients of celiac disease. The results of the study were not used, but rather the information cited in the introduction.

11 Mårild K, Stephansson O, Grahnquist L, Cnattingius S, Söderman G, Ludvigsson JF. Down Syndrome Is Associated with Elevated Risk of Celiac Disease: A Nationwide Case-Control Study. *J Pediatr* 2013; **163**: 237–242.

- This paper describes a case-control study that assessed the risk of celiac disease in patients with Down syndrome. This study was large-scale, using data from Swedish health registers to identify patients. It found that there was a six-fold increased incidence of celiac disease in patients with Down syndrome than in the general population (1.4% compared to 0.1%).
- This paper was published in the peer-reviewed journal, The Journal of Pediatrics, and is included in important scientific journal databases such as PubMed and Scopus. Thus, this is likely a credible source.
- This paper was used to confirm the assertion by Caio et al. (2019) that there is an association between celiac disease and Down syndrome, and to find more specific figures regarding their concomitant prevalence.

12 Kumar V, Jarzabek-Chorzelska M, Sulej J, Karnewska K, Farrell T, Jablonska S. Celiac Disease and Immunoglobulin A Deficiency: How Effective Are the Serological Methods of Diagnosis? *Clin Diagn Lab Immunol* 2002; **9**: 1295.

- This paper describes a study that investigates the possibility of IgA deficiency in celiac disease patients creating false negative results during serological test-based diagnosis. The rationale was that most current serological methods in clinical use only detected IgA antibodies, and that IgA deficiency is notably more common in celiac patients than in the normal population.
- It was published in the journal Clinical and Diagnostic Laboratory Immunology, a peer-reviewed journal published by the American Society for Microbiology, a reputable organization for microbiologists. Thus, this source can be considered credible.
- This paper was used to confirm the assertion by Caio et al. (2019) that there is an association between celiac disease and IgA deficiency and to find more specific figures regarding the prevalence of IgA deficiency in celiac patients.

13 Diagnosis of Celiac Disease - NIDDK. https://www.niddk.nih.gov/health-information/digestive-diseases/celiac-disease/diagnosis (accessed 8 Apr2026).

- This webpage focuses on how celiac disease is diagnosed. It explains that doctors begin with blood tests that measure antibodies, such as tissue transglutaminase IgA. It emphasizes that patients must continue eating gluten before testing to ensure accurate results. If blood tests suggest celiac disease, then small-intestinal biopsy is typically performed to confirm the diagnosis.
  This source is credible because it is published by the National Institute of Diabetes and Digestive and Kidney Diseases, a government health organization. It is clearly written and easy to understand. However, it is less detailed than journal articles.
  This source will be used specifically to support the diagnostic workflow and testing sequence for the learning module.

14 Lebwohl B, Sanders DS, Green PHR. Coeliac disease. *The Lancet* 2018; **391**: 70–81.

- This review article describes the pathogenesis, diagnosis, and clinical presentation of celiac disease. It explains that ingestion of gluten triggers an immune response in genetically susceptible individuals, leading to production of autoantibodies such as tissue transglutaminase antibodies. The article outlines how immune activation results in inflammation of the small intestine and characteristic duodenal changes, including villous atrophy, crypt hyperplasia, and increased intraepithelial lymphocytes. The review emphasizes that diagnosis relies on serologic testing followed by confirmation with duodenal biopsy while the patient is consuming gluten.
  This source is highly credible because it is published in *The Lancet*, a peer-reviewed medical journal and the article is written by experts in gastroenterology. A major strength is its comprehensive scope and discussion of both clinical and research perspectives. A limitation is that review articles summarize existing studies rather than presenting original research.
  This source will be used to support discussion of antibody testing and duodenal histologic changes in celiac disease diagnosis.

15 Rubio-Tapia A, Hill ID, Kelly CP, Calderwood AH, Murray JA. ACG clinical guidelines: Diagnosis and management of celiac disease. *Am J Gastroenterol* 2013; **108**: 656–676.

- This guideline provides details on the role of genetic testing for the diagnosis of celiac disease. It explains that most individuals with celiac disease carry HLA-DQ2 or HLA-DQ8 haplotypes, and absence of these alleles makes the diagnosis unlikely. The guideline states that genetic testing is not recommended for routine diagnosis but is useful in specific situations, such as patients already following a gluten-free diet, normal biopsy results or unclear serologic results. It outlines the use of serologic testing and small-intestinal biopsy, while also emphasizing that diagnosis should be made while patients are consuming gluten.
  This source is highly credible because it is an official guideline from the American College of Gastroenterology confirmed by experts and evidence review. A strength is its clear recommendations for when genetic testing is

appropriate.
This source will be used to support the role of HLA-DQ2 and HLA-DQ8 genetic testing and explain when genetic testing is helpful in diagnosing celiac disease.

16 Daley SF, Haseeb M. Celiac Disease. *StatPearls* 2025.https://www.ncbi.nlm.nih.gov/books/NBK441900/ (accessed 8 Apr2026).

- This source provides a comprehensive clinical overview of celiac disease, including its pathophysiology, symptoms, diagnosis, and prognosis. It explains that celiac disease is an immune mediated disorder triggered by gluten ingestion in genetically predisposed individuals. The article describes how exposure to gluten leads to inflammation and villous atrophy in the small intestine, resulting in malabsorption. The source emphasizes that diagnosis typically involves serologic testing, followed by small-intestinal biopsy. It also discusses treatment and the prognosis, highlighting lifelong adherence to a gluten-free diet as the primary management strategy.
This source is credible because it is published in StatPearls and hosted by the National Center for Biotechnology Information (NCBI), a reputable biomedical database. It is written by healthcare professionals and regularly updated which makes it highly reliable. A strength is its clear organization and clinically focused information. However, the source only gives a general overview and does not provide experimental data or discussions
This source will be used to confirm the point that Villous atrophy reduces the surface area available for nutrient absorption. The source also is used to explain the prognosis of celiac disease with a following a gluten free diet vs not adhering to a gluten free diet.

17 Ludvigsson JF, Card T, Ciclitira PJ, Swift GL, Nasr I, Sanders DS *et al.* Support for patients with celiac disease: A literature review. *United European Gastroenterol J* 2015; **3**: 146–159.

- This literature review issues a comprehensive, evidence-based framework for the clinical management of celiac disease in adults. The review was developed by a multidisciplinary panel of experts, and outlines the “best practice” recommendations for the entire patient journey. This source is credible and provides systematic review of all available literature regarding patient support for celiac disease. Though the article was published in 2014, these guidelines remain the primary reference point for many gastroenterologists globally and are essential for establishing the correct medical procedures in the treatment of the disease. For the learning module, this source provided information regarding the implications of adhering to a gluten-free diet and potential areas of concern.

18 Future Therapies | Celiac Disease Foundation. https://celiac.org/about-celiac-disease/future-therapies-for-celiac-disease/ (accessed 10 Apr2026).

- This resource provides a detailed overview of the potential future pharmaceutical therapies in development for the treatment of celiac disease, particularly

highlighting treatments that are currently in various phases of clinical trials. While currently the only known treatment for celiac disease is a strict gluten-free diet, this source explains several novel therapeutic approaches designed to supplement or replace dietary restriction.

- As an official publication of the Celiac Disease Foundation, this source is highly credible and reflects the current state of pharmaceutical innovation. This source is specifically valuable for its ability to categorize complex biotechnological approaches into lay terms.
- This source provides a “future approaches” factor for the treatments/therapies section of the learning module, as it is important to acknowledge that dietary management of celiac disease alone is often insufficient for many patients due to cross-contamination and social challenges.

19 Jouanin A, Gilissen LJWJ, Schaart JG, Leigh FJ, Cockram J, Wallington EJ *et al.* CRISPR/Cas9 Gene Editing of Gluten in Wheat to Reduce Gluten Content and Exposure—Reviewing Methods to Screen for Coeliac Safety. *Front Nutr* 2020; **7**: 51.

- This article reviews the revolutionary approach of creating celiac-safe wheat using CRISPR/Cas9 gene-editing technology. Since the wheat genome is highly complex, traditional breeding techniques cannot easily remove the specific immunogenic epitopes that trigger the immune reaction in celiac disease. The authors assess methods for silencing or deleting gluten genes while attempting to preserve the essential baking properties of the dough, i.e. the elasticity.
- This source was published in Frontiers in Nutrition, a highly reputable, peer-reviewed journal.
- This source was exceptional to include within the treatments/therapies section of the learning module, as it considers future directions in the management of celiac disease that go beyond the strict gluten-free diet.