**What’s the deal with gluten?**

Gluten refers to the proteins found in cereal grain’s endosperm (a type of tissue produced in seeds that are ground to make flour). Gluten both nourishes plant embryos during germination and later affects the elasticity of dough, which in turn affects the chewiness of baked products.

To fully understand gluten-intolerance, it is necessary to have an understanding of how gluten is digested. Then, how that digestion results in pain.

In the gut, protein digesting enzymes are secreted. These enzymes will come from the stomach, walls of the small intestine, and the pancreas. With most proteins, enzymes break down the protein into single amino acids, or small di- or tri- amino acids.

Glutenin, the first protein in the gluten-matrix, is digested by these enzymes easily because it is a long protein with a great amount of surface area for the enzymes to attach and degrade. However, gliadin, the other protein, is a densely packed protein with a low surface area to volume ratio, making it difficult for enzymes to encounter. In addition, gliadin protein has a large amount of amino acids that are especially difficult to digest.

As such, naturally occurring protein digesting enzymes have difficulty degrading gliadin. Due to the difficulty protein-digesting enzymes have with gliadin, gluten is digested into long amino acid chains, called oligopeptides, rather than the di- or tri-amino acids that otherwise occur with normal protein digestion.

An inflammatory response is created during gluten digestion because of these oligopeptides. The body mounts an attack on gliadin, degraded gliadin, and the enzyme that helps in gliadin digestion, transglutaminase.  This inflammatory response is not localized to the small intestine, but, rather, it is a systemic inflammation response.

Therefore, gluten results in pain to a gluten-intolerant individual because of the systemic inflammation resulting from the difficulty that protein digesting enzymes have with the gliadin, and other members of the prolamin family of grain proteins.

Not all grains contain gluten, though. Some examples of gluten-free grains are sorghum, millet, brown rice, buckwheat, wild rice, amaranth, quinoa, corn (polenta) and teff. Oats are also gluten-free, but can be contaminated during processing, said Lori Chong, a registered dietitian.

Gluten is only bad for certain people. These people are gluten-sensitive or gluten-intolerant, which means their bodies produce an abnormal immune response when breaking down gluten during digestion. About 18 million Americans have gluten sensitivity, according to the National Foundation for Celiac Awareness.

The most well-known form of gluten intolerance is celiac disease, which affects one in every 141 people in the United States, according to the U.S. Department of Health and Human Services. When someone with celiac disease consumes gluten, it triggers an immune response that damages their intestines, preventing them from absorbing vital nutrients.

The chronic gastrointestinal disorder called irritable bowel syndrome (IBS) is another condition that is affected by gluten. IBS affects 7 to 20 percent of adults in the United States, according to a paper published in the journal Gastroenterology & Hepatology. Chong explained that gluten grains are high in starches and sugars that can be easily fermented by intestinal bacteria. This can cause bloating, cramping and/or diarrhea.

Wheat allergy is a rare type of allergy that is marked by skin, respiratory or gastrointestinal reactions to wheat allergens, but is not necessarily caused by gluten. According to the American College of Allergy, Asthma and Immunology, 65 percent of children with a wheat allergy outgrow it by age 12.

In cases of gluten intolerance, doctors typically recommend a gluten-free diet. Patients must avoid eating any foods and ingredients that contains gluten, including bread, beer, French fries, pasta, salad dressing, soy sauce and even some soups (unless otherwise marked as "gluten-free").

In recent years, many people without gluten intolerance have taken up gluten-free diets. In fact, according to the Mayo Clinic, 80 percent of people on gluten-free diets do not have a celiac disease diagnosis. Experts worry, however, that going on these diets without explicitly needing to could be detrimental to a person's health, as gluten-free foods are often nutrient-deficient. Dr. Refaat Hegazi, medical director for Abbott’s Adult Nutrition, says that going gluten-free can affect the body in many ways.

First, it can affect weight loss. Food restrictions associated with a gluten-free lifestyle can help some lose weight, especially when starches are replaced by healthier options, like quinoa, which doesn’t contain gluten. “But it can also backfire – consumption of too much “healthier” gluten-free food can cause weight gain,” said Hegazi. Food manufacturers often include additional fat or sugar to make gluten-free products tastier, increasing the product’s calorie count and sometimes deceiving those using the diet to control their waistline.

Second, going gluten-free can cause nutrient deficiencies. Many whole grains are rich in vitamins and minerals, like vitamins B and D, iron and fiber. “Whether you need to be gluten-free as prescribed by a doctor, or you are choosing to cut back for personal reasons, a gluten-free diet is doable if followed carefully,” said Hegazi.

What Is Gluten? By Alina Bradford, Live Science Contributor, December 23, 2015

How is Gluten Digested? April 9, 2013 · by jakemknew

**Short Answer Questions:**

1. Gluten is what type of macromolecule? What are the monomers for this type of molecule?
2. What are the two types of protein that make up gluten? What makes one easier to digest than the other?
3. What are three diseases/conditions that are affected by gluten?
4. If you were doctor treating a patient with gluten intolerance, what treatment would you recommend? Include in your recommendation at least one warning about how this treatment might affect the patient.