VibrantWellness

CORN ZOOMER

Corn Zoomer

Evaluate the full spectrum of corn peptide antigens and identify corn sensitivity

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Final Report Date:	04-09-2018 12:57	Specimen Collected:	04-03-2018 12:44
Accession ID:	1512010000	Specimen Received:	04-04-2018 09:04

LAST NAME	FIRST NAME	MIDDLE NAME	GENDER	DATE OF BIRTH	ACCESSION ID
TESTNAME	PATIENT		FEMALE	1980-10-10	1512010000

PATIENT

Name: PATIENT TESTNAME
Date of Birth: 1980-10-10
Gender: Female
Age: 37

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Fasting: FASTING No. of hours: 12.0
EMR #: V1609100001

PROVIDER

Practice Name: Demo Client, MD
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For doctor's reference

Your Vibrant Wellness Corn Zoomer results are enclosed. These results are intended to help you make healthy lifestyle and dietary choices in consultation with your healthcare provider. It is intended to be used as a tool to encourage informed nutritional and health changes.

Vibrant Corn Zoomer is an array of corn antigens which offers very specific antibody-to-antigen recognition. The panel is designed to assess an individual's IgG and IgA sensitivity to these antigens at the peptide level.

Interpretation of Report: The test results of antibody levels to the individual proteins are calculated by comparing the average intensity of the individual protein antibody to that of a healthy reference population. Reference ranges have been established using 192 healthy individuals. The results are displayed as Positive, Moderate Sensitivity or Negative. A Positive result indicates that you have an increased IgG/IgA reaction to the antigen with respect to the reference range. A Moderate sensitivity result indicates that you have a moderate IgG/IgA reaction to the food antigen with respect to the reference range. A Negative or no sensitivity result indicates that you have a low IgG/IgA reaction to the food antigen with respect to the reference range. Vibrant utilizes proprietary fluorescent analysis which is designed to assay specific total IgG (subclasses 1, 2, 3, 4), and total IgA (subclasses 1, 2) antibodies. The classification of Positive to Moderate to Negative denotes the level of IgG and/or IgA antibodies detected through this analysis.

The Vibrant Wellness platform provides tools for you to track and analyze your general wellness profile. Testing for corn sensitivity offered by Vibrant Wellness is performed by Vibrant America LLC, a CLIA certified lab CLIA#:05D2078809. Vibrant Wellness provides and makes available this report and any related services pursuant to the Terms of Use Agreement (the "Terms") on its website at www.vibrant-wellness.com. By accessing, browsing or otherwise using the report or website or any services, you acknowledge that you have read, understood, and agree to be bound by these terms. If you do not agree to accept these terms, you shall not access, browse or use the report or website. The statements in this report have not been evaluated by the Food and Drug Administration and are only meant to be lifestyle choices for potential risk mitigation. Please consult your physician/dietitian for medication, treatment, or lifestyle management. This product is not intended to diagnose, treat, or cure any disease

Please Note - It is important that you discuss any modifications to your diet, exercise and nutritional supplementation with your physician before making any changes. To schedule an appointment with Vibrant Clinical Dietitians please call: Toll-Free **866-364-0963.**

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INTRODUCTION

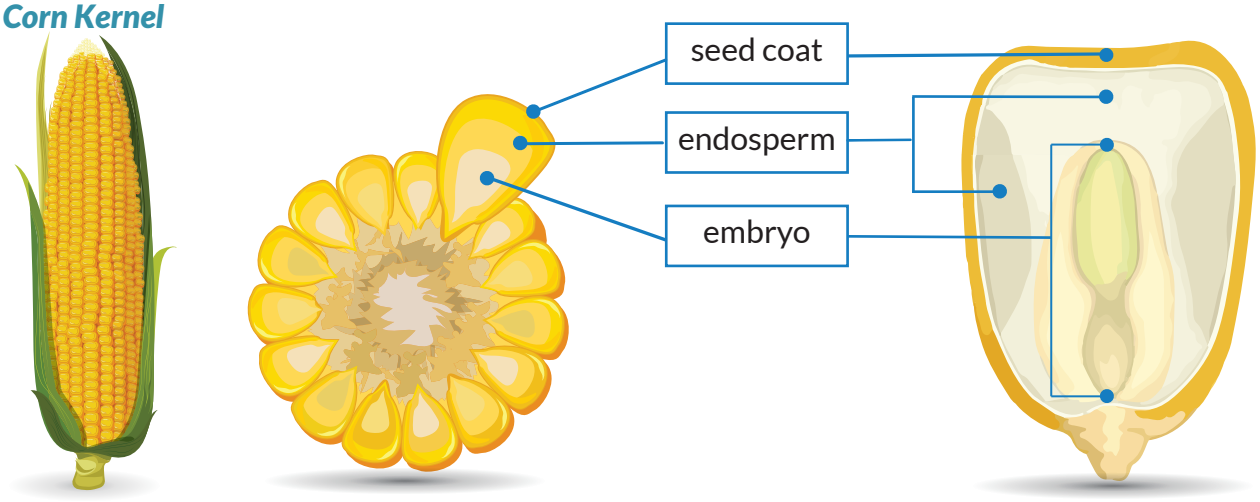
Corn, also known as "maize", is one of the most popular cereal grains in the world. While popcorn and sweet corns are widely consumed, corn-derived products are used in many processed foods as well as other everyday items. The protein content of corn ranges from 10-15% depending on corn variety.[1] The most abundant protein in corn is Zein, accounting for 44-79% of the total protein content.[2] Corn Zein contains amino acid sequences that are similar to the gluten proteins in wheat. Corn zeins, like gluten, are poorly digested and undergo deamidation resulting in immunogenic peptides which can elicit an immune response in the intestinal mucosa. Wheat sensitive individuals on a gluten free diet can have persistent symptoms due to consumption of corn, which also happens to be the main substitute for gluten in gluten free foods. Complete remission of symptoms has been achieved in such cases only when both gluten and corn are avoided.[25]

Living with corn sensitivity is a life-changing and often difficult process because corn exposure is very difficult to manage. Corn and corn syrup have replaced sugar as the primary sweetener in an overwhelming number of food products. It is found in the ingredients labeled citric acid, ascorbic acid, tocopherols, "natural flavors", caramel color, and dextrose. Corn is not only found in food sources, but its various forms and derivatives are in raw materials, beverages, vaccines, medicines, and household items such as shampoo and body powder. Even infant formulas are often made with high-fructose corn syrup. Corn is a building block for literally thousands of consumer and industrial products.

Corn sensitivity has been a complex problem due to the wide use of corn products and the presence of a variety of corn proteins. Symptoms of a corn sensitivity develop when an individual's immune system becomes sensitized and overreacts after eating corn or corn-containing ingredients, or after being exposed to corn pollen. Diagnosis of corn sensitivity is difficult because normal skin or blood tests can not differentiate from other sensitivities such as grass pollens, seeds, and grains. Having a reliable test to achieve early diagnosis and intervention is extremely important.

The Vibrant Corn Zoomer has an exclusive antibody panel which includes 13 major corn protein families and Cry Proteins used in genetically modified (GM) corn at the peptide level. The identification of peptides instead of proteins reduces the possibility of cross-reactivity with similar species. The peptide-based microarray technique eliminates the requirement of testing different forms of corn (raw vs. cooked) and removes the false positives caused by cross reaction with pollens often seen in raw extracts.

Corn Kernel



whole ***Cross section***

LAST NAME	FIRST NAME	MIDDLE NAME	GENDER	DATE OF BIRTH	ACCESSION ID
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SUMMARY

Positive for IgG: Consider eliminating these foods from your diet in consultation with your healthcare provider.
Moderate for IgG: Consider rotation plan/eliminating these foods from your diet in consultation with your healthcare provider.
Positive/Moderate for IgA: Consider eliminating these foods from your diet in consultation with your healthcare provider.

Positive		Moderate		Negative			
IgG	IgA	IgG	IgA				
	Corn protein family Corn-Wheat overlap epitope	**GMO corn** Corn Cry Protein	**Corn protein family** Corn Globulin Corn Thioredoxin	**Corn protein family**			
				Corn Zein Corn Endochitinase Corn Pollen Allergen	Corn Albumin Corn Profilin	Corn Glutelin Corn Lipid transfer protein	Corn Expansin Corn Exopolygalacturonase

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LIFESTYLE CONSIDERATION

Consider using digestive enzyme supplements

The role of digestive enzymes is primarily to help break down larger molecules of food into more easily absorbed particles that the body can use to survive. Taking a good digestive enzyme supplement can help minimize the negative effects of consuming partially undigested food proteins. When you are looking for a digestive enzyme supplement in the market, please note that a good one should have the following properties:

- Contain a variety of enzymes: different enzyme subtypes can address different digestion problems and provide a variety of benefits. The necessary enzymes include carbohydrate metabolizing enzymes, proteolytic enzymes, and fat-metabolizing enzymes.
- Function in a wide pH range: the pH ranges in the stomach and small intestine are significantly varied. In the stomach the pH is 1.5 to 3.5 and in the small intestine the pH is 6 to 7.4. This means the enzymes should be formulated to survive and thrive in both pH ranges.
- Bioavailable enzymes: Intestinal stress is a major contributor to the formation of intestinal permeability. Bioavailable enzymes can reduce the stress on the gut and improve nutrient absorption.

Avoid/rotate corn-containing foods and ingredients

If you have a corn sensitivity, one dietary choice is to avoid/rotate all food products that contain corn or a corn-derivative as an ingredient. Reactions to corn can occur from both raw and cooked corns. Before you buy any food product, always read the entire food label to make sure the product is safe.

Obvious sources of corn:

Corn flakes	Corn flour	Corn meal	Corn oil	Corn starch
Corn sugars	Corn syrup	Grits	Hominy	Popcorn
Fresh corn	Succotash	Canned or frozen corn		

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LIFESTYLE CONSIDERATION

Hidden sources of corn:

Ketchup	Aspirin	Coffee (instant)	Baking mixes	Baking powder
Toothpaste	Beverages	Breads and pastries	Candy	Cheerios
Fried foods	Flour (bleached)	Deep fat frying oils	Gravies	Custard
Plastic food wrap	Tea (instant)	Jam	Soups	Jellies
Sorbet	Milk in paper cartons	Oleo margarine	Pies (cream)	Frosting
Paper containers (when wet)	Tortillas	Powdered sugar	Puddings	Salad dressing
Salt (seasoned)	Adhesives used in envelopes, stickers, stamps, and tapes			

Note: Full disclosure of all corn containing ingredients on a product label is not required. Corn is not considered a major allergen since reactions to corn are rare.

Cooking tips to replace corn in recipes

The following can be used as sweeteners, thickeners, and leavening agents instead of corn-containing products:

Fruit juice	Honey	Beet or cane sugar	Maple syrup	Wheat starch
Cream of tartar	Potato starch	Rice starch	Tapioca	

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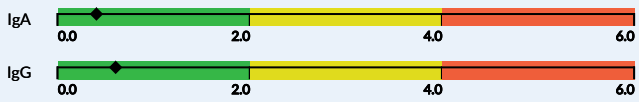
In kernel:

Corn Zein

Zein, a corn prolamin, is located in the cytoplasm of corn endosperm cells between starch granules. Zein is the major storage protein of corn and comprises 44–79% of the protein in corn.[2] Zein is particularly rich in glutamic acid (21–26%), leucine (20%), proline (10%) and alanine (10%), but deficient in basic and acidic amino acids. Zein does not contain all 9 essential amino acids to meet the body's needs and has little nutritional value. The commercial value of zein is the ability to form tough, glossy, hydrophobic grease-proof coatings and the resistance to microbial attack. However, zein may induce inflammation and exacerbate immune responses, especially for wheat and corn sensitive individuals:

- Incomplete protein digestion – Pepsin and trypsin, the main peptidases of the intestinal tract, cannot completely digest corn zein. The result is the release of peptides larger than nine amino acids, which are capable of eliciting innate and adaptive immune responses. [4]
- Gluten-like characteristics – A high degree of homology has been found between corn zein peptides and wheat gluten peptides. Zein undergoes deamidation and is better recognized than native antigens by IgA antibodies. Deamidated peptides can bind to HLA-DQ2 and HLA-DQ8 to elicit a comprehensive immune response that resembles gluten peptides.[5]
- Gluten- and corn-free diet – Persistent symptoms in wheat sensitive individuals on gluten-free diet could be due to their consumption of corn-based food, which is the most common alternative to wheat. Antibodies to zein may remain high until both corn and wheat are withdrawn from the diet. [6]



	Current Result	Previous Result	Reference Range
IgA	0.4 −	1.4 −	≤2.0
IgG	0.6 −	1.3 −	≤2.0

Corn-Wheat overlap epitopes

An epitope is the part of an antigen that is recognized by the immune system. For example, the epitope is the specific piece of the antigen to which an antibody binds. Epitope mapping is the process of experimentally identifying the binding sites, or 'epitopes', of antibodies on their target antigens. Other than the identified antigens, corn has overlapping peptides (epitopes) with wheat. Since corn has been the most common alternative to wheat in gluten-free food, these overlapping epitopes can be problematic for wheat sensitive individuals who are on a gluten-free diet but not corn-free diet. Detection of antibodies to corn-wheat overlap epitopes is predictive of an immune reaction to both corn and wheat.[6]

Food	Peptide	Sequence
Wheat	α-Gliadin	LQLQPFPQPQLPYPQPQLPYPQPQLPYPQPQPF
Wheat	α-Gliadin	LQLQPFPQPQLPYPQPQLPYPQPQLPYPQPQPF
Corn	α-Zein	LQQAIAASNIPLSPLLFQQSPALSLVQSLVQTIR

**Demidation locations for tTG in gliadin & zein*

	Current Result	Previous Result	Reference Range
IgA	5.8 +	0.9 −	≤2.0
IgG	0.8 −	0.8 −	≤2.0

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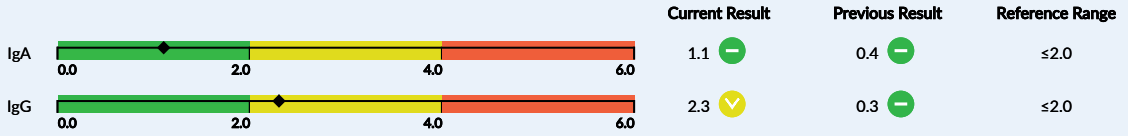
Corn Cry Proteins

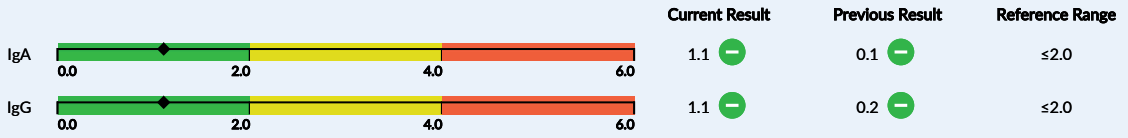
Pesticidal crystal proteins (thus the name "cry" proteins, short for crystal) are endotoxins produced by Bacillus thuringiensis (Bt) and have been used to control crop pests since the 1920s.[7] Cry proteins have been used as pesticides by either spraying on crops or adding to the DNA of genetically modified corns. Cry proteins kill insects only when ingested. They form pores in the gastrointestinal tract of the insect thus causing water and cations to enter. This leads to swelling and ultimately lysis resulting in death of the insect. Thereby, reducing the need for the use of insecticides.[8] Cry proteins were claimed to be digestible in humans but a study in different populations has shown that the Bt toxin has been found in the blood of:[9]

- 93% of pregnant women tested
- 80% of umbilical blood in their babies
- 67% of non-pregnant women



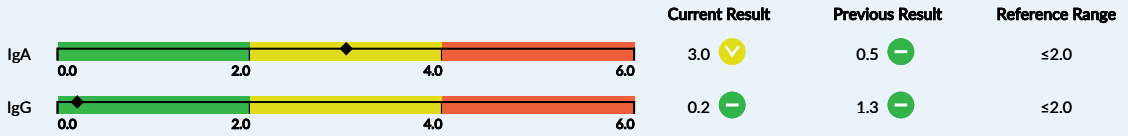
Corn Albumin

The water-soluble albumins are a major group of storage proteins located in the germ of corn. They provide required nutrition to the plant during germination and seedling growth. Albumins show a high concentration during the mid development stage of corn and decline with maturity. The major antigen in the albumin family is 2s albumin.[12]



Corn Globulin

The salt-soluble water-insoluble globulins in corn belong to the Cupin superfamily. The most abundant antigens of this family are globulin-1 and globulin-2 (Zea m G2)[13] located in the embryo of the grain, thus serving as embryo storage proteins.[14] Globulin-2 is a main antigenic protein in corn. The route of exposure of this antigen is via corn seeds.[15] The accumulation of globulins shows a maximum concentration in matured corn.



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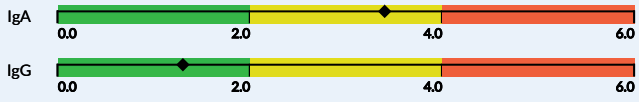
Corn Glutelin

Glutelin, a major protein in corn endosperm, is a constituent of the cellular matrix in which starch granules and zein protein bodies are embedded. Most components of glutelin are cross-linked together by disulfide bonds. Corn glutelin antigens are alcohol-insoluble and alkali extractable. They are highly insoluble in the most potent protein dissociating solvents. These antigens contain all essential amino acids and promote normal growth. Glutelin-2 has antigenic properties in corn. They act as nutrient reservoirs providing required nitrogen and other nutrients to the seed.[15]

	Current Result	Previous Result	Reference Range
IgA	1.2	0.3	≤2.0
IgG	0.8	1.2	≤2.0

Corn Thioredoxin

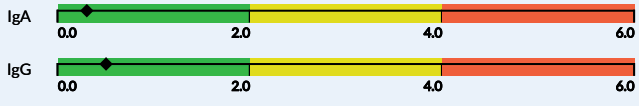
Corn thioredoxin (e.g., Zea m 25) has been identified in corn seeds. These redox proteins are known to be present in all organisms and play an important role in photosynthesis, growth, flowering, and the development and germination of seeds. They are heat stable antigens and are also involved in the modulation of enzymatic activities by thiol redox control, during light and dark transitions. Cross-reactivity of corn thioredoxin antigen has been found in wheat thioredoxin and grass pollen thioredoxin, which are closely related to baker's asthma.[16]



	Current Result	Previous Result	Reference Range
IgA	3.4	1.0	≤2.0
IgG	1.3	1.1	≤2.0

Corn Lipid Transfer Protein

One of the major groups of antigens in corn is the lipid transfer proteins (LTP) such as Zea m 14. LTPs are located in the cell wall of corn seeds and are capable of transferring phospholipids across membranes. Corn LTPs are well known for resistance to proteolytic attack and food processing. Stability of corn LTPs allows them to reach the gastrointestinal lining without any conformational change, thus inducing severe immune symptoms. Corn LTP is exceptionally heat-stable; even after cooking at 100 0C for 160 min, they were able to retain their antigenicity. Hence, food processing at high temperatures does not affect the adverse effects of LTP proteins in corn.[17] The corn LTPs show a high degree of cross reactivity with peach and rice LTPs, hence it may cause adverse effects if corn sensitive individuals consume peach or rice.[26]



	Current Result	Previous Result	Reference Range
IgA	0.3	4.2	≤2.0
IgG	0.5	0.9	≤2.0

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In pollen:

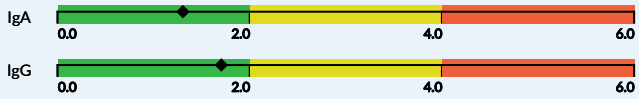
Corn Expansin

Expansin is a large superfamily of proteins that are key regulators of cell wall extensibility in plant growth and development. Expansins are relatively small proteins that lack enzymatic activity and are found in the plant cell walls. Their function is to aid fertilization by loosening the cell wall of the stigma and style, thereby facilitating penetration of the pollen tube. Zea m 1, a member of the β-expansin subfamily, is the major corn pollen antigen.[18,19]

	Current Result	Previous Result	Reference Range
IgA	0.0	0.9	≤2.0
IgG	1.4	0.1	≤2.0

Corn Endochitinase

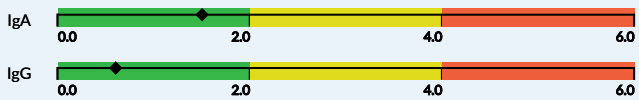
Corn endochitinase was recognized as a corn antigen that belongs to the class of pathogenesis-related proteins, the PR3 chitinases. PR3 chitinases are important weaponry of plants against pathogens and have the ability to inhibit fungal growth. They are also involved in catalysis of the compounds that constitute the integral part of the plant cell wall. Corn endochitinase A and B precursors have significant sequence homology with tomato endochitinase C (homology 58.4%) and with grape endochitinase IV (homology 62%). The high rate of homology between grape and corn endochitinase may lead to cross-reactivity and clinical reactions.[20]



	Current Result	Previous Result	Reference Range
IgA	1.3	1.6	≤2.0
IgG	1.7	1.3	≤2.0

Corn Profilin

Corn profilin belongs to actin-binding proteins, which regulates the function and activities of the cellular cytoskeleton. In plant cells, profilins play a role in cytokinesis, cytoplasmic streaming, cell elongation as well as growth of pollen tubes and root hairs. The corn profilin antigen (Zea m 12) is present in corn pollen and therefore cross-reactivity with other profilin-containing pollen may be anticipated.[21] Because of their fundamental role in the formation of the cytoskeleton, profilins are highly conserved proteins.



	Current Result	Previous Result	Reference Range
IgA	1.5	0.9	≤2.0
IgG	0.6	1.2	≤2.0

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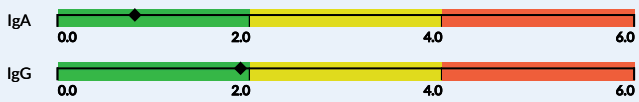
Corn Exopolygalacturonase

Zea m 13, also known as corn exopolygalacturonase, is a family of pectin-degrading enzymes. It is mainly localized in the cytoplasm of the dry pollen grains and plays an important role in cell wall metabolism during ripening. Immunological and biochemical comparison showed that Zea m 13 can cause cross-reactivity to grass pollen antigen group 13. However, it does not cross-react with polygalacturonases from trees and weeds.[22]



	Current Result	Previous Result	Reference Range
IgA	0.8	0.2	≤2.0
IgG	1.9	1.2	≤2.0

Other Corn pollen allergens

Besides the pollen allergens described above, several seasonal sensitivities caused by corn pollen antigens have been characterized.[23] Some of these pollen antigens are present in corn kernel as well. To name a few, Zea m 2 belongs to group 2 pollen antigens in corn. Its function is yet unknown but is believed to participate in sexual reproduction in plants. Zea m 7 belongs to polcalcin superfamily and functions as a calcium binding antigenic protein in maize pollen. Zea m 11 belongs to 2s albumin family and can be found in both pollens and corn seeds. Zea m zm13 is another pollen antigen that belongs to Ole e 1 superfamily. Its function includes contribution in hydration, germination and/or pollen tube growth, and other reproductive functions in pollen physiology. Zea m 22 belongs to Enolase superfamily with glycolytic function.

	Current Result	Previous Result	Reference Range
IgA	0.1	0.6	≤2.0
IgG	1.8	1.8	≤2.0

Key Terms/Glossary

Actin	Actin protein is an important contributor to the contractile property of muscle and other cells.
Allergen	A protein alternatively known as the antigen that can invoke an immune response.
Antibody	An antibody, also known as an immunoglobulin (Ig), is a large, Y-shaped protein produced mainly by plasma cells that is used by the immune system to neutralize pathogens such as pathogenic bacteria and viruses.
Cell elongation	Cell elongation is a developmental process that is regulated by light and phytohormones and is of critical importance for plant growth.
Conformational change	Conformational change is a change in the shape/structure of the protein that often alters the function of the protein upon changing the shape/structure.
Cross reactivity	Cross reactivity happens when an antibody directed against one specific antigen (allergen) is successful in binding with another different antigen.
Cytokinesis	Cytokinesis is the process by which the cellular contents are divided into two daughter cells, and it is therefore essential for the growth of all cellular organisms.
Cytoplasm	In cell biology, cytoplasm is the material within a living cell, excluding the cell nucleus.
Cytoplasmic streaming	Cytoplasmic streaming is the directed flow of cytosol (the liquid component of the cytoplasm) and organelles around plant cells.
Cytoskeleton	Cytoskeleton is the overall name given to protein filaments and motor proteins (also called molecular motors) in the cell.
Deamidation	Deamidation is a chemical reaction in which an amide functional group in the side chain of the amino acids asparagine or glutamine is removed or converted to another functional group.
Endosperm	Endosperm is the part of a seed that acts as a food store for the developing plant embryo, usually containing starch with protein and other nutrients.

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Key Terms/Glossary

Endotoxins	Endotoxin is a toxic substance bound to the bacterial cell wall and released when the bacterium ruptures or disintegrates.
Germ	Germ is also known as embryo, from which the new plant develops.
HLA-DQ	HLA-DQ is a cell surface receptor protein found on antigen presenting cells.
IgA	Immunoglobulin A (IgA), as a major class of antibody present in the mucosal secretions of most mammals, represents a key first line of defense against invasion by inhaled and ingested pathogens at the vulnerable mucosal surfaces.
IgE	Immunoglobulin E (IgE), as a major class of antibody, is produced by the immune system and mostly associated with allergic responses, including asthma.
Leaky gut	Leaky gut, also known as "intestinal permeability," is a condition in which the lining of the small intestine becomes damaged, causing undigested food particles, toxic waste products and bacteria to "leak" through the intestines and flood the blood stream.
Pectin	Pectin is a fiber found in fruits including pears, apples, guavas, quince, plums, gooseberries, oranges and other citrus fruits.
Peptidases	A peptidase is a catalytically active protein that cleaves one or more peptide bonds in a protein or peptide by hydrolysis.
Prolamin	Prolamin is a group of plant storage proteins having a high proline content and found in the seeds of cereal grains.
Proteolytic attack	Proteolytic attack is degradation of proteins by protease enzymes.
Superfamily	Superfamily is a taxonomic category that ranks above family and below and comprised of families sharing a set of similar nature or character.

Citations/Sources

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This test has been developed and its performance characteristics determined by Vibrant America LLC., a CLIA certified lab. These assays have not been cleared or approved by the U.S. Food and Drug Administration.

Quantification of specific IgG and IgA antibodies is not FDA- recognized diagnostic indicator of allergy.

Corn sensitivity testing is performed at Vibrant America, a CLIA certified laboratory, and utilizes ISO-13485 developed technology. Vibrant America has effective procedures in place to protect against technical and operational problems. However, such problems may still occur. Examples include failure to obtain the result for a specific antigen due to circumstances beyond Vibrant's control. Vibrant may re-test a sample in order to obtain these results but upon re-testing the results may still not be obtained. As with all medical laboratory testing, there is a small chance that the laboratory could report incorrect results.

A tested individual may wish to pursue further testing to verify any results. The information in this report is intended for educational purposes only. While every attempt has been made to provide current and accurate information, neither the author nor the publisher can be held accountable for any errors or omissions.

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