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# CAS JAMAICA

FOOD SAFETY NEWSLETTER

IN THIS ISSUE



## A letter from the editor

According to the Center for Disease Control, each year 48 million people get sick from a foodborne illness, 128,000 are hospitalized, and 3,000 die. Food safety is everyone's responsibility. No one is immune to the treat of food safety. Hazards associated with foods may be divided into three categories: Biological, Chemical or Physical. These hazards can lead to people getting sick or even dying. Lets have a look at the different hazards associated with foods.

Biological hazards are the most common cause of foodborne illnesses and may be due to the presence of microorganisms, viruses or parasites. Mesophilic bacteria such as *Listeria monocytogenes*, *Staphylococcus aureus*, *Salmonella* and *Clostridium botulinum* are common agents of foodborne illness. *L. monocytogenes* is commonly associated with dairy products and ready to eat (RTE) foods. Environmental monitoring is very important when packaging RTE foods to prevent recontamination of products after processing.

*Salmonella* is especially problematic given that it can survive at a pH as low as 3.7. Norovirus also known as cruise ship virus is the main cause of viral foodborne illnesses. Viruses cannot replicate on their own and require a host. Good hygienic practices are important to prevent the spread of viruses such as proper hand washing techniques. Parasites such as Trichinella leads to trichinosis. It is found in raw meats such as pork. Mad cow disease, caused by a prion, results in abnormal folding of proteins within the brain.

Chemical hazards as the name suggests are chemicals that can result in foodborne illnesses. These may occur naturally in foods or may be intentionally or unintentionally added. Natural toxicants include Hypoglycin A which can be found in immature ackees or solanine present in the skin of green potatoes. Allergens such as peanuts, treenuts, shellfish, fish, eggs, wheat, milk and soy, are also examples of natural toxicants accounting for 1/3 of the reported foodborne illnesses in the United States of America.

Melamine is an example of an intentional and economically motivated chemical hazard which was added to milk to mimic high protein content. In 2008, it was reported that baby formula manufactured in China was contaminated with melamine. The scandal was unearthed on 16 July 2008 when it was discovered that 16 babies had kidney stones. Other examples of economically motivated hazards are lead chromate which has been added to turmeric to give it a bright colouration.

Turmeric

Physical hazards are the least reported cause of foodborne illnesses and include stones, glass, metal, wood and plastics. Their presence in foods should not be overlooked. They may be detected utilizing simple or sophisticated machinery. The simplest technique that can be utilized for their detection is that of sieving. More sophisticated methods include X ray or metal detectors.

Food safety is everyone's responsibility. No one is immune to the potential deleterious effects of foodborne illnesses. Ensure that your foods are properly cooked and stored at the right temperatures. Seek medical attention if necessary. Good food safety systems monitor foods from farm to fork. Let's play our part in reducing the occurrence of foodborne illnesses which can be life threatening.

*Dr Andrea Goldson-Barnaby currently serves as the Head of the Food Division in the Department of Chemistry at the University of the West Indies. She is also the Programme Coordinator for the MSc in Food and Agro Processing Technology.*

# Advances in nanomaterials for food application

*By Yanique Black*

Nanotechnology is that aspect of applied science and technology that involves the creation, manipulation and use of materials, systems and components at the nanoscale i.e., at the molecular and atomic levels (1-100 nm in size). An interdisciplinary science it has influences from physics, chemistry, engineering, biology and toxicology (1). Its application is quite pervasive extending into agriculture, biotechnology, food processing, food packaging and safety, medicine and pharmaceutics, information technology, transportation, electronics, the aerospace industry, sports and home supplies. It is anticipated that nanoscience will continue to have an impact in other areas of science and life.

Nanoscale materials possess certain unique properties that set them apart from their bulkier counterparts. They show differences in their physical, chemical and biological functionalities which are manipulated and utilized in various fields (2). These novel functionalities are due to their size, structure, shape, surface area to volume ratio, aggregation state, solubility and chemical composition (3,4). The technique that is used to obtain these nano entities is mainly through reduction using methods such as low flow injection, precipitation by antisolvents and evaporation (5).

Some researchers have posited two methods, the top-down and bottom-up approaches. The top-down procedure, is achieved by reducing the size of the smallest entities (via mechanical-physical means such as grinding, milling and crushing) to the nanoscale. The bottom-up procedure is achieved by shaping individual atoms and molecules into nanostructures by means of manipulation (6,7).

The capability to design as needed these 'exploitable' structures have paved the way for a myriad of products to be developed in the future (3). The widespread interest and appeal of this science and the potential it possesses to solve certain scientific problems have resulted in an exponential increase in both public funding and applications for patents (3,8). The fast-paced developments in nanoscience have sparked transformations to the food and agricultural sectors particularly. With respect to the food industry, improvements in food quality and safety have been made. An example is through the use of smart and active packaging by way of nanosensors for the detection of pathogens, undesirable chemicals, unwanted gasses and pesticides. The possibility also exists to alter the sensory nature of foods in order to enhance the taste, texture and colour. Another area of application is through using nanoencapsulation to facilitate the efficient delivery of bioactive molecules for the purpose of improving bioavailability in foods (9, 10).

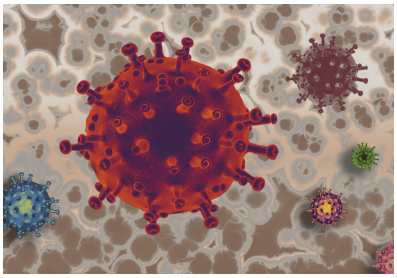
In terms of agriculture, nanotechnology has opened up a number of possibilities such as providing new agrochemical substances to boost crop productivity thereby lessening the use of high concentrations of pesticides, using nanosensors in crop protection to identify chemical residues and diseases, utilizing nano devices for gene manipulation of plants, diagnosing plant diseases, delivery of growth hormone and DNA to plants and animals, bio-nanosensors for detecting metabolic products such as lactate, glucose and ATP within animals, removal or detoxification of harmful pollutants in soil or groundwater (11,12).

**FOOD APPLICATIONS**

Nanofoods is defined as “food which have been cultivated, produced, processed or packaged using nanotechnology techniques/ tools or to which nanomaterials have been added” (13). Nanofoods are intended to improve the nutritive value, taste, quality and safety of food and also reduce the cost to buy such. It is hoped that consumers will benefit from these nanofoods in terms of attaining their health and dietary requirements. The benefit that businesses anticipate include new market opportunities, product differentiation and financial gains (14).

A number of nanofood additives are incorporated in food with the most common being synthetic amorphous silica (SAS) known also as E551. SAS used either in the form of a precipitate or fumed silica, is composed of particle aggregates in the lower nanometer size range. It is used in the beverage industry as a clarifying agent, as a free-flowing and anti-caking agent in powdered food items, as a thickener, and a carrier of fragrances and flavours (15,16).

Titanium dioxide which is used as a pigment to improve the whiteness of dairy foods and candies. It is also incorporated in food as an additive and flavour enhancer in non-white foods including dried vegetables, nuts, seeds, soup, beers, wines and mustard. Of increasing interest is the dietary intake of titanium dioxide. In a recent study conducted, it was found that about 5-36% of titanium dioxide that was found in common food products were in the nano-size range (15,17). Nanoform titanium dioxide is also used as an antimicrobial agent in combination with other substances such as nickel oxide and cobalt for the inactivation of foodborne pathogens (15,18).



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# Food Allergens

*By Melissa Brown and Jodé Hylton*

Food safety issues have resulted in the spread of many food-borne illnesses. This has caused the hospitalization of many individuals as well as the death of some. In order to combat the outbreak of these food-borne illnesses, one must become familiarized with the many food safety issues that exist because it is our health that is at risk and it is our responsibility to maintain it. One such food safety issue is that of food allergens.

Food allergens refer to the proteins of foods or their derivatives that cause abnormal immune responses(1). The immune systems of those who experience allergies mistake these vital proteins as potential threats to the body and therefore carry out the necessary responses to combat the perceived threat. On September 13, 2021, a report was posted on the NBC WCMH-TV website about the Utica-based ice cream company Velvet Ice Cream having to remove their Raspberry Fudge Cordial ice cream from shelves due to an undeclared peanut allergen after being reported by a customer (2). According to the Center for Disease Control and Prevention (CDC), approximately 4% - 6% of children and 4% of adults in the USA have food allergies (3). The 8 major food allergies, according to the Food and Drugs Administration (FDA) are milk, eggs, fish, shellfish, wheat, tree nuts, peanuts, and soybeans (4). Allergies are a serious food safety issue and in order to combat this issue, it is important to address the causative factor of these allergies, symptoms of allergic reactions, associated risks that make an individual susceptible to allergies, and relevant precautionary measures that may be put in place to combat the adverse effects.

Soybean

Treenuts

Food allergies are caused by specific proteins found in foods. These proteins are considered by the immune system as antigens, therefore, triggering an appropriate immune response. Allergies can be categorized into two groups: IgE mediated allergies and non-IgE mediated allergies. As it relates to non-IgE mediated allergies, not much is understood about the mechanism. However, it is known that they involve the immune system but the IgE antibodies are not what triggers them. It is believed that there are other parts of the immune system, such as cells and antibodies, which interpret the proteins as threats and proceed to fight against them (5).

On the other hand, IgE-mediated allergies, which are the most common type of allergy, are caused by the IgE antibodies produced by the immune system. They are accosted by dendritic cells and hydrolyzed into small peptides which are displayed on the cells' surface (6). The cells then migrate to the mesenteric lymph nodes where they interact with T cells to initiate an adaptive immune response (6). In the presence of Th-2 promoting cytokines, the T cells become Th-2 type helper cells which migrate to different tissues and produce cytokines such as IL4, IL5, and IL13, which causes food antigen-specific B cells to differentiate into plasma cells that produce antigen-specific IgE antibodies (6). These antibodies that are produced will bind to mast cells. Therefore the next time food is ingested containing the same protein, it is officially considered an antigen within the body.

The IgE antibodies bound to mast cells that are specified to identify that particular protein will interact with it thus triggering the mast cells to release a number of chemicals, most specifically histamines (6). As a result, an allergic response is observed. The 3 major allergens are eggs, milk, and peanuts. In milk, the protein casein tends to be the most allergenic protein. For peanuts, the major allergenic proteins are Ara h1 and Ara h3 of the cupin superfamily as well as Ara h2 and Ara h6 of the prolamin superfamily (7). In eggs, the allergenic proteins are mostly associated with the egg white, also known as the albumin.

Symptoms associated with allergic reactions include:

1. Itching sensation in mouth, throat, or skin
2. Hives/red rashes on the skin
3. Vomiting
4. Diarrhea
5. Swelling in the face, around eyes, lips, or tongue
6. Nausea
7. Shortness of breath
8. In serious cases, anaphylaxis

Precautionary measures for preventing an allergic reaction include avoiding the allergen, doing an allergy test, and utilizing antihistamines. Additionally, precautions should be taken to prevent cross-contact.

## Allergens

Milk

Fish

Shellfish

Egg

Peanut

Wheat

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# Omics Technologies In Foods

*by Paula-Shay Ashman*

The food industry is constantly evolving to satisfy the demands of its consumers. With a growing health-conscious population, consumers are demanding more minimally processed, nutritionally beneficial foods, some of which include fruits, vegetables, dairy, seafood and meat (1). Producers are seeking innovative food processing solutions to produce aesthetically pleasing, delicious, safe and properly packaged foods that appeal to consumers (1). One innovation utilized in the food industry to achieve this is omics technologies. There are four main technologies genomics, transcriptomics, proteomics and metabolomics. These are the entire set of genes, mRNA, proteins and metabolites respectively that are present within an organism.

Genomics monitors an individual's response to certain food products (1). The genome is evaluated to determine the best-suited diet or nutritional plan for the individual to prevent nutrition-related diseases in genetically predisposed persons. The human genome contains approximately 20,000 to 25,000 genes that can be analysed in a single reaction using different genomic tools (2). Some genomic tools include DNA microarray and next-generation sequencing which can detect subtle changes in a person's genetic makeup such as mutations or single nucleotide polymorphism (2).

Transcriptomics identifies how distinct nutrients modulate gene expression and its correlation to disease prevention (1). It is the most used and developed omics technology concerning food. It can be utilized along with DNA microarray and multiplex PCR tests for gene expression profiling.

Proteomics can be utilized for the detection of contaminants, allergens, pathogens and cancer-causing food bioactive ingredients (1). The information gathered using proteomics can potentially identify new and emerging contaminants along with the predicted nutritional content of food. Mass spectrometry and gel electrophoresis are used to analyse proteomics (2). Metabolomics can be used to identify the occurrence of different processes such as fermentation.

**Enhancing Food Safety**

Omics can assist in the identification of known and unknown microbes including spoilage and pathogenic microorganisms by improving screening and subtyping tools (3). Food spoilage microorganisms contribute to reduced shelf-life while pathogenic microorganisms may result in outbreaks of foodborne illnesses. The increased knowledge of these microorganisms can help to design food processing methods to reduce microbe contamination that may result in accelerated spoilage and future outbreaks.

Scientists acquire knowledge of fundamental biological characteristics of these microorganisms such as virulence, antimicrobial resistance and response to environmental factors such as temperature and pH (3). The application of omics technologies requires a deep understanding of the genes of microorganisms, how these genes are regulated and how they correlate to protein structure and function without the need for experimentation (3). The genes are converted by transcription to form mRNA which forms protein after translation occurs.

*Clostridium botulinum* is a pathogenic, spoilage bacteria that is likely to occur in low-acid canned foods. From research, it is known that C. *botulinum* is heat-resistant so, high temperatures are used during the canning process to kill any microorganisms present and achieve commercial sterility. *Salmonella*, is a pathogen that has been recently discovered to have the ability to tolerate dry conditions and low water activity. This is concerning because it increases its chance of survival during processing and may result in a food-related outbreak.

Foodborne illnesses have damaging effects on the food industry such as economic losses suffered by producers and health implications suffered by the public. Food contamination will require producers to recall their products and damage the trust established between consumers and manufacturers which can cause manufacturers to lose loyal customers resulting in huge monetary losses. Omics can help to determine the genes which enable *Salmonella* to survive in such conditions and what steps can be taken to inhibit or prevent the growth of *Salmonella*.

Food safety is also compromised by food adulteration which can occur at the procurement or manufacturing stage of production. Genomics and others can play an essential role in maintaining food authenticity and integrity. The genomic method is mainly used for species detection and identification. Omics technology can also aid in creating better tools for microbial source tracking investigations (3). Since DNA is constant in every cell in organisms, genomics can be used to differentiate between morphological similarities between species.

DNA amplification and DNA-barcoding are two methods used for taxonomic differentiation. DNA-barcoding is commonly used for the authentication of seafood and fish. Recently in Jamaica, the Counter Terrorism and Organized Crime Investigations Branch (CTOC) seized ten million dollars worth of counterfeit brown sugar in Kingston (4). The investigating officer identified dextran as the chemical marker to determine the origin of the “sugar” and that it was imported. Dextran is a compound produced by *Lactobacillus* bacteria during sugar refinement.

Since food adulteration is a multi-million dollar business, precautions must be taken to ensure that these products do not saturate the local market. This will protect consumers from potential health risks that may present themselves due to improper sanitation techniques and poor-quality foods. Omics technologies could help to combat food adulteration as the advancements in sequencing technologies allow for rapid detection and high-resolution subtyping (5). Therefore, the source of pathogens, spoilage organisms and adulterated foods can be identified and future outbreaks can be avoided. This approach can be paired with available databases via technology such as cell phones or computer applications for quicker detection.

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# Food Security

*by Debbie Ann Phillips*

Food safety and quality refers to safety measures undertaken from the farmers/suppliers to the beneficiaries. This ensures the safety, nutritional quality, and acceptability of the delivered foods. Food security is a measure of the availability of food required to support a household, region (community or country), and or nation. It is a measure of how much food is available, its quality and accessibility.

Food security may be reduced by:

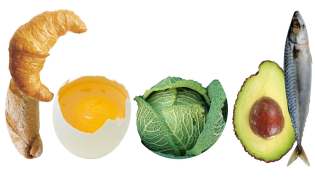
- An increase in human population. Birth rates are increasing, and many people have better access to health care.
- Changing diets.
- New pests and pathogens that attack crop and farm animals.
- Environmental changes due to global warming.
- Increased costs of farming due to an increase in natural disasters or increased technology.
- Armed conflicts.
- Pandemics

The five stages of food supply from farm to fork are:

- Agricultural production,
- Post-harvest handling,
- Processing,
- Distribution,
- Consumption.

There are two systems which are used in food safety and quality:

- Regulations and laws using standards,
- Voluntary standards which are used by international association and market laws (1).



Various safety measures are implemented to ensure the safety and quality of our foods. These include personal hygiene, using personal protective equipment, sanitization of surfaces and working environments, safe handling/preparation/ delivery of food, and maintaining social distancing in a communicable disease pandemic.

Pandemics can have a negative impact on the global economy due to a disruption in the food supply chain process from farm to table. Restrictions in the movement of people will lead to changes in consumer demands, closure of processing plants, restricted food policies and financial pressures in the food supply chain (2).

COVID-19 is the fifth pandemic, following the 2009 Pandemic flu (H1N1), 1968 influenza virus (H3N2), 1957 influenza virus (H2N2), and the 1918 influenza virus (H1N1), which has resulted in the death of millions of people (3).

The pandemic of recent years does not directly affect food production by infecting agricultural produce. The pandemic affects the food supply due to restrictions in transportation of people posed by the government. Temporary and or seasonal workers involved in planting, sorting, harvesting and in processing are now absent due to lockdown of borders or due to the fear of contracting the debilitating virus. This causes labor shortage and hence the food supply chain is disrupted on all levels, causing food shortage and also increased risk of possible food illnesses as proper safety measures may not carried out by the different entities.

With the disruption of the food supply chain in 2020 the ripple effect of food security will be greatly affected for preceding years and have a negative effect on the food supply chain. Food may be available but without the necessary laborers throughout the supply chain foods may be discarded. This jeopardizes the ability of agricultural businesses to continue their business as usual, and may have negative effects on food quality, freshness and food safety, hindering access to markets and affordability. Logistics barriers that disrupt food supply chains further weaken high-value goods due to their short shelf life (4).

The COVID-19 outbreak has resulted in an increase in food demand. The increased demand is said to be as a result of boredom, with the consumption of high amounts of fats, carbohydrates and protein. Boredom and stress from quarantine leads to food cravings for sugary food to feel positive. The closure of restaurants and limited service eating places has affected eating/purchasing habits and resulted in an unusual demand shift from foodservice to retail.

Due to road constraints, farmers have limited access to seeds, pesticides, fertilizers, and labor shortages. The pandemic has changed food trade policies, with governments mainly allowing imports and little to no exports. The restriction in export causes domestic price drop, which negatively affects farmers and causes production to fall which leads to long term food insecurities on all levels. Export restrictions undermine the exporter's reputation and encourage importers to reduce confidence in the world market, thereby reducing trust in international trade and destroying future business opportunities for exporters (5). In summary trading moves products from surplus to deficit areas, preventing shortages and food insecurity related to reliance only on domestic production (6).

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## Highlights from CHEMFEST 2021

### Portland, Jamaica

CHEMFEST was hosted over a three day period, under the theme, "Chemistry in the World Around Us". This year the festival was geared towards primary level studet from rural areas of Jamaica with participants from Windsor Castle All Age, Buff Bay Primary and Turnberry Infant and Primary Schools. Students were exposed to fun science experiments using everyday household items. Prof Melvin Pascall from Ohio State University was the guest speaker. The initiative was sponsored by the American Chemical Society. Thanks to our volunteers, Debbie Ann Phillips, Marcel Denny, Ricaldo Pryce, Kiara Shannan, Kyra Taylor, Tritch-Ann Whyte and Dane Warren.


# CHEMFEST feedback

**Windsor Castle All Age**

- I love this event. It was so interesting and I love the science experiments and I would like to go to another one.
- It was very interesting. We learned cool experiments like the balloon experiments, the paper clip experiments etc. It was fun.
- It is good. It's a fun event and I learned a few things today about chemistry. I learned a lot today.
- I think this chemistry festival is the best thing. I think I want to be a scientist in the future.
- I learn a lot of things and I think I like this subject and want to become a scientist.
- Thank you for sharing.
- This was amazing event. I hope you come again.
- I learned a lot today. Some of these things I didn't know and when I grow up I hope I can become a scientist.

;**Buff Bay Primary**

- Yes it was very fun doing my experiment with my class mates❤😊.
- I LOVE YOUR CLASS.
- It was amazing, I like Chemistry, a lot of people say its hard and boring but with my experience today, they were wrong.
- I have fun today.
- Yes I would it was very interesting.
- The event was fun.
- It was an interesting and educational day and I really enjoyed it.
- Was excited and I learned new things.
- The event were very interested today. I can't wait for another time to come again. I enjoy every bit of I thank everyone at UWI for giving us the opportunity to learn new thing. Thank you all so much.

**Turnberry Infant and Primary School**

- This chemistry event was very fun and interesting and I hope to do it sometime again.
- I like the balloon one and the color change one. It was very interesting and I would like to do more. It was fun and I would like to thank Dr Barnaby.
- Yes it was very fun and I enjoyed it very much. I especially liked the one where we were to put the toothpick in the balloon because I was very successful in it and I would love to do it again.
- I love to learn new things. I love school and this is the best the ever.
- I love the vinegar and balloon experiment. Dr Barnaby's experiments always brings me joy. I will share this at home for sure. Today was fun and educational. Love
- I was very interesting. I would like to be in more events. This was very interesting. Love always
- Today was fun. I learned something new and I love the part with vinegar and marker.
- Today was very interesting and fun from what I learn.
- Today I learned about Chemistry. Chemistry is something I love.
- Today's event was very interesting because I learn thing about science that I have never imagine and today was very fun.
- It is good and it interesting and we learn so much today.
- Today was a very interesting day. Chemistry experiments are very important in science. It also helps our vocabulary.

## Meet Our Scholars


Ms Kyra Taylor, a graduate student of the M Sc in Food and Agro Processing Technology Programme at the University of the West Indies, Kingston, Jamaica, is one of the recipients of a BOOST Fellowship. The National Baking Company Foundation (NBCF) Enhancement Scholarship Fund was established through Agreement with The University of the West Indies, Mona (Faculty of Science and Technology) and the National Baking Company Foundation in March 2021. The overall objective of the programme is to enhance STEM education in Jamaica by providing a continuous stream of quality science and mathematics teachers through an innovative 'back-end' incentivized scholarship programme that entails 'Building Out Our Stem Teachers' (BOOST).

Ms Jacquél Johnson, a graduate student of the MSc in Food and Agro Processing Technology Programme at The University of the West Indies, Kingston, Jamaica is a recipient of The Professor Pauline O. Lawrence and Professor Carlton G. Davis Scholarship which was instituted at the Faculty of Science and Technology (FST) at The UWI Mona Campus, from which Professor Lawrence received a BSc (Honours) degree in Zoology. Professor Davis was a Ford Foundation International Research Scholar and later, Visiting Professor in the Department of Agricultural Economics at The UWI St. Augustine Campus, in Trinidad and Tobago. Their investment will support Jamaican students pursuing BSc degrees and MSc degrees in the areas of Agricultural Entrepreneurship, Plant Production and Protection, Biotechnology and Food and Agro Processing Technology for up to three years.

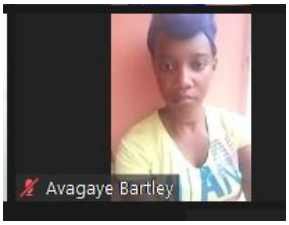
# Preventive Controls Qualified Individuals

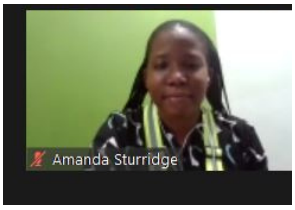
*by Andrea Goldson-Barnaby*

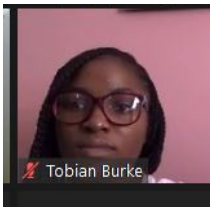
Meet our latest Preventive Controls Qualified Individuals.

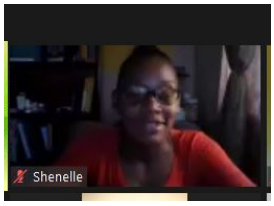
Akenio Patterson, Shenelle Sicard, Rakeima Johnston, La Toya, Roberts, Sherdon Sterling, Deneikah Jackson, Amanda Sturridge, Avagaye Bartley, Marvia Whtye, Brittania Cheese

The training was conducted virtually and was sponsored by the American Chemical Society. Lead Instructors for the course were Dr Andrea Goldson-Barnaby and Ms Hope L. Kerr. Participants consisted of both graduate and undergraduate students from the University of the West Indies as well as Industry personnel. Preventive Controls Qualified Individuals are trained in the area of Food Safety and ways to effectively develop Food Safety Plans.










# Mangrove Art Competition Update

Shania Norman is the winner of our recently hosted Mangrove Art Competition. Shania is a Grade 9 student from Muschett High School in Wakefield, Trelawny. Her favorite subjects are Mathematics, Music and Visual arts. In the future she wishes to pursue a career in Politics.


1st Shania Norman
Muschett High School,
Wakefield, Trelawny

**Mangroves protecting us from storm surges**

# Food Allergens

| I | O | K | L | I | M | S | C | S | U | L | L | O | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P | I | S | T | A | C | H | I | O | Y | S | T | E | R |
| T | O | O | E | S | T | R | E | E | N | U | T | S | R |
| S | S | A | L | M | O | N | D | S | H | R | I | M | P |
| W | E | C | R | U | S | T | A | C | E | A | N | S | S |
| M | A | T | B | A | R | L | E | Y | E | H | S | I | F |
| P | U | L | I | T | H | A | Z | E | L | N | U | T | S |
| L | E | S | N | H | A | T | M | U | S | T | A | R | D |
| E | O | A | S | U | P | E | F | R | B | U | O | N | C |
| M | U | B | N | E | T | L | H | S | E | A | S | A | E |
| A | A | T | S | U | L | S | U | W | L | T | R | L | C |
| S | C | E | T | T | T | C | A | S | H | E | W | C | A |
| E | E | U | A | C | E | S | T | U | N | O | C | O | C |
| S | O | I | O | E | O | R | N | I | E | T | O | R | P |

MILK
SULPHITES
CRUSTACEANS
LOBSTER
PROTEIN
BARLEY
TREENUTS
MUSTARD
COCONUT
WALNUTS
CRAB
CASHEW
ALMOND
PISTACHIO
MOLLUSCS
HAZELNUTS
PEANUTS
SESAME
MUSSEL
WHEAT
OYSTER
FISH
SHRIMP
OATS

Play this puzzle online at : https://thewordsearch.com/puzzle/3154163/