THE VORTEX

AMERICAN CHEMICAL SOCIETY CALIFORNIA SECTION
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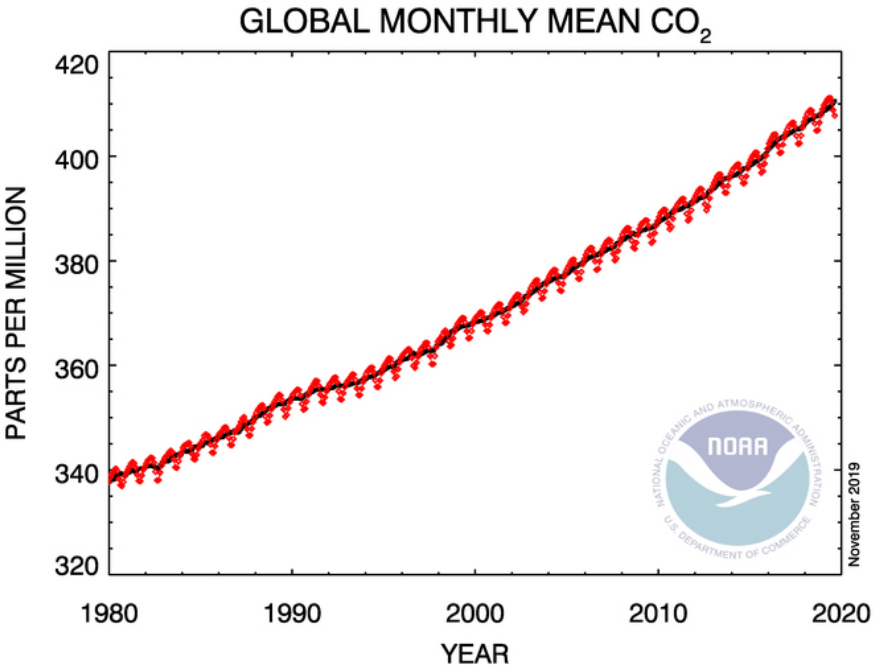

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AWIS
ASSOCIATION FOR WOMEN IN SCIENCE
East Bay California

ACS Chemistry for Life®
California Section

Women CHEMISTS Committee

Chevron Oronite

All are welcome.

This is a FREE event.
Registration is required.

January 8, 2020 - 5:30-7:30 pm

Location: Chevron Richmond Technology Company (RTC) Building 10 Auditorium, Chevron Gate 19, 525 Castro St., Richmond, CA 94802
On-site parking is available.

Schedule:
5:30 PM Light Bites + Networking
6:00 PM Main session with Q&A
7:00 PM Light Bites + Networking
7:30 PM End of the event

An AWIS and ACS Joint event, sponsored by Chevron Oronite Company

FIRESIDE CHAT WITH BARBARA SMITH

Vice President, Products and Technology Chevron Oronite Company

You are invited to a special event and candid conversation with Barbara Smith, VP of Chevron Oronite Company. This is a rare opportunity to hear about Ms. Smith's career from graduate school to VP of a global company. There is plenty of opportunity to network with local scientists.

About the Speaker

Dr. Barbara Smith is vice president of Products & Technology for Chevron Oronite Company, a position she has held since June 2013. Previously, Smith served as technical manager and senior business manager of the Chevron's Richmond Refinery. Smith has held a variety of technical and leadership roles in environmental and biotechnology areas.

A native of New Zealand, Smith joined Chevron in 1989 as a research engineer in catalyst and process development. Smith graduated in 1981 from the University of Canterbury, New Zealand, with a bachelor's degree in chemical engineering. She received a master's degree in technology and policy in 1984 and a doctorate in chemical engineering in 1989, both from the Massachusetts Institute of Technology.

Meeting Reminder

The meeting is free. Registrations is required' e-mail: office.@calacs.org

THE VORTEX

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EDITOR:
Louis A. Rigali
255 4th St. Ste #101 Oakland 94607 510-268-9933

Advertising Manager

OFFICE ADMINISTRATIVE MANAGER
Julie Mason
2950 Merced St. # 225 San Leandro CA 94577 510-351-9922

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California Section Web Site: http://www.calacs.org

CONTRIBUTING EDITORS:

Nicki Davis
Evaldo Kothny
William Motzer

EDITORIAL STAFF:

Lee Latimer
Alex Madonik
Jim Postma
Linda Wraxall
Wally Yokoyama

Chair's Message

Jim Postma

Groundhog Day isn't until February but you may feel a bit like Phil Connors, Bill Murray's character in the memorable movie as you welcome me to the Chair position in the California Section. Haven't we done this before? Yes, back in 2012 (and 2017.) But other greats, such as Attila Pavlath have done the same, so it's not unheard of.

If you read the December *Vortex* you would have a sense of why someone would want to be Chair: it's a great Section. Past Chair Lee noted our Section's leadership in the ACS Project SEED thanks to Elaine Yamaguchi and others. Alex Madonik noted the extensive array of outreach activities. We have a very active Women's Chemists Committee and several energetic Student Affiliate groups. We're a notable presence in all of the Bay Area's science festivals. Our Younger Chemists Committee has been growing noticeably the past few years and we even have a fledgling Senior Chemists Committee. There are a lot of ways to get involved; please join us.

As Alicia Taylor takes over as Programming Chair (part of the Chair-Elect role) there's already a few events scheduled in 2020. On Wednesday, January 8, 2020 at 5:30, there will be a Fireside Chat with Dr. Barbara Smith sponsored by our Women Chemists Committee. Dr. Smith is a VP at the Chevron Oronite Company. The event will be held at the Chevron Richmond Technology Center, Building 10 Auditorium.

At the end of January, I will be giving a talk in Chico on the 2019 Nobel Prize in Chemistry, describing the work of John B. Goodenough, M. Stanley Whittingham and Akira Yoshino. The explanation of lithium-ion batteries and their significance will be targeted at a science-interested audience, not strictly chemists. We started this series last year with the help of an ACS Mini-Grant for Innovative Programs. This year we plan to have talks on the prize-winning work in Physics and Medicine (Biology) in addition to the chemistry talk. Check our website (www.calacs.org) for details.

We also have a Section Meeting planned for mid-February, "Imminent Shaking: What Kind of Earthquake Warning is Possible?"

Once again the ACS has scheduled one of its National Meetings in San Francisco, so we will be co-hosting that event along with the Silicon Valley Section. Those events always provide lots of opportunities for member involvement and it's exciting to see the big world of chemistry that is represented. Hang on for a busy 2020.

California Section
American Chemical Society

Women CHEMISTS Committee

All are welcome

Saturday, February 15, 2020

USDA, 800 Buchanan Street Albany, CA 94710

Title
"Imminent Shaking": What Kind of Earthquake Warning is Possible?

Time
10:30-11:00am

Snack and Coffee

11:00am

Discussion and lunch

Reservation
Please register (including lunch or for talk only) by email to office@calacs.org or by phone 510.351.9922. If mailing a check in advance, please make payable to: "California Section ACS" and send to Cal Section office, 2950 Merced Street #225, San Leandro, CA 94577, postmarked no later than February 7, 2020.

Cost

Technical discussion is free
$15 ($7 for students and the unemployed)

Directions
From I-80 W: Take the Albany Exit, and make a left turn onto Cleveland Avenue at the stop sign. Parallel the railroad tracks, and stay on that road until the end, when you must turn left and drive past a USDA gate (on your right). You will reach a signal stop at Pierce and Buchanan; prepare to stop. Stay in the right lane because you will make a right turn very soon into the USDA driveway, where you will be met by a USDA representative for entrance to parking.
From I-80 E: Take the Albany Exit, and exit toward the right at the top of the off-ramp. You will now be on Buchanan Street. Drive toward the signal stop at Pierce and Buchanan; prepare to stop. Stay in the right lane because you will make a right turn very soon into the USDA driveway, where you will be met by a USDA representative for entrance to parking.

Dr. Sarah Minson

About the Speaker

Sarah Minson is a research geophysicist with the U.S. Geological Survey's Earthquake Science Center. Her research interests include using probabilistic inference for seismological problems such as determining the physics of earthquake ruptures, and estimating the slip distribution and predicting the ground motion from earthquakes in real-time for earthquake early warning. She received her B.A. from the University of California, Berkeley, and M.S. and Ph.D. degrees from the California Institute of Technology. Prior to her current position, she was a Mendenhall post-doctoral fellow with the U.S. Geological Survey as well as a post-doctoral fellow at the California Institute of Technology. She is a winner of the Presidential Early Career Award for Scientists and Engineers (PECASE) and a Kavli Fellow (National Academy of Sciences and The Kavli Foundation). More info: https://www.usgs.gov/staff-profiles/sarah-minson.

Abstract

The United States is developing ShakeAlert, an earthquake early warning system that will provide California, Oregon, and Washington with advanced warning of potentially damaging shaking. The hopes for early warning systems are high, but the reality of what can be expected from earthquake early warning is nuanced. Earthquakes don't happen in an instant and don't tell us how big they will become. This means that any forecasts that we make will be imperfect, and the amount of warning will be short: in many cases, only a few seconds of warning will be possible. In spite of these limitations, there could still be significant value to earthquake early warning, especially for people who are willing to adopt a "better safe than sorry" strategy of taking protective action for earthquakes that have only a small chance of causing damage. What kind of warning system would you prefer? One that issues alerts for weak shaking, but also sends alerts for many events that do not go on to produce strong shaking? Or an earthquake early warning system that issues alerts only once ground shaking is expected to be damaging, but there is an increased chance that the alerts could be issued too late? During this talk, you will discover how an earthquake early warning system works, how warnings are issued and how much warning is possible.

Comments on the Integrity of Content and Reprints of Scientific Papers on the Internet

The authors in a recent paper on gluten sensitivity, B. H.. Keirns, et. al, *A Comparative Study of Modern and Heirloom Wheat on Indicators of Gastrointestinal Health,* Journal J. Agric. Food Chem. 2019, 67, 51, 14027-14037, an ACS Journal, draw the conclusion that the modern variety of wheat does not compromise barrier function or contribute to gut inflammation in mice compared to its heirloom predecessor. The title of the abstract and the abstract noted on the ACS website, omitted the words, "in mice" The reprint that appeared on the website of The National Center for Biotechnology, a NIH publication also left out the same two words.

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It is Elementary (Part 5)

Bill Motzer

In celebration of the 150th anniversary of Dmitri Mendeleev's original periodic table, in Part 3 (November 2019 Vortex) I discussed the discovery, mostly by British and Scottish physicists and chemists, of Group 18 elements known as the noble gases. In Part 4 (December 2019 Vortex), I discussed the amazing discoveries of the radioactive elements polonium (Po, Z=84) and radium (Ra, Z=88 by Marie and Pierre Curie and francium (Fr; Z=87) by Marguerite Catherine Perey.

In the late 1800s and early 1900s, the new science of radiochemistry was extremely competitive with many chemists and physicists endeavoring to find additional radioactive elements and their isotopes. In 1899, French chemist Andre´Louis Debierne (1874-1849) discovered actinium (Ac, Z=89) by extracting it from the uranium (U, Z=92) pitchblende (largely uraninite or U_3O_8) ore. Actinium isotopes naturally occur with Ac-227 as a transient member of the U-Ac decay series, beginning with U-235 or plutonium-239 (Pu, Z=94) and ending with stable lead-207 (Pb, Z=82). Ac-238 is a transient member of the thorium (Th, Z=90) decay series, beginning with Th-232, ending with stable Pb-208. Ac-235 is transiently present in the neptunium (Np, Z=93) decay series, beginning with Np-237 (or U-233) and ending with thallium-205 (Tl, Z=81) and near-stable bismuth-209 (Bi, Z=83). Although all primordial Np-237 has decayed, it is continuously produced by neutron knock-out reactions on natural U-238. Actinium is extremely rare: in the U-235 decay series isotopic sequence, one tonne of natural uranium ore contains ~0.2 mg of Ac-227, and one tonne of thorium ore contains ~5 ng of Ac-228.

In 1902, actinium was independently isolated by the German organic chemist, Friedrich Oskar Giesel (1852-1927), who was unaware of its earlier discovery; therefore, he gave it the name emanium. This name was changed to actinium from the Greek actinos meaning "a ray." Because of Debierne's seniority in actiniumís discovery, he is named as its discoverer. Actinium's discovery was important in that it gave the name to the actinide series, a group of 15 currently known similar elements with atomic numbers between actinium and lawrencium (Lr, Z=103). (Note: actinide elements above Lr would begin with unbiunium (eka-actinium) or element 121, a hypothetical chemical element with the temporary IUPAC symbol Ubu until it's actual creation. Discovery or synthesis of this element in an extended periodic table would begin the series of superactinides.)

In 1871, Mendeleev predicted existence of an element between thorium and uranium. However, discovery of this intensely radioactive unnamed element eluded discovery until 1900, when it was separated by the British chemist/physicist Sir William Crookes (1832-1919); however, Crookes was unable to characterize it and named it uranium-X (UX). This new actinide element is now known as protactinium (Pa, Z=91). In 1913, Polish-American physicist Kasimir Fajans (1887-1975) and German chemist Otto Göhring (1889-1915) determined that the new radioactive element decayed by beta emission with a half-life ($t_{1/2}$) of 6.75 hours. This actually was Pa-234, and they named it brevium (Latin for, brevis, meaning "brief" or "short") because of its fast half-life.

In 1915, in Great Britain, English radiochemist, Frederick Soddy (1877-1927), Scottish research chemist, John A. Cranston (1891-1972), and Soddy's principal research chemist, Ada Florence Remfry Hitchins (1891-1972) first isolated Pa-231 with a $t_{1/2}$ of 32,760 years. Hitchins was responsible for isolating such samples from uranium ores and for taking precise and accurate atomic mass measurements that provided the first experimental evidence for the existence of different isotopes. However, Soddy delayed announcement of their discovery because he was called for service during the First World War. Hitchins was also called up for service and in 1918, Soddy and Cranston published

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their paper, but Hitchins was not included as an author. However, Soddy gave her significant credit for her work, without which their discovery may not have been possible.

In 1917 and 1918, at the Kaiser Wilhelm Institute in Berlin, Austrian-Swedish chemist Lise Meitner (1878-1968) and German chemist Otto Hahn (1879-1968) also isolated Pa-231 and are credited with its discovery because their published work preceded that of Soddy and Cranston. Meitner and Hahn changed the name to protoactinium (Greek for protos meaning "first" because it is produced by the radioactive decay of actinium. In 1949, for ease of pronunciation, the IUPAC shortened the name to protactinium.

Lise Meitner went on to be the discoverer of nuclear fission along with Hahn, and Meitner's nephew, Austrian-born British physicist Otto Robert Frisch (1904-1979). Although Meitner spent most of her scientific career as a physics professor and department head at the Kaiser Wilhelm Institute in Berlin, Germany, in the 1930s she lost these positions because of Nazi Germany's anti-Jewish Nuremberg Laws.

In 1938, she fled to Sweden, ultimately becoming a Swedish citizen. Hahn, although anti-Nazi, remained in Germany, publishing their discovery alone because the regime would not recognize achievements of Jewish scientists or allow them to publish in scientific journals. Therefore, Meitner and Frisch did not share in 1944's Nobel Prize in Chemistry for the discovery of nuclear fission, which was awarded solely to Hahn. However, between 1924 and 1947, Meitner was nominated 19 times for the Nobel Prize in Chemistry, and between 1937 and 1965, 29 times for the Nobel Prize in Physics. In 1992, she was posthumously honored with the naming of chemical element meitnerium (Mt, Z=109).

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The authors did note that some support for the study came from the The Oklahoma Wheat Commission. That information is not directly provided in the various reprints or summaries on the internet.

One can argue that Journal Editors should not need to offer clarifying statements regarding conclusions made by Authors. By design and tradition published papers are directed to others in the field who will discover and report on any limitations and deficiencies. That gets reported and little harm is done. However sometimes a study is not primarily directed to the scientific community, but is for commercial and nonscientific purposes. It appears to this writer that the Keirns' paper is primarily directed to influence consumers on their food purchases. The study selected a very limited number of wheat products in either of the wheat categories, did not include the manufacturing process in terms of its effects on the agents that are the cause of "gluten sensitivity" nor did they show potential variability of sensitivity depending which agents caused the reactions. All of this information was available in a previously published study. See page 8 this issue for details..

When information is presented by organizations like ACS and NIH, a meaningful effort should be made by either the organization or the editors of the Journals to provide clarifying statements that would help non-technical readers and others to better interpret conclusions and limitations of studies particularly on issues regarding food or health related products. The Editors of the Journal that originally accepted the paper made a poor judgement call by not offering appropriate clarifying statements.

Lou Rigali, Editor

AI and Chemistry: Protein Engineering and East Bay Biotech Meeting Report

Nicki Davis, PhD

On Tuesday, November 19, 2019, a full-capacity crowd of 40 gathered at Amyris in Emeryville to hear three experts discuss applying artificial intelligence (AI) and machine learning (ML) to protein engineering. The event was hosted by the California Section of the American Chemical Society (CALACS). Panelists included Yue Yang, PhD, Director of Program Management at Amyris; Louis Metzger, PhD, Chief Scientific Officer at Tierra Biosciences; and Loren Perelman, PhD, Vice President of Scientific Solutions at Riffyn.

Dr. Yang showed how Amyris uses high-throughput enzyme engineering (EE) of *Saccharomyces cerevisiae* strains for commercial-scale production of natural products. EE requires multiple cycles of design/build/test to produce *S. cerevisiae* strains with enzymes optimized to synthesize a specific target molecule from sugar. Amyris has automated their strain engineering process to produce and screen 12,000 enzyme variants per week, increasing their throughput 1000-fold in ten years. Future plans for EE include using ML to integrate knowledge of enzyme structure, catalysis mechanisms, genotypic data, phenotypic data, and data quality control.

Dr. Metzger showed how Tierra Biosciences uses its synthetic biology platform to discover new molecular entities (NMEs) for applications in pharma, industrial biotech, and agriculture—molecules that might otherwise remain hidden inside the complex metabolism in living cells. Their technology simplifies the problem by removing biosynthetic pathways of interest from the cell and then studying them *in vitro.* This isolation allows fine-tuning of reaction conditions and rapid assessment of proteins' relative expression levels and other functionalities without interference from other cellular processes. Using AI with these high-quality data sets will illuminate patterns of protein expression and folding. AI might even lead to the Holy Grail of protein structure biology, the ability to predict the 3D structure of a protein from its amino acid sequence.

Dr. Perelman showed how the Riffyn Software Development Environment (SDE) addresses a critical issue in using the large amounts of experimental and process data produced by technologies like those of Amyris and Tierra Biosciences for AI... the need to consolidate and show interrelationships among the data. At present, much of this data is stored in spreadsheets and other files and must be consolidated manually...a time-consuming and error-prone process. In fact, companies might spend up to 80% of their development time consolidating their data to achieve the quality required for meaningful analysis by AI. Unlike electronic lab notebooks (ELNs) and laboratory information management systems (LIMS), Riffyn SDE organizes information around a process flow diagram. This approach enables researchers to show connections between different processes and experiments, and to use versioning to track changes in processes. Scientists can record not only data tables, but also workflows, videos, PDFs, analysis scripts, and other types of files. Because all of the data is stored in one repository and because the relationships among the data are pre-defined, there is no need for manual data consolidation.

The program ended with a lively question and answer session between the speakers and the audience.

We are grateful to Amyris for providing the venue for this program. Nicki Davis is a longtime member of the American Chemical Society (ACS) with experience in NMR spectroscopy and cheminformatics. She is also an Associate Fellow of the Society for Technical Communication (STC).

A Grounded Guide to Gluten: How Modern Genotypes and Processing Impact Wheat Sensitivity (Volume 1)

Lisa Kissing Kucek, Lynn D. Veenstra, Plaimein Amnuaycheewa, Mark E. Sorrells,
First published: 17 February 2015

The role of wheat, and particularly of gluten protein, in our diet has recently been scrutinized. This article provides a summary of the main pathologies related to wheat in the human body, including celiac disease, wheat allergy, nonceliac wheat sensitivity, fructose malabsorption, and irritable bowel syndrome. Differences in reactivity are discussed for ancient, heritage, and modern wheats. Due to large variability among species and genotypes, it might be feasible to select wheat varieties with lower amounts and fewer types of reactive prolamins and fructans. Einkorn is promising for producing fewer immunotoxic effects in a number of celiac research studies. Additionally, the impact of wheat processing methods on wheat sensitivity is reviewed. Research indicates that germination and fermentation technologies can effectively alter certain immunoreactive components. For individuals with wheat sensitivity, less-reactive wheat products can slow down disease development and improve quality of life. While research has not proven causation in the increase in wheat sensitivity over the last decades, modern wheat processing may have increased exposure to immunoreactive compounds. More research is necessary to understand the influence of modern wheat cultivars on epidemiological change.

Introduction

Wheat (*Triticum* spp.) has been consumed by humans for over 8500 years, and currently supplies about 20% of global dietary protein (Braun and others 2010). Recently, the role that wheat, and particularly gluten proteins, play in our diet has been scrutinized. The public discourse, however, often vacillates between extreme viewpoints on the basic question, "Is gluten good or bad for human health?" The facts are often muddled and incomplete on both sides. Gluten-free diet promoters have described modern wheat as a "perfect, chronic poison" (Davis 2011), while commodity groups have countered that "wheat gluten isn't bad" (National Association of Wheat Growers 2013).

Divided viewpoints also exist when interpreting epidemiological trends. Although studies have suggested that celiac disease has increased 2- to 4-fold over the last 50 years (Lohi and others 2007; Rubio-Tapia and others 2009), causes have not been fully determined. Several authors have questioned whether the last 60 years of breeding produced wheat varieties with more reactivity (Davis 2011; Junker and others 2012), while others consider modern wheat processing to be implicated in epidemiological changes (Di Cagno and others 2010). Without understanding why wheat sensitivity has increased in the population, policy makers cannot effectively address the problem. To help inform consumers, researchers, and policy makers, this article provides a comprehensive summary of (1) the compounds in wheat that can cause wheat sensitivity; (2) the pathologies associated with wheat components in the human body; (3) the differences in reactivity among ancient, heritage, and modern wheats; and (4) the impact of processing methods on wheat components and wheat sensitivity.

Components in Wheat That Can Cause Sensitivity

A grain of wheat is mostly composed of carbohydrates, proteins, lipids, and minerals. While these components can provide basic dietary sustenance for most people, consuming wheat causes negative responses in a small subset of the population. Not all components of the wheat kernel, however, are equally causative of sensitivity to wheat. This

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section introduces wheat proteins and fructans, which are most commonly implicated in various types of wheat sensitivity.

Wheat proteins can be classified into 3 main types called gluten, globulin, and albumin. While glutens mainly supply nitrogen to growing seedlings, globulin and albumin proteins serve other specific functions, such as for enzymes, enzyme inhibitors, and structural elongation. The term gluten defines a very diverse and complex group of two water insoluble wheat proteins: gliadin and glutenin. Gliadins are prolamin proteins which are rich in proline and glutamine. The hydrophobic proline is relatively bulky, and thus provides viscosity to dough, allowing it to flow and rise. With a classification system based on repetitive amino acid sequence patterns, gliadins can be grouped into α, β, γ, and ω types. Glutenins are polymeric proteins that provide the elasticity and strength to dough, allowing bread to hold its shape. Glutenins can be classified based on electrophoretic mobility at acidic pH into high molecular weight (HMW) and low molecular weight (LMW) types. Similar storage proteins in barley (*Hordeum vulgare L.*) and rye (*Secale cereale L.*) are termed hordein and secalin, respectively.

During gastrointestinal digestion, each type of wheat protein breaks down into a wide array of peptides of varying lengths. The rich proline residues in glutens create tight and compact structures that can be difficult to digest (Arentz Hansen and others 2002). Certain types of these digestion-resistant gluten peptides are found to mediate adverse immune reactions in predisposed individuals.

Amylase-trypsin inhibitors (ATIs), which are albumin proteins, are also implicated in wheat sensitivity. As plant defense proteins, ATIs can block animal enzymes from digesting starch and glycogen in the grain. ATIs have diverse conformational structures that are specific to the enzymes of different animal species, leading some ATIs to affect insect pests without acting strongly against human enzymes (Franco and others 2000). ATI fractions 0.19 and 0.38, which are classified based on fractionation in chloroform and electrophoretic mobility, were found to be active against α-amylase in human saliva and pancreas, respectively (Choudhury and others 1996). ATIs are also found in wheat, rye, triticale, and barley.

In addition to seed proteins, wheat also contains clinically relevant carbohydrates known as fructans. Fructans are fructose polymers with, or without, one glucose conjoined by β-glycosidic linkages (Haskå and others 2008). Fructans can be classified based on their β-glycosidic bond pattern (linear of branched) and the degree of polymerization (short or long). Linear fructans include inulin and levan/phlein which contain β(2–1) and β(2–6) bonds, respectively. Branched fructans are graminan-type and contain a mixture of β(2–1) and β(2–6) bonds. In wheat, these polymers serve the purpose of increasing tolerance to cold and drought (Calderon and Pontis 1985; Hendry 1993).

Fructans are considered dietary fiber as humans are unable to hydrolyze the β-glycosidic bonds. Fructans pass through the upper gastrointestinal tract without undergoing digestion and arrive in the large intestine, where Bifidobacteria and other probiotics can utilize and cleave the β-linkages (Playne and Crittenden 1996). Fructans are generally beneficial for most individuals by promoting the growth of healthy gut probiotics, improving stool frequency, and adding fecal bulk (Den Hond and others 2000; Roberfroid 2005; Kleessen and others 2007). Evidence indicates that fructans may reduce fasting insulin levels and thus regulate satiety (Jackson and others 1999; Maziarz 2013) as well as increase absorption of minerals and trace elements (Scholz-Ahrens and Schrezenmeir 2007). However, consumption of high levels of fructans (>15 g/d) may increase bloating, flatulence, and

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abdominal discomfort (Grabitske and Slavin 2009). While the United States population consumes an average of 3.91 g fructan/d, which is well below the 15 g/d threshold, other global populations consume up to 20 g/d (Moshfegh and others 1999; Shepherd and Gibson 2006).

Although wheat is the major source of fructans in American diets, fructans are also found in 15% of all flowering plants, including artichoke, banana, broccoli, garlic, leek bulb, melon, onions, white peach, and rye (Nelson and Smith 1986; Roberfroid 2005; Muir and others 2007; Fedewa and Rao 2014). Recently, fructans have been grouped into a large family of dietary carbohydrates called fermentable oligosaccharides, disaccharides, monosaccharides, and polyols (FODMAPs), which can be fermented by bacteria in the large intestinal tract. In addition to fructans, FODMAPs includes sorbitol (stone fruits), raffinose (legumes, lentils, cabbage, Brussels sprouts), and lactose (dairy; Shepherd and others 2008).

Disease Pathologies Associated with Wheat

This section reviews the various sensitivities and intolerances that are found to relate to wheat components including wheat allergy, celiac disease, and non-celiac wheat sensitivity (NCWS), fructose malabsorption, and irritable bowel syndrome (IBS).

Celiac disease

Celiac disease is defined as a chronic, immune-mediated enteropathy precipitated by exposure to dietary gluten in genetically predisposed individuals with human leukocyte antigens (HLAs) DQ2 and/or DQ8 (Ludvigsson and others 2013). During digestion, some wheat proteins that are resistant to proteolytic degradation create relatively large peptides. In individuals with celiac disease, some gluten peptides behave like stress-inducing agents that modulate intestinal epithelia and immune cells (Tuckova and others 2002; Londei and others 2005; Thomas and others 2006; Cinova and others 2007), while a few gluten peptides mediate increased intestinal epithelial permeability and increase peptide contact with reactive immune cells (Fasano and others 2000; Clemente and others 2003; Lammers and others 2008; Tripathi and others 2009). The digestion-resistant gluten peptides are translocated or absorbed to lamina propria (Terpend and others 1998; Schumann and others 2008) where the peptides bind to HLA DQ2 or DQ8 on antigen presenting cells. Due to presence of glutamine and proline in the amino acid sequence, a number of gluten peptides directly bind DQ2 or DQ8 in the binding groove while other peptides require prior modification to enhance binding. The HLA DQ2 and DQ8 receptors preferentially bind peptides with negatively charged amino acids and bulky amino acids at certain anchor residues (Tjon and others 2010). Moreover, tissue-bound transglutaminase selectively deamidates glutamine to create glutamic acid, which allows certain gluten peptides to fit in the binding pockets of HLA DQ2 and DQ8 (van de Wal and others 1998; Arentz-Hansen and others 2000; Vader and others 2002a; Kim and others 2004; Stepniak and others 2005). Once bound to HLA, antigen presenting cells deliver gluten peptides, called T cell epitopes, to T cells. The gluten-restricted T cells proliferate and differentiate into effector Th1 cells that mediate intestinal inflammation through secretion of proinflammatory cytokine interferon-gamma (IFN-γ). The T cells reactive to the tissue transglutaminase could also lead to destruction of the epithelia through generation of autoreactive antibody (Salmi and others 2006; Lindfors and Kaukinen 2012).

Editor's note

Volume 2 of the above article will be continued in February followed by Volume 3 in March which will include the role of glutens in Celiac disease, variations in wheats, the role of processing, and the list of references.

BUSINESS DIRECTORY

SEARCHING FOR THAT SPECIAL JOB?

There are many companies and organizations searching for chemical and biochemical personnel to fill important jobs in their organizations.

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- http://www.calacs.org/page.asp?id=22

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