



the

# CORNUCOPIA

including AGFD abstracts for the

240th American Chemical Society National Meeting

August 22 - 26, 2010

in

## BOSTON

ALYSON MITCHELL, Program Chair

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visit our website: <http://agfd.sites.acs.org>

deadline for submission of content for Spring 2011 Cornucopia: January 15

## MESSAGE FROM THE CHAIR

The Spring 2010 ACS National Meeting in San Francisco was a huge success with over 18,000 meeting attendees, and the Division of Agricultural and Food Chemistry contributed over 270 presentations. I thank the symposium organizers, sponsors, speakers, division volunteers and presiding officers for their contributions to the AGFD program.

Alyson Mitchell, AGFD Chair-elect and Program Chair, has put forth an exceptional effort organizing the AGFD technical program for the 240<sup>th</sup> ACS National Meeting in Boston. The Division will have three rooms of programming throughout the entire national meeting. AGFD has several symposia which fall under the "Chemistry for Preventing and Combating Disease" theme lead by thematic program co-organizers John Finley (AGFD councilor) and Kenneth Jacobson. In addition, our Division has several award symposia planned for Boston. On Sunday August 22, we will hold the first AGFD Undergraduate Research Symposium and the annual AGFD Young Scientist Award Symposium. On Monday and Tuesday of the meeting, AGFD will honor Terry Acree as the recipient of the Award for the Advancement of Application of Agricultural and Food Chemistry, and his special contributions to the division.

Developing timely symposia is a major function of AGFD. The Subdivisions Joint meeting and Future Programs meeting promote this effort and are scheduled for Sunday and Monday of the national meeting. The AGFD Business meeting will be held on Tuesday, with the AGFD Poster Session and Social Hour in the afternoon, and the AGFD Banquet in the evening.

AGFD has a new website, <http://agfd.sites.acs.org/>, which highlights many activities of the Division, including the online version of the Cornucopia, the AGFD Future Programs document, a calendar of upcoming events, and access to many additional AGFD and ACS resources. The site also features online interviews of several AGFD presenters. Content for the website can be contributed to our webmaster Victoria Finkenstadt ([victoria.finkenstadt@ars.usda.gov](mailto:victoria.finkenstadt@ars.usda.gov)).

Selected presentations at recent ACS National Meetings are now available online through the ACS website ([www.acs.org](http://www.acs.org)). AGFD-related presentations include the recent Sterling B. Hendricks Memorial Lectureship presentations by Charles Arntzen (2009) and Chris Somerville (2010).

Food is a great topic to communicate key concepts of chemistry, and next year we will be celebrating the International Year of Chemistry (IYC). Agricultural and food chemists have a special opportunity during next year to communicate the importance of chemistry using food-related concepts familiar to many, including non-chemists. I invite AGFD members and colleagues to use AGFD resources to highlight their IYC activities, such as the website, Cornucopia, or ACS Network.

Finally, I would like to express my sincere appreciation to the division volunteers for their contributions and dedication to AGFD. Special thanks are in order to our Program Chair Alyson Mitchell for an outstanding effort with the Fall 2010 AGFD program, Hospitality Chair Charles Brine for organizing the social events, and Cornucopia Editor-in-Chief Carl Frey.

Michael Appell  
2010 AGFD Chair  
[michael.appell@ars.usda.gov](mailto:michael.appell@ars.usda.gov)

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Staff	C. Kent, L. Lane, J. Olsen		

## FUTURE PROGRAMS

submit abstracts via the ACS Program & Abstract Creation System (PACS) - [www.acs.org](http://www.acs.org) click on Meetings

### **ANAHEIM - March 27-31, 2011**

**AGFD International Year of Chemistry Symposium** - Deepthi Weerasinghe [dkweerasinghe@att.net](mailto:dkweerasinghe@att.net) Michael Appell USDA [michael.appell@ars.usda.gov](mailto:michael.appell@ars.usda.gov) Alyson Mitchell, U. of California, Davis [aemitchell@ucdavis.edu](mailto:aemitchell@ucdavis.edu) Neil Da Costa, International Flavors and Fragrances [neil.dacosta@iff.com](mailto:neil.dacosta@iff.com)

**Agronomics chemistry of natural resource: local production vs. organic, production cost vs. bringing it to market** (co-sponsored by AGRO)

**Bioactives in Natural Sweeteners** - Navindra Seeram, University of Rhode Island [nseeram@mail.uri.edu](mailto:nseeram@mail.uri.edu)

**Cereal Grains: Chemistry, Nutrition & Health** - Joseph Awika Texas A&M University [jawika@ag.tamu.edu](mailto:jawika@ag.tamu.edu)

**Effect of Agricultural Practices on Bioactive Compounds** (co-sponsored w/AGRO) - Agnes Rimando USDA ARS NPURU [agnes.rimando@ars.usda.gov](mailto:agnes.rimando@ars.usda.gov) Lucy Yu U of Maryland, Dept of Nutrit. and Food Sci. [lyu5@umd.edu](mailto:lyu5@umd.edu)

**General Papers and General Posters** - Alyson Mitchell, University of California - Davis [aemitchell@ucdavis.edu](mailto:aemitchell@ucdavis.edu)

**Graduate Student Symposium** - Charles Brine, CJ Brine and Associates [brinec11@verizon.net](mailto:brinec11@verizon.net)

**IYC Contribution of Women to Agricultural and Food Chemistry**

**IYC Public Appreciation of Agricultural and Food Chemistry: Food Tastes Good**

**Nanotechnology for Food and Agriculture** - Bosoon Park, USDA-ARS-RBRRC [bosoon.park@ars.usda.gov](mailto:bosoon.park@ars.usda.gov) James Oxley, Southwest Res. Inst. [james.oxley@swri.org](mailto:james.oxley@swri.org); Michael Appell, USDA [michael.appell@ars.usda](mailto:michael.appell@ars.usda)

**Tolerant Crops** (co-sponsored w/AGRO) - David Kendra, Quaker Oats [Kendra.David@gmail.com](mailto:Kendra.David@gmail.com)

**Tree nuts** - Fereidoon Shahidi, Memorial University of Newfoundland, Dept. of Biochemistry [fshahidi@mun.ca](mailto:fshahidi@mun.ca)

**Undergraduate Symposium** - Charles Brine, CJ Brine and Associates [brinec11@verizon.net](mailto:brinec11@verizon.net)

**Utilizing waste products** - Fereidoon Shahidi, Memorial University of Newfoundland, Department of Biochemistry [fshahidi@mun.ca](mailto:fshahidi@mun.ca) Alyson Mitchell, University of California, Davis [aemitchell@ucdavis.edu](mailto:aemitchell@ucdavis.edu)

**Vitamins: Effectiveness of Supplements vs. Food** - Gene Lester USDA-ARS [gene.lester@ars.usda.gov](mailto:gene.lester@ars.usda.gov) Michael Appell USDA-ARS-NCAUR [michael.appell@ars.usda.gov](mailto:michael.appell@ars.usda.gov)

**ACS National Meeting Theme for Spring 2011, Anaheim** - Chemistry of Natural Products

### **DENVER - August 28 - September 1, 2011**

**AGFD Division Award Symposium** - Alyson Mitchell, University of California, Davis [aemitchell@ucdavis.edu](mailto:aemitchell@ucdavis.edu)

**AGFD International Year of Chemistry Symposium** - Deepthi Weerasinghe [dkweerasinghe@att.net](mailto:dkweerasinghe@att.net) Michael Appell USDA-ARS-NCAUR [michael.appell@ars.usda.gov](mailto:michael.appell@ars.usda.gov) Alyson Mitchell, U. of Calif., Davis [aemitchell@ucdavis.edu](mailto:aemitchell@ucdavis.edu) Neil Da Costa, International Flavors and Fragrances [neil.dacosta@iff.com](mailto:neil.dacosta@iff.com)

**Agricultural Consumer Safety for the Global Market** (co-sponsored by AGRO) - Aristobulo Loaiza, BASF Corporation [aristobulo.loaiza@basf.com](mailto:aristobulo.loaiza@basf.com)

**Aquaculture and Aquaculture Feed** - Agnes Rimando USDA ARS NPURU [agnes.rimando@ars.usda.gov](mailto:agnes.rimando@ars.usda.gov) Fereidoon Shahidi, Memorial University of Newfoundland, Department of Biochemistry [fshahidi@mun.ca](mailto:fshahidi@mun.ca)

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**Environmentally Derived Food and Beverage Taints and Toxins** (co-sponsored w/AGRO) - Gavin Sacks Food Science and Technology, Cornell University gls9@cornell.edu

**Flavonoid Nutrition and Interactions** - Fereidoon Shahidi, Memorial University of Newfoundland Department of Biochemistry fshahidi@mun.ca

**Food for Extreme Environments** - Neil Da Costa International Flavor and Fragrances neil.dacosta@iff.com

**General Papers and General Posters** - Neil Da Costa International Flavor and Fragrances neil.dacosta@iff.com

**Measuring Flavor Dynamics** - Andy J. Taylor The University of Nottingham andy.taylor@nottingham.ac.uk

**Recent Advances in Analysis of Food and Flavor** - Cynthia Mussinan International Flavors and Fragrances cynthia.mussinan@iff.com Steven Toth International Flavors and Fragrances stephen.toth@iff.com

**Sterling Hendricks Memorial Lecture** (co-sponsored by AGRO &AGFD) - Michael H. Tunick, Dairy Processing & Prod. Res. Unit, USDA michael.tunick@ars.usda.gov Kim Kaplan, USDA, Beltsville, MD kim.kaplan@ars.usda.gov Stephen O. Duke, Natural Prod. Utilization Res. Unit, USDA sduke@olemiss.edu

**Tropical Fruits: Flavors, Color and Health Benefits** - Bhimu Patil, Vegetable & Fruit Improvement Ctr, Texas A&M Univ. b-patil@tamu.edu Kanjana Mahattanatawee, Dept of Food Tech., Siam Univ., Thailand kanjana@siam.edu Coralia Osorio, Dept of Chem., Univ. Nacional de Colombia, cosorior@unal.edu.co Fatima Jabalpurwala, Food Sci and Human Nutrition Dept Citrus Res. and Edu. Ctr Univ. of Florida, Lake Alfred, FL fatimaj@crec.ifas.ufl.edu

**Young Scientist Award Symposium** - Charles Brine, CJ Brine and Associates brinec11@verizon.net

## **SAN DIEGO - March 25-29, 2011**

**Carotenoid Cleavage Products** - Peter Winterhalter, Technische Universität Braunschweig p.winterhalter@tu-bs.de Sue Ebeler, U. of California - Davis seebeler@ucdavis.edu Russell Rouseff U. of Florida RLR@crec.ifas.ufl.edu

**Chocolate: Science and Technology** - Joe A. Vinson, University of Scranton vinson@scranton.edu

**Graduate Student Symposium** - Charles Brine, CJ Brine and Associates brinec11@verizon.net

**General Papers and General Posters** - Neil Da Costa, International Flavor and Fragrances neil.dacosta@iff.com

**Hispanic Foods** co-sponsored by AGRO - Michael H. Tunick, Dairy Processing and Products Research Unit, USDA, ARS, Eastern Regional Research Center michael.tunick@ars.usda.gov Elvira D. De Mejia, Univ. of Illinois - Urbana-Champaign, Dept. of Food Science and Human Nutrition edemejia@uiuc.

**Metabolism and Bioavailability of Bioactives** - Alyson Mitchell, University of California, Davis aemitchell@ucdavis.edu Navindra Seeram, University of Rhode Island nseeram@mail.uri.edu

**Undergraduate Symposium** - Charles Brine, CJ Brine and Associates brinec11@verizon.net

## **PHILADELPHIA - September 9 - 13, 2012**

**AGFD Division Award Symposium** - Neil Da Costa, International Flavor and Fragrances neil.dacosta@iff.com

**Discovering Active Compounds** - John Finley, Louisiana State University Agcenter JFinley@agcenter.lsu.edu

**Essential Oils: Natural Materials for Flavor, Fragrance and Bioactives** - Neil Da Costa, International Flavor and Fragrances neil.dacosta@iff.com

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**General Papers and General Posters** - Neil Da Costa, International Flavor and Fragrances neil.dacosta@iff.com

**Instrumental Methods for the Analysis of Bioactive Molecules** (co-sponsored by AGRO) - G. K. Jayaprakasha; Texas A&M University gjayaprakasha@ag.tamu.edu Bhimu Patil; Texas A&M University b-patil@tamu.edu

**Snack Foods** - Fereidoon Shahidi Memorial Univ. of Newfoundland, Dept. of Biochemistry fshahidi@mun.ca

**Synthesis of Natural Products: New Reagents and Reactions** - Michael Appell; USDA-ARS-NCAUR michael.appell@ars.usda.gov Richard Petroski USDA-ARS-NCAUR richard.petroski@ars.usda.gov

**Young Scientist Award Symposium** - Charles Brine, CJ Brine and Associates brinec11@verizon.net

**Other PROGRAMS and SYMPOSIA** - unscheduled or beyond 2012

**Authentication and Adulteration of Food** - Fereidoon Shahidi Memorial University of Newfoundland, Department of Biochemistry fshahidi@mun.ca

**Colorants and Pigments** - Fereidoon Shahidi, Memorial University of Newfoundland, Department of Biochemistry fshahidi@mun.ca Kazuo Miyashita Hokkaido University kmiya@fish.hokudai.ac.jp

**Nano-Biotechnology in Foods and Nutraceuticals** - Fereidoon Shahidi Memorial University of Newfoundland, Department of Biochemistry fshahidi@mun.ca

**Natural Products for Health and Pharmaceuticals and Biotech** - John Finley, Louisiana State University Agcenter JFinley@agcenter.lsu.edu

**Urban Agriculture** (AGRO-cosponsor) - Michael Appell, USDA-ARS michael.appell@ars.usda.gov

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## AGFD Executive Committee MEETING MINUTES

Sunday, March 21, 2010 Moscone Center, San Francisco, CA *Takes place at each ACS National Meeting*

Attendees: Michael Appell, Charles Brine, Keith Cadwallader, Neil Da Costa, John Finley, Ch-Tang Ho, Guddadarang Jayaprakasha, Jane Leland, Alyson Mitchell, Michael Morello, Cynthia Mussinan, Bhimu Patil, Michael Qian, Rajah Rajasekaran, Agnes Rimando, Sara Risch, Gavin Sacks, Navindra Seeram, Fereidoon Shahidi, Michael Tunick, Deepthi Weerasinghe

AGFD Chair Michael Appell called the meeting to order at 5:10 p.m.

The **minutes** of the previous meeting were approved with no changes.

Cynthia Mussinan gave the **Treasurer's Report**. Her Annual Report for ACS was e-mailed to Executive Committee members before the meeting. The investments have been recovering. The treasury has \$411,000, and the Division will receive another \$28,000 from ACS for dues, attendance, posters, etc. The checking account contains \$62,000, and Cynthia will ask the Investment Committee Chair if some of this money should be moved into mutual funds or another type of account. The AGFD dues for next year will remain at \$8.

In the **Program Report**, Mike Appell noted that there were 28 oral sessions and one poster session in San Francisco, with more than 270 papers overall. The meeting has over 12,000 papers scheduled, a record, and may be the largest ACS meeting ever held. The Hendricks Award and reception, poster social hour, and Chair's reception are all on Tuesday. Alyson Mitchell said that 18 symposia were planned for Boston, many in response to the meeting theme (Chemistry for Preventing and Combating Disease), and that some will have to be combined to create a

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manageable program. Some symposia are being cosponsored with the American Society of Nutrition. Mike Morello moved that \$750 be budgeted for 40 sessions in Boston, and the motion passed. The **International Year of Chemistry** is in 2011, and symposia on public perceptions of food chemistry and contributions of women to agricultural and food chemistry were suggested. Keith Cadwallader and Mike Morello of the **Multidisciplinary Program Planning Group** said that the themes for Anaheim, Denver, San Diego, and Philadelphia are scheduled to be "Chemistry of Natural Resources" and "Chemistry of Air, Space, and Water," "Chemistry of Life," and "Materials for Health and Medicine," respectively. An idea about an alternate format for posters, in which five-minute overviews would be given at the start of the session, was suggested. It would take place in one of the regular meeting rooms in the late afternoon or early evening. Neil Da Costa attended a meeting about IUPAC, with several ACS tie-ins discussed.

Mike Morello gave the **Councilor's Report**. The Spring 2014 meeting slated for Washington, DC will be moved to Dallas. The Sunday evening Exposition openings will be discontinued starting with the Boston meeting. No-shows for presentations will have their abstracts pulled out of the Chemical Abstracts Service.

Fereidoon Shahidi announced that the **Award** for the Advancement of Application of Agricultural and Food Chemistry will go to Terry Acree. The Executive Committee approved this unanimously. He also said that the Fellow Awards will be selected soon. Chi-Tang Ho reported that no suitable nominations for the Roy Teranishi Graduate Fellowship in Food Chemistry were received, so this award will not be given this year. Charles Brine said that the Graduate Student Award winner will be announced later at this meeting (they were Josephine Charve, first place, and Ying Zhong, second place). He also reported that applications are arriving for the Young Scientist and Undergraduate Student Awards, and that he will work with Division of Chemical Education on the latter. Mike Tunick reported that Chris Sommerville won the Sterling Hendricks Memorial Lectureship Award. Charlie suggested Terry Acree for a Special AGFD Distinguished Service Award, but it was decided to nominate him for an ACS Fellow Award instead. Several other candidates for ACS Fellow were identified.

Mike Appell reported for **Cornucopia** editor Carl Frey and said there were problems obtaining abstracts for the newsletter from the new abstract system. He is publishing the Cornucopia three weeks before each meeting.

**Hospitality/Public Relations** Chair Charlie Brine has arranged the reception for this meeting, in which ACS Fellow winner Glenn Fuller will be recognized. He is the only AGFD member in the first class of ACS Fellows.

Mike Appell reported for **Membership** Chair Lucy Yu and said that AGFD had 2799 members, including 20 who are celebrating 25 years with the Division.

DK Weerasinghe, the Chair of the **Nominating Committee**, informed the full AGFD membership about openings in the Executive Committee and solicited nominations. Almost 20 responses were received. A nominating committee of Mike Appell, Charlie Brine, Keith Cadwallader, Neil Da Costa, John Finley, Chi-Tang Ho, Jane Leland, Alyson Mitchell, Mike Morello, Cynthia Mussinan, Mike Tunick, and DK Weerasinghe decided on Sara Risch as the candidate for the Councilor position and Russell Rouseff and Bhimu Patil for Alternate Councilor.

Chi-Tang Ho and John Finley reported that the **Journal** is targeting a rejection rate of 60%, up from the low 50s. A new journal on bioactives is being discussed.

Mike Appell reported for Victoria Finkenstadt about the **Website**, which has been moved to a new ACS server. Vicky's efforts were acknowledged.

In **New Business**, Mike Appell said that members will have to create an online ID to access the abstract submittal system. Cynthia Mussinan suggested that we develop a protocol for sending officers to training. The Executive Committee approved using the officer rotation. Alyson Mitchell said that the Communications Committee will approve messages to be e-mailed to the membership, and that we should limit their number because of complaints from some members. If a message could present a problem, it will be sent to the Executive Committee first. We will try to make sure other divisions and ACS entities approach AGFD to co-organize food-related programs.

The meeting was adjourned at 7:20 p.m.

*Submitted by Michael Tunick, AGFD Secretary*

## ELECTION OF DIVISION COUNCILORS

If you are a full member of AGFD, please vote by marking the ballot below, **signing in the space provided**, and printing your name legibly beneath the signature. Fold the page on the dotted lines so that the ballot is on the inside and the mailing address on the outside. Tape or a staple the open edges, affix postage and mail. Ballots must be received by November 1, 2010. After your membership is verified, the portion of the form with your signature and name will be removed prior to opening and counting the ballots. Thank you for exercising your democratic franchise.

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Vote for 1 Councilor for the 2011 - 2013 term (or write in your own candidate)

**Sara Risch**

write in  \_\_\_\_\_

Vote for 2 Alternate Councilors for the 2011 - 2013 term (or write in your own candidates)

**Russell Rouseff**

**Feridoon Shahidi**

write in  \_\_\_\_\_

write in  \_\_\_\_\_

----- fold down & tape -----

member  
signature \_\_\_\_\_  
member  
printed name \_\_\_\_\_

affix stamp
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to **Michael H. Tunick**  
**USDA-ERRC**  
**600 E. Mermaid Lane**  
**Wyndmoor PA 19038**

**BEANTOWN**

1	2	3	4	5	6	7	8	9	10	11	12	13
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79							80			81		

**A prize to the first to fax**

**a correct solution to:**

**Carl Frey at Pepsi-Cola R&D**

**914-749-3329**

**Congratulations to the**

**winner of the coveted**

**Spring 2010 prize -**

**Michael Auerbach**

**of MARS, Inc.**

**ACROSS**

- 1 --- for one and one for ---
- 5 film studio founded by Pickford and Chaplin
- 6 Boston ---- or banana ----
- 14 follows 'Ode' in titles
- 15 after sun passes its zenith
- 16 Boston harbor craft
- 17 Shrek, for instance
- 19 corp. spin dept.
- 21 ruby or sapphire
- 22 stable keeper?
- 24 useful PC programs
- 27 airwaves overseer
- 30 short for tin
- 31 "----- is fatal to prejudice" - Mark Twain
- 33 largest city in Nebraska
- 35 assists
- 37 MIT degree option
- 38 a barbarian or an O'Brien
- 39 Fleming or Anderson
- 40 it can be genetic
- 42 sign of a sell-out
- 43 make a mistake

- 44 holiday preceder
- 46 a feel good place
- 47 corrida appreciation cry
- 48 fuel economy measure
- 49 'Livestrong' Armstrong
- 51 it can be a line or a stick
- 52 defenses for castles
- 54 Moscow affirmative
- 55 stiff drinks
- 57 get up
- 58 empower
- 60 blood factor
- 62 RR stop
- 63 1857 ---- Scott decision
- 64 *West Side Story* song
- 66 Grecian 'earth'
- 68 Elliott's unique friend
- 70 guns the engine
- 71 theatre?
- 76 promo
- 78 teachers's --- or --- peeve
- 79 dumping *Camellia sinensis* in Boston Harbor
- 80 get up partner
- 81 Barcelona Olympics win

**DOWN**

- 1 elemental units
- 2 Boston gateway
- 3 swinish triglycerides
- 4 'Hands --!' or 'Heads --!'
- 5 fruity energy drink
- 6 neighbor of NY and RI
- 7 at. no. 44
- 8 albumin sources
- 9 Honest ---
- 10 one parent
- 11 another parent
- 12 Take -- or leave -- !
- 13 at. no. 99
- 18 consumed
- 20 Toyota SUV model: --- 4
- 23 A-Team gold chain wearer
- 25 jury box member
- 26 best request opener
- 27 spreads wide
- 28 Boston/Cambridge divider
- 29 paddler's craft
- 32 '-- *Time Goes By*'
- 33 ---- mom or ---- hedral
- 34 NYY ace relief pitcher

- 36 negotiate
- 40 it can be legal
- 41 sum of an org's knowledge and trade secrets
- 43 Ms. Thompson & Ms. Lazarus
- 44 logical partner of 'if' and 'then'
- 45 Santana's '*Oye Como --*'
- 50 sugar ---- or candy ----
- 51 transparent
- 53 a famous Eliot
- 55 guitarist King
- 56 nightmarish street
- 59 Gator ---
- 61 must
- 63 portal
- 65 Emilio Estevez flick '---- *Man*'
- 66 rip off
- 67 important time period
- 69 it can be radioactive
- 71 JFK piloted craft: -- 109
- 72 the 24 hour race of -- Mans
- 73 abusers recovery group
- 74 hourly worker benefit
- 75 M.West flick: -- *Little Chickadee*
- 77 Yoda: '-- or -- not, there is no try'



## AGFD DIVISION MEMBERSHIP APPLICATION

The Agricultural and Food Chemistry Division of the American Chemical Society is a non-profit organization dedicated to the technical advancement of all aspects of agricultural and food chemistry. The Division encourages AGFD technical advancement by -

- organizing AGFD symposia at ACS National Meetings and other venues
- providing workshops in AGFD topics
- publishing proceedings of AGFD symposia
- providing cash awards to leading grad students, post docs, and established AGFD scientists
- publishing *the Cornucopia* newsletter
- hosting social gatherings at national meetings

Join the over 2600 members of the AGFD division. At ACS National Meetings you can meet and discuss division activities at the AGFD hospitality table located near the AGFD technical session rooms. Use the membership application form (below) or join on-line at [www.acs.org](http://www.acs.org) (click on Technical Divisions and then select Join a Division).

<b>APPLICATION FOR AGFD DIVISION MEMBERSHIP (7623P)</b>	
title	
name	
1 <sup>st</sup> address line	
2 <sup>nd</sup> address line	
city	
state	
Zip code	
country	
e-mail address	
phone	
	<b>MEMBERSHIP FEE</b>
check one	(\$2.50 is added for international addresses to cover <i>Cornucopia</i> extra mailing costs)
<input type="checkbox"/>	I am an ACS member and wish to join AGFD (\$8.00 in US, \$10.50 international)
<input type="checkbox"/>	I am not an ACS member and wish to join AGFD (\$10.00 US, \$12.50 international)
<input type="checkbox"/>	I am a full time student and wish to join AGFD (\$5.00 US, \$7.50 international)
<b>Be cool JOIN AGFD</b>	Return application, with payment, to AGFD Membership Chair: Dr. Lucy Yu University of Maryland Department of Nutrition & Food Science, 3303 Marie Mount Hall College Park MD 20742

## 2010 AGFD OFFICERS & COMMITTEE MEMBERS

**Chair** - Serves 1 year. Presides over Division meetings, appoints committees and chairs Spring Meeting Program.  
Michael Appell  
USDA-ARS  
National Center for Agricultural Utilization Research  
1815 N. University St.  
Peoria IL 61604  
309-681-6249  
Michael.Appell@ars.usda.gov

**Chair-Elect** - Serves 1 year. Substitutes for the chair as needed and chairs Spring Meeting Program.  
Alyson Mitchell  
University of California  
One Shields Ave.  
Davis CA 95616-8598  
530-752-1465 aemitchell@ucdavis.edu

**Vice Chair** - Serves 1 year. Assists Chair-elect in developing future technical programs.  
Neil Da Costa  
International Flavors and Fragrances R&D  
1515 Hwy. 36  
Union Beach NJ 07735  
732-335-2110 neil.dacosta@iff.com

**Secretary** - Responsible for Division correspondence and meeting minutes.  
Michael Tunick  
USDA-ARS  
Eastern Regional Research Center  
600 E. Mermaid La.  
Wyndmoor PA 19038  
215-233-6454  
michael.tunick@ars.usda.gov

**Treasurer** - Responsible for Division finances.  
Cynthia Mussinan  
International Flavors & Fragrances R&D  
1515 Hwy. 36  
Union Beach NJ 07735  
732-335-2401 cynthia.mussinan@iff.com

**Cornucopia Editor** - Edits newsletter.  
Carl Frey  
Pepsi-Cola R&D, 100 E. Stevens Avenue,  
Valhalla NY 10595 914-742-4832  
carl.frey@pepsi.com

**Councilors** - Represent Division for 3 years on ACS council.  
John Finley (thru '11),  
jfinley@agcenter.lsu.edu  
Michael Morello (thru '11),  
mike\_morello@quakeroats.com  
Agnes Rimando (thru '12),  
agnes.rimando@ars.usda.gov  
Sara Risch (thru '10),  
sjsrisch@sbcglobal.net

**Alternate Councilors** - Substitute for Councilors that can not attend Council meetings. Serve 3 years.  
Charles Brine (thru '12),  
brinec11@verizon.net  
Keith Cadwallader (thru '11),  
cadwldr@uiuc.edu  
Chi-Tang Ho (thru '10),  
ho@aesop.rutgers.edu  
Russ Rouseff (thru '10),  
rlr@crec.ifas.ufl.edu

**At-Large Executive Committee Members** - Assist in management of Division. Serve 3 years.  
Terry Acree (thru '10), tea2@cornell.edu  
Jane Leland (thru '11),  
jleland@kraft.com  
Robert McGorin (thru '11),  
robert.mcgorin@oregonstate.edu  
Harold Pattee (thru '10),  
Harold\_Pattee@ncsu.edu

**Awards Committee** - Solicits nominations and oversees awards process.  
Chair - Steve Nagy  
agscience@aol.com  
Student Awards - Chi-Tang Ho  
ho@aesop.rutgers.edu  
Fellow Awards - Fereidoon Shahidi  
fshahidi@mun.ca  
Awards Canvassing - Lauren Jackson  
lsj@cfhsan.fda.gov

**Finance** - Monitors the Division's finances for 1 year. Filled by Immediate Past Chair  
Deepthi Weerasinghe,  
dkweerasinghe@att.net

**Hospitality** - Organizes receptions and banquets.  
Charles Brine - brinec11@verizon.net

**Membership** - Responsible for recruitment and retention of Division members.  
Lucy Yu - lyu5@umd.edu

**Nominations** - Develops slate of officers. Serves 1 year. Filled by Immediate Past Chair.  
Deepthi Weerasinghe,  
dkweerasinghe@att.net

**Public Relations** - Publicizes Division.  
Charles Brine - brinec11@verizon.net

**Web Master** - Maintains web site.  
Victoria Finkenstadt,  
victoria.finkenstadt@ars.usda.gov

**Flavor subdivision** - Develops symposia.  
Chair - Mathias Sucan,  
mksucan@aol.com  
Chair-Elect - Kotamballi N.C. Murthy,  
kncmurthy@neo.tamu.edu  
Vice-Chair - Kevin Goodner,  
klg@sensusflavors.com  
Secretary - Gavin Sacks,  
gls9@cornell.edu

**Functional Foods & Natural Products subdivision** - Develops symposia.  
Chair - Richard Petroski,  
richard.petroski@ars.usda.gov  
Chair-Elect - Guddadarang Jayaprakasha,  
gjayaprakasha@ag.tamu.edu  
Vice-Chair - Navindra Seeram,  
nseeram@mail.uri.edu  
Secretary - Gene Lester,  
gene.lester@ars.usda.gov  
2011 Secretary - Luke Howard,  
lukeh@uark.edu

**This space reserved  
for your name.**

**Stop by the AGFD hospitality  
table and find out how you  
can get involved.**

## MUSSINAN'S MEMOIRS

### FRISCO FEATURE

As always, first things first! Here is the Principeza auditioning for the Boston Symphony (actually playing at a church recital!). Turning now to the photo contest. The response was, again, underwhelming. In fact, I only had one entry. Fortunately, Mike Morello, illustrious Councilor from our Division was able to correctly identify all three people, i.e. Marshall Phillips on the right, yours truly in the middle, and Don Withycombe on the left. Marshall, of course, is a long time AGFD member, Councilor, past chair, and associate editor of JAFC. Don Withycombe was an ardent supporter of our Division who passed away in the late '80's. Our Graduate Candidate Award is named for him. So, Mike can look forward to receiving the grand prize of a genuine



18 year old IFF pen and pencil set (may not work) and a hotel pen (which I still have to swipe from the Hilton!) Due to the lack of response, I think I'm gonna give this contest a rest (at least temporarily). So far San Francisco is a great place to have a meeting. Weather is perfect; facilities are nice, and attendance is record-breaking, i.e. more than 20,000. As usual, our programs are very good - - OK enough of that. Having "paid my dues" at Sunday's meetings, Gail and I were off on Monday for our play date. What shall we do? To make a long story short, we decided to rent "go-cars"!! These are sort of like a cross between a motorcycle and a go-cart. They hold two people. You sit essentially on the ground and drive the things right out with the trucks and buses. The most difficult part we found was getting into and out of the darn thing. For Gail, it might have been getting the helmet on and off that was the hardest. Eventually, I mastered a sort of system for getting out, i.e. reaching behind with one arm to haul myself up via the roll bar while jamming one foot under the steering column and pushing. Getting in was somewhat easier. You just sort of stand inside and let your feet slide out from under you. Anyway, this was such fun that we did it all day ~8 hours. The go-car was equipped with a GPS which took us all over San Francisco including down Lombardi Street which really gave the brakes a test. When we finished, I dropped Gail off near her hotel so that she could buy Mike a microscope made out of wire for their 25<sup>th</sup> anniversary (better than when he took her to the expo for their 20<sup>th</sup>!!!) What we both forgot, however, was the fact that I have no sense of direction. This has been featured in numerous memoirs including those from the last meeting. Since the go-car had a GPS, you might think finding the return office would not be a problem. However, it was not that sort of GPS, i.e. not programmable. So here I am riding around trying to find where we started from as I watched the gas gauge plant itself squarely on the 0. To complicate things, the one way streets didn't always cooperate with where I wanted to go. Eventually I pulled over, got out and asked in a store for directions. When I saw the Hilton on the right, I knew I was home. The only problem was that I needed to make a left hand turn, and the road was one way - the wrong way. With no gas, I said no way am I going around the block again. I shot up onto the sidewalk, and the guy came running out to direct me. Hey, I was back, riding on fumes, with only 15min until closing. Most important - - we lived through this and did not crash!!

Next report to come to you from Boston. If you miss the photo contest, please let me know!

**In keeping with the theme for this ACS meeting, Chemistry for Preventing and Combating Disease, AGFD and the American Society of Nutrition are co-sponsoring several symposia:**

**Plenary Session** - Dr. Ames, Oakland Children's Hospital, will talk of diet and chronic diseases. Dr. Susan Roberts, Tufts Univ., will discuss childhood obesity and health outcomes later in life and how food chemistry, nutrition and medicine can together to improve the outcomes. Dr. Deborah Sheely, NIFA Competitive Program will discuss how NIFA funding programs will help influence and support Chemistry/Nutrition/Medicine research (starts Mon. PM)

**Cardiovascular Disease and Diabetes** - addresses obesity and diabetes risk factors, biochemical causes and how diet improvements including fiber, antioxidants and anti-inflammatory components in foods can reduce risk of diabetes and CVD. (starts Mon. PM)

**Nutrition, Brain Aging and Neurodegenerative Disease** - a memorial to the recently passed James Joseph, USDA Tuft's Center on Aging, and his outstanding work in brain biochemistry, provides evidence that diet can play an important role in increasing "brain health span" and prevent or forestall age-related neuronal deficits. The inclusion of and fruits (e.g., berryfruit), beverages (e.g. red wine), fish or walnuts containing compounds with antioxidant/anti-inflammatory properties may prevent neurodegenerative disease and promote healthy brain aging. (starts Tues. AM)

**Agricultural and Food Derived Natural Products for Preventing and Combating Disease** - addresses the chemistry of natural products for their application in disease prevention through in vitro and human intervention studies. Fundamental reasoning of the cause and effect of these natural products can be made possible through researching the structural properties and their putative health beneficial properties - specifically by - 1) Purification and characterization of natural compounds - 2) In vitro model for prevention and combating disease - 3) In vivo model for prevention and combating disease - 4) Human intervention studies. (starts Sun. AM)

**Small Wonders: Peptides for Disease Control** - highlights advances on the structure/function and use of small peptide molecules to control plant and human diseases. Naturally occurring and synthetic peptides can function as a) antimicrobial/anticancer agents, b) immunomodulators, and c) signaling molecules/hormones throughout plant and animal kingdoms. Automated peptide synthesizers and combinatorial peptide chemistry has made it possible for rational synthesis of stable and target specific peptides with increased efficacy to control diseases. (starts Thurs. AM)

**New perspectives on antioxidants** - focuses on three areas of antioxidant understanding - 1) 'mitohormesis', the hypothesis that a small amount of oxidative stress is actually healthy and necessary for prevention of some chronic diseases such as diabetes - 2) a specific gene activation pathway that a large body of research is proving to be extremely important in control of intra-cellular oxidative stress and serves as a model for other potential mechanisms, the NRF2-Antioxidant Response Element axis - 3) natural products that activate antioxidant enzymes, especially those in the NRF2 pathway. The food and nutrition industry should carefully examine such research when developing products that claim "antioxidant" or "anti-aging" potential (starts Weds. AM)

**Antioxidant Analysis: Challenges and Critical Issues** - Antioxidants, phytochemicals distributed throughout the plant kingdom, may protect cells from the damage caused by unstable free radicals. The session will deal with factors influencing extraction of antioxidants from different plants and food matrices, application of different antioxidant methodologies and issues and challenges associated with each antioxidant assay. (starts Wed. AM)

**Antioxidants and Health** - addresses the roles of phytochemical antioxidants in maintaining human health, mechanisms behind effects of most antioxidants on lipid oxidation and other oxidative processes involving vital biomolecules such as protein and DNA, and antioxidant activities of individual or a group of phytochemicals such as polyphenols and carotenoids. (starts Thurs. AM)



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<b>AGFD Program, 240th ACS Nat'l Meeting, Boston, Aug. 22-26, 2010</b>
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AGFD Subdivisions - joint meeting	12:15 - 1:15 pm Sunday	August 22
Executive Committee meeting	5:00 - 8:00 pm Sunday	August 22
Future Programs meeting	12:15 - 1:15 pm Monday	August 23
Poster Session and Social Hour	2:00 - 4:00 pm Tuesday	August 24
AGFD Awards Banquet	6:00 - 8:00 pm Tuesday	August 24

**AGFD technical sessions take place at the Boston Convention & Exhibition Center**

**SUNDAY MORNING August 22**

**Section A Boston Convention & Exhibition Center Room 160A**

**Undergraduate Research Symposium**

C. J. Brine, Presiding                      C. Brine, Organizer

- 8:35 1. Chemical and mathematical approaches to promote the development of functional foods rich in natural antioxidants. J. Hao
- 9:05 2. Investigating the effect of common antioxidants on the generation and fate of pyrazinium radicals in the Maillard reaction. Q. Bin, D. G. Peterson, R. J. Elias
- 9:35 3. Stability of dietary polyphenolics under gastrointestinal conditions. M. A. Krook
- 10:20 4. Starch retrogradation in gluten-free sorghum bread. E. Buckley
- 10:50 5. Accumulation and toxicity of engineered nanoparticles to agricultural crops. J. Hawthorne
- 11:20 6. Total polyphenol antioxidants in legumes: A major source of antioxidants. B. W. Redan, M. G. Coco, J. A. Vinson

**Section B Boston Convention & Exhibition Center Room 161**

**Agricultural and Food Derived Natural Products for Preventing and Combating Disease**

**Purification and Characterization of Natural Compounds**

F. Pellati, G. Gowda, Presid. B. Patil, G. Jayaprakasha, K. Chidambara Murthy, N. P. Seeram, Organizers

- 8:35 7. Comprehensive study of Digitalis Purpurea by selective ionization of cardiac glycosides using ESI-LC-QTrap. F. Shadkami, M. D. Celiz, A. D. Jones
- 9:00 8. Rapid method for the separation of polymethoxyflavones using flash chromatography. R. M. Uckoo, G. K. Jayaprakasha, B. S. Patil
- 9:25 9. Release of bound procyanidins from cranberry pomace by alkaline hydrolysis. B. L. White, L. R. Howard, R. L. Prior
- 10:05 10. Correlating component variability of black raspberry (*Rubus occidentalis* L.) fruit extracts with chemical and biological responses using NMR data and multivariate statistical analysis. F. J. Wyzgoski, R. N. Reese, L. Paudel, P. L. Rinaldi, M. Ozgen, M. M. Giusti, J. Johnson, A. Z. Tulio, J. A. Bomser, J. K. Hardy, A. M. Chanon, J. C. Scheerens, A. R. Miller
- 10:30 11. Metabolic profiling using isotope enhanced NMR spectroscopy methods for disease diagnostics. G. Gowda, D. Raftery
- 10:55 12. Isolation and identification of polyphenolic compounds from Early Black Cranberry (*Vaccinium macrocarpon*), a pest-resistant cultivar. C. A. Dao, C. C. Neto, M. R. Salvas, J. E. Vanden Heuvel, B. T. Murphy

**Section C Boston Convention & Exhibition Center**

**General Papers**

A. Loaiza, N. Da Costa, Presiding      A. Mitchell, Organizer

- 8:35 13. Cranberry flavonol glycoside bioavailability in humans with type-2 diabetes. N. Vorsa, A. P. Singh, T. Wilson, V. Vorsa
- 8:55 14. Selective separation of polyphenols using magnetic beads coated with hydrogen bonding ligands. T. Dong, Q. Zhou, X. Xiong, S. Chen
- 9:15 15. Induction of HCT116 and HT29 colon cancer cell death by cranberry proanthocyanidins via mitogen activated protein kinase pathway. A. M. Liberty, T. P. Ferreira, C. C. Neto
- 9:35 16. Resveratrol as a kcat type inhibitor of tyrosinase enzyme: Potentials as a melanogenesis inhibitor. H. Satooka, I. Kubo
- 10:10 17. Content of nutritional substances in commercial tea beverages. S. Li, C. Lo, N. E. Rawson, P. Lucas-Schnarre, C. Ho
- 10:10 18. Acrylamide in cereal products: Precursors, formation, and control measures. A. Mustafa
- 10:30 19. Surface plasmon resonance (SPR) detection of staphylococcal enterotoxin A in food samples. M. B. Medina

### **Nutritional Chemistry Symposium Sponsored by SOCED, Cosponsored by AGFD**

**SUNDAY AFTERNOON August 22**

**Section B Boston Convention & Exhibition Center Room 161  
Agricultural and Food Derived Natural Products for Preventing and Combating Disease In Vitro Model**

- N. P. Seeram, Org., Presid B. Neelwarne, Presid. B. Patil, G. Jayaprakasha, K. Chidambara Murthy, Orgs
- 1:05 20. Isolation, structure elucidation, synthesis and cytotoxic activity of polyacetylenes and polyenes from *Echinacea pallida*. F. Pellati, A. Chicca, B. Adinolfi, G. Orlandini, F. Prati, P. Nieri, S. Benvenuti
- 1:30 21. Potential therapeutic applications of common agro-food byproducts and Chilean wild plants. J. S. Torres, M. N. Garcia, M. Rubilar, M. Cascante, E. Alvarez, M. Sanchez
- 1:55 22. Compositional characteristics of fruits of hawthorn (*Crataegus* sp.) and emblic leafflower (*Phyllanthus emblica*). B. Yang, H. Kallio, P. Liu, M. Kortensniemi
- 2:20 23. Natural pigments enhance stability of mRNAs of anti-oxidant enzymes in cultured mammalian cells. B. Neelwarne, J. M. Veigas
- 3:00 24. Sugar maple (*Acer saccharum*) phytochemicals: Antioxidant, antibacterial, and cancer cell cytotoxicity properties. L. Li, N. P. Seeram
- 3:25 25. Carrot bisacetylenic oxylipins: Phytochemicals behind the mask of the superfood. B. T. Metzger
- 3:50 26. Beyond olive oil: Active components and health aspects of some less known Mediterranean plant products. N. Kalogeropoulos, A. Chiou, A. C. Kaliora, V. T. Karathanos, N. K. Andrikopoulos

**Section A Boston Convention & Exhibition Center Room 160A  
Young Scientist Award Symposium**

- C. J. Brine, Presiding C. Brine, Organizer
- 1:35 27. Bioactive secondary metabolites from agro-food industrial byproducts as source of dietary supplements. G. Jayaprakasha, B. S. Patil
- 2:05 28. Bioavailability and delivery of nutraceuticals using nanotechnology. Q. Huang
- 2:35 29. Rhizospheric signaling: From positive feedback to innate plant defense. H. Bais
- 3:20 30. Stable isotope dilution assays for quantification of bioactives: Challenges and pitfalls. T. Stark
- 3:50 31. Electrospun nanofibrous membranes: Novel materials for food technology applications. A. Arecchi
- 4:20 32. Analytical techniques ensure performance and quality of encapsulates. D. DiNallo

**Section C Boston Convention & Exhibition Center  
General Papers**

- A. Mitchell, Organizer, Presiding N. Da Costa, K. Mahattanatawee, Presiding
- 1:35 33. Enrichment of the antioxidant activity in potato tuber by ultrasound and electric treatments. K. Hironaka, T. Funato, H. Koaze

- 1:55 34. Enhanced infusion of natural antioxidants into fruits using high hydrostatic pressure processing. S. Mahadevan, M. V. Karwe  
 2:15 35. Pressurized hot ethanol extraction of carotenoids from carrot waste. A. Mustafa, C. Turner  
 2:35 36. New paradigm for microwave extraction of essential oils and natural compounds. D. Gunn  
 2:50 37. Food for thoughts: The potential for food patenting. K. B. Drake  
 3:10 38. In vivo aroma release and sensory perception: The effect of HPMC concentration and viscosity. G. T. Eyres, D. C. Frank, U. Piyasiri, C. M. Delahunty  
 3:30 39. GC-MS and sensory strawberry flavor changes at five maturity stages. X. Du, A. Plotto, E. Baldwin, R. Rouseff

**Careers in Chemistry      What it's Like in the Real World and How Do I Get the Job?**  
**Sponsored by SOCED, Cosponsored by AGFD**

**MONDAY MORNING      August 23**

**Section A      Boston Convention & Exhibition Center      Room 160A**  
**Symposium Honoring Prof. Terry E. Acree on the Occasion of his 70th Year**

- B. Halpern, C. J. Brine, Presiding      C. Brine, Organizer  
 8:05 40. Flavor chemistry and the perception of flavor. T. E. Acree  
 8:45 41. Internet as a research tool for flavor chemistry: FlavorNet and beyond. D. D. Roberts  
 9:15 42. Retronasal smelling: The roles of nasal cavity and oral cavity sensory systems. B. P. Halpern  
 10:00 43. Unexpurgated CHARM of Terry Acree. J. V. Leland  
 10:30 44. Phragrance and pharmacology. S. Firestein

**Section C      Boston Convention & Exhibition Center      Room 160C**

**General Papers**

- A. Rimando, K. Cadwallader, V. Acquarone, Presiding      A. Mitchell, Organizer  
 8:05 45. Rapid screening method for the determination of rodenticide content of commercial bait formulations. D. A. Goldade, D. L. Griffin, D. T. Keller  
 8:25 46. Multiresidue pesticide analysis of botanical dietary supplements by GC-MS/MS and LC-MS/MS. F. Shi, J. W. Wong, K. Zhang, D. G. Hayward, T. H. Begley  
 8:45 47. Determination of diphacinone in kestrel and rat brain tissue. S. F. Volker, K. E. Horak, B. A. Rattner, D. A. Goldade  
 9:05 48. Genetic makeup of native proteins changes the secondary structure features: A synchrotron FTIR study of Arabidopsis seed storage proteins. T. Sanjeewa, D. D. Hegedus, P. Yu, X. Qiu, T. C. McIntosh, T. May, J. P. Wanasundara  
 9:40 49. Effect of novel cutinase CcCut1 in degrading potato suberin and berry cutin. R. Järvinen, U. Holopainen, A. Nyyssölä, A. Silvestre, A. Gil, P. Lehtinen, J. Buchert, H. Kallio  
 10:00 50. Native and synthetic autoinducers regulate the virulence of the plant pathogens Pectobacterium carotovora and Pseudomonas syringae in host plants. A. G. Palmer, E. Streng, H. E. Blackwell  
 10:20 51. Poly(lactic acid) and Osage orange wood fiber composites for agricultural mulch films. V. Finkenstadt, B. Tisserat  
 10:40 52. Uptake of organochlorine pesticides by agricultural crops: Mechanistic studies. W. A. Berger, M. I. Mattina

**Section B      Boston Convention & Exhibition Center      Room 161**  
**Agricultural and Food Derived Natural Products for Preventing and Combating Disease      In Vitro Model**

- G. Jayaprakasha, Org., Presid.      H. Xiao, H. Humpf, Presid.      B. Patil, K. Chidambara Murthy, N. P. Seeram, Orgs  
 8:35 53. Hydroxylated polymethoxyflavones from orange peel as novel cancer preventive agents. H. Xiao, P. Qiu, P. Dong, C. Ho, S. Li  
 9:00 54. Anthocyanin-containing fruits and vegetables are functional foods with potential to ameliorate debilitating diseases. M. G. Nair

- 9:25 55. Lipid accumulation and inflammation inhibition by *Vaccinium floribundum* proanthocyanidins. M. Schreckinger, J. Wang, G. Yousef, M. Lila, E. Gonzalez de Mejia
- 9:50 56. Mediterranean wild plants: Endless source of natural food additives? A. Fiorentino, B. D'Abrosca, A. Esposito, M. Isidori, P. Monaco, S. Pacifico, S. Piccolella, A. Ricci, M. Scognamiglio
- 10:30 57. Pig cecum model: A powerful system to mimic the human intestinal metabolism of flavonoids. G. van 't Slot, K. Rose, A. Engemann, H. Humpf
- 10:55 58. Bioactive constituents from Formosan *Kadsura* and *Schisandra*. Y. Shen
- 11:20 59. Chemical properties and antioxidant capacity of Chinese bay berry juice. X. Ye

**MONDAY AFTERNOON August 23**

**Section B Boston Convention & Exhibition Center Room 161**

**Agricultural and Food Derived Natural Products for Preventing and Combating Disease In Vitro Model**

- D. Klimis-Zacas, S. Poulouse, Presid. B. Patil, G. Jayaprakasha, K. Chidambara Murthy, N. P. Seeram, Orgs.
- 1:05 60. Berry extracts and brain aging: Clearance of toxic protein accumulation in brain via induction of autophagy. S. M. Poulouse, D. F. Bielinski, B. Shukitt-Hale, D. R. Fisher, J. A. Joseph
- 1:30 61. Composition of fruit and vegetative cranberry phenolics with relation to antioxidant capacity. N. Vorsa, A. P. Singh, T. Wilson, M. R. Freeman, V. Vorsa
- 1:55 62. Enhanced production of anticancer Camptothecins in *Camptotheca*. S. Li, Z. Zhang, P. Wang, W. Yuan
- 2:20 63. Chemical constituents and biological activity of Taiwanese sugar cane extract. Y. Wu
- 3:00 64. Inhibition of intestinal alpha-glucosidases and anti-postprandial hyperglycemic effect of grape seed extract. K. Zhou
- 3:25 65. Wild Blueberries (*Vaccinium angustifolium*): Modulators of vascular function, structure and metabolism. D. Klimis-Zacas
- 3:50 66. Distribution and biological activity of Citrus juices flavonoids. D. Barreca, E. Bellocco, C. Caristi, U. Leuzzi, G. Gattuso

**Section A Boston Convention & Exhibition Center Room 160A**

**Symposium Honoring Prof. Terry E. Acree on the Occasion of his 70th Year Award Symposium**

- A. Taylor, D. Roberts, Presiding C. Brine, Organizer
- 1:35 67. Flavor of foods: The sound of an orchestra rather than that of a single instrument. P. H. Schieberle
- 2:05 68. What do we taste, when we taste? T. Hofmann
- 2:35 69. Aroma release, qualia and perceived flavour. A. J. Taylor
- 3:20 70. Identification of new strawberry sulfur volatiles and changes during maturation. X. Du, M. Song, R. L. Rouseff
- 3:50 71. Gas chromatography olfactometry applications to dairy products: A wonderful friendship. S. Carpino
- 4:20 72. Integrating the culinary arts and sciences in Terry Acree's flavor world. C. Loss

**Section C Boston Convention & Exhibition Center Room 160C**

**Cardiovascular Disease and Diabetes**

- J. Finley, Organizer, Presiding
- 1:35 73. Does lycopene have a role in the prevention of cardiovascular disease?. H. D. Sesso
- 2:05 74. Dietary fat and cardiovascular disease: Quantity or quality? A. Lichtenstien
- 2:35 75. Polyunsaturated fatty acids and the endocannabinoid signalling system. B. A. Watkins
- 3:10 76. Milk proteins in the regulation of food intake and metabolic syndrome. H. Anderson, B. Luhovyy, T. Akhavan, S. Panahi
- 3:40 77. Cardiovascular health benefits of soy foods. J. W. Anderson

**Section D Boston Convention & Exhibition Center  
Chemistry and Nutrition for Better Health Plenary Lecture**



J. Finley, Organizer, Presiding

4:00 78. Impact of early life nutrition on health and wellness. S. Roberts

4:30 79. Optimum diets and natural products for disease prevention. B. N. Ames

**Undergraduate Research Posters Agricultural and Food Chemistry  
Sponsored by CHED, Cosponsored by AGFD and SOCED**

**MONDAY EVENING August 23**

**Boston Convention & Exhibition Center**

**Sci-Mix**

**8:00pm - 10:0pm**

N. Da Costa, Organizer

6, 114, 118, 125, 126, 128, 131, 137, 138, 140, 141, 142, 145, 151, 154, 155, 157, 160

See previous or subsequent listings for paper titles.

**TUESDAY MORNING**

**August 24**

**Section A Boston Convention & Exhibition Center Room 160A**

**Symposium Honoring Prof. Terry E. Acree on the Occasion of his 70th Year Award Symposium**

K. Cadwallader, R. McGorin, Presiding C. Brine, Organizer

8:05 80. Flavor chemistry of lemon-lime flavored carbonated beverages. B. Hausch, K. Cadwallader

8:35 81. Perspectives on flavor analysis linked to chemosensory impact. R. J. McGorin

9:05 82. Zen and the art of chemosensory perception. J. F. Delwiche

9:50 83. Playing with food: Flavor and food chemistry in the experimental restaurant kitchen. H. J. McGee

10:20 84. Progression of the retronasal aroma simulator and flavor release sampling. K. D. Deibler

10:50 85. Commercial consequences of Shallenberger and Acree's AH,B theory of sweet taste. M. G. Lindley

**Section C Boston Convention & Exhibition Center Room 160C**

**Nutrition and Brain Aging**

J. Finley, Organizer, Presiding

8:05 86. Behavioral and signaling effects of blueberries, strawberries, and walnuts: Quenching the fires of aging. J. Joseph, B. Shukitt-Hale, D. Fisher

8:35 87. Application of calorie restriction and calorie restriction mimetics to attenuate brain aging. D. Ingram

9:20 88. Role of an antioxidant diet and behavioral enrichment on cognition and neuropathology in the canine model of aging. E. Head

9:50 89. Prevention approaches to Alzheimer disease: Omega-3 fatty acids and curcumin. G. M. Cole, Q. Ma, F. Yang, D. Gant, O. Ubeda, S. A. Frautschy

**Section B Boston Convention & Exhibition Center Room 161**

**Agricultural and Food Derived Natural Products for Preventing and Combating Disease In Vitro Model**

B. Dayal, C. Erlanson-Albertsson, Presid B. Patil, G. Jayaprakasha, K. Chidambara Murthy, N. P. Seeram, Orgs

8:35 90. Methyl jasmonate: A plant stress hormone as an anticancer agent. E. Flescher

9:00 91. Methyl nomilinate inhibits SW480 colon cancer cells growth through modulation of cell cycle regulators. J. Kim, G. Jayaprakasha, A. Vikram, B. S. Patil

9:25 92. Isolation and chemical characterization of limonoids from *Azadirachta indica* and *Melia azaderach* with biological activity. P. Caboni, N. Ntalli, C. E. Bueno, L. E. Alchè

10:05 93. Characterization of bioactive compounds of selected (sub)tropical fruits and leaves grown in Jeju and their antiproliferative effects on human cancer cells through apoptosis. S. K. Cho

10:30 94. Influence of the target molecule on the ORAC index. C. López-Alarcón

10:55 95. Bioactive compounds from okra seeds: Potential treatments for diabetes-Type 2 and cardiovascular disease. B. Dayal, M. Lea, N. H. Ertel

**TUESDAY AFTERNOON August 24**

**Section B Boston Convention & Exhibition Center Room 161**

**Agricultural and Food Derived Natural Products for Preventing and Combating Disease In Vivo Model**

K. Shetty, Y. Park, Presiding B. Patil, G. Jayaprakasha, K. Chidambara Murthy, N. P. Seeram, Organizers

1:05 96. Citrus monoterpene induces apoptosis and inhibits angiogenesis in human colon cancer cells.

K. N. Chidambara Murthy, G. K. Jayaprakasha, B. S. Patil

1:30 97. Bioactives from a traditional herb collected from the tropical rainforest. C. Choo

1:55 98. (-)-Epigallocatechin-3-gallate protects neonatal rat cardiomyocytes against oxidative stress induced by anoxia/reoxygenation injury. W. Li, S. Nie, M. Xie, S. Zhang, K. Zhu

2:20 99. Conjugated fatty acids as a prevention tool for obesity and osteoporosis. Y. Park, Y. Park

3:00 100. Phenolic antioxidant-enriched plant foods for prevention and management of type 2 diabetes and its complications. K. Shetty

3:25 101. Bioactive constituents from Calamus quiquesetinervius and Astragalus membranaceus, and their evaluations in treating metabolic syndrome. Y. Kuo

3:50 102. Protective effect of sesamol on stress-related mucosal disease in rats. D. Hsu, M. Liu

**Section A Boston Convention & Exhibition Center Room 160A**

**Flavor Chemistry of Alcoholic Beverages**

M. Qian, Organizer, Presiding T. Shellhammer, Organizer

1:35 103. Spice up your life: Analysis of key aroma compounds in Shiraz. M. J. Herderich, T. Siebert,

M. Parker, D. Capone, D. Jeffery

2:00 104. Formation of carotenoid-derived aroma compounds in wine. P. Winterhalter, R. Goek

2:25 105. Aroma composition of a native American grape species (*Vitis cinerea*) wine by SPME-GC/O/MS. Q. Sun, E. Lavin, T. E. Acree, G. L. Sacks

3:10 106. Streamlined analysis of potent odorants in distilled alcoholic beverages. J. Lahne, K. Cadwallader

3:35 107. (In)stability of the beer's bitter taste: A molecular insight. T. Hofmann

4:00 108. Analytical investigations to relate important wine odorant 3-mercaptohexan-1-ol to its precursors. D. L. Capone, M. A. Sefton, D. W. Jeffery

**Section C Boston Convention & Exhibition Center Room 160C**

**Cardiovascular Disease and Diabetes**

J. Finley, Organizer, Presiding

1:35 109. Is the antioxidant activity of polyphenols relevant for protection against cardiovascular. P. C. Hollman

2:00 110. Fine chemical structures of dietary polyphenols and their importance in understanding their role in the prevention of diseases. A. Scalbert, J. Perez-Jimenez, J. Rothwell, M. Touvier, L. Feuzeu, P. Galan

2:25 111. Cardiovascular health effects of plant polyphenols. K. D. Croft

3:05 112. Food synergy and nutritional research. D. R. Jacobs

3:30 113. Berry intake ameliorates pro-inflammatory factors that increase risk of cardiovascular disease. P. E. Milbury, W. Kalt

**Section D Boston Convention & Exposition Center Hall C 2:00pm - 4:00pm**

**General Posters**

N. Da Costa, Organizer, Presiding

114. Direct detection of microbial mRNA by rolling circle amplification. T. Kobori, H. Takahashi, A. Matsumoto, S. Sugiyama

115. Post mortem changes in gene expression of fish muscle tissues. M. Saito, T. Higuchi, N. Uchida, H. Suzuki

116. Tensile and solubility properties of calcium caseinate films cross-linked with genipin. P. M. Tomasula, P. Qi
117. Effect of estradiol-17  $\beta$  on embryos of the giant freshwater prawn, *Macrobrachium rosenbergii*(de Man). N. Pakdeenarong
118. Determination of chitosan in aqueous solutions. S. Zivanovic, R. Davis, J. Li
119. Diterpenoids from the cultured soft coral *Klyxum simplex*. B. Chen, Y. Lu, J. Sheu
120. Synthesis and biological evaluation of novel acylphloroglucinols. C. Chang, C. Tang, J. Liu
121. Antibacterial properties of Baicalin (*Radix scutellariae*) and Berberine (*Rhizama coptidis*) for *Staphylococcus aureus*, *Escherichia coli* and *Bacillus atrophaeus*. A. Shah, S. Cai
122. Globospiramine, a new antituberculosis bisaspidospermidine indole alkaloid from *Voacanga globosa*. A. G. Macabeo, W. S. Vidar, M. Barbic, A. M. Aguinaldo, S. G. Franzblau, G. A. Cordell
123. Studies of prenylflavonoids from the plant origin of Okinawan propolis. S. Kumazawa, N. Momose, M. Murase, T. Ohta, S. Fukumoto
124. Preparation of bioactive peptides derived from wheat bran responsible for angiotensin I converting enzyme (ACE I) inhibition and nitric oxide (NO) produced acceleration and effects on hypertension. Y. Sauchi, M. Sakashita, M. Suga, M. Ochiai, T. Kon, K. Yamaguchi, Y. Ogihara
125. Head space solid phase microextraction (HS-SPME) gas chromatography mass spectroscopy (GC/MS) analysis of volatile components of garlic. J. D. Williams, J. G. Clemente
126. Flavor characteristics of Australian *Botrytis Semillon*. C. E. Hofmann, A. C. Clark, L. M. Schmitdke
127. Enzymatic modification of wheat protein for the formation of pyrazines and other heterocyclic compounds through Maillard reaction. S. Lee, Y. Kim
128. Determination of the levels of polycyclic aromatic hydrocarbons (PAH) in US and Swedish smokeless tobacco products. K. G. McAdam, A. Faizi, H. Kimpton, B. Rodu
129. Cytotoxic terpenoids from *Calocedrus macrolepis* var. *formosana*. Y. Kuo
130. Investigation on the flavor enhancing components in glutathione-Maillard reaction products using metabolomic approach. S. Lee, G. Kwon, K. Kim, Y. Kim
131. Effect of hot-water extraction on non-carbohydrate components of hardwoods. M. J. Goundalkar, B. Bujanovic, T. E. Amidon
132. Aroma profile comparisons of "Strawberry Festival" and "Florida Radiance" strawberries by GC-Olfactometry, odor activity values, and sensory evaluation. X. Du, A. Plotto, E. Baldwin, R. Rouseff
133. Effect of short passage time on the polishing and storage temperature of milled and cooked rice quality. Y. Oh, W. Jeong, H. Jeong
134. Metabolite profiling by gas chromatography-mass spectrometry (GC-MS) and principal component analysis (PCA) of *Schizandra chinensis* Baillon (omija fruits) according to their origins. H. Lee, I. Cho, Y. Kim
135. Comparison of the volatile composition of pasteurized and unpasteurized makgeolli, a traditional Korean rice wine. H. Park, Y. Kim
136. Determination and comparison of Saponins in Black *Panax ginseng* C.A. Mayer. S. H. Cho, O. Choi, C. Sung
137. Insecticidal and antioxidant activities of abietane diterpenoids from *Hyptis verticillata* Jacq. R. B. Porter, D. A. Biggs, L. A. Williams
138. Scopolamine-induced memory impairment in mice and antioxidant activities of aqueous antler extract. O. Choi, C. Sung, S. H. Cho
139. Curcuminoids promote neuronal differentiation of PC12 cells through PKC-dependent phosphorylation of CREB protein. K. Liao, K. Lee, M. Wu, C. Ho, J. Yen
140. Phytochemical composition and anti-fungal activity of extracts from cranberry cultivars (*Vaccinium macrocarpon* Ait.) that vary in resistance to plant pathogens. M. C. Nunnelley, J. L. Carpenter, C. C. Neto, F. L. Caruso
141. Semi-continuous method for recovering anthocyanins and procyanidins from White Zinfandel (*V. Vinifera*) red grape pomace using subcritical water. J. Monrad, L. R. Howard, K. Srinivas, J. W. King, A. Mauromoustakos
142. In vitro estimation of antioxidant activities in red and white cranberry extracts. A. Z. Tulio, Jr., I. Edirisinghe, C. Chang, J. E. Jablonski, R. K. Tadapaneni, B. Burton-Freeman, L. S. Jackson

143. Phenolic content, antioxidant activity, and anti-proliferative property of cold-pressed grape seed flours. L. A. Binzer, R. L. Brinsko, J. J. Cha, Z. Chen, S. E. Green, K. E. Grob, J. Hao, C. M. Hitz, L. J. Li, S. N. Swamy, M. Y. Wolf, M. Xu, M. C. Yanik
144. Chemical composition and antioxidant properties of cold-pressed grape seed oils. L. A. Binzer, R. L. Brinsko, J. J. Cha, Z. Chen, S. E. Green, K. E. Grob, J. Hao, C. M. Hitz, L. J. Li, S. N. Swamy, M. Y. Wolf, M. Xu, M. C. Yanik
145. Improved stability of blueberry juice anthocyanins by acidification and refrigeration. L. R. Howard, C. Brownmiller, R. L. Prior
146. *Salvia fruticosa* mediates protection against H<sub>2</sub>O<sub>2</sub>-induced DNA damage in HEK293 cells. S. A. Bani hani
147. Phytochemicals in winged sumac (*Rhus copallinum*) fruit. H. Ma, L. Li, N. P. Seeram
148. Phytochemicals in Fraser's Marsh St. John's Wort (*Triadenum fraseri*). L. Li, D. Woolridge, J. Jennings, R. Saing, G. E. Henry, N. P. Seeram
149. Phytochemicals in blueberry (*Vaccinium corymbosum*) stems and roots. A. Cirello, L. Li, L. R. Howard, N. P. Seeram
150. Compounds from *Eugenia jambolana* (Jamun) berries beyond anthocyanins. R. Omar, L. Li, A. Cirello, N. P. Seeram
151. Composition of flavonoids and other phenolics in foliage from cranberry cultivars (*Vaccinium macrocarpon*) that vary in susceptibility to cranberry tipworm and other pests. E. Yiantsidis, C. Dao, A. Averill, S. Tewari, F. Caruso, J. Hicks, K. Colson, K. B. Killday, C. Neto
152. Pterocarpan and flavonoids from *Derris laxiflora* Benth. S. Chien
153. Biocatalytically polymerized flavonoids with enhanced antioxidant activity. K. Daita, S. Tripathy, S. Nagarajan, R. Nagarajan, F. F. Bruno, L. Samuelson, J. Kumar
154. Purification of homohexameric cruciferin from seeds of mutant *Arabidopsis thaliana*. T. Sanjeeva, D. D. Hegedus, X. Qiu, T. C. McIntosh, J. P. Wanasundara
155. Methods of identification of adulterated food products based on carbohydrate profiles by UPLC. C. Hudalla, C. Boissel, P. Iraneta, D. Walsh, K. Wyndham
156. Analysis of hormones and their conjugates in animal waste using QuEChERS method coupled with liquid chromatography-electrospray-tandem mass spectrometry. J. Kwon, K. L. Armbrust, K. Xia
157. Photolysis of pesticides on alternate matrices compared to soil. M. C. McGuire, S. B. Hibler, L. R. Marks
158. Fingerprint-based classification of a commercial odor database. A. B. Yongye, T. L. Peppard, J. L. Medina-Franco, K. Martinez-Mayorga
159. Overview of sampling and analytical methodologies in the Food Safety and Inspection Service's National Residue Program. D. Pagan-Rodriguez
160. Increased air pressure substantially reduces the time required to remove raffinose-series oligosaccharides from legumes. R. Rakijian, J. L. Payne, S. Manzano, M. A. Payne
161. *Vitis labrusca* L.: Antioxidant and antiproliferative properties of its components. M. Gallicchio, G. D'Angelo, S. Pacifico, A. Fiorentino, B. D'Abrosca, P. Monaco
162. What can we learn from massive docking? K. T. Nguyen, M. M. Mysinger, B. K. Shoichet, J. J. Irwin
163. Lanostane triterpenoids and a degraded steroid from *Antrodia camphorata*. H. Huang, Y. Kuo
164. New mechanism for the generation of acyl radical in cigarette smoke. N. Hu, S. A. Green
165. Determination the impact odorants of 'Hutai' icewine from Hu county (China) using headspace solid-phase microextraction. H. Wang, L. Zhang, Y. Liang
166. Detecting and predicting adulteration in Chinese garlic oil by gas chromatography analysis and chemometrics. D. Bolliet
167. Blackberries and raspberries: Effects of storage on antioxidant potential. S. B. Gacasan, N. Mwebi
168. Constituents of maple syrup residue, a waste/by-product of the maple syrup industry. O. Ashorobi, L. Li, D. Worthen, N. Seeram

**WEDNESDAY MORNING August 25**

**Section A Boston Convention & Exhibition Center**

**Room 160A**

**Flavor Chemistry of Alcoholic Beverages**

- M. Qian, Organizer, Presiding T. Shellhammer, Organizer
- 8:05 169. 1,1,6-Trimethyldihydronaphthalene: Effects of cluster light exposure timing and contribution to Riesling aroma. G. L. Sacks, T. E. Acree, J. E. Vanden Heuvel, M. T. Kwasniewski, L. Karoui
- 8:30 170. Headspace solid-phase dynamic extraction (SPDE) and GC-MS for distinguishing a) styles of South African Chenin Blanc wines and b) types of pot-distilled brandies from regions around the world. V. A. Watts, I. Christ, J. Stadler, Z. Bellingan
- 8:55 171. A little twist for wine aroma. M. C. Qian
- 9:40 172. Fermentation and post-fermentation factors affecting accumulation and degradation of odour-active sulfur compounds during wine bottle storage. M. Ugliano, M. Kwiatkowski, P. A. Henschke, E. J. Waters
- 10:05 173. Impact of the oxygen exposure during bottling and oxygen barrier properties of different closures on wine quality during post-bottling. P. Lopes, M. A. Silva, M. Cabral, P. Darriet, P. Teissedre, D. Dubourdieu
- 10:30 174. Assessing smoke taint in grapes and wine. K. L. Wilkinson, R. Ristic, K. Dungey, Y. Hayasaka
- 10:55 175. Smoke taint aroma assessment in 2008 California grape harvest. H. Chong

### **Section C Boston Convention & Exhibition Center Room 159**

#### **Antioxidant Analysis: Challenges and Critical Issues**

- L. Howard, D. Luthria, Organizers, Presiding J. Finley, Organizer
- 8:05 176. Significance of extraction and spectral fingerprinting methodology for the assay of bioactive phytochemicals. D. Luthria, J. Harnly
- 8:30 177. Stability for extraction and analysis of acylated anthocyanins. H. Matsufuji
- 8:55 178. Determination of extractable and nonextractable food polyphenols. L. R. Howard, B. L. White
- 9:20 179. Revising and redirecting the chemistry of antioxidant (antiradical) activity assays. K. M. Schaich
- 10:00 180. Luminescent molecular and nano probes for quantifying reactive oxygen species and the scavenging activity of dietary antioxidants. D. Huang
- 10:25 181. Dietary modulation of oxidative stress in humans: Methodology, physiological meaning and value of the non enzymatic antioxidant capacity (NEAC). M. Serafini
- 10:50 182. Assays for scavenging capacities against hydroxyl and DPPH radicals. L. Yu
- 11:15 183. Challenges and issues with the ORAC assay. R. L. Prior
- 11:40 184. Main and modified CUPRAC methods of antioxidant characterization. R. APAK, M. ÖZYÜREK, B. BEKTASOGLU, K. GÜÇLÜ

### **Section B Boston Convention & Exhibition Center Room 161**

#### **Agricultural and Food Derived Natural Products for Preventing and Combating Disease Human Intervention Studies**

- K. Chidambara Murthy, Org, Presid. C. Neto, J. Novotny, Presid. B. Patil, G. Jayaprakasha, N. P. Seeram, Orgs
- 8:35 185. Cranberry phytochemicals: Potential benefits against disease and infection. C. C. Neto
- 9:00 186. Queen Garnet plum, a new plum variety rich in antioxidant compounds: First results from a pilot study with healthy human subjects. M. Netzel, K. Fanning, G. Netzel, D. Zabarar, D. Russell, R. Stanley
- 9:25 187. Anthocyanins: Disease preventing pigments with complex bioavailabilities. J. A. Novotny
- 9:50 188. Food polyphenol consumption may reduce prevalence of hypertension in high cardiovascular risk population. R. M. Lamuela-Raventos, A. Medina-Remón, R. Estruch, C. Andres-Lacueva
- 10:30 189. Oral consumption of cranberry juice inhibits cellular adhesion and biofilm formation of uropathogenic bacteria. Y. Tao, P. A. Pinzon, A. B. Howell, T. A. Camesano
- 10:55 190. Effects of oral sea buckthorn (*Hippophaë rhamnoides*) oil on dry eye. P. S. Larmo, R. L. Järvinen, N. L. Setälä, B. Yang, M. H. Viitanen, J. R. Engblom, R. L. Tahvonen, H. P. Kallio

11:20 191. Thylakoids promote satiety in healthy humans: Metabolic effects and mechanisms. C. Erlanson-Albertsson, P. Albertsson, R. Köhnke, M. Rayner, S. Emek, M. Landin-Olsson, B. Weström, C. Montelius, K. Gustafsson, L. Svensson, I. Sjöholm

**WEDNESDAY AFTERNOON**

**August 25**

**Section A Boston Convention & Exhibition Center Room 160A**

**Flavor Chemistry of Alcoholic Beverages**

M. Qian, Organizer, Presiding T. Shellhammer, Organizer

1:35 192. Evidence for demethylation of 3-isobutyl-2-methoxypyrazine during maturation of bell pepper (*Capsicum annuum*) and winegrapes (*Vitis vinifera*). I. Ryona, G. Sacks

2:00 193. Free and potential aroma compounds and sensory profile in long-time grape skin macerated white wines. G. Versini, B. Fedrizzi, R. Ferrarini, F. Finato, E. Casarotti, G. Piubelli, M. Cipriani

2:25 194. Assessing variability in the coopering process. T. S. Collins, S. E. Ebeler

3:10 195. Bitter, twisted truth of the hop. P. L. Ting, D. Ryder

3:35 196. On the flavor of Bourbon Whiskey: How the manufacturing process influences the concentrations of its key aroma molecules. P. H. Schieberle, M. Vocke

4:00 197. Aroma characterization of Chinese liquor: Yanghe Daqu, Wuliangye, Jiannanchun and Maotai. M. C. Qian, W. Fan, Y. Xu

4:25 198. Characteristic aroma compounds of Chinese rice wine by gas chromatography–olfactometry and quantitative analysis using headspace solid phase microextraction gas chromatography–mass spectrometry. W. Fan, Y. Xu

**Section B Boston Convention & Exhibition Center**

**Room 161**

**General Papers**

A. Mitchell, Organizer, Presiding N. Da Costa, Presiding

1:35 199. Seed's protein and oil content, fatty acid composition, and growing cycle length of a single genotype of chia (*Salvia hispanica* L.) as affected by environmental factors. R. Ayerza

1:55 200. Extra virgin olive oil increases uncoupling protein 1 content in brown adipose tissue, and enhances noradrenaline and adrenaline secretions in rats. Y. Oi-Kano

2:15 201. Inhibition of human NADPH oxidase by apocynin derived oligophenols. J. M. Mora Pale, S. Kwon, M. Weiwer, R. J. Linhardt, J. S. Dordick

2:35 202. Antileishmanial, trypanocidal, antituberculosis and cytotoxic activities of targeted plant species from the Peruvian rain forest. z. jin, J. C. Aponte, V. A., M. Sauvain, R. Gilman, G. Hammond

3:10 203. Phytochemical analysis and antioxidant efficacy of fruits produced in Italy. N. Tsafantakis, S. Pacifico, M. Scognamiglio, S. Piccolella, B. D'Abrosca, A. Fiorentino

3:30 204. Transcriptional control of alkaloid biosynthesis by methyl jasmonate in *Catharanthus roseus* hairy root cultures. S. Goklany, R. H. Loring, J. Glick, C. W. Lee-Parsons

3:50 205. Molecular cloning and characterization of a novel down-regulated TOM20 gene associated with the onset of tapping panel dryness (TPD) syndrome from the inner bark tissues of rubber tree (*Hevea brasiliensis* Muell. Arg.) by mRNA differential display. V. Perumal

**Section C Boston Convention & Exhibition Center**

**Room 159**

**New Perspectives on Antioxidants**

J. Finley, Organizer, Presiding

1:35 206. Relating in vitro research on the antioxidant impact of crucifer components to dietary redox regulation. E. Jeffery

2:05 207. Too much of a good thing: Risk of over-antioxidation. X. Lei

2:35 208. Regulation of the iron storage protein ferritin by the antioxidant responsive element. K. J. Hintze

3:20 209. Antioxidant adaptation and signaling in response to physical exercise. L. Ji

3:50 210. Dietary antioxidants: From activating Nrf2 signaling to genomics in prevention of cancer. A. Kong

**THURSDAY MORNING**

**August 26**

**Section A Boston Convention & Exhibition Center Room 160A**

**Small Wonders: Peptides for Disease Control**

K. Rajasekaran, Organizer, Presiding

Cosponsored by BIOT

8:35 211. Application of small molecule microarrays in high-throughput screening of protein targets. M. Uttamchandani

9:05 212. Plant antimicrobial peptides: Thionins as nature's invention for weapons of mass protection. S. Oard, T. Chouljenko, N. Maiti, F. Enright

9:50 213. Results of a double blind randomized, multi-center phase-II clinical trial of geno pep, a topical cream in the treatment of burn wounds. J. M. Jaynes, V. Reddy, P. Ramesh

10:20 214. Effect of transgenic cotton plants transformed with antimicrobial synthetic peptide D4E1 on cotton seedling disease, soil microbial diversity, and enzymatic activity. L. J. Odom, R. O. Ankumah, J. Jaynes, C. Bonsi, J. W. Cary, M. Egnin, D. Mortley, L. Ogden, K. Rajasekaran

10:50 215. Transformation of antimicrobial peptides from frog skin into therapeutically valuable anti-infective agents. J. Conlon

**Section B Boston Convention & Exhibition Center Room 161**

**Caffeine and Other Natural Product Stimulants**

J. Weil, Presiding E. Demejia, Organizer

8:40 216. Caffeine: Health benefits and safety concerns. E. Gonzalez de Mejia

9:00 217. On the circumstances which modify the action of caffeine: The scope of science since Runge's discovery until nowadays. J. G. Weil

9:20 218. Energy drinks: An assessment of their ingredient profile and functionality. M. Heckman, E. Gonzalez de Mejia

9:40 219. Rapid determination of pungent compounds of ginger by a combination of chromatography and vanilloid receptor (VR1) assay. Y. Yang, S. Liu, N. Mannava

10:00 220. Natural components in yerba mate tea and coffee byproducts enhance antioxidant capacity, inhibit lipid synthesis, and suppress body fat and lipogenic genes. E. Gonzalez de Mejia, M. Heckman

**Section C Boston Convention & Exhibition Center Room 159**

**Antioxidants and Health**

J. Finley, Organizer

8:35 221. Antioxidants in black rice bran. Z. Xu, S. Jang, X. Yue

9:05 222. Soybean antioxidant properties affected by food processing and in vitro digestion. K. Zhou

9:35 223. Health effects of natural antioxidants from the selected edible botanical materials. L. Yu

10:20 224. Catechin/Epicatechin metabolism and excretion in rats fed different berries. R. Khanal, S. E. Wilkes, T. J. Rogers, L. R. Howard, R. L. Prior

10:50 225. Antioxidant activity of lutein and its protective effects on ischemia-hypoxia injury in cultured rat cortical neurons. M. Wang, R. Tsao

11:20 226. Influence of extraction methodology on the assay of antioxidant phenolic compounds. D. Luthria

**THURSDAY AFTERNOON August 26**

**Section A Boston Convention & Exhibition Center**

**Room 160A**

**Small Wonders: Peptides for Disease Control**

K. Rajasekaran, Organizer, Presiding

Cosponsored by BTEC

1:35 227. NMR structural insights on the function of antimicrobial peptides. A. Ramamoorthy

2:05 228. Synthetic antimicrobial peptides as novel pesticides for plant disease control. E. Montesinos

2:35 229. Antimicrobial and immunomodulatory peptides for combating infections. R. E. Hancock

3:20 230. Transgenic expression of lytic peptides for elimination of mycotoxins in food and feed crops.

K. Rajasekaran, J. W. Cary, J. M. Jaynes, D. Bhatnagar, T. E. Cleveland

3:50 231. In vitro effects of two newly designed lytic peptides LHRH conjugates on prostate cancer. S. M. Sharp

**Section B Boston Convention & Exhibition Center Room 161**

## General Papers

N. Da Costa, Presiding

A. Mitchell, Organizer

1:35 232. Activation energy measurements of cheese. M. H. Tunick

2:00 233. Impact of electrostatic deposition of anionic biopolymers on the stability of lactoferrin-coated oil droplets. T. Tokle, U. Lesmes, J. McClements

2:25 234. Comparison of molecular and aggregation properties of soy proteins treated with various endopeptidases. M. J. Cho, D. Ryan, P. Ghosh

3:05 235. Development of a sodium-free salt for food applications. D. L. Holliday, A. Prudente, J. W. Finley

3:30 236. Foliage extracts of conifers as potential sources for isolation of shikimic and quinic acids, precursors to Tamiflu®. L. Gedivinne Vithanage, B. J. Cole, R. C. Fort Jr., J. M. Genco, A. Shaffer, M. Rowe

3:55 237. Efficacy of Ichthyophthirius vaccines in channel catfish against white spot disease. D. Xu, P. Klesius, C. Shoemaker

## Section C Boston Convention & Exhibition Center

Room 159

### Antioxidants and Health

J. Finley, Organizer

1:35 238. Pterostilbene reduces colon tumor multiplicity and inflammatory markers in animal models of colon cancer. A. M. Rimando, S. Paul, N. Suh

2:05 239. Multifunctional branched gold nanoparticle for prevention of cancer cells. P. C. Ray

2:35 240. Chitosan grafted with phenolics to promote antioxidant activities. S. B. Schreiber, S. Zivanovic

3:20 241. Bioassay-guided isolation and EPR-assisted antioxidant evaluation of two valuable compounds from mango peels. L. Jiang, S. He, Y. Pan

3:50 242. Urinary excretion of phenolic acids in rats fed cranberry, blueberry, or black raspberry. R. Khanal, S. E. Wilkes, T. J. Rogers, L. R. Howard, R. L. Prior

## AGFD Abstracts, 240th ACS Nat'l Meeting, Boston, Aug. 22-26, 2010

**1 - Chemical and mathematical approaches to promote the development of functional foods rich in natural antioxidants** Junjie Hao. Dept. of Chemistry and Biochemistry, Univ. of, Coll. Park, MD, US Chemical assays to demonstrate the antioxidant properties and the mathematical approaches to identify the key factors altering antioxidant availability are critical for developing successful functional foods. Fluorometric and electron spin resonance (ESR) assays will be discussed for their applications in investigating the scavenging capacities of clove bud, lavender, rosemary, and thyme essential oils (EO) against 2,2-diphenyl-1-picrylhydrazyl (RDSC) and hydroxyl (HOSC) radicals. The fluorometric assays will also be discussed for their use in comparing the antioxidant properties of organic and conventional EO of oregano and lavender. In addition, the chemical compositions of the EOs and their antimicrobial activities against Staphylococcus aureus, Enterococcus faecalis, Escherichia coli, and Pseudomonas aeruginosa will be presented. Finally, statistical analyses for determining the effects of genetic variability (G), environment (E), and G×E on soybean antioxidant capacity and chemical composition, as well as between-test correlation and correlation of data with different environmental factors will be discussed.

**2 - Investigating the effect of common antioxidants on the generation and fate of pyrazinium radicals in the Maillard reaction** Qing Bin, Devin G. Peterson, Ryan J. Elias. Dept of Chemistry, The Pennsylvania State Univ., Univ. Park, PA, Dept. of Food Science and Nutrition, Univ. of Minnesota, St. Paul, MN, The Pennsylvania State Univ., Univ. Park, PA, US The effect of various compounds with purported "antioxidant properties" (epigallocatechin-3-gallate, catechin hydrate, 4-methylcatechol, cysteine, bisulfite) on the generation and fate of pyrazinium radicals in the Maillard reaction was investigated. In this study, glyoxal and glycolaldehyde, two important intermediates formed during Maillard sugar fragmentation, as well as glucose, were used to generate pyrazinium radicals. Electron paramagnetic resonance (EPR) was used to study the resulting radicals' structural information and to quantify radical yield. It was observed in most of the cases that in glyoxal and glycolaldehyde models, low concentrations (<50 mM) of these antioxidants increased pyrazinium radical generation, while high concentrations of these tested compounds suppressed it. In glucose models, these antioxidants were only found to have inhibitory effects on the radical generation as concentrations increased. This finding demonstrating inhibition of radical formation supports previous published studies in which polyphenols and bisulfite decrease the formation of several products during the Maillard reaction by binding to, or reacting with, product precursors. However, the observation that low concentrations of these compounds catalyze pyrazinium radical formation in glyoxal and glycolaldehyde models is novel, and may help to elucidate other important mechanistic details of the Maillard reaction.



**3 - Stability of dietary polyphenolics under gastrointestinal conditions** Melanie A. Krook. Dept. of Chemistry & Biochemistry, Miami Univ., Oxford, OH, US Examining the stability of food-derived polyphenolics (tannins) under conditions that mimic the gastrointestinal tract will help us assess whether dietary tannins have a positive or negative affect on human health. The stability of pentagalloyl glucose (PGG) and epigallocatechin gallate (EGCG) were examined in aqueous solutions designed to represent the conditions of the mammalian gastrointestinal tract. The simulated gastric system included a solution that mimicked saliva, followed by a sequential pH adjustment to mimic the stomach and the small intestine. We added pepsin, bile, pancreatin and lipase at physiological concentrations, and in some cases added foods to more accurately simulate digestion. The stability of the tannins was evaluated by HPLC by examining for both losses and the conversion to simpler phenolic compounds. In general, the compounds were stable under gastric conditions but degraded quickly at intestinal pH. Food or digestive enzymes gave some protection from decomposition.

**4 - Starch retrogradation in gluten-free sorghum bread** Elyse Buckley. Food Science Inst., Kansas State Univ., Manhattan, KS, US There are an estimated 3 million Americans with Celiac disease. Many gluten-free breads available on the market stale extremely quickly. 5 surfactant treatments: 0.5% DATEM, 0.5% sodium stearoyl-2-lactylate, 0.15-.2% lecithin, 0.5% Surfax(sorbitan monostearate, polysorbate 60, mono-diglycerides), 0.5% GMS 90 (glycerol monostearate, propionic and phosphoric acid) were evaluated for their effect on staling of sorghum based gluten-free bread. Texture analysis was measured with a TA.XT2 texture analyzer and water activity was recorded with an Aqua Lab CX2 for each treatment on days 0, 2, 5. Lecithin was worse than the control (1.12kg vs 0.54kg) while GMS 90 was the best crumb softener with the lowest force(0.51kg vs 0.54kg) required to compress the slice of bread. DATEM, SSL and Surfax reduced crumb stiffness slightly. The Aw reading for lecithin was the lowest(0.992). This research identified an effective surfactant with the capability to extend the shelf life of sorghum based gluten free bread.

**5 - Accumulation and toxicity of engineered nanoparticles to agricultural crops** Joseph Hawthorne. Univ. of New Haven, We have been evaluating the uptake and toxicity of engineered nanoparticles (NPs) to agricultural crops. Experimental data have shown select nanoparticles behave significantly different than their bulk counterparts. In hydroponics NP Ag, Cu, and multi-walled carbon nanotubes significantly reduced zucchini biomass and transpiration relative to controls and plants exposed to corresponding bulk materials. Zucchini grown in NP Ag solutions contained 4.7-fold more Ag than did plants exposed to equivalent concentrations of bulk Ag. Conversely, NP Si, single walled carbon nanotubes, and fullerenes had no impact on zucchini biomass or transpiration. Current investigations are underway using a variety of instrumental analyses. Atomic force microscopy (AFM) and microscopy-based hyperspectral imaging are being used to isolate and characterize the uptake of carbon-based nanoparticles within plant cells and xylem sap. Inductively coupled plasma mass spectroscopy (ICP-MS) is being used to quantify other elemental nanoparticles as well as bulk elements in plant tissues and hydroponic solutions.

**6 - Total polyphenol antioxidants in legumes: A major source of antioxidants** Benjamin W Redan, Michael G Coco Jr., Joe A Vinson Dept. of Chemistry, The Univ. of Scranton, Scranton, Pennsylvania, US Legumes are regarded as an extremely healthy food, and there are numerous studies showing a correlation between the consumption of beans and a decreased risk of chronic diseases, including cardiovascular disease, cancer, and obesity. However, the active ingredient(s) remains yet to be confirmed. Researchers first thought that the high fiber content of the beans was the active ingredient, but recently polyphenol antioxidants have been hypothesized to be more important. Total polyphenol concentration in 9 varieties of commercial canned beans and boiled beans, and 18 varieties of raw beans was determined using alkaline hydrolysis to liberate fiber-bound polyphenols prior to analysis by Folin-Ciocalteu's and FRAP reagent using catechin as a standard along with a correction for interferences. The effect of cooking methods on the amount of phenolics present will be discussed. When considered on a per serving basis, the amount of phenolics in beans is comparable to that provided by fruits.

**7 - Comprehensive study of Digitalis Purpurea by selective ionization of cardiac glycosides using ES/IC-QTrap** Farzad Shadkami, Mary Dawn Celiz, A. Daniel Jones Dept. of Biochem. and Molecular Biology, Michigan State Univ., East Lansing, MI, Digitalis purpurea is an important medicinal plant and source of cardiac glycosides used in treatment of heart disease. There is a great value in developing tools for identifying and quantifying cardiac glycosides and related metabolites in different plant tissues because of unknown biosynthesis of these compounds. Many cardiac glycosides lack acidic and basic functional groups and may not ionize with high efficiency or reproducibility. In this study, we developed reversed phase separations using fused-core silica C18 particles and a mobile phase gradient containing ammonium formate yielded common [M - H]<sup>-</sup> and [M + H]<sup>+</sup> ions using ESI-LC-QTrap. In addition, cardiac glycosides yielded unusual and selective pseudomolecular ions of [M + formate]<sup>-</sup> in negative ion mode and [M + NH<sub>4</sub><sup>+</sup> + HCOOH - H<sub>2</sub>O]<sup>+</sup> in positive ion mode. This richness of ionization chemistry facilitated quantitative analyses and discovery of new related metabolites using tandem MS. Further data analysis employed multivariate statistical analyses to differentiate metabolites that exhibit differential accumulation in various plant tissues.

**8 - Rapid method for the separation of polymethoxyflavones using flash chromatography** Ram M Uckoo MS, Dr G K Jayaprakasha, Dr Bhimmanagouda S Patil Dept. of Horticultural Sciences, Vegetable and Fruit Improvement Center, Coll. Station, TX, US Isolation of polymethoxyflavones (PMF) from citrus is a challenging task due to complex sample matrices. Due to potential use of citrus PMFs as chemopreventive agent, rapid isolation method is critical. In the present study, a rapid isolation method using flash chromatography was developed for isolation of PMFs. Dried peels of Cleopatra mandarin (Citrus reshni Hort. ex Tan.) and Marrs sweet orange (Citrus sinensis L. Osbeck) fruits were powdered and extracted in a Soxhlet. The extract was purified using flash chromatography with silica column. The isolated compounds were identified as sinensetin, nobiletin, and heptamethoxyflavone using NMR and mass spectrometry. The developed flash method was validated by evaluating repeatability and robustness. To the best of our knowledge this is first report on isolation of PMFs from Cleopatra mandarin and Marrs sweet orange. The present research report is based on work supported by "Designing Foods for Health" through USDA CSREES Grant # 2009-34402-19831.

**9 - Release of bound procyanidins from cranberry pomace by alkaline hydrolysis** Brittany L. White, Luke R. Howard, Ronald L. Prior. Food Science, Univ. of Arkansas, Fayetteville, AR, US; USDA-ARS, Arkansas Children's Nutrition Center, Little Rock, AR, US We optimized alkaline hydrolysis conditions to liberate bound procyanidins from dried cranberry pomace. Five mL of sodium hydroxide (2, 4, or 6N) was added to 0.5 g of cranberry pomace in glass tubes, which were flushed with nitrogen. Tubes were placed into a water bath set at 25,

40, or 60C with shaking for varying amounts of time. Sodium hydroxide was then neutralized with concentrated HCl. Procyanidins were extracted with ethyl acetate and analyzed using HPLC. Alkaline hydrolysis resulted in an increase in procyanidin extraction, and greater amounts were extracted at higher temperature, short time combinations. The most procyanidins were extracted at 60C for 15 m. Compared to conventional extraction using homogenization with solvent, alkaline hydrolysis increased procyanidin extraction by 3.8 to 14.9-fold, with the greatest increase being DP1 (14.9x) and A-type DP2 (8.4x) procyanidins. These findings indicate that procyanidins are not fully extracted by conventional extraction methods.

**10 - Correlating component variability of black raspberry (*Rubus occidentalis* L.) fruit extracts with chemical and biological responses using NMR data and multivariate statistical analysis** Faith J Wyzgoski, R. Neil Reese, Liladhar Paudel, Peter L Rinaldi, Mustafa Ozgen, M. Monica Giusti, Jodee Johnson, Artemio Z Tulio Jr., Joshua A. Bomser, James K. Hardy, Ann M. Chanon, Joseph C. Scheerens, A. Raymond Miller. Dept. of Chemistry, The Ohio State Univ., Mansfield, OH, US; Dept. of Biology and Microbiology, South Dakota State Univ., Brookings, South Dakota; Dept. of Chemistry, Univ. of Akron, Akron, OH; Dept. of Horticulture, Gaziosmanpasa, Tasliciftlik, Tokat, Turkey; Dept. of Food Science and Technology, The Ohio State Univ., Columbus, OH; Dept. of Human Nutrition, The Ohio State Univ., Columbus, OH, US; U. S. FDA, Summit-Argo, IL, US; Dept. of Horticulture and Crop Science, The Ohio State Univ.-Ohio Agricultural and Research & Development Center, Wooster, OH, US A growing number of nuclear magnetic resonance spectroscopy (NMR) -based metabolomic studies are being conducted to investigate agricultural and food products. Our multidisciplinary research uses high field NMR data of highly variable black raspberry (*Rubus occidentalis* L.) fruit extracts and partial least squares regression analysis to examine relationships between active constituents and assay responses. Our initial model correlated measurements of total monomeric anthocyanin content (TMA) and antioxidant capacity by the ferric reducing antioxidant power (FRAP) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) with assay -specific structure-property relationships among the secondary products, most notably, the anthocyanins, cyanidin 3-O-rutinoside; cyanidin 3-O-(2(G))-xylosylrutinoside and cyanidin 3-O-glucoside. Subsequent model construction with black raspberries in varying stages of ripeness where NMR data was regressed against in vitro measurements of inhibition of proliferation of human cancer cell growth indicated that synergistic relationships between anthocyanins and other phenolic compounds may contribute significantly to chemopreventive effects.

**11 - Metabolic profiling using isotope enhanced NMR spectroscopy methods for disease diagnostics** G. A. Nagana Gowda, Daniel Raftery. Dept. of Chemistry, Purdue Univ., West Lafayette, IN, US The emerging field of “metabolomics,” in which a large number of small molecules (metabolites) from human biofluids or tissue are detected quantitatively in a single step, promises immense potential for early diagnosis, therapy monitoring and understanding the pathogenesis of many diseases. Metabolomics methods are mostly focused on the information rich analytical techniques of nuclear magnetic resonance (NMR) spectroscopy and mass spectrometry (MS). While MS is highly sensitive, NMR spectroscopy provides more reproducible and quantifiable data. Currently, peak identification in the complex NMR spectra and relatively low sensitivity of NMR are major challenges in the discovery of early disease biomarkers. To alleviate these limitations, we have been exploring a variety of new approaches including spectral editing and <sup>13</sup>C/<sup>15</sup>N/<sup>31</sup>P isotope tagging of the metabolites. These developments will be discussed. In addition, some applications of metabolite profiling approaches for disease diagnosis as well as for understanding the underlying biochemistry will be presented with emphasis on hepatobiliary cancers/diseases.

**12 - Isolation and identification of polyphenolic compounds from Early Black Cranberry (*Vaccinium macrocarpon*), a pest-resistant cultivar** Christine A Dao, Catherine C Neto, Michelle R Salvas, Justine E Vanden Heuvel, Brian T Murphy Chemistry and Biochemistry, Univ. of Massachusetts Dartmouth, North Dartmouth, Ma, US; Cranberry Experiment Station, Univ. of Massachusetts Amherst, Wareham, MA, US; Horticultural Sciences, Cornell Univ., Geneva, NY, US; Scripps Institution of Oceanography, LaJolla, CA, US Several insect pests that cause cranberry crop damage in MA demonstrate a feeding preference to Howes variety cranberry leaves over Early Black, suggesting that compounds with pest-deterrent properties vary between the cultivars. Comparison of the phenolic composition of the two cultivars targeted possible feeding deterrents. Uprights were harvested at pest infestation time points in Wareham, MA. Extraction and HPLC analysis of foliage showed higher quantities of several phenolic acid and flavonol derivatives in Early Black. The identities of metabolites were determined by fractionating crude leaf extracts on Sephadex LH-20. Five quercetin glycosides were identified by HPLC-DAD analysis. Other phenolic derivatives were isolated by preparative HPLC for structure elucidation by MS and NMR. Several coumaroyl and caffeoylquinic acid derivatives were identified, including a coumaroyl iridoid glycoside previously reported in cranberry fruit. HPLC-DAD also identified procyanidins B1, B2, and A2 in the foliage. Structures of larger oligomers are under investigation.

**13 - Cranberry flavonol glycoside bioavailability in humans with type-2 diabetes** Nicholi Vorsa, Ajay P Singh, Ted Wilson, Vasil Vorsa, Philip E. Marucci Center for Blueberry and Cranberry Research and Extension, 125A Lake Oswego Rd, Rutgers Univ., Chatsworth, NJ 08019, NJ, US; Plant Biology & Pathology, Rutgers Univ., New Brunswick, NJ, US; Dept. of Biology, Winona State Univ., 232 Pastuer Hall, 725 West Mark Street., MN, US Type 2 diabetes, often called non-insulin dependent diabetes, is the most common form of diabetes affecting millions of people. Studies suggest that oxidative stress may facilitate the disease progression of type 2 diabetes. Flavonol glycosides are abundant in cranberries. Several dietary intervention trials have shown that consumption of flavonoid-rich foods associates with a significant increase in plasma flavonoids levels in diabetic patients. Little is known regarding the pharmacokinetics parameters associated with cranberry flavonols due to analytical limitations. These issues were addressed in single cross-over trial in which type 2 diabetics (n = 13) were administered white bread (WB, 57g, 160 Cal, 1 g fiber), raw cranberries (RC, 55g, 21 Cal, 1 g fiber), conventional sweetened dried cranberries (SDC, 40g, 138 Cal, 2.1g fiber), and an SDC formulation containing less sugar (SDC-LS, 40g, 113 Cal, 1.8g fiber + 10g polydextrose as a bulking agent). Plasma samples were collected immediately prior to consumption, 30, 60, and 120 minutes postprandially. The principal cranberry flavonols were Q-3-galactoside, Q-3-arabinofuranoside, Q-3-rhamnoside, which were detected in plasma at nanogram/ml level in 10 participants receiving cranberry products. One metabolite, Q-3-glucuronide was also detected at very low levels postprandially in plasma at 60 and 120 min. Flavan-3-ols were not detected. The major circulating compounds in the plasma after 30 min were identified as quercetin-3-galactoside (?0.0015ng/ml), Q-3-arabinofuranoside (?1 picogram/ml), Q-3-rhamnoside (?2 picogram/ml). Plasma concentrations at 60 and 120 min plasma declined indicating rapid elimination of cranberry flavonols.

**14 - Selective separation of polyphenols using magnetic beads coated with hydrogen bonding ligands** Tao Dong, Qian Zhou, Xiaochao Xiong, Shulin Chen. Dept. of Biological Systems Engineering, Washington State Univ., Pullman, WA, Research indicates that polyphenols may reduce the risk of cardiovascular disease and cancer as antioxidants. In this research, separation of polyphenols based on hydrogen bonding affinity was proved to be a superior technique due to its high efficiency. The magnetic adsorbents with hydrogen affinity ligands were synthesized by immobilization of -O- groups on the surface of the magnetic supports. The NMR data indicated that the affinity of the adsorbent is based on the hydrogen bonding between the -O- on the adsorbent and -OH on the polyphenols. Polyphenols could be selectively separated according to different phenolic structural groups. The free radical scavenger assay (DPPH) suggested that the polyphenols separated by hydrogen bonding affinity had higher antioxidant capacity than compounds purified by XAD-4 resin. Compared with XAD-4 resin, this innovative approach could result in a higher yield with better antioxidant capacity in a much shorter time.

**15 - Induction of HCT116 and HT29 colon cancer cell death by cranberry proanthocyanidins via mitogen activated protein kinase pathway** Anne M. Liberty, Tracie P. Ferreira, Catherine C. Neto Chemistry/Biochemistry, Univ. of Massachusetts, Dartmouth, N. Dartmouth, MA, US No abstract.

**16 - Resveratrol as a kcat type inhibitor of tyrosinase enzyme: Potentials as a melanogenesis inhibitor** Hiroki Satooka, Isao Kubo. Dept. of Nutritional Science & Toxicology, Univ. of California, Berkeley, Berkeley, CA, US; Dept. of Environmental Science, Policy and Management, Univ. of California, Berkeley, Berkeley, CA, US trans-Resveratrol (trans-3,5,4'-trihydroxystilbene) exhibited inhibitory activity against mushroom tyrosinase (EC1.14.18.1) through a kcat inhibition mechanism. Tyrosinase oxidized resveratrol and multiple oxidation products were observed with high performance liquid chromatography (HPLC) analysis. In the inhibitory assays, resveratrol did not inhibit the diphenolase activity of tyrosinase when L-3,4-dihydroxyphenylalanine (L-DOPA) was used as a substrate; however, L-tyrosine oxidation by tyrosinase was suppressed in presence of 100  $\mu\text{M}$  of resveratrol. Oxidation of resveratrol and inhibition of L-tyrosine oxidation suggests the kcat inhibition of resveratrol against tyrosinase. After tyrosinase was pre-incubated with resveratrol, both monophenolase and diphenolase activities of tyrosinase were significantly reduced, which indicates kcat inhibition. Furthermore, investigation was extended to the cellular experiments by using B16-F10 murine melanoma cells. Cellular melanin production was significantly suppressed by resveratrol without any cytotoxicity up to 200  $\mu\text{M}$ . of it. trans-pinosylvin was used as a comparison. These results suggest that possible usage of resveratrol as a tyrosinase inhibitor and a melanogenesis inhibitor.

**17 - Content of nutritional substances in commercial tea beverages** Shiming Li, Prof Chih-Yu Lo, Nancy E Rawson, Patricia Lucas-Schnarre, Prof Chi-Tang Ho Natural Product, WellGen Inc., North Brunswick, NJ, US; Dept. of Food Science, National Chiayi Univ., Chiayi, Taiwan, Taiwan Republic of China; Dept. of Food Science, Rutgers Univ., New Brunswick, NJ, US The health benefits attributed to black and green tea have been linked to active constituents with anti-oxidant, anti-tumor, anti-inflammatory, and anti-diabetic properties. Both in vitro and in vivo research indicate that the bioactive nutraceutical components are phenolic compounds such as polyphenols, particularly catechins like EGCG from green tea and theaflavins from black tea. In the US alone, ready-to-drink tea beverages account for over \$1 billion in sales and sales have grown rapidly during the past several years in parallel with the increased recognition of these healthful associations. Accordingly, there are numerous tea products on the market which occupy a growing portion of the beverage market both in volume and sales. However, the contents of the health promoting substances remain unknown, particularly to consumers, as reporting of these nutrients on a product label is not required by FDA. Accordingly, we used high performance liquid chromatography to determine the content of specific polyphenols in a sample of tea beverages with different market positioning for comparison with freshly brewed tea. This information may assist consumers in making informed choices regarding beverage consumption.

**18 - Acrylamide in cereal products: Precursors, formation, and control measures** Arwa Mustafa Dept. of Food Science, Swedish Univ. of Agricultural Sciences (SLU), Uppsala, Sweden Acrylamide (AA), is classified as a "probable human carcinogen" and a neurotoxin. AA is found at concentrations of up to a few mg/kg in carbohydrate-rich foods subjected to high thermal processing. AA is formed in foods via the Maillard reaction with free asparagine (Asn) and reducing sugars as the precursors, with the former being limiting in cereal products. Since the discovery of occurrence of AA in foods, many studies have investigated the factors affecting its formation and means of mitigating measures. The aim of this paper to give an over view on acrylamide's formation and the strategies that control its formation in cereal products. The principal of these strategies is to control or limit the availability of the Asn or modifying processing conditions. The strategies include: Controlling time and temperature of baking; addition of other amino acids, yeast fermentation or enzyme addition; addition of metal ions and antioxidants; addition of organic acids and changing the pH. Main results indicate that: optimizing baking parameters could be used as an effective means to control AA formation. Yeast fermentation has a pronounced reducing effect. And the addition of the amino acid glycine affects both AA content and bread's colour quality.

**19 - Surface plasmon resonance (SPR) detection of staphylococcal enterotoxin A in food samples** Marjorie B. Medina . Eastern Regional Research Center, USDA, 600 East Mermaid Lane, Wyndmoor, PA, An automated and rapid method for detection of staphylococcal enterotoxins (SE) is needed. A sandwich assay was developed using a surface plasmon resonance (SPR) biosensor for detection of staphylococcal enterotoxin A (SEA) at subpicomolar concentration. Assay conditions were optimized for capturing SEA from samples by the immobilized anti-SEA sensor followed by probing the SEA molecules by the injection of the second anti-SEA. Analysis of SEA in spiked chicken extracts resulted in  $r = 0.986 (+/-0.02 \text{ SD})$  for the captured SEA and  $0.994 (+/-0.006 \text{ SD})$  for anti-SEA binding. SEA was detected from the binding response units (RU) of the second anti-SEA using the  $B/B_0$  ratio where B was RU of samples and  $B_0$  was RU of zero control. SEA was detected in spiked chicken extracts at 1 ng/mL with the use of CM5 sensor chip. With use of CM3 sensor chip, SEA was detected at 0.5 ng/mL in spiked chicken tissues. These results show higher sensitivity than those reported in literature using the SPR sandwich assay for SE toxins.

**20 - Isolation, structure elucidation, synthesis and cytotoxic activity of polyacetylenes and polyenes from Echinacea pallida** Federica Pellati, Andrea Chicca, Barbara Adinolfi, Giulia Orlandini MD, Fabio Prati, Paola Nieri, Stefania Benvenuti Dept. of Pharmaceutical Sciences, Univ. of Modena and Reggio Emilia, Via G. Campi 183, Modena, Italy; Dept. of Psychiatry, Neurobiology, Pharmacology and

Biotechnology, Univ. of Pisa, Pisa, Italy; Dept. of Chemistry, Univ. of Modena and Reggio Emilia, Modena, Italy Lipophilic extracts of Echinacea roots were screened for their cytotoxic activity on human cancer cell lines and *E. pallida* was found to be the most active. Ten polyacetylenes and polyenes were then isolated by bioassay-guided fractionation from *E. pallida*, characterized and tested for cytotoxic activity. (8Z,13Z)-Pentadeca-8,13-dien-11-yn-2-one was the most active constituent, particularly on the colonic COLO 320 cancer cells ( $IC_{50} = 2.3 \pm 0.3 \text{ ?M}$ ). The cytotoxicity of this compound was also tested on breast carcinoma MCF-7 ( $IC_{50} = 2.5 \pm 0.7 \text{ ?M}$ ), melanoma MeWo ( $IC_{50} = 28.6 \pm 2.3 \text{ ?M}$ ) and pancreatic MIA PaCa-2 cancer cells ( $IC_{50} = 32.2 \pm 3.9 \text{ ?M}$ ). Apoptotic cell death was found to be involved in its mechanism of action. The total synthesis of this secondary metabolite was also described. A HPLC stability study of this polyenic compound indicated that the cytotoxic activity can be mainly attributed to the genuine not oxidized molecule.

**21 - Potential therapeutic applications of common agro-food byproducts and Chilean wild plants** Jorge Sineiro Torres, Maria Jose Nuñez Garcia, Monica Rubilar, Marta Cascante, Ezequiel Alvarez, Marivel Sanchez. Dept. of Chemical Engineering, Univ. of Santiago de Compostela, Santiago de Compostela, A Coruna, Spain; Dept. of Chemical Engineering, Univ. de La Frontera, Temuco, Temuco, Chile; Dept. of Biochem. and Molecular Biology, Univ. of Barcelona, Barcelona, Barcelona, Spain; Dept. of Medicine, Univ. of Santiago de Compostela, Santiago de Compostela, A Coruna, Spain; Dept. of Technology and Processes, Centro de Genómica Nutricional Agro-acuicola, Temuco, Temuco, Chile Procyanidins from pine bark were obtained by extraction with ethanol and further fractioning through Sephadex LH-20 using methanol/water mixtures. Extracts from grapeseed were preconcentrated with Amberlite XAD16 and further fractionated through Sephadex LH-20 or Toyop earl HW-40F. Comparison of galloylated and non-galloylated procyanidins showed the effect influence of galloylation on the induction of apoptosis in colonic cancer cells and in melanoma cells. Fractions from grapes showing galloylation percentages between 15 and 34 % and polymerization degrees between 1.7 and 3.4 induced apoptosis. The cardioprotective potential of proanthocyanidin-containing fractions from grape pomace were studied by measuring the inhibition of human endothelial NADPH oxidase.  $IC_{50}$  values for NADPH inhibition were in the range 2.5-3.4 mg/L. Extracts from green parts of murta (*Ugni molinae* Turcz.) and maqui (*Aristotelia chilensis*) are rich in flavonols (kaempferol, myricetin, rutin, among others) and the fruits were very rich in anthocyanins (malvidin triglycoside, cyanidin cumaroylglycoside). Murta and maqui extracts showed antihemolytic activity and inhibited alphasglucosidase, but not alpha-amylase.

**22 - Compositional characteristics of fruits of hawthorn (*Crataegus* sp.) and emblic leafflower (*Phyllanthus emblica*)** Dr Baoru Yang, Dr Heikki Kallio, Mr Pengzhan Liu MSc, Ms Maaria Kortensniemi. Dept. of Biochemistry and Food Chemistry, Univ. of Turku, Turku, Finland Nutraceuticals and functional foods play an important role in the management of lifestyle-related health problems in the western population. Compositional investigation on new potential raw materials is crucial for the development of nutraceuticals and functional foods. Fruits of hawthorn (*Crataegus* spp.) and emblic leafflower (*Phyllanthus emblica*) have been traditionally used both as food and as medicine in China. In western countries, these fruits are increasingly popular as new raw materials for food and food supplements with targeted physiological effects. Scientific evidence suggests beneficial effects of the fruits on sugar and lipid metabolism, cardiovascular health and immune functions. Current knowledge on the bioactive components and the mechanisms responsible for the health benefits is scanty. The aim of the present work is to investigate the composition of hawthorn and emblic leafflower fruits with special focus on sugars, acids and phenolic compounds important for the sensory properties and biological activities of the fruits. The analytical methods applied were high performance liquid chromatography (HPLC), gas chromatography (GC), mass spectrometry (MS), and nuclear magnetic resonance spectroscopy (NMR). Glucose was a major sugar commonly present in hawthorn, whereas sucrose was found only in some varieties. Fruits of emblic leafflower contained mostly fructose and glucose in the sugar fraction. The major fruit acids were citric, quinic and malic acids in hawthorn, malic acid in emblic leafflower. In addition, both fruits contained polyols, which may play a role in both the sensory profiles and health effects of the fruits. The major phenolic compounds in hawthorn were flavonol glycosides (hyperoside, isoquercitrin and other quercetin glycosides), anthocyanin (ideain), proanthocyanidins (epicatechin, B-type dimmers, trimers, tetramers and pentamers) and their glycosides. Fruits of emblic leafflower contained monomeric ellagitannins, gallic acid derivatives, galactaric acid gallates and derivatives as the prominent phenolic compounds. Significant compositional variation was revealed among species, cultivars and varieties of hawthorn and emblic leafflower, suggesting the need for selection of optimal raw material for specific applications

**23 - Natural pigments enhance stability of mRNAs of anti-oxidant enzymes in cultured mammalian cells** Bhagyalakshmi Neelwarne, Jyothi M Veigas Plant Cell Biotechnology, Central Food Technological Research Inst., Mysore, Karnataka, India A substantial amount of literature points to the fact that natural pigments offer enormous health benefits owing to their antioxidant properties. While there have also been a few studies on their DNA-protection and DNA-damage-reversal, the harm caused to RNA by pro-oxidants and ageing are seldom studied, although particularly mRNA is more prone to such damages due to its not-so-well protected situations in the cell as compared with DNA. Therefore, a study was done to check the efficacies of natural pigments on the mRNAs of defense/scavenger proteins of oxidative molecules as well as the other cellular protections offered by hydrophilic and hydrophobic pigments. Alterations in tert-butylhydroperoxide (TBH)-induced cytotoxicity by anthocyanins and carotenoids were studied in primary rat hepatocytes and human hepatocellular carcinoma (HCC) cell line, Hep3B. Cells treated with carotene-fractions (CF) and xanthophylls (XF) from flowers of *Delonix regia* and anthocyanins from fruit peels of *Sisymbrium cumini*, followed by TBH were compared with treatments with standard antioxidants such as epigallocatechin gallate (EGCG) and quercetin. Expressions of the antioxidant enzymes catalase (CAT), glutathione peroxidase (GPx) and superoxide dismutase (SOD), and key apoptotic pathway genes, Bcl-2 and Bax were followed along with other parameters like cell viability, cellular glutathione (GSH) content, lipid peroxidation, activities of antioxidant enzymes, Caspase-3 activity, DNA damage and morphological changes by microscopy. Exposure of cells to 0.5mM TBH caused 50% cell death in 3h, which was significantly reversed by prophy laxis with the pigment extracts, where anthocyanin was more efficient in circumventing the damage than the carotenoids. In the latter, XF effects were more pronounced than that of CF. Pigment extracts, but not the standards, elevated the GSH content above the control level indicating an ability to stimulate cellular GSH synthesis. TBH induced a 2-fold increase in lipid peroxidation which was abolished by XF, CF as well as EGCG and quercetin. Cell death by TBH was effected by apoptosis evidenced by microscopy, caspase-3 activation and reduced Bcl2/Bax ratio. Pretreatment of cells with extracts and standards increased expression ratio of Bcl2 to Bax and almost completely inhibited Caspase-3 activation. TBH induced SOD activity and inhibited GPx- CAT-activities were significantly reversed by pigments and standards, and even the alterations in TBH-induced transcript levels of antioxidant enzymes were reversed by pigments. Also, the mRNAs of antioxidant

enzymes were available for translations for much longer periods than in respective controls. The results suggest that antioxidant enzyme modulation by anthocyanins and CF and XF could chiefly be functioning against oxidative stress through regulation at transcription level, translation efficiency and signaling cascades involved in cell survival.

**24 - Sugar maple (*Acer saccharum*) phytochemicals: Antioxidant, antibacterial, and cancer cell cytotoxicity properties** Liya Li, Navindra P. Seeram. Biomedical and Pharmaceutical Sciences, Coll. of Pharmacy, Univ. of Rhode Island, Bioactive Botanical Research Laboratory, Kingston, RI, US Among the maple (*Acer*) genus, 6 species are native to North America. Of these, the sugar maple (*Acer saccharum*) tree is well known for providing maple syrup, a natural sweetener which is obtained by concentrating the tree sap. As part of our laboratory's ongoing research program to investigate medicinal plants native to the north east North American region, we initiated a comprehensive phytochemical investigation of the sugar maple plant parts (leaves, stems, bark, flowers, etc.) and products (sap, syrup and maple syrup residue; all obtained from Quebec, Canada). So far, twenty two compounds have been identified from Canadian maple syrup including 11 phenolic acid derivatives, 2 flavanols (catechin and epicatechin), 5 lignans (lyoniresinol, and coniferyl alcohol derivatives), 3 gallotannins (ginnalins A, B and C), and a stilbene (3,3'-dimethoxy-4,4'-dihydroxystilbene). The gallotannins and gallic acid were also predominant constituents in the sugar maple leaves. Several of these maple isolates have been previously reported to show antioxidant, antibacterial and anticancer activities. Therefore we evaluated the compounds and maple extracts for their biological activities. The antioxidant activities of the gallotannin isolates, measured as ability to scavenge DPPH free radicals, were comparable to ascorbic acid (IC50 10 ppm) and superior to the synthetic commercial antioxidant, butylated hydroxytoluene (IC50 583 ppm). Data on the inhibition of growth of methicillin resistant *Staphylococcus aureus* (MRSA) and a panel of human tumor cell lines by maple extracts and pure isolates will also be presented.

**25 - Carrot bisacetylenic oxylipins: Phytochemicals behind the mask of the superfood** Brandon T. Metzger Research and Development, Standard Process Inc., Palmyra, WI, US Carrots are an important vegetable of the American diet and contain numerous bioactive phytochemicals. Polyacetylenes are bitter tasting bisacetylenic oxylipins in the family of plants known as "Umbelliferae or Apiaceae", which include carrot, parsley, dill, fennel, celery, caraway, and Queen Anne's lace. Polyacetylenes are cytotoxic to certain fungi, microorganisms, and protective against various cancer cells in both in vitro and in vivo studies. Polyacetylenes possess bioactive properties which include the inhibition of lipid transport enzymes, induction of liver phase II detoxification enzymes, and anti-inflammatory activity. Carrots contain three predominate polyacetylenes which include falcarinol, falcarinol, and falcarinol 3-acetate. Recently, nine other bisacetylenic oxylipins were characterized. The concentration of polyacetylenes in colored carrot varies by as much as seven fold and may be dependent upon growing condition, type of root tissue, storage and processing conditions. Polyacetylenes have traditionally been extracted with ethyl acetate or dichloromethane, or more recently by supercritical fluid extraction.

**26 - Beyond olive oil: Active components and health aspects of some less known Mediterranean plant products** Nick Kalogeropoulos, Antonia Chiou, Andriana C. Kaliora, Vaios T. Karathanos, Nikolaos K. Andrikopoulos Dept. of Dietetics and Nutritional Science, Harokopio Univ., Athens, Greece Current advances on health benefits of Mediterranean diet components considered foods or functional food items, namely legumes, aromatic plants, currants, and Chios mastic, provide significant guidance for further research and for industries in developing nutraceutical products. Cooked legumes' polyphenols (11.8-25.9 mg gallic acid eq (GAE)/100g) - mainly flavonoids in lentils and chickpeas, phenolic acids in the others - and triterpenic acids (0.29-8.55 mg/100g) inhibit LDL oxidation in vitro. The infusions of 12 aromatic plants (polyphenolic content between 5.3-159.2 mg GAE/cup) exhibit potent antiradical activity (7.7-201.3 mg Trolox® eq/cup) and antioxidant capacity (FRAP values between 0.5-66.5 mg ascorbic acid eq/cup). Terpene rich Chios mastic exhibits potent antioxidant, anti-inflammatory and in vivo immunoregulating activity in inflammatory bowel disease. Polyphenol rich currants (151-246 mg GAE/100g, mainly phenolic acids) exhibit antiradical, LDL antioxidant and mononuclear cell cytoprotective activity. Further, currants induce death and exhibit antiproliferative and anti-inflammatory effect in gastric adenocarcinoma cells.

**27 - Bioactive secondary metabolites from agro-food industrial byproducts as source of dietary supplements** G.K. Jayaprakasha, Bhimanagouda S. Patil Horticultural Sciences, Vegetable & Fruit Improvement Center, Texas A&M Univ., Coll. Station, Texas, Recent years, dietary compounds harvested from bounties of nature have received much attention, primarily because epidemiological studies have shown that the consumption of fruits and vegetables associated with reduced risk of several diseases. Thus past few decades, natural products yielded a considerable number of drug candidates. It is imperative to rummage around the dietary components for identifying the biologically active molecules for the prevention of certain disease. In the present study, methods for bioactivity-guided isolation, purification and identification of secondary metabolites from byproducts such as juice and spice processing industries were explored. Byproducts of grapes, pomegranates, citrus and turmeric were extracted by solid liquid extractions. The extracts were fractionated by liquid-liquid partitioning followed by various chromatographic separation techniques such as flash chromatography, column chromatography (CC) and preparative high-performance reversed-phase liquid chromatography. The structures of the isolated compounds were elucidated by recent spectroscopic techniques, especially 2D NMR and mass spectrometry analysis. Isolation of bioactive secondary metabolites is usually monitored by bioactivity assays, e.g., antioxidant (2, 2-diphenyl-1-picryl hydrazyl) and cytotoxicity activities in human cancer cells. The present research report is based on work supported by the "Designing Foods for Health" through USDA CSREES Grant # 2009-34402-19831.

**28 - Bioavailability and delivery of nutraceuticals using nanotechnology** Qingrong Huang. Dept. of Food Science, Rutgers Univ., New Brunswick, NJ, US Nanotechnology is an enable technology that has the potential to revolutionize agriculture and food systems. Driven by increasing consumer demand for healthy food products, researchers have been applying tools and knowledge in nanotechnology to address the issues relevant to food and nutrition. This talk is mainly focused on nanoemulsions and polymer micelles-based delivery systems which have shown enhanced oral bioavailability and biological efficacies (i.e., antiinflammation, anti-cancer etc.) of different phytochemicals. Nanoemulsions are a class of extremely small droplets that appear to be transparent or translucent with a bluish coloration. Nanoemulsion preparation, characterization, and bioavailability will be discussed. Curcumin nanoemulsions show 85% inhibition of TPA-induced mouse ear inflammation as well as the inhibition of cyclin D1 expression, while dibenzoylmethane (DBM) nanoemulsion shows about three-fold

increase in oral bioavailability compared to the conventional DBM emulsion. Biopolymer micelles show significantly improved water solubility/dispersibility and in vitro anticancer

**29 - Rhizospheric signaling: From positive feedback to innate plant defense** Harsh Bais Dept. of Plant and Soil Sciences, Delaware Biotechnology Inst., Newark, DE, US The rhizosphere is the critical interface for initiating both beneficial and harmful interactions between plants and microbes and it has become apparent that plants use root exudates to manipulate these interactions. Our previous research shows that *Bacillus subtilis*, a known plant root associated rhizobacterium, forms a continuous biofilm on the plant root surface and this association is regulated by host root secretions. The genus *Bacillus* has great potential use in agriculture, as its members are able to synthesize antimicrobial metabolites to ward off plant pathogens. While plant-associated bacterial chemical signals have been identified as activators of plant defences, plant metabolites that elicit rhizobacterial responses have yet to be characterized. The oral presentation will emphasise the importance of root derived signals as modulators for beneficial bacteria recruitment leading to plant productivity and survival.

**30 - Stable isotope dilution assays for quantification of bioactives: Challenges and pitfalls** Timo Stark. Food Chemistry and Molecular Sensory Science, Technische Universität München, Freising, Freising, Germany Although much effort was put in the past on the correct structure determination of biologically active as well as toxicologically relevant natural products, their quantitative analysis is frequently lacking robustness and accuracy. This is, however, a necessary prerequisite for high-throughput routine quantitation of target molecules as required in food quality control as well as in biomedical research. As the use of stable isotopomers of analytes is known to enable the correction of compound discrimination during extraction, cleanup, chromatographic separation, and MS detection, stable isotope dilution assays (SIDA) are believed to be the most versatile and reliable method for the quantitative determination of bioactive molecules in food and biofluids. As the development of a SIDA is often hampered by the lack of stable isotope labelled standards, different strategies will be presented for the straightforward production of stable isotope labelled standards involving independent chemical synthesis as shown for a class of recently identified N-phenylpropenoyl amino acids, bioactives in cocoa, coffee and herbal drugs, a hemisynthetic approach based in the transformation of precursor molecules into the labeled target compound as demonstrated by resveratrol and ? -1-O-ethylvescalagin, both natural products in red wine, and, third, a biological approach using the biosynthetic power of a microorganism to produce the labeled compound as demonstrated for the quantitative analysis of cereulide, produced by emetic *Bacillus cereus* strains and causing an increasing number of severe food borne intoxications world-wide. Using these examples, the challenges and pitfalls of the strategies mentioned above will be discussed in the presentation.

**31 - Electrospun nanofibrous membranes: Novel materials for food technology applications** Alessandra Arecchi Dept. of Food Science, Technology and Microbiology, Univ. of Milan, Milan, Lombardia, Italy Nanotechnology regards the characterization, fabrication, and manipulation of biological and non-biological structures at dimensions of 1 to 100 nm. It provides materials with unique and novel functional properties interesting for many industrial sectors. This oral communication presents the results of exploiting nanostructured materials produced by electrospinning (nanofibrous membranes) for food technology applications. First, they were used as solid encapsulation systems of liposoluble bioactives (e.g. eugenol) by including liquid structures, emulsion droplets, in the polymer matrix. Then, electrospun membranes were used as a component of electrochemical and optical sensing devices for food quality control improving their analytical performance. Nylon nanofibrous meshes were utilized as protective coating of the surface of electrochemical transducers from the passivation of flavonoids, as bio-catalytic membrane in amperometric biosensors for the detection of glucose and polyphenols and, in combination with other nanomaterials, as sensitive surface of a disposable optical nanoprobe for the rapid detection of reducing sugars.

**32 - Analytical techniques ensure performance and quality of encapsulates** Danielle DiNallo. IFF Research and Development, Union Beach, NJ, US Fragrance ingredients are used in a wide variety of household and personal care products. However, it is often the case that hedonically important fragrance molecules are incompatible with various bases, are not substantive or would be more impactful if they could be released at specific points of product use. This can be achieved through development of encapsulated fragrance ingredients. The creation of successful fragrance capsule systems and products requires a significant amount of analytical support to ensure quality, monitor stability and confirm performance. This presentation will address the development of chromatography based methods that we have employed to evaluate fragrance capsule systems, how our lab has incorporated automation to handle large volumes of samples for these various methods and how chromatography data fits the creation of successful fragrance encapsulates.

**33 - Enrichment of the antioxidant activity in potato tuber by ultrasound and electric treatments** Kazunori Hironaka, Ms Takuro Funato MD, Hiroshi Koaze Dept. of Food Science, Obihiro Univ. of Agriculture and Veterinary Medicine, Obihiro, Japan Increased consumer interests in the health benefits of foods have led to significant development of nutraceuticals and functional foods. Potato (*Solanum tuberosum* L.) is one of the world's most important crops, ranking fifth in terms of human consumption and fourth in worldwide production. This study was initiated to improve antioxidant activity of potatoes by using ultrasound or electric treatments. The ultrasound treatment consisted of immersing whole potatoes in water and subjecting them to ultrasound instrument (600 w) for 5 or 10 min. For the electrical treatment, a potato was immersed in a 3% NaCl solution for 10 s and subsequently treated with 15 V and 4.5 mA (DC) for 10, 20 and 30 min in a parallel copper plate. Antioxidant activity and phenols were measured. Results indicated that the ultrasound treatment for 5 min increased the antioxidant activity (1.5 times) and chlorogenic acid content (1.5 times) as compared with non-treatment. The electric treatment for 10 min increased the antioxidant activity (1.6 times), total phenol content (1.2 times) and chlorogenic acid content (1.7 times) as compared with non-treatment. This study indicates that ultrasound or electric treatments can be useful for enriching antioxidant activity of potatoes.

**34 - Enhanced infusion of natural antioxidants into fruits using high hydrostatic pressure processing** Swetha Mahadevan, Mukund V Karwe. Dept. of Food Science, Rutgers, The State Univ. of New Jersey High hydrostatic pressure processing (HHPP), a non-thermal process, has been shown to enhance mass transfer rates by permeabilizing plant cell structures. This phenomenon can be used to infuse selective substances, such as antioxidants, to develop nutrient-dense food products. This study investigates HHPP aided infusion, as a model system, of quercetin into cranberries. Scarified-frozen-thawed cranberries processed between 100-551 MPa for 10 min showed a 3-fold

increase in the amount of quercetin infused compared to that in fruits processed at ambient conditions (control). Quercetin infused under HHPP for 10 min was same as that infused into control in 3 hours. Cell-structure permeabilization measurements showed no significant differences between control, HHPP treated scarified-frozen-thawed cranberries and scarified-fresh cranberries. All these samples, however, were significantly more permeabilized than unprocessed scarified-fresh cranberries. These results suggest that cell permeabilization, unlike in previous studies, may not be the primary cause of HHPP aided infusion in scarified-frozen-thawed cranberries.

**35 - Pressurized hot ethanol extraction of carotenoids from carrot waste** Arwa Mustafa, Assoc. Charlotta Turner Analytical Chemistry, Uppsala Univ., Uppsala, Sweden Carotenoids are known for their antioxidant activity and are of high nutritional importance. Carrots are among the richest sources of carotenes. However, due market policies, carrots should meet strict standards of size and shapes, making about 25% of carrots go as waste. The aim of this study is make use of carrots waste by extracting their carotenoids. Nevertheless, conventional extraction methods require the use of organic solvents, which are costly and environmentally hazardous. Therefore, the objective of this study is to optimizing a sustainable technology extraction procedure for carotenoids. Pressurized liquid extraction (PLE) utilizes conventional solvents at elevated temperatures and pressure, it requires less solvent in a shorter period of time, the set-up of the technique contain samples in an oxygen and light-free environment. The extraction solvent of choice was ethanol. The extraction procedure was optimized by varying the extraction time (2 - 10 min) and the temperature (60-180 °C).  $\beta$ -carotene is the most abundant form of carotenes in carrots (60 - 80 %), and hence was used as an indicator for carotenoids content in carrot waste. Results show a content of 8-19 mg/100g FW.

**36 - New paradigm for microwave extraction of essential oils and natural compounds** David Gunn. Milestone Inc, Shelton, CT, US Physical methods like steam and dry distillation, solvent extraction or cold pressing are traditionally used to isolate compounds such as essential oils or dyes from natural sources. All of them suffer of long extraction times, poor recovery, high energy consumes, losses of some volatile components, thermal or hydrolytic degradation and presence of toxic residues in the extracts. SolventFree Microwave Extraction (SFME) for essential oils and Microwave Hydrodiffusion and Gravity (MHG) for extraction of higher boiling point compounds overcome all drawbacks associated with processes performed under conventional heating. Microwaves allow direct homogeneous heating of the bulk of the natural material and cause the rupture of the cells and the glands more rapidly than conventional heating. This results in much shorter extraction time and higher extraction yields compared to traditional methods. Essential oils are obtained through SFME in concentrate form, free of any residual solvents or degradation side-products. Higher boiling compounds like flavonoids are similarly extracted through MHG retaining all antioxidants and organoleptic properties typical of fresh unprocessed products. The new microwave platforms Milestone NEOS and NEOS-GR fully dedicated to SFME and MHG, respectively, represent a major step forward towards the application of microwaves to promote and enhance the processes of extraction of essential oils and natural compounds.

**37 - Food for thoughts: The potential for food patenting** Kirby B Drake. Fulbright & Jaworski L.L.P. Despite widely held beliefs to the contrary, food-related inventions can indeed be patented although many challenges often arisen when these food-related patents are enforced. There have been several recent lawsuits concerning food-related patents including Martek Biosciences v. Nutrinova (a case dealing with the patentability issues related to supplemental DHA, an essential omega-3 fatty acid), Kemin Foods, L.C. v. OmniActive Health Technologies (a case dealing with a purified lutein made through a patented process) and various lawsuits by Monsanto related to crop seed patents. While patents may be sought for food-related inventions, patenting is not the only way, or always the best way, to protect these inventions. For example, The Coca-Cola Company has maintained the formula for Coca-Cola syrup secret for many years, and this is the crown jewel of its business. Similarly, the secrecy surrounding McDonald's Big Mac secret sauce or Kentucky Fried Chicken and the Colonel's secret recipe are an inherent part of the value of those companies, but the recipes/formulas have never been patented. Therefore, it is key to consider the interplay between patents and trade secrets and weigh the pros and cons of each form of protection for food-related inventions.

**38 - In vivo aroma release and sensory perception: The effect of HPMC concentration and viscosity** Graham T Eyres, Damian C Frank, Udayasika Piyasiri, Conor M Delahunty. Food and Nutritional Sciences, CSIRO, North Ryde, NSW, Australia A controlled consumption protocol utilising oral manipulation was used to investigate volatile aroma release during consumption of hydroxypropyl-methylcellulose (HPMC) samples. The release of five compounds (two ethyl-esters and three methyl-ketones with a range of physico-chemical properties) was measured during consumption using in-vivo proton-transfer-reaction mass spectrometry (PTR-MS). A significant decrease in pre-swallow volatile release ( $F=32$ ,  $p<0.0001$ ) was measured in samples with HPMC concentrations above 0.57g/100g. Sensory evaluation demonstrated that perceived fruity intensity of ethyl butanoate was significantly decreased by 40% with 3.2g/100g HPMC ( $F=12$ ,  $p<0.001$ ). Cross-modal interactions were observed, where sucrose enhanced perception of fruity aroma, and ethyl butanoate enhanced sweetness at low levels of HPMC. However, enhancement of both sweetness and fruity aroma was reduced at high concentrations of HPMC (3.2g/100g). Results demonstrate that volatile release, sweetness perception, fruity flavour perception and the taste-aroma interactions are significantly affected by HPMC concentration, particularly when the sample is manipulated in the mouth.

**39 - GC-MS and sensory strawberry flavor changes at five maturity stages** Xiaofen Du, Anne Plotto, Elizabeth Baldwin, Prof Russ Rouseff Ph D. Citrus Research and Education Center, Univ. of Florida, IFAS, Lake Alfred, Florida, US; Citrus and Subtropical Products Research Laboratory, USDA-ARS, Winter Haven, Florida, US; Citrus and Subtropical Products Research Laboratory, USDA-ARS, Winter Haven, FL, US; Citrus Research and Education Center, Univ. of Florida, IFAS, Lake Alfred, Florida, US Sensory and volatile changes of 'Festival' and 'Radiance' strawberries grown in Florida at five fruit developmental stages were examined at three harvest dates. Volatiles were extracted using SPME and quantified with GC-MS. Approximately 80 volatiles were quantified using an internal standard. Total volatiles increased continuously with fruit development. Major volatiles in the white and half red stages were hexanal, cis-3-hexenal, trans-2-hexenal, cis-3-hexenol, and trans-2-hexenol. In the three-quarter red stage, methyl, ethyl, butyl, and hexyl esters, linalool, and ? -decalactone increased dramatically. Ethyl butanoate, ethyl hexanoate, mesifurane, Furaneol, and ? -decalactone, increased 3 to 30 times between the final two maturity stages. The volatile profiles of 'Festival' and 'Radiance' cultivars were similar. Descriptive sensory analysis by 14 trained panelists indicated green flavor decreased dramatically, while strawberry flavor intensity increased continuously from white to overripe maturity stages. No sensory differences were observed between the two cultivars at equivalent maturity stages.

**40 - Flavor chemistry and the perception of flavor** Terry E Acree. Dept. of Food Science and Technology, Cornell Univ., Geneva, NY, US Riesling winegrapes produce aromatically distinctive wines, but the key odorants responsible for Riesling typicity are not well established. Previous literature and gas chromatography-olfactometry - mass spectrometry (GC-O/MS) studies indicate that monoterpenes, volatile thiols, vinyl phenols, sugar degradation products, and 1,1,6-trimethylidihydronaphthalene (TDN, "petrol") plus volatiles typical of alcoholic fermentation potentially contribute to Riesling typicity. Of the suprathreshold volatiles, only TDN is uniquely higher in Riesling than in other varieties and is typically at concentrations in excess of threshold. By comparison, monoterpenes (linalool, geraniol) in New York State Riesling rarely exceeded sensory threshold. The role of TDN in the perception Riesling varietal character exemplifies the challenges posed in predicting perceptions from chemical composition. I will describe some approaches we are taking to overcome these challenges.

**41 - Internet as a research tool for flavor chemistry: FlavorNet and beyond** Deborah D. Roberts Flavor Science Consulting LLC, Columbus, OH, US One of Terry Acree's passions was communication of flavor chemistry to other scientists through entertaining and educational lectures, given at worldwide scientific meetings. With the internet, Terry found a way to communicate to the whole world easily, and to share valuable flavor chemistry data. Jointly with Henri Arn at the Univ. of Zurich, he established FlavorNet <http://www.nysaes.cornell.edu/fst/faculty/acree/flavornet.html>, one of the first flavor chemistry databases. It was first published on the internet in 1997 and still serves as a key source for anyone doing GCO and trying to identify the compound with a particular odor at a certain retention index. In this presentation, I will compare flavor chemistry information currently available on the internet and possible future ways for us to communicate and perform research. I will show an example of how to use this information in an insightful way. Comments or ideas of these approaches can be added to the discussion at [www.flavorscience.net/blog](http://www.flavorscience.net/blog).

**42 - Retronasal smelling: The roles of nasal cavity and oral cavity sensory systems** Bruce P Halpern. Dept.s of Psychology and Neurobiology and Behavior, Cornell Univ., Ithaca, New York, US Smelling of odorants originating from the oral cavity and exhaled from the nasal cavities, i.e., retronasal smelling, can depend upon three sensory systems: the trigeminal innervations of the oral cavity and of the nasal cavities, and the olfactory system of the nasal cavities. The relative contributions of these three sensory systems depend upon the specific vapor-phase chemicals that are present and their concentrations. Stimulation might occur first in the oral cavity, followed by nasal trigeminal and finally nasal olfactory responses. The sequence could be important because initial central nervous system response to sensory input may elicit inhibition or modulation of later inputs. However, some chemicals, such as vapor-phase coumarin, octanoic acid, stearic acid, and vanillin do not stimulate the oral cavity trigeminal system. Other chemicals, e.g. TRPM8 agonists l-carvone, isopulegol, and linalool, provide less sensory information for oral cavity versus nasal cavities stimulation. Chemical, sensory system, and location all matter.

**43 - Unexpurgated CHARM of Terry Acree** Jane V. Leland . Research, Development, and Quality, Kraft Foods, Glenview, IL, US Terry Acree is revered in the scientific community and has also distinguished himself as a highly successful, selfless mentor to a wide range of protégés over his 40+ years as a Cornell Univ. professor. In this landmark observational study of more than 60 such subjects over a 30 year period, the speaker attempted to answer the question: "Just what makes Terry Acree so "quarking" special?" The speaker will introduce her "Unified Theory of Acree Specialness" which culminates from years of close study and reveals insights about their unique relationship. Now, finally, the "charmed" characteristics of Acree, which have for years elicited such admiration and curiosity, will be illuminated. In essence, the data substantiate an "Acree Impact Factor" with high statistical significance that quantifies the phenomenal effect and expansive reach of his unique contributions to mentee success and scientific research.

**44 - Phragrance and pharmacology** Professor Stuart Firestein Dept. of Biological sciences, Columbia Univ., New York, NY, US The mammalian odor receptor repertoire is the largest gene family in the genome and the largest collection of G-protein couple receptors (GPCRs) anywhere on the planet. As these receptors also participate in many other brain functions they are an important class of receptors. Indeed it is estimated that more than 50% of drugs have a GPCR as their target. We anticipate that learning about the properties of olfactory GPCRs should uncover basic principles of receptor function and regulation that will be relevant to pharmacological studies, including drug development. Especially important is the ability to use a varied and large chemical library from flavor and fragrance chemistry to investigate odor receptors. Detailed data on the properties of one particular odor receptor will be discussed, as will more general characteristics of odor receptors. Similarly ideas from pharmacology, such as antagonism and partial agonism, will be considered for application to odor receptors.

**45 - Rapid screening method for the determination of rodenticide content of commercial bait formulations** David A Goldade, Doreen L Griffin, Dustin T Keller. National Wildlife Research Center, Fort Collins, CO, US Rodents cause significant damage to many forms of agriculture and pose a significant threat to human health. Use of rodenticide baits is one popular method to help mitigate this damage. As a result of commercial applications or commensal use, the potential exists for unintended exposures to livestock, pets, wildlife, or humans. A variety of methods for the analysis of these baits can be found throughout the literature, but most are cost and/or time intensive approaches. We propose a rapid, simple, cost effective technique to screen bait formulations of unknown content. The technique employs microwave extraction followed by simple dilution and filtration before analysis by HPLC with UV detection. Results from fifteen different bait formulations containing seven different active ingredients are favorable with recovery for the majority of the active ingredients averaging 98%.

**46 - Multiresidue pesticide analysis of botanical dietary supplements by GC-MS/MS and LC-MS/MS** Feng Shi, Jon W Wong Kai Zhang, Douglas G Hayward, Timothy H. Begley. Center for Food Safety and Applied Nutrition, U.S. FDA, Colledge park, Maryland, US Many botanicals in dietary supplements are produced by conventional agricultural practices which include the application of pesticides. Therefore, analytical methods are needed but the complexity of these matrices present difficulties such as smaller sample sizes, concentrated matrices, and lower detection limits. Multiresidue procedures based on salt-out organic solvent extraction and cleanup procedures based on procedures used for fresh fruits and vegetables have been modified to analyze pesticides in botanicals. GC-MS/MS and LC-MS/MS procedures have been developed because of the specificities of these techniques to screen, quantitate, and identify pesticides in complex botanical matrices. Limits of quantitation at levels < 10-20 µg/kg levels, recoveries > 70% and relative standard deviations < 20% have been



determined for many pesticides in ginseng, a common botanical dietary supplement. Other botanicals studied were *Gingko biloba*, saw palmetto, kava kava, and chamomile. The goal of this work is to present a strategy that would lead to cost-effective and efficient pesticide analysis in a variety of botanicals based on validated procedures and advanced instrumentation such as GC-MS/MS and LC MS/MS.

**47 - Determination of diphacinone in kestrel and rat brain tissue** Steven F Volker, Katherine E Horak, Barnett A Rattner, David A Goldade. Analytical Chemistry Project, National Wildlife Research Center, Fort Collins, CO, US; USGS-Patuxent Wildlife Research Center Beltsville Laboratory, Beltsville, MD, US Diphacinone is an anticoagulant rodenticide registered for the control of numerous pest species. The accumulation of diphacinone residues in tissues plays an important role in determining potential exposure and toxicity to non-target animals in ecological risk assessments. To determine the concentration of diphacinone following acute oral dosing, the brains of kestrels and rats were excised and homogenized. Samples were extracted with acetonitrile and cleaned up by solid-phase extraction. Diphacinone content was determined by ion-pair reverse-phase HPLC with ultraviolet detection at 325 nm. The method limit of detection (MLOD) for kestrel and rat brains averaged 0.047 and 0.081  $\mu\text{g/g}$ , respectively. The mean recoveries at 0.17 and 1.7  $\mu\text{g/g}$  were 97( $\pm$ 3)% and 96( $\pm$ 2)% for kestrels, and 114( $\pm$ 8)% and 102( $\pm$ 1)% for rats, respectively. Results generated by this method will be incorporated into a physiologically-based pharmacokinetic model of diphacinone in birds and mammals.

**48 - Genetic makeup of native proteins changes the secondary structure features: A synchrotron FTIR study of Arabidopsis seed storage proteins** Mr. Thushan Sanjeeva MSc, Dwayne D. Hegedus, Peiqiang Yu, Xiao Qiu, Ms. Tara C. McIntosh, Tim May, Janitha P.D. Wanasundara Agriculture and Agri-Food Canada, Saskatoon, Saskatchewan, Canada; Dept. of Food and Bioproduct Sciences, Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada; Dept. of Animal and Poultry Science, Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada; Canadian Light Source Inc., Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada Seed storage proteins (SSP) of *Arabidopsis thaliana* (a Crucifer) is consisted of cruciferin (11S, 60%) and napin (2S, 20%). Cruciferin of *A. thaliana* (cv. Columbia) is a hexameric protein composed of 6 subunits encoded by three paralogous genes (CRUA, CRUB and CRUC) and napin isoforms are encoded by 5 genes. Mature seeds of six *A. thaliana* lines [wild type (WT), three cruciferin double knockouts (D-KO; AAbbcc, aaBBcc, and aabbCC), one triple cruciferin knockout (T-KO) and a napin knockout (N-KO)] were used for Synchrotron-FTIR (S-FTIR) analysis of secondary structure properties of the entire SSP complement. Significantly different secondary structure features were observed for deconvoluted amide I bands, especially in the lines containing modified proteins (Fig. 1). Curve fitting of deconvoluted spectra gave higher  $\beta$ -sheet values than  $\beta$ -helices in the WT proteins (Table 1). Proteins of cruciferin completely eliminated lines (T-KO) showed increased turns and disordered structures suggesting the presence of filler proteins that are unable to fold into higher order secondary structures. Seed protein from napin eliminated (N-KO) lines exhibited slightly less  $\beta$ -sheets than that from wild type lines. Among the cruciferin D-KOs,  $\beta$ -helices and disordered structures were significantly higher than wild type indicating that these modified protein mixtures may exhibit different properties. The results show that S-FTIR can reveal differences between SSP of different composition and suggests usefulness of this technique in the field of in-situ protein structure determination in proteogenomics.

**49 - Effect of novel cutinase CcCut1 in degrading potato suberin and berry cutin** Riikka Järvinen, Ulla Holopainen, Antti Nyysölä, Armando Silvestre, Ana Maria Gil, Pekka Lehtinen, Johanna Buchert, Heikki Kallio. Dept. of Biochemistry and Food chemistry, Univ. of Turku, Turku, Finland; VTT Technical Research Centre of Finland, Espoo, Finland; CICECO and Dept. of Chemistry, Univ. of Aveiro, Aveiro, Portugal Cutinases catalyze the hydrolysis of natural cuticular polyesters (cutin, suberin) to lower molecular weight components. These enzymes are thus potentially valuable tools for by-product exploitation in agricultural industry. Cutin and suberin polymers are composed of long chain non-substituted and hydroxy/epoxy-substituted  $\omega$ -hydroxy fatty acids and  $\omega,\omega'$ -dicarboxylic acids. A novel cutinase CcCUT1 (from *Coprinus cinereus*) was investigated for degradation of potato suberin and black currant cutin. Cutinase hydrolysis and chemical methanolysis of suberin were compared and the  $\text{CHCl}_3$ -soluble monomeric fragments identified as TMS derivatives with GC-MS. The solid, hydrolysis-resistant residues of suberin were analyzed with solid state  $^{13}\text{C}$  CP-MAS NMR and FT-IR. The cutinase hydrolysis resistant residual microstructures, of both potato suberin and black currant cutin, were analysed by light and confocal microscopy. Gravimetric analysis showed that methanolysis was more effective than cutinase treatment for releasing  $\text{CHCl}_3$ -soluble material. The results of the analysis of monomeric components indicate that cutinases are more specific towards  $\omega,\omega'$ -dioic acids than  $\omega$ -hydroxy acids. Spectroscopic analysis and microscopy of the residues further revealed the mode of action.

**50 - Native and synthetic autoinducers regulate the virulence of the plant pathogens Pectobacterium carotovora and Pseudomonas syringae in host plants** Andrew G Palmer, Evan Streng, Helen E Blackwell Dept. of Chemistry, Univ. of Wisconsin-Madison, Madison, WI, US Many bacteria display distinct phenotypes as a function of cell density, a phenomenon known as quorum sensing (QS). QS-regulated phenotypes are frequently critical in initiating or maintaining associations with their eukaryotic hosts. We propose that plant-pathogenic bacteria, such as *Pectobacterium carotovora* Ecc71 and *Pseudomonas syringae* B278A, whose virulence is regulated by QS, are ideal systems for evaluating QS under native conditions. Herein we have utilized a library of AHL and AHL analogues to regulate QS mediated virulence in both *P. carotovora* and *P. syringae* upon inoculation into their hosts, *Solanum tuberosum* (potato) and *Phaseolus vulgaris* (green beans), respectively. These model host-pathogen systems support the use of synthetic AHLs to regulate bacterial behavior under native conditions, while simultaneously highlighting the limits of QS assays performed in culture. Finally, these compounds identify a number of prospective inhibitors for reducing virulence factor production in plant-pathogenic bacteria.

**51 - Poly(lactic acid) and Osage orange wood fiber composites for agricultural mulch films** Victoria Finkenstadt, Brent Tisserat. Nat'l Center for Agricultural Utilization Research, USDA, Peoria, IL Osage orange wood (OO) was combined with poly(lactic acid) (PLA) to form a polymer composite intended for use as an agricultural mulch film. The PLA-OO mechanical properties were comparable to existing mulch film products and had the advantage of being completely biodegradable through a single growing season. PLA-OO composites were evaluated for mechanical properties in both dry and wet conditions. The availability of its organic components useful for release into the environment was determined to be significantly higher than native OO before thermomechanical treatment. PLA-OO mulch films will provide a weed barrier and control soil erosion, as well as allowing the controlled release of the OO phytochemical components for additional protection.

**52 - Uptake of organochlorine pesticides by agricultural crops: Mechanistic studies** William A. Berger, MaryJane I. Mattina, Emeritus. Analytical Chemistry, The Connecticut Agricultural Experiment Station, New Haven, CT Organochlorine pesticides, such as chlordane, belong to a group of compounds known as persistent organic pollutants (POPs). Work at CAES has shown that Cucurbita pepo (zucchini) plants have the ability to phytoextract significant quantities of chlordane from soil, and has identified the root physiology as primarily responsible. Experiments employing hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) as a source of hydroxyl radicals (\*OH), known to inhibit aquaporins in root cells, will be described. Zucchini plants were grown hydroponically for six weeks prior to being spiked with technical chlordane. Chlordane content in roots and xylem sap was significantly reduced in plants treated overnight with H<sub>2</sub>O<sub>2</sub>. Significant changes in enantiomeric profile of some chiral chlordane components were also seen in the roots. The implication of aquaporins in POPs uptake by C. pepo, and the involvement of \*OH as an inhibitor, may assist in the further elucidation of the uptake mechanism.

**53 - Hydroxylated polymethoxyflavones from orange peel as novel cancer preventive agents** Hang Xiao, Peiju Qiu, Ping Dong, Chi-Tang Ho, Shiming Li. Dept. of Food Science, Univ. of Massachusetts, Amherst, MA, US; Dept. of Food Science, Rutgers, the State Univ. of New Jersey, New Brunswick, NJ, US Polymethoxyflavones (PMFs) are a unique class of flavonoids mainly found in citrus plants, and they exhibited a broad spectrum of biological activity including anti-cancer effects. Recently, hydroxylated PMFs (OH-PMFs) have been isolated from aged orange peel extracts. Our results showed that OH-PMFs, such as 5-hydroxy -6,7,8,3',4'-pentamethoxyflavone (5HPMF), 5-hydroxy -3,6,7,8,3',4'-hexamethoxy flavone (5HHMF), and 5-hydroxy -6,7,8,4'-tetramethoxyflavone (5HTMF) potently inhibited the growth of multiple human cancer cells. Furthermore, we demonstrated that the growth inhibitory effects by OH-PMFs were associated with induction of apoptosis and cell cycle arrest. By investigating the effects of OH-PMFs on several isogenetic variants of HCT116 human colon cancer cells, we found that OH-PMFs, especially 5HHMF and 5HTMF induce apoptosis and cell cycle arrest by a p53 and BAX dependent manner. Our results also demonstrate that combination of OH-PMFs with certain pharmacological drugs, such as statins can produce strong synergy in inhibiting human cancer cell growth.

**54 - Anthocyanin-containing fruits and vegetables are functional foods with potential to ameliorate debilitating diseases,** Muraleedharan G Nair, CChem., FRSC.. Horticulture and National Food Safety & Toxicology Center, Michigan State Univ., East Lansing, Michigan, US The quality of food consumed has significant impact on the overall wellbeing of the humans. Food and health are synonymous these days to many even in countries with less food security. This is because daily consumption of food containing beneficial bioactive natural products could deliver an effective dose of such non-nutritional components with potential to ameliorate chronic pain to a number of debilitating diseases including cancer, metabolic syndrome and Alzheimer's disease. Fruits, vegetables, berries and other generally regarded as safe (GRAS) plants play an important role in filling this space occupied by functional foods. Among the bioactive natural products present in fruits and vegetables, the water-soluble anthocyanins have demonstrated strong antioxidant, anti-inflammatory, anticancer activities in addition to its ability to reduce weight gain under obese conditions and ameliorate blood sugar.

**55 - Lipid accumulation and inflammation inhibition by Vaccinium floribundum proanthocyanidins** Maria Schreckinger, Jinzhi Wang, Gad Yousef, Mary Ann Lila, Elvira Gonzalez de Mejia., Univ of Illinois, Urbana, IL The objective was to characterize anthocyanins and proanthocyanidins in V. floribundum and evaluate their capacity to modulate adipogenesis and lipid accumulation in 3T3-L1 adipocytes. The inflammatory properties were also evaluated on lipopolysaccharide-stimulated RAW 264.7 macrophages. Total anthocyanin content was 10.6 mg/g DW cyanidin-3-glucoside equivalents while 5.2 mg/g DW epicatechin equivalents of total proanthocyanidins were detected. Trimers (68%), pentamers (16%) and hexamers (8%) were found. A commercial powder contained proanthocyanidin oligomers, mainly dimers (34%) and trimers (23%). Total phenolics and antioxidant capacity were highly correlated (R<sup>2</sup> 0.86). Proanthocyanidin enriched-fraction (PAC) inhibited lipid accumulation 38% when treated throughout the differentiation process and increased Pref-1 expression, a transmembrane protein highly expressed in preadipocytes that inhibits the initiation of adipogenesis. PAC decreased production of nitric oxide, prostaglandin E<sub>2</sub> and the expression of inducible nitric oxide synthase and cyclooxygenase-2. V. floribundum phytochemicals limit adipogenesis and fat accumulation, and inflammatory pathways in vitro, demonstrating health promoting properties and the need for in vivo studies.

**56 - Mediterranean wild plants: Endless source of natural food additives?** Prof Antonio Fiorentino, Brigida D'Abrosca, Assunta Esposito MD, Marina Isidori MD, Pietro Monaco MD, Severina Pacifico, Dr Simona Piccolella MD, Andreina Ricci, Monica Scognamiglio MD. Life Sciences, Second Univ. of Naples, Caserta, Italy There is a growing interest in the search of new natural products to be used as additives, instead of synthetic compounds, in preserving flavour, improving taste and appearance and preventing food and drinks from mouldy or stale.<sup>1</sup> Mediterranean area is known to be a hot spot of a very high plant species biodiversity and, for its strong environmental conditions (e.g. drought stress), a potential source of wide phytochemical diversity.<sup>2</sup> In this context and in order to discover new bioactive compounds, we carried out phytochemical analysis of Mediterranean wild plants species.<sup>3,4</sup> Several new metabolites have been isolated and their structural elucidation performed by a combined approach using ESI-MS/MS techniques and 1D and 2D NMR experiments.<sup>5</sup> Crude extracts and pure metabolites have been tested by using different antioxidant and radical scavenging bioassays as well as antiproliferative tests on stabilized cell lines.<sup>6</sup> In order to propose the use of such compounds in industrially processed foods, an overall toxicity approach has been adopted considering aquatic toxicity testing, mutagenesis, genotoxicity and endocrine active compound testing.

**57 - Pig cecum model: A powerful system to mimic the human intestinal metabolism of flavonoids** Gordon van 't Slot, Katrin Rose, Anna Engemann, Hans-Ulrich Humpf. Inst. of Food Chemistry, Univ. of Muenster, Muenster, Germany In our daily diet, we ingest flavonoids by consuming fruits, vegetables and any kind of plant-based foods and beverages (e.g. coffee, tea, wine and chocolate). Flavonoids are well known for their antioxidative properties and experimental studies using animals or cultured human cell lines support a role of polyphenols in the prevention of cardiovascular diseases, cancer, neurodegenerative diseases, diabetes or osteoporosis. However, the data on the bioavailability of polyphenols are very limited and mainly based on the analysis of blood, urine or fecal samples. There is little information regarding the intestinal absorption and metabolism by the gut microbiota. For this reason different in-vitro systems have been developed studying the metabolism by the intestinal microbiota. However most in-vitro experiments are not comparable with the in-vivo

conditions. For example incubation experiments with single bacterial species represent only a small section of the complex gut microbiota with its more than 400 bacterial species. Furthermore the incubation with fecal samples is critical due to the strict anaerobiosis in the intestine. For a better reproducibility of the in-vivo conditions, we have recently developed a new ex-vivo model system. Here, the gut microbiota is directly isolated from the cecum and colon ascendens of freshly slaughtered pigs under strict anaerobic conditions. The characterization of the pig cecal microbiota by fluorescence in situ hybridization (FISH) with 16S rRNA-based oligonucleotide probes confirmed that the pig cecum is an excellent model to mimic the human intestinal metabolism of flavonoids. The isolated inoculum was suspended in a phosphate buffer containing a trace element solution. To maintain anaerobiosis, the buffer was supplemented with a reducing reagent and flushed with a mixture of N<sub>2</sub> and CO<sub>2</sub>. The incubation of flavonoids with the cecal microbiota was performed on a micro scale. In this presentation the pig cecum model will be described in detail and the intestinal metabolism of flavonoids with different aglycones, sugar moieties, and types of glycosidic bonds will be presented. Most of the tested compounds were metabolized by the gut microbiota and these results clearly indicate that the intestinal metabolism plays an important role in the metabolism and bioavailability of flavonoids.

**58 - Bioactive constituents from Formosan Kadsura and Schisandra** Ya-Ching Shen. Sch. of Pharmacy, Coll. of Medicine, National Taiwan Univ., Taipei, Taiwan, Taiwan Republic of China Plants of the genus *Kadsura* and *Schisandra* are rich in novel lignans and triterpenoids with interesting biological functions. Recently we have isolated many new dibenzooctadiene lignans and novel triterpenoids, including taiwankadsurins A-C, kadsuphilactones A-B were from Formosan medicinal plant *Kadsura philippinensis*. Phytochemical investigation of the *Schisandra arisanensis* also yielded many new aryltetralone lignans and novel nortriterpenoids. Arisandilactone A possesses an unprecedented skeleton having a 5/5/7/5/8/5-fused hexacyclic ring system. Fractionation of acetone extract by extensive chromatographic analysis afforded additional five new nortriterpene lactones, arisanlactones A-E. Arisanlactone A is a wuweiziartane-type nortriterpenoid, which contains a new class of fused ring system. Arisanlactone B is categorized as a schisanartane-type, and arisanlactones C-E are pre-schisanartane-type nortriterpenoids. All the structures of the above compounds were elucidated by 1D, 2D-NMR, HRMS, CD and single crystal X-ray diffraction analysis. Antitumor, antioxidative, anti-viral and immunomodulatory activities of these compounds were tested and evaluated. Biogenetic pathways for these novel triterpenoids were also proposed.

**59 - Chemical properties and antioxidant capacity of Chinese bay berry juice** Xingqian Ye. Dept. of Food Sci. and Nutrition, Zhejiang Univ., Hangzhou, China Chinese bayberry (*myrica rubra*) is one of evergreen subtropical fruit in China. Some studies showed that Chinese bayberry had good antioxidant activity, and the assay also showed that the antioxidant ability may attributed to higher anthocyanins, flavonoids and total phenols content. Phenolic compounds and antioxidant capacities of bayberry juices from 14 cultivars were investigated. HPLC-DAD and Folin-Ciocalteu methods were used for the analysis of the phenolic compounds. Biqi had the highest content of total flavonols ( $56.75 \pm 4.68$  mg/l), Wuzi had the highest content of phenolic acids ( $30.1 \pm 0.05$  mg/l), and Lihzhizhong had the highest content of anthocyanins ( $514 \pm 46.1$  mg/l) and total phenolics ( $1055 \pm 9.32$  mg GAE/l). The FRAP and ABTS[1]<sup>+</sup> assay indicated that bayberry juices possessed considerable antioxidant activities, and all the analysed phenolic components contributed to the antioxidant capacities. The results showed that bayberry juices from red coloured cultivars possessed higher contents of phenolic compounds than those from white coloured cultivars. The higher antioxidant capacities of red bayberry juices imply they might be resources for the development of functional drinks.

**60 - Berry extracts and brain aging: Clearance of toxic protein accumulation in brain via induction of autophagy** Shibu M Poullose, Donna F Bielinski, Barbara Shukitt-Hale, Derek R Fisher, James A. Joseph Neuroscience, USDA-ARS, Jean Mayer Human Nutrition Research Center on Aging., Boston, MA, US; HNRCA, Tufts Univ., Boston, MA, US Blueberries and strawberries are known to enhance brain health via their antioxidant and anti-inflammatory properties. We investigated the rescuing effects of these berry extracts on neurons through induction of autophagy, a mechanism by which toxic debris are sequestered in the brain. Studies using HT22 hippocampal neuronal cells and BV2 microglial cells have indicated that the extracts at 0.1 to 2mg/ml concentrations inhibited mTOR (mammalian target of rapamycin), which negatively regulates autophagy. Further studies using MAP1-LC3-I&II, autophagosome markers, indicated a dose dependent increase in LC3-II formation and clearance. The cells negated the effects of bafilomycin A1, an autophagy inhibitor, when pre-treated with berry extracts. Immunofluorescence and western blots showed the clearance of polyubiquitin-binding protein p62/SQSTM1 at varying concentration of these extracts. Overall, the results strongly suggest that the benefits of both berries extend beyond the antioxidant and anti-inflammatory effects to cellular toxic clearance through induction of autophagy in brain.

**61 - Composition of fruit and vegetative cranberry phenolics with relation to antioxidant capacity** Nicholi Vorsa, Ajay P Singh, Ted Wilson, Michelle R Freeman, Vasil Vorsa Marucci Center for Blueberry and Cranberry Research and Extension, 125A Lake Oswego Rd, Rutgers Univ., Chatsworth, NJ, US; Plant Biology and Pathology, Rutgers Univ., New Brunswick, NJ, US; Dept. of Biology, 232 Pastuer Hall, 725 West Mark Street, Winona State Univ., Winona, MN, US Plant products include complex mixtures compositions of phenolic acids. Phenolic acids are present in the human diet and many studies suggest that these components may provide beneficial effects by several possible mechanisms, including prevention of oxidative stress by scavenging free radicals, preservation of other antioxidants owing to their redox potential, chelation of transition metals involved in free radical generation, and modulation of the activity of enzyme activity and second messenger function. The phenolic acids from leaf, stems and fruit of cranberry have received little attention as compared to proanthocyanidins and flavonols towards health benefits. Furthermore, limited information is available regarding quantitative evaluation of phenolic acids and correlation with antioxidant capacity of cranberry cultivars grown in United States. Phenolic acids in leaves (0.2mg/gram), stems (0.01mg/gram) and fruit (0.8mg/gram) were analyzed using the reverse phase ultra performance liquid chromatography (UPLC) attached to Tandem Mass spectrometry (LC-MS-MS). More than 10 phenolic acids were identified in leaves, stem and fruit of cranberry cultivars, Extract antioxidant activity was determined by using 10uM Cu<sup>++</sup> and A234nm lag-time. All leaf extracts had a significantly higher GAE than all stem extracts at 0.1 mg/L, with no correlation between runner and upright tissues. The cultivar Mullica Queen (MQ) demonstrated significantly higher vegetative antioxidant activity relative to Early Black and Demoranville. This is first report to use precursor ion, neutral ion and products ion scans to identify the 3-caffeoylquinic acid and 5-caffeoylquinic acid along with minor acids protocatechuic acid, p-coumaric acid-O-glucoside, p-coumaroylquinic acid, dicaffeoylquinic acid, caffeic acid-O-glucoside, 4-caffeoylquinic acid, 3-acetyl-4-caffeoylquinic acid and other caffeic acid conjugates and other minor acids. MS-MS scans were able to confirm the 3 and 5-

caffeoylquinic acids in leaf and 5 and 4-caffeoylquinic acids in fruit. Cranberry plant phenolics and antioxidant activity may be important for the development of future cranberry-derived health products.

**62 - Enhanced production of anticancer Camptothecins in *Camptotheca*** Shiyu Li, Zhizhen Zhang, Ping Wang, Wei Yuan, Arthur Temple. Coll. of Forestry and Agriculture, Stephen F. Austin State Univ., Nacogdoches, TX, US. *Camptotheca Decaisne* (Nyssaceae) is the main source of anticancer camptothecins (CPTs). Since 1993, our research has focused on developing *Camptotheca* as pharmaceutical crops: discovered two additional species to the monotypic Chinese genus, measured genetic diversity, preserved endangered germplasm, developed four high CPT-yielding cultivars with desirable features, analyzed CPT accumulation and variation, and developed crop harvest and commercial production methods for CPTs. We found that auxin-reducing pruning induced *in vivo* biosynthesis of CPTs and increased CPT content by about three fold. Pruning treatment could also increase the derivatization of the alkaloids in *Camptotheca* and three new alkaloids were isolated from the induced trees of *C. acuminata* Decaisne. 10-methoxy-20-O-acetylcamptothecin, a new CPT analog showed cytotoxicity against several human tumor cell lines. Unlike cytotoxic CPTs those poisoning the DNA-Topoisomerase I (TOP1) cleavage complex, five flavonoids inhibited TOP1 catalytic activity by interacting directly with the free enzyme and preventing the formation of the DNA-TOP1 complex. Endogenous autotoxicity in *Camptotheca* induced by elevated CPT levels will be also discussed.

**63 - Chemical constituents and biological activity of Taiwanese sugar cane extract** Yang-Chang Wu. Graduate Inst. of Natural Products, Kaohsiung Medical Univ., Kaohsiung, Taiwan, Taiwan Republic of China. Taiwan is one of the important countries in sugar production in the World War II. In these decades, the research had been focused on elevating the yield of sugar, and the scale of this industry decreased due to the higher labor fees. In this study, the experimental material is a special by-product of sugar cane extract obtained during sugar production. The extract showed good activity of antioxidant, anti-inflammatory, as well as anti-platelet aggregation effects. The above preliminary data lead us to investigate on the chemical constituents and biological activity of this special sugar cane extract. Using bioassay-guided fractionation and purification, 40 pure compounds were obtained from this special sugar cane extract. The chemical and biological profiles will be reported in this presentation.

**64 - Inhibition of intestinal alpha-glucosidases and anti-postprandial hyperglycemic effect of grape seed extract** Kequan Zhou. Nutrition and Food Science, Wayne State Univ., Detroit, MI, US. Because intestinal  $\alpha$ -glucosidase plays a key role in carbohydrate digestion and absorption, the inhibition of  $\alpha$ -glucosidase provides a metabolic enzyme target as a therapeutic option for diabetes through improving postprandial glucose control. We recently identified an extract of specific grape seed (GSE) significantly inhibited yeast and mammalian  $\alpha$ -glucosidases. The inhibition of GSE on yeast  $\alpha$ -glucosidase was significantly stronger than that of acarbose, a commercial  $\alpha$ -glucosidase inhibitor. GSE also inhibited rat  $\alpha$ -glucosidases in a dose- and time-dependent manner with an IC<sub>50</sub> of 0.87 mg/mL in the reaction. The inhibition of GSE on both yeast and rat  $\alpha$ -glucosidases followed a competitive pattern as shown by Lineweaver-Burk plots. The potential anti-diabetic effect of GSE was further evaluated in an animal model. Male 6 week-old C57BLK/6NCr mice were treated by streptozocin (STZ) to induce diabetes. The results showed the oral intake of GSE (400mg/kg, body weight) significantly suppressed postprandial hyperglycemia in STZ-induced diabetic mice. Oral administration of GSE reduced postprandial blood glucose in the diabetic mice by 20.5% and 40.2% at 30 and 60 min after the starch meal. Overall, GSE intake reduced the incremental AUC<sub>0-120min</sub> (area under postprandial glycemic curve) by 27.3% as compared to the control. Our results strongly suggest the potential of developing GSE, as a novel inhibitor of  $\alpha$ -glucosidases, for diabetes prevention and treatment.

**65 - Wild Blueberries (*Vaccinium angustifolium*): Modulators of vascular function, structure and metabolism** Dorothy Klimis-Zacas. Dept. of Food Science and Human Nutrition, Univ. of Maine, Orono, Maine, US. We were the first to document that wild blueberries, high in phenolics and anthocyanins, when incorporated into the diets of rats with functional, Sprague-Dawley (SD), and dysfunctional endothelium, SHRs (Spontaneously Hypertensive Rats) affect the biomechanical properties of arteries by decreasing Phenylephrine-induced vasoconstriction through endothelium-related pathways, possibly Nitric Oxide (NO). In contrast in the young and adult SHR, wild blueberry diets increase Achetylcholine-induced, endothelium-dependent vasorelaxation by modulating the Cyclooxygenase pathway (COX) and production/activity of COX-derived prostanoids. Furthermore wild blueberry-enriched diets result in structural alterations of aortic glycosaminoglycans (GAGs) such GAG concentration, redistribution and lower concentration of oversulfated disaccharides in GalAG populations both in the SD and SHR models affecting cellular signal transduction pathways and leading to a less atherogenic profile in the SHR. Thus, wild blueberry consumption may be important in maintenance of vasomotor tone and atheroprotection with implications to preventing CVD and improving endothelial dysfunction.

**66 - Distribution and biological activity of Citrus juices flavonoids** Davide Barreca, Dr Ersilia Bellocco, Corrado Caristi, Ugo Leuzzi, Giuseppe Gattuso. Dipartimento di Chimica Organica e Biologica, Università di Messina, Messina, Italy. A rapid methodology based on a single chromatographic course by reverse-phase HPLC-DAD-ESI-MS-MS has allowed us to determine the qualitative and quantitative profiles of the flavonoid and furocoumarin components of several Citrus juices. Recently we have investigated the closely related taxons, bergamot, myrtle-leaved orange and sour orange and, as expected, we found significant amounts of naringin, neohesperidin and neoeriocitrin (6-136 mg/L). We also detected, for the first time, a wide variety of C-glucosyl flavone (lucenin-2, vicenin-2, lucenin-2 4'-methyl ether, stellarin-2, scoparin, isovitexin, orientin 4'-methyl ether; 0.2-66 mg/L), as well as O-glycosyl flavones and flavanones (rhoifolin, rhoifolin 4'-glucoside, narirutin 4'-glucoside, narirutin, melitidin, brutieridin; 0.2-190 mg/L), whose beneficial properties are yet to be studied. Furthermore, we investigated the antioxidant activity of these crude juices, along with the ability of selected flavonoids to induce apoptotic cascade by caspase activation, and to interact with biological macromolecules.

**67 - Flavor of foods: The sound of an orchestra rather than that of a single instrument** Peter H. Schieberle. Dept. of Chemistry, Food Chemistry, Garching, Bavaria, Germany. In the early days of food flavor research, most people were convinced that the aroma of foods is the result of one single component bearing the same aroma attribute. In particular the discovery of vanillin in vanilla beans, and its successful synthesis in the 19th century, had strengthened the idea of such "character impact odorants". However, it turned out quite fast that only in a very few cases, for example for 1-octen-3-one in mushrooms, benzaldehyde in bitter almonds or menthone in peppermint leaves, such

“character impact odorants” could be identified. Instead, in particular the application of gas chromatography since the early sixties resulted in the identification of hundreds of compounds in the volatile fractions of foods. Terry Acree was among the first to come up with the idea that not a single, but a small set of key aroma compounds is needed to generate a given food aroma. To differentiate these compounds from the bulk of odorless volatiles method like CHARM analysis or the odor activity values were developed. Using several food flavors as examples, the talk is intended to show that these and similar approaches, like the aroma extract dilution analysis and aroma reconstitution experiments, have been established today as successful tools to unravel the flavor of foods. Although it is still not understood why a small number of compounds, clearly differing in their odor notes from the respective food flavor, are finally able to mimic the respective food aroma, undoubtedly the identification of the “key instruments” is the only way to generate the right sound of flavor's music.

**68 - What do we taste, when we taste?** Thomas Hofmann Food Chemistry & Molecular Sensory Science, Technische Universitaet Muenchen, Muenchen, Germany Mammalian taste perception consists of the gustatory taste sensation, i.e. the sweet, bitter, sour, salty and umami basic taste modalities, as well as lingual somatosensory sensitivity resulting from temperature and tactile stimulation as well as chemical activation of chemosensory receptors on the perigemmal fibers. In combination, this sensory detection system provides valuable information on the sensory active ingredients of the food we eat. Although very important for the overall sensory quality of foods, compared to aroma-active volatiles, relatively little attention has been paid to tongue responses induced by non-volatiles. In particular, the molecular structures as well as the stereochemistry of sensory active non-volatiles which are not present in foods per se, but are generated during food processing, remain mainly unknown. In addition, the development of healthy food products reduced in sugar, salt, glutamate, and fat, respectively, or enriched in plant-derived bioactive, health promoting micronutrients, which are claimed to be beneficial for health and well-being of the consumers, induced non-acceptable flavor defects in the products and unexpected flavor challenges for the food industry. Driven by the consumer's demand for healthy but tasty foods the need to discover the key players inducing the food taste, natural product chemistry combined with analytical human psychophysics, followed by taste receptor deorphanization made tremendous efforts in recent years to identify the most intense taste compounds in our diet sensed by our taste receptors. The presentation will highlight some recent studies on the identification of orphan key taste stimuli in foods and will pinpoint the importance of these molecules as valuable molecular tools to be used for the elucidation of hTAS2R gene polymorphisms supposed to affect food selection and dietary behaviour.

**69 - Aroma release, qualia and perceived flavour** Andrew J Taylor. Div. of Food Sciences, Univ. of Nottingham, Loughborough, Leics, United Kingdom Over the last 15 years, flavour scientists have recognised the importance of measuring both proximal and distal flavour stimuli, a concept borrowed from psychology and philosophy. The distal stimulus is defined as the composition of flavour in the food, while the proximal stimulus is the flavour profile that actually contacts the flavour receptors in the mouth and nose. While the distal stimulus is fixed, the proximal stimulus varies in timing and intensity depending on the properties of the compound and the food matrix. The hypothesis that the proximal stimulus relates better to sensory perception has been proposed and tested for some time but measuring the proximal stimulus requires rapid and sensitive techniques to fully capture the information. The current state of knowledge on the relationship between aroma profile and sensory perception will be discussed and the contribution of Terry Acree's group to this area of science will be highlighted.

**70 - Identification of new strawberry sulfur volatiles and changes during maturation** Xiaofen Du, Ms. Mei Song, Professor Russell Lee Rouseff Citrus Research and Education Center, Univ. of Florida, Inst. of Food and Agricultural Science, Lake Alfred, Florida, US A static headspace SPME sampling technique coupled with high resolution capillary GC using pulsed flame photometric detection, PFPD, was employed to measure 23 sulfur volatiles in Florida strawberries. Ten sulfur volatiles are reported for the first time in strawberries. Two popular cultivars, 'Festival' and 'Radiance', were harvested at five developmental stages (white, half red, three-quarter red, full ripe, and overripe) on three different occasions. Newly identified strawberry sulfur volatiles include: ethyl (methylthio)acetate, methyl 2-(methylthio)butyrate, methyl 3-(methylthio)propionate, ethyl 3-(methylthio)propionate, and methyl thiohexanoate, carbon disulfide, diethyl sulfide, diethyl disulfide, 1-propene-1-thiol, and methyl 1-methyl-1-(methylthio)- propyl disulfide. Some are considered to be important aroma constituents. All were identified by matching LRI's of authentic standards and GC-MS spectra when possible. Most sulfur volatiles increased with increasing maturity. In the white stage (most immature), only hydrogen sulfide, methanethiol, carbon disulfide, and dimethyl sulfide were detected. Most sulfur volatiles increased dramatically between three-quarter red, full ripe and overripe stages.

**71 - Gas chromatography olfactometry applications to dairy products: A wonderful friendship** Stefania Carpino Dr, Regione Siciliana, Reseach Management, CoRFiLaC, Ragusa, Italy It was in 1997 that gas chromatography olfactometry (GCO) and Sicilian traditional cheeses met. The speaker was finishing her Master's degree and planning a Ph.D project and reading scientific publications which led her to a new and exciting instrument/technique called GCO as well as a collaboration with a special professor at Cornell named Terry Acree. The presentation will consist of a look back at the beginnings of a career-long collaboration and highlight the special qualities of Acree as a mentor and friend, and will include discussion of data and projects utilizing the GCO technology he pioneered as applied to the analysis of artisan cheeses and animal forage materials currently being researched at CoRFiLaC dairy research Inst. in Ragusa, Sicily.

**72 - Integrating the culinary arts and sciences in Terry Acree's flavor world** Chris Loss Director. Dept. of Menu Research and Development, The Culinary Inst. of America, Saint Helena, CA, US The culinary arts and natural sciences have been an estranged couple for hundreds of years that rarely share perspectives and insights. However, Terry Acree's work to understand the link between the chemical compounds in food and human perception of flavor can help cross-pollinate these disparate disciplines, and will greatly influence future generations of chefs to come. In this talk I will review aspects of Terry's work that are pertinent to culinary educators and professionals, and describe how his insights can help elevate the body of culinary techniques and traditions to an academic field that is ripe for more scientific inquiry. His lectures and workshops on flavor chemistry and perception instill an infectious sense of wonderment for the natural world, and provide inspiration for careers in science and education.

**73 - Does lycopene have a role in the prevention of cardiovascular disease?** Howard D Sesso, Div. of Preventive Medicine, Brigham & Women's Hospital, Boston, MA Studies in nutritional epidemiology have consistently demonstrated that those who consume greater amounts of fruits and vegetables tend to have lower rates of cardiovascular disease (CVD), cancer, and other chronic diseases. Researchers

have actively sought to identify particular constituents of foods that underlie a potential effect. Basic research and clinical studies demonstrate plausible mechanisms by which lycopene, a major carotenoid predominantly found in tomato products, may prevent or retard atherogenesis. Observational epidemiologic studies suggest that individuals with high dietary intake of lycopene and tomato-based food products may have more favorable cardiovascular risk factor profiles along with a decreased risk of cardiovascular disease. Several studies have also examined lycopene measured in the blood in relation to coronary biomarkers and the development of CVD. These initial findings have yet to be extended to randomized clinical trial settings testing lycopene. Therefore, existing and emerging evidence on the role of lycopene on the risk of CVD will be discussed in the context of underlying biological mechanisms, epidemiologic studies, and randomized clinical trials.

**74 - Dietary fat and cardiovascular disease: Quantity or quality?** Alice Lichtenstien. USDA Human Nutrition Research Center on Aging, Tufts Univ., US Dietary fat intake is associated with cardiovascular disease (CVD) risk. Current data do not support an association between dietary fat quantity and CVD risk, but do support an association between dietary fat quality and CVD risk. Displacement of saturated fat with polyunsaturated fat, and to a lesser degree monounsaturated fat, is associated with improved CVD outcomes. Within the category of unsaturated fat there is clear evidence that fatty acids containing trans double bonds result in less favorable CVD risk factors than fatty acids containing cis double bonds. Within the category of polyunsaturated fatty acids those with a double bond in the omega-3 position have positive associations with CVD risk, particularly those with very long chains (eicosapentaenoic acid and docosahexaenoic acid). One approach to ensuring optimal dietary fat quality intake is to choose a diet rich in whole grains, vegetables and fruits, low and non-fat dairy products, legumes, fish at least twice a week and lean meat.

**75 - Polyunsaturated fatty acids and the endocannabinoid signalling system** Bruce A Watkins. Purdue Univ., US The endocannabinoids (EC), endogenous derivatives of arachidonic acid which is an omega-6 (n-6) polyunsaturated fatty acid (PUFA), were recently discovered to play regulatory roles in energy metabolism. The EC signaling system consists of the G-protein coupled cannabinoid receptors, CB1 and CB2 that are expressed in central and peripheral tissues and cells, which are activated by the production and on demand release of endogenous agonists. With respect to the EC signaling system, there is interest in the balance between omega-6 and omega-3 (n-3) PUFA as an important modifier for the activation and suppression of endocannabinoid receptors and therefore, downstream signaling actions in cells. The potential of dietary PUFA to regulate this signaling system in order to influence the metabolic and physiological outcomes favorable to muscle and adipose health is the purpose of this talk. The role of n-3 PUFA in metabolic and physiological processes that benefit muscle and control fat accumulation will be presented. In addition, this talk will describe the EC agonists (ligands) and their receptors (CB1 and CB2) and general actions in EC signaling in muscle and adipose. How dietary PUFA influence the levels of endogenous agonists and the implications to impact this system to maintain insulin sensitivity and reduce body fat will be discussed.

**76 - Milk proteins in the regulation of food intake and metabolic syndrome** Professor Harvey Anderson Ph.D, Bohdan Luhovyy, Tina Akhavan MSc, Shirin Panahi MSc. Dept. of Nutritional Sciences, Univ. of Toronto, Toronto, Ontario, Canada Consumption of dairy products is associated with healthier body weights. In short-term studies milk proteins increase satiety and reduce food intake and blood glucose response when consumed alone or with carbohydrate. Thus, in the prevention and management of the metabolic syndrome dairy proteins are of interest because proteins are more satiating than either carbohydrate or fat. Furthermore, they regulate food intake and metabolic functions by the combined actions of the intact protein, encrypted peptides and amino acids on physiologic mechanisms regulating food intake and blood glucose. These benefits can be achieved within the range of usual consumption of dairy. In addition, recent research points to an intrinsic value of small amounts of milk protein or dairy consumed shortly before a meal to reduce the glycemic response to carbohydrate and that this is not at the cost of increased demand for insulin. The increased use of dairy products and functional food products based on dairy proteins may provide a practical food solution for prevention and management of the metabolic syndrome.

**77 - Cardiovascular health benefits of soy foods** James W Anderson MD. Medicine and Clinical Nutrition, Univ. of Kentucky, Lexington, KY, US Soy foods provide high quality protein, dietary fiber, complex carbohydrate, phospholipids and an array of health-promoting antioxidants and phytochemicals. These components appear to act independently and synergistically to enhance cardiovascular health. The most readily-measured changes in humans relate to effects of soy protein consumption on serum lipoproteins and blood pressure. Soy proteins significantly and favorably affect fasting serum lipids by decreasing low-density lipoprotein (LDL)-cholesterol (c), decreasing triglycerides, and increasing high-density lipoprotein (HDL)-c (Anderson NEJM 335:567, 1995). The FDA affirmed these observations and approved a health claim indicating that soy protein, 25 g/d, may reduce risk for coronary heart disease. Recent observers have questioned the efficacy of soy protein effects on serum lipids, perhaps related to clinical studies with suboptimal designs. We have performed an updated meta-analysis and study-quality analysis of 42 randomized clinical trials published since 1995. The 20 parallel trials had significantly higher average quality scores (15.8) than the 22 cross-over trials (10.1,  $P < 0.001$ ). Parallel interventions included 954 soy-treated subjects who had a net (soy minus control) LDL-c reduction of 5.5%; higher quality studies had a LDL-c reductions of 6.2%. Crossover interventions included 970 soy-treated subjects who had net LDL-c reductions of 3.9%; higher quality studies had LDL-c reductions of 4.7%. Meta-analyses of all groups showed significant LDL-c reductions but parallel studies were associated with significantly greater reductions than cross-over studies ( $P < 0.0001$ ). In parallel studies, that provided adequate duration, the following changes were noted for 919 soy-treated subjects: triglycerides, -9.8%, ( $P < 0.008$ ) and HDL-c, +3.2%,  $P < 0.007$ . These analyses affirm the beneficial effects of soy protein intake on serum lipoproteins and suggest that soy protein intake of 15 to 25 g/d may, independent of other dietary and lifestyle alterations, reduce risk for coronary heart disease by approximately 15%.

**78 - Impact of early life nutrition on health and wellness** Susan Roberts. Jean Mayer USDA HNRCA at Tufts Univ., US Understanding and controlling childhood obesity is a major national priority, and obesity is central to the theme of how chemistry can play a critical role in the prevention of disease. Obesity can result in many negative health outcomes including diabetes, cardiovascular disease and compromised immune function. The diet in early stages of life can have a major role in the pattern of fat deposition in the body and the resulting growth patterns. Early life diet can impact appetite and food consumption patterns throughout life impacting the risk of obesity and the multiple adverse side effects of obesity. Understanding how all components of diet, genetics and lifestyle interact in the individual are critical to

defining causes and establishing effective means to optimize growth patterns. The integration of food chemistry with nutrition and medicine can ultimately lead to innovative approaches to address childhood and adult obesity

**79 - Optimum diets and natural products for disease prevention** Bruce N Ames. Children's Hospital Oakland Research Inst., US  
Medical costs escalate with unhealthy behavior. Are balanced diets, supplements, education, and proper incentives the prescription? 1) Most of the world's population has inadequate intake of one or more micronutrients (~40 essential vitamins, minerals, fatty acids and amino acids); we posit that this accelerates the degenerative diseases accompanying aging, such as cancer, cardiovascular disease, cognitive decline, and immune dysfunction. A perfect balanced diet (and adequate sunshine) would optimize levels of all micronutrients, but few reach this standard; fortunately inexpensive supplements can help. 2) Too much refined food causes a shortage of micronutrients and fiber and an excess of calories (sugar, fat, and alcohol) which contributes to chronic inflammation and diseases, such as diabetes, associated with obesity. 3) many plant polyphenols, and other natural products, are weak oxidants, as is exercise, and induce our antioxidant defenses such as phase-2 enzymes, which help to combat oxidative damage from inflammation and micronutrient shortage.

**80 - Flavor chemistry of lemon-lime flavored carbonated beverages** Bethany Hausch, Keith Cadwallader. Dept. of Food Sci. and Human Nutrition, Univ. of Illinois, Urbana, IL "Lemon-lime" is a universally recognizable and popular carbonated beverage flavor. The present study was undertaken with the hypothesis that there is a unique group of odorants responsible for lemon-lime flavor. Aroma-active compounds in three different commercial brands of lemon-lime flavored carbonated beverages were determined by gas chromatography-olfactometry (GCO), aroma extract dilution analysis and GC-MS. The potent odorants were similar across products, with linalool - fresh, lemony, lavender aroma - having the highest FD factor in all brands. Other contributing odorants included octanal (pungent, orange), 2,3-dehydro-1,8-cineol (minty), borneol (earthy, camphorous), p-cresol (stable) and 4-hydroxy-2,5-dimethyl-3(2H)-furanone (burnt sugar). These key odorants originated either from the lemon oil flavoring or were derived by acid-catalyzed degradation of the major lemon-oil terpene constituents, among other sources. Interestingly, geranial and neral (a.k.a. citral) - recognized as major flavor constituents in fresh lemon oil - did not make a significant aroma contribution. Results of quantification of selected potent odorants and sensory aroma studies will be presented.

**81 - Perspectives on flavor analysis linked to chemosensory impact** Robert J McGorin. Dept. of Food Science & Technology, Oregon State Univ., Corvallis, Oregon, US The application of chemical methods and analytical instruments to measure volatile flavor and aroma compounds in foods has advanced considerably over the past 40-50 years. Much of the early flavor chemistry involved the development of concentration and separation techniques to identify trace aroma components in complex food mixtures. The cornerstone of these early flavor discoveries relied heavily on gas chromatography-mass spectrometry to identify chemical structures of new aroma compounds. While initial flavor analysis studies primarily focused on chemical methodology and volatile composition, major advances occurred when analytical procedures evolved to include sensory-directed techniques. The Acree lab has been one of the pioneers in development and application of aroma response technology (CharmAnalysis) to flavor research, enabling the relative potency of individual odorants to be determined independent of their chemical structures. This has led to the compilation of flavor compound databases (e.g., Flavornet) for comparisons across research laboratories. Examples will be discussed that illustrate a key premise of the Acree research group: The ultimate goal of flavor analysis is the integration of volatile intensity, structure, and interactions in order to reliably predict flavor perception.

**82 - Zen and the art of chemosensory perception** Jeannine F Delwiche . Firmenich, Inc., Princeton, NJ, US "In a laboratory situation... when everything... is so screwed up by unexpected results you can't make head or tail out of anything, you start looking... from a wholly unexpected direction, from a direction that's not even understood as a direction until the knowledge forces itself upon one." -- Robert M. Pirsig As scientists become more and more specialized, it becomes increasingly difficult for them to learn of relevant findings in other fields. And yet, cross-disciplinary exchanges can lead to improved understanding of chemosensory perception. To enhance an interdisciplinary approach in the investigation of the human perception of chemicals, Terry Acree and Andy Taylor conceived of a new journal, Chemosensory Perception. The goal of this journal is to encourage the interaction of chemists, neuroscientists, psychologists, and sensory scientists from academia, government, and industry. The inception of the journal and its goals will be discussed.

**83 - Playing with food: Flavor and food chemistry in the experimental restaurant kitchen** Mr. Harold J McGee Curious Cook, San Francisco, CA, US Over the last decade, some of the world's leading restaurant chefs have adopted a new, experimental approach to cooking, one that draws on food chemistry for fresh ideas, tools and ingredients, and a better understanding of traditional food preparation. I will describe this approach and show examples of the startling dishes it has generated.

**84 - Progression of the retronasal aroma simulator and flavor release sampling** Kathryn D Deibler Beverage Research and Development Consultant, White Plains, NY, US As flavor science has progressed and become more interdisciplinary, sampling methods have evolved to account for its unique chemistry and sensory aspect. In order to potentially have an effect on flavor perception, aroma chemicals not only must be volatile, but must volatilize during human consumption, eventually reach receptors on the olfactory epithelium, and be able to activate an olfactory receptor(s). Initially various forms of solvent extractions were utilized to sample chemicals in foods and beverages that might modulate flavor perception. As the impact of other components and structure of the food on the partition coefficient, rate of release, and diffusion on the volatilization of aroma compounds (termed flavor release) became apparent, methods for sampling of the volatile phase became more prevalent. Further, the emphasis on the impact of human physiology and the process of food consumption on flavor release led to development and improvements of simulation and in vivo measurements. In particular, the progression of the Retronasal Aroma Simulator (RAS) developed by Terry Acree's group at Cornell Univ. will be discussed.

**85 - Commercial consequences of Shallenberger and Acree's AH,B theory of sweet taste** Mike G Lindley. Lindley Consulting, Crowthorne, UK Robert Shallenberger and Terry Acree, his then graduate student at Cornell Univ., published a 1967 paper in Nature that described their AH,B hypothesis of sweet taste. This hypothesis sought to bring logical order to the great diversity of chemical structures that were known to elicit sweetness and proposed that all sweet tasting compounds contained common structural elements positioned in defined

geometrical arrangements, described for a broad range of sweet tasting compounds, including saccharin, amino acids, sugars, chloroform and even inorganic salts. The paper generated huge interest and stimulated research aimed at extending the theory and using it to design new commercial sweeteners. Important extensions to the AH,B theory by Kier and Tinti and Nofre retained the central AH,B structural elements as central for sweetness. Researchs seeking to identify new high potency sweeteners drew on these design theories with some notable successes. The AH,B theory and Kier's extension brought rationality to the structure-taste relationships of halogenated derivatives of sucrose, helped to identify alitame as a sweetener and with the developments of Tinti and Nofre, identified neotame as a super-potent sweet structure. The sweet taste inhibitor lactisole was discovered by application of the AH,B hypothesis. The AH,B hypothesis with these extensions has undoubtedly made a critical contribution to the discovery and development of a series of sweeteners and sweetness modifiers that have been commercially successful. They will be described and commercial developments of these theories reviewed.

**86 - Behavioral and signaling effects of blueberries, strawberries, and walnuts: Quenching the fires of aging** James Joseph, Barbara Shukitt-Hale, Deerek Fisher. USDA Human Nutrition Research Center at Tufts Univ., US The onset of age-related neurodegenerative diseases is superimposed on a declining nervous system enhancing the motor and cognitive behavioral deficits that normally occur in senescence. Applying molecular biological approaches to slow aging in the human condition may be years away. However, studies indicate that nutritional modulation may be important in this endeavor, since it appears that berryfruits and nuts may reverse age-related behavioral deficits in animals and that the addition of blueberries (BB) to the human diet may enhance cognitive function in human aging. Research further suggests that mechanistically, the polyphenolic compounds in berries e.g., [(BB), strawberries (SB)] or nuts [walnuts (WAL)] may exert their beneficial effects by altering oxidative stress (OS,e.g., nuclear factor kappa B,) or inflammatory (INF, e.g., cytokines, cyclooxygenases I and II) signaling and neuronal communication (dendritic spine density, neurogenesis). Ultimately, these stress signals produce negative cellular effects and enhance further OS/INF in the brain.

**87 - Application of calorie restriction and calorie restriction mimetics to attenuate brain aging** D.K. Ingram. Pennington Biomedical Research Center, US As demonstrated in a variety of animal models, calorie restriction (CR) has proven to be the most robust means to retard brain aging. Reducing intake of a nutritious diet by 20-50% can increase lifespan, reduce the incidence and retard the onset of chronic diseases, enhance stress protection, and maintain youthful function, including behavioral performance. Recent reports of persons electing to practice CR as well as formal clinical studies indicate such regimens can positively impact indices of health and risk factors for chronic disease. Nonetheless, if evidence existed that life-long CR could produce beneficial effects in humans, implementation would be problematic due to difficulties of compliance as well as other quality of life issues impacted by CR. To address this challenge, we introduced the concept of CR "mimetics" (CRM) as a method to obtain "anti-aging" and health-promoting benefits of DR without reducing food intake. Several candidate CRM compounds have been proposed including the sirtuin activator, resveratrol, and the insulin sensitizer, metformin, but neither candidate has shown reliable and consistent prolongevity effects. Following our previous work with 2-deoxyglucose, we have been examining the anti-aging benefits of glycolytic inhibition produced by mannoheptulose (MH), a seven carbon sugar that inhibits hexokinase. Preliminary results in several animal models indicate that a diet supplemented with an avocado extract enriched with MH, has great potential as a CRM for attenuating aging.

**88 - Role of an antioxidant diet and behavioral enrichment on cognition and neuropathology in the canine model of aging** Elizabeth Head. Univ. of Kentucky, US Oxidative damage may contribute to cognitive dysfunction associated with aging. Behavioral enrichment may promote neuron health. To test these hypotheses, aged beagles received a 2.5 year treatment with an antioxidant diet (AOX), either alone or in combination with behavioral enrichment (BEH). Twenty-four beagles were placed into one of four groups: (1) control/control (C/C), (2) BEH/control diet (E/C), (3) control enrichment/AOX diet (C/A), and (4) BEH/AOX diet (E/A). The AOX diet contained ? -tocopherol (800IU), vitamin C (10 mg/kg), fruit and vegetable extracts (1%), dl-lipoic acid (2.7 mg/kg), and l-carnitine (6 mg/kg). The BEH enrichment consisted of social and cognitive enrichment, and physical exercise. Each treatment improved cognition with the combination being superior. Mitochondrial function was improved in AOX but not BEH treated dogs. Animals provided with BEH treatment showed less hippocampal neuronal loss. The combination of an AOX diet with BEH may improve neuronal function through separate yet synergistic molecular pathways.

**89 - Prevention approaches to Alzheimer disease: Omega-3 fatty acids and curcumin** Greg M Cole, Qiulan Ma, Fusheng Yang, Dana Gant, Oliver Ubeda, Sally A Frautschy. UCLA, US Alzheimer Disease (AD) protein aggregate lesions accumulate and begin to plateau prior to the cognitive decline that accompanies the onset of regionally selective synapse and neuron loss. These lesions include amyloid beta (A $\beta$ 42) accumulation in plaques and intraneuronal neurofibrillary tangle aggregates comprised of the microtubule-associated protein tau. Prevention approaches that target plaque and tangle lesion accumulation should begin in the decades prior to cognitive deficits and therefore require outstanding safety and side-effect profiles. However, most prevention and treatment approaches have not been tested post-lesion accumulation in animal models or have side-effect concerns and most have failed in the clinic. Our research has focused on testing dietary interventions with outstanding safety profiles including the omega-3 fatty acid, DHA, and curcumin, a polyphenolic antioxidant/ non-steroidal anti-inflammatory component of the curry spice, turmeric. DHA reduces A $\beta$ 42 production, while curcumin limits aggregation and promotes clearance of pre-existing A $\beta$  deposits. Both agents have neuroprotective and anti-inflammatory activities that promote insulin/ neurotrophic pathways and both show efficacy in reducing A $\beta$ 42 accumulation in a late intervention (post pathology) paradigm in amyloid plaque forming transgenic mice. We have recently tested late intervention with DHA and curcumin in a pure tau pathology model and find evidence of efficacy even with an intervention beginning after tangles, synapse loss and cognitive deficits are well-established. We find synergistic pleiotropic mechanisms for anti-inflammatory control of arachidonic acid metabolism, tau kinase activation and downstream loss of tau function and insulin/neurotrophic factor resistance relevant to synaptic and cognitive protection with these interventions. Omega 3 fatty acids already show promise with early intervention in the clinic, but testing curcumin efficacy in humans has been limited by bioavailability issues that can be resolved. Because of their low cost and outstanding safety profiles, DHA and curcumin show great promise for cost-effective prevention of AD and likely other age-related pathologies.



**90 - Methyl jasmonate: A plant stress hormone as an anticancer agent** Eliezer Flescher Dept. of Clinical Microbiology and Immunology, Tel Aviv Univ, Israel Methyl jasmonate (MJ) exhibits cytotoxic effects against various tumors, including drug-resistant ones, both in vitro and in vivo. Its cytotoxicity against transformed cells is highly selective, thus suggesting low levels of side-effects usually encountered with existing cytotoxic drugs. Several mechanisms have been proposed to explain these anti-cancer activities, including induction of severe ATP depletion in cancer cells via mitochondrial perturbation. Indeed, MJ binds specifically to mammalian hexokinase and disrupts its interaction with the mitochondrial protein VDAC, leading to detachment of hexokinase from the mitochondria. This, in turn, results in cytochrome c release, perturbation of mitochondrial permeability, and disruption of overall cellular bioenergetics. In addition to being cytotoxic, MJ inhibits cellular proliferation, and induces cell cycle arrest in various breast and prostate carcinoma, as well as neuroblastoma cell lines. Finally, MJ was proven to have anti-metastatic effects on murine metastatic melanoma and lung cells, both in vitro and in vivo.

**91 - Methyl nomilinate inhibits SW480 colon cancer cells growth through modulation of cell cycle regulators** Jinhee Kim, G.K. Jayaprakasha, Amit Vikram, Bhimanagouda S. Patil Horticultural Sciences, Vegetable & Fruit Improvement Center, Texas A&M Univ., Coll. Station, TX Citrus contain several health maintaining bioactive compounds that may have potential for prevention of certain diseases. While lemon is ranked among top three popular citrus fruit in fresh market or in processed foods, understanding role of bioactive compounds in lemon and their potential of reduction of risk for diseases are not explored. Methyl nomilinate seems to have potential health benefits but until now only one study has explored the biological activity. In order to understand the role of lemon bioactive compounds such as obacunone, limonin, and methyl nomilinate were isolated and identified. The lemon seed powder was sequentially extracted with hexane and ethyl acetate (EtOAc) using Soxhlet extractor for 16 h. The dried extract was purified by chromatographic techniques, identified by TLC and purity was confirmed by HPLC using a C18 column at 210 nm. Furthermore, the structures of the isolated compounds were confirmed by APCI-MS and 2D NMR spectroscopic techniques. Moreover, these compounds were evaluated for their potential biological effect on SW480 human colon adenocarcinoma cell proliferation including mechanism of growth-inhibition. Our results indicate that, methyl nomilinate is the most potent inhibitor of cell metabolic activity in MTT and EdU incorporation assay. Although, these limonoids did not affect the apoptotic markers such as Caspase 3 and PARP, methyl nomilinate demonstrated a significant induction of G0/G1 cell cycle arrest in SW480 cells. This project was supported by the USDA-CSREES#2009-34402-19831 "Designing Foods for Health" through the Veg. & Fruit Improvement Ctr.

**92 - Isolation and chemical characterization of limonoids from Azadirachta indica and Melia azedarach with biological activity** Prof Pierluigi Caboni, Nikoletta Ntalli, C E Bueno, Laura E Alchè Toxicology, Univ. of Cagliari, Cagliari, Italy, Italy; Pesticide Science Laboratory, Aristotle Univ. of Thessaloniki, Thessaloniki, Greece, Greece; Chemistry, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Buenos Aires, Argentina, Argentina Azadirachta Indica (AI) and Melia azedarach (MA) are species rising scientific interest for being a store-house of limonoids, exhibiting a wide range of biological activities. In order to correlate the observed activities to the chemical composition, specific, rapid and repeatable analytical methods need to be developed for the limonoids elucidation and quantitation. In the course of screening for active principles within the extract, in the present study we report the chromatographic purification and characterisation of its most abundant limonoids from AI and MA. AI afforded azadirachtin A and B, nimbin, salannin and their acetyl derivatives. MA afforded a new triterpenoid, named 3-O-tigloyl-melianone, as well as three known limonoids named methyl kulonate, sendanone acetate and melianone. Structures elucidation was performed by means of NMR and 2D-NMR and the accuracy of theoretical exact mass values, was deduced by the employment of HPLC-Q-TOF analysis. By interfacing LC/MS ESI and APCI analysis, in positive and negative ionisation mode, care was taken for selection of structurally informative fragment ions. Additionally, different mobile phase additives were explored for their effect on the ionization in LC/MS. Limonoids from AI and MA were tested for their cytotoxic and antiproliferative effects using a tumorigenic cell line (A549). This study present the development of a chromatographic and spectroscopic methods for the identification of limonoids purified from A. Indica and M. azedarach, with biological activities.

**93 - Characterization of bioactive compounds of selected (sub)tropical fruits and leaves grown in Jeju and their antiproliferative effects on human cancer cells through apoptosis** Somi Kim Cho Dept. of Biotechnology, Jeju Nat'l Univ., Rep. of Korea; Subtropical Horticulture Res. Inst., Jeju, Rep. of Korea Six (sub)tropical fruits (guava, red pitaya, white pitaya, green mango, ripe mango and immature Citrus grandis Osbeck) and two leaves (Citrus grandis Osbeck and guava) from Jeju Island of Korea were evaluated for antiproliferative activities. The antiproliferative effect of the immature Citrus grandis Osbeck (Dangyuja) fruit extract was observed in U937 human leukaemia cells using the hexane fraction (HF), whereas the maximum cytotoxic effects of Dangyuja leaves on five human cancer cell were elicited by the chloroform fraction (CF) of the leaves. Analyses of the HF by gas chromatography (GC) and GC-mass spectrometry (MS) tentatively identified 19 compounds, including  $\beta$ -sitosterol, 7-methoxy-8-(2-oxo-3-methylbutyl) coumarin, and stigmaterol. The major components of the CF of the Dangyuja leaves were identified as isosinensetin, sinensetin, tetramethyl-O-isoscutellarein, nobiletin, tangeretin, and 5-hydroxy-6,7,8,3',4'-pentamethoxyflavone by liquid chromatography-electrospray ionization tandem mass spectrometry (LC-ESI-MS/MS). Similarly, the chloroform fraction (CF) of guava (Psidium cattleianum sabine) leaf extract induces apoptosis in SNU-16 cells. The major phytochemicals of the CF of guava were identified as ferulic acid, genistein, 3', 4', 5' trimethoxyflavone, phlorizin, and oleanolic acid by HPLC-PDA-MS/MS. Together, our results suggest that the HF of the immature C. grandis Osbeck (Dangyuja) fruit and the CF of Dangyuja and guava leaves are an excellent source of functional polymethoxylated flavones, which may potentially be a useful agent for the treatment of certain malignancies.

**94 - Influence of the target molecule on the ORAC index** Camilo López-Alarcón. Facultad de Química, Departamento de Farmacia, Pontificia Universidad Católica de Chile, Santiago, Metropolitana, Chile The ORAC (Oxygen Radical Absorbance Capacity) assay has been widely used to evaluate the antioxidant capacity of fruits, vegetables and beverages. The method considers the use of a source of peroxy radicals, a target molecule (probe), and the sample to study. According with the model of the assay, antioxidant(s) compete with the target molecule by peroxy radicals, increasing the area under the curve (AUC) of the kinetic profiles associated to the consumption of the probe. In this scenario, the AUC, relative to a standard antioxidant (Trolox), would be independent of the target molecule employed. In the present work, it is discussed how ORAC index depends on the selected target molecule. Results employing different probes such as fluorescein,

pyrogallol red, alizarin red and pyranine show that in some cases the ORAC index is more influenced by stoichiometric factors, reactivity of the antioxidants, or by the presence of ascorbic acid in the sample. Acknowledgments: FONDECYT grant(n°1100659)

**95 - Bioactive compounds from okra seeds: Potential treatments for diabetes-Type 2 and cardiovascular disease** Bishambar Dayal, Michael Lea, Norman H. Ertel. Dept. of Medicine, umdnj-new jersey medical Sch., Newark, New Jersey, US; Dept. of Biochemistry and Molecular Biology, UMDNJ-New Jersey Medical Sch., Newark, New Jersey, US; Medicine, umdnj-new jersey medical Sch., Newark, New Jersey, US We recently reported that bioactive compounds isolated from Okra Seeds (*Hibiscus esculentus*) could serve as potential inhibitors of advanced glycation end products (AGEs). Such advanced glycation end products accumulate in proteins with age and at an increased rate in both Type-2 Diabetes and Cardiovascular Disease. Glycated proteins are toxic, antigenic and trigger cellular injury. We recently measured HDL apolipoprotein A-1 cholesterol levels (J Proteome Res. 2002) in severely controlled Type-2 diabetes patients and found increased levels of glycosylated HDL. We also carried out studies to measure inflammatory markers of coronary risk such as high-sensitivity C-Reactive Protein (hs-CRP) and interleukin-6 (IL-6) and found that elevated levels of IL-6 accelerates the hs-CRP Pathway. We believe that the flavonoids present in Okra seeds may not only inhibit the HDL-*apoA-1* glycation but also diminish the production of hs-CRP, a known cardiovascular biomarker. A recent Iranian publication *Grasas Y Aceities*, 61(1) Enero-Marzo 30-60 (2010) reported that the methanol extract of Okra seeds had a remarkable antihypoxic effect in both models of circulatory and haemic hypoxia. The seed extract had protective effect against hypoxia-induced lethality in mice. Present studies will highlight the potential benefits of highly antioxidant nature of flavonoids present in Okra Seeds on HDL-*apoA1*, hs-CRP, IL-6 protein expression profiles and implications of blood-brain barrier chemistry.

**96 - Citrus monoterpene induces apoptosis and inhibits angiogenesis in human colon cancer cells** Kotamballi N Chidambara Murthy, G K Jayaprakasha, Bhimanagouda S Patil Dept. of Horticulture Sciences, Texas A&M Univ., Coll. Station, Texas, US Monoterpenes are the major components found in citrus volatile oil and d-limonene is most abundant in majority of citrus species. Volatile oils from citrus are gaining importance due to their health benefits. Both animal and human studies have demonstrated safety of d-limonene and other volatile components. However, very little is known regarding the mechanism by which the specific monoterpenes inhibit cancer cells. Therefore, current study was an attempt to understand the mode of inhibition colon cancer cells using d-limonene rich citrus volatile oil (CVO). The CVO has shown relatively higher induction of cell death in SW480 cells (IC50 of less than 100µg mL<sup>-1</sup> at 24 h) compared to HT-29 (IC50 of more than 170 µg mL<sup>-1</sup> at 24 h). Furthermore, protein expression results demonstrate the induction of programmed cell death major cause for cytotoxicity in both cells. Additionally, CVO also inhibited expression of VEGF through modulation of HIF-1 $\alpha$  induction pathway as observed in case of HT-29 cells. The result seems to suggest that CVO not only induce apoptosis but also act as anti-angiogenic to prevent colon cancer. Moreover, CVO was found to be less toxic to non cancerous colon epithelial cells. While results of the study demonstrate ability of CVO to inhibit colon cancer under in vitro conditions, further research using in vivo system may help to understand the clinical efficacy in preventing cancer. These results are based on the work supported by the USDA-CSREES # 2009-34402-19831 "Designing Foods for Health" through the Vegetable & Fruit Improvement Center.

**97 - Bioactives from a traditional herb collected from the tropical rainforest** Chee Yan Choo Dept. of Pharmaceutical Sciences, Universiti Teknologi MARA, Bandar Puncak Alam, Selangor, Malaysia Malaysia is a country rich with its biodiversity heritage. Through generations of practice, we have relied upon the tropical rainforest for medical relief. Nonetheless, few scientific reports supported its usage. The aim of this study is to evaluate the efficacy of *Brucea javanica* Merr (Simaroubaceae) for diabetes treatment. The seeds were extracted with methanol through bioactivity guided fractionation, bruceines D and E exhibited hypoglycaemic activity. Normoglycemic mice administered intraperitoneally (i.p.) with 0.05 mg/Kg of bruceines D and E exhibited blood glucose lowering of 31.4 + 11.3 % and 40.5 + 12.9 %, respectively. Both bruceines D and E also exhibited blood glucose lowering of 50.4 + 19.9 and 88.0 + 2.9 % in streptozotocin induced diabetic rats administered with 1 mg/Kg (i.p.). This was comparable to diabetic rats fed (i.p.) with glibenclamide with reduction of 71.5 + 18.7 %. In conclusion, this study supported use of herbs for metabolic diseases.

**98 - (-)-Epigallocatechin-3-gallate protects neonatal rat cardiomyocytes against oxidative stress induced by anoxia/reoxygenation injury** Dr Wen-Juan Li, Dr Shao-ping Nie, Dr Ming-Yong Xie, Shen-Shen Zhang, Ke-Xue Zhu. Nanchang Univ., State Key Laboratory of Food Science and Technology, Nanchang, JiangXi, China It is now well established that oxidative stress plays a causative role in the pathogenesis of anoxia/reoxygenation (A/R) injury. (-)-Epigallocatechin gallate (EGCG), the most abundant component in green tea, has potent antioxidant activity. The aim of this study was to investigate the ability of EGCG to protect against A/R injury in a neonatal rat cardiomyocyte model. The results showed that EGCG reduced lactate dehydrogenase (LDH) release and increased cell viability in a dose-dependent manner and concomitantly decreased malondialdehyde contents, while significantly increased the activities of superoxide dismutase, catalase and glutathione peroxidase. Moreover, the treatment with EGCG decreased ROS production and apoptosis in cardiomyocytes undergoing A/R injury. These findings suggest that EGCG protects cardiomyocytes against oxidative stress induced by A/R injury by attenuating ROS production, apoptosis and increasing activities of endogenous antioxidant enzymes.

**99 - Conjugated fatty acids as a prevention tool for obesity and osteoporosis** Yeonhwa Park, Yooheon Park. Dept. of Food Science, Univ. of Massachusetts, Amherst, MA, US Since the identification of conjugated linoleic acid (CLA) as an anti-carcinogen from beef in the 1970s, it has been studied for a wide range of biological activities, including reducing development of atherosclerosis, enhancing animal growth, modulating immune responses, and interestingly reducing body fat while enhancing lean body mass. The variety of biological activities of CLA may be due to two main isomers, *cis-9,trans-11* and *trans-10,cis-12*. In addition, a 19-carbon cognate of CLA, conjugated nonadecadienoic acid (CNA), showed greater efficacy on body fat reduction in animal model, where CLA and CNA share biochemical mechanisms, such as increasing energy expenditure, modulating adipocyte metabolism, and increasing fatty acid  $\beta$ -oxidation. Effects of CLA on adipocytes have been linked to improving bone mass by suppressing bone marrow adipogenesis while improving osteoblastogenesis. Thus conjugated fatty acids have great potential to be used to prevent obesity and osteoporosis in conjunction with currently available treatments. Supported by NIH 1R21AT004456, USDA CSREES MAS00919, and AHA SDG.

**100 - Phenolic antioxidant-enriched plant foods for prevention and management of type 2 diabetes and its complications** Professor Kalidas Shetty Food Science, Univ. of Massachusetts, Amherst, Massachusetts, US Due to increased intake of refined high calorie foods globally we are facing disorders of carbohydrate metabolism leading to chronic health problems such as obesity and associated type 2 diabetes. Important therapeutic approaches available for managing early stages of type 2 diabetes is by controlling the absorption of glucose through the reduction of starch hydrolysis by inhibiting pancreatic alpha-amylase and limiting the absorption of glucose by inhibiting intestinal alpha-glucosidase enzymes. Natural alpha-amylase and alpha-glucosidase inhibitors from plant foods offer a good strategy to control the post-prandial hyperglycemia and provide benefits without the side effects. Further these plant foods have bioactive profiles that have potential to manage the macrovascular complications such as blood pressure through inhibition of Angiotensin I-Converting Enzyme (ACE) and micro vascular complications through antioxidant activity. These biochemical strategies provide the rationale basis for animal and clinical studies to design effective dietary therapies for managing for type 2 diabetes.

**101 - Bioactive constituents from Calamus quiquesetinervius and Astragalus membranaceus, and their evaluations in treating metabolic syndrome** Prof Yao-Haur Kuo Division of Herbal Drugs and Natural Products, National Research Inst. of Chinese Medicine, Taipei, Taiwan Republic of China The tender shoots of Calamus quiquesetinervius are consumed in salads or soups by native people of Taiwan. Astragalus membranaceus is the most important tonic in TCM that reinforces "qi" (vital energy) and strengthens resistance. We report here that several types of small molecules, including flavonolignans, neolignans, phenylpropanoid glycosides, and steroids were isolated from C. quiquesetinervius, and a series of isoflavonoids and astragalosides were yielded from A. membranaceus. Structural elucidation of new isolates was based on the spectroscopic analysis. By using HPLC-PDA and -ELSD, the chemical fingerprint for quality control of active fractions from the titled plants was investigated. In addition, biological evaluations of vasorelaxation, platelet aggregation, hydroxyl radical scavenging, and anti-NO activities for isolated compounds, as well as metabolic syndrome as cardiovascular and diabetes related animal tests for partial purified extracts were established. The preliminary structure-activity relationship studies of the potential agents isolated from the above plants are also presented.

**102 - Protective effect of sesamol on stress-related mucosal disease in rats** Dur-Zong Hsu, Ming-Yie Liu Dept. of Environmental and Occupational Health, Nat'l Cheng Kung Univ., Tainan, Taiwan Rep. of China; Sustainable Environment Research Center, National Cheng Kung Univ., Tainan, Taiwan Republic of China The aim of this study was to investigate the effect of sesamol on water immersion restraint (WIR)-induced stress-related mucosal disease in rats. Rat gastric ulcer and hemorrhage were induced by WIR. Rats were pretreated orally with various doses of sesamol (0.1, 0.3, and 1 mg/kg, respectively) 30 min before WIR. WIR increased gastric mucosal ulcer and hemorrhage, tumor necrosis factor (TNF)- $\alpha$ , interleukin (IL)-1 $\beta$ , and IL-6 levels, but failed to affect mucosal lipid peroxidation and mucus secretion compared with non-WIR. Sesamol significantly decreased gastric ulceration and hemorrhage, and inhibited mucosal TNF- $\alpha$ , IL-1 $\beta$ , and IL-6 production, and NF- $\kappa$ B activity in WIR-treated rats. In addition, increased myeloperoxidase and CD68 levels in gastric mucosa were found in WIR-treated rats compared to non-WIR rats. Sesamol did not affect myeloperoxidase, but decreased CD68 levels in mucosa in WIR-treated rats. We hypothesize that sesamol protects stress-related mucosal disease by inhibiting gastric mucosal proinflammatory cytokines in rats.

**103 - Spice up your life: Analysis of key aroma compounds in Shiraz** Markus J Herderich, Tracey Siebert, Mango Parker, Dimitra Capone, David Jeffery. The Australian Wine Research Inst. (AWRI), Urrbrae/Adelaide, South Australia, Australia Shiraz is Australia's favourite red variety and some of Australia's 'icon' wines are made from Shiraz grapes. Anecdotal evidence suggests that a spicy, 'pepper' aroma is important to some high quality Australian Shiraz wines. However, the compound responsible for this distinctive 'pepper' aroma in Shiraz has remained unknown until recently. This presentation will detail the untargeted metabolomics approaches<sup>1</sup> and GC-MS-O experiments employed for the characterisation and identification of key grape and wine sesquiterpenes,  $\beta$ -ylangene<sup>2</sup> and the powerful peppery aroma compound rotundone<sup>3</sup>. In addition we will explore the contribution of rotundone to Shiraz aroma and discuss factors that influence rotundone concentrations in wine.

**104 - Formation of carotenoid-derived aroma compounds in wine** Peter Winterhalter, Recep Goek. Food Chemistry, TU Braunschweig, Braunschweig, Germany Carotenoid-derived aroma compounds which are also called C13-norisoprenoids are important contributors to the overall aroma of wine. The different steps of biooxidative cleavage of carotenoids will be summarized and pathways for the formation of norisoprenoid volatiles from intermediate break-down products will be presented. Examples which will be discussed in more detail are the formation of the off-flavor compound 1,1,6 trimethyl-1,2-dihydronaphthalene (TDN) as well as the intensely odorous  $\beta$ -damascenone.

**105 - Aroma composition of a native American grape species (Vitis cinerea) wine by SPME-GC/O/MS** Qun Sun, Edward Lavin, Terry Edward Acree, Gavin Lavi Sacks. Dept. of Food Science and Technology, Cornell Univ., Geneva, NY Native American grape species have desirable properties for wine grape breeding including disease, pest and cold resistance. However, the aromas of native species impart to interspecific hybrids are typically undesirable. Therefore, we determined the key odorants in wine produced from the American grape species, Vitis cinerea, and compared them to wine produced from European winegrapes (Vitis vinifera). Volatile compounds were extracted by solid-phase-micro-extraction (SPME) and evaluated by quantitative gas chromatography olfactometry/mass spectrometry (GC-O/MS). Most compounds with high FD values had been previously reported in GC-O studies and were common to both Vitis species, including ethyl esters (ethyl isovalerate, ethyl butanoate, ethyl hexanoate, ethyl octanoate, ethyl phenylacetate), acetate esters (isoamyl acetate), and fusel alcohols (phenylethanol, isoamyl alcohol). However, several compounds in Vitis cinerea extracts had significantly higher flavor dilution values, including 1,8-cineole (FD=4), cis-3-hexenol (FD=2), and eugenol (FD=128), and these differences were confirmed by quantitative GC-MS.

**106 - Streamlined analysis of potent odorants in distilled alcoholic beverages** Jacob Lahne, Keith Cadwallader. Dept. of Food Science and Human Nutrition, Univ. of Illinois, Urbana, IL, US The quantification of potent odorants in a food product is usually a time-consuming process with many steps. In the case of distilled alcoholic beverages, like whiskey, tequila, or gin, it is possible to forego the solvent or solvent-less extraction step necessary for most food products, and use direct injection with a PTV inlet, coupled with use of isotopically

labeled standards, in order to perform a quick, direct quantification of potent odorants. In the current work, American rye whiskey was first analyzed by sample dilution analysis (SDA) in order to identify potent odorants quickly. Isotopic standards of these odorants - including 2-[<sup>2</sup>H<sub>3</sub>]-methoxy-6-methoxyphenol, 2-[1,2-<sup>13</sup>C<sub>2</sub>]-phenylethanol, and 3-methyl-[3,4-<sup>2</sup>H<sub>2</sub>]-butan-1-ol - were synthesized (or purchased), calibrated against unlabeled standards, and used to spike whiskey samples, which were then analyzed by GC-MS to quantify the selected compounds. It is hypothesized that creation of a library of stable, isotopic analogues of commonly occurring compounds in alcoholic beverages could allow for quick, routine quantification of potent odorants in distilled alcohol beverages.

**107 - (In)stability of the beer's bitter taste: A molecular insight** Thomas Hofmann Technische Univ. Muenchen, Germany Due to its alluring aroma and taste, beer is widely appreciated by consumers all over the world. As an integral part of the taste profile, the typical bitterness of fresh beer is mainly imparted by the cis- and trans-iso-a-acids generated from hop a-acid isomerization during the wort boiling process. Unfortunately, the typical bitterness induced by these compounds are not stable and a significant decrease in intensity as well as a change in bitter quality is observed with increasing age of the beverage. Studies showed evidence that the amount of trans-iso-a-acids in beer decreases during aging, whereas the cis-iso-a-acids seem to be rather stable. As scientific data on these degradation are lacking in literature, the objective of the present study was to elucidate the molecular mechanisms involved in storage-induced trans-iso-a-acid degradation and formation of unpleasant and harsh bitter compounds in aged beer. In the presentation, model experiments combined with spectroscopic studies, computational modeling, as well as quantitative monitoring of previously not reported harsh bitter molecules in beer samples by means of LC-MS/MS experiments will elucidate the chemical mechanism playing the crucial role in the alteration of the beer's taste.

**108 - Analytical investigations to relate important wine odorant 3-mercaptohexan-1-ol to its precursors** Ms Dimitra L Capone, Dr Mark A Sefton, Dr David W Jeffery Research - Chemistry, The Australian Wine Research Inst., Glen Osmond, SA, Australia; Sch. of Agriculture, Food and Wine, Univ. of Adelaide, Adelaide, SA, Australia 3-Mercaptohexan-1-ol (3-MH) is among a group of varietal thiols that contribute to the tropical or citrus aromas in wine. The odour of 3-MH is commonly described as 'passionfruit' or 'grapefruit': in reality 3-MH exists as two enantiomers which exhibit different odor qualities. Significantly, 3-MH is released during fermentation from odourless, non-volatile conjugates present in grape juices. These conjugates consist of two individual diastereomers which are cleaved biologically to yield their respective 3-MH enantiomers, but many questions about this process remain unanswered. Recently developed and validated stable isotope dilution assay (SIDA) methods for individual conjugates and free thiol have been applied to studies involving grape juices and wines. The combination of these methods will continue to enhance our understanding of the factors affecting the formation and fate of 'tropical fruit' aroma in wine. Results to date from our ongoing investigations of these grape and wine components will be presented.

**109 - Is the antioxidant activity of polyphenols relevant for protection against cardiovascular diseases** Peter C.H. Hollman. Wageningen Univ. and RIKILT, The Netherlands The putative health effects of antioxidants have attracted much attention of consumers and food industry. A lot of interest has been shown for the large family of polyphenols, antioxidants that are ubiquitously present in plant foods, thus potentially explaining the beneficial effects of a high consumption of vegetables and fruits. The common structural feature of all polyphenols, the phenolic hydroxyl group, is the basis of their antioxidant activity. A growing number of observational studies has examined the association between the intake of foods rich in polyphenols (onions, apples, tea, cocoa, red wine) and cardiovascular diseases (CVD) as well as the relation between the intake of individual dietary flavonoids (mainly flavonols, flavones and catechins) and CVD. This beneficial effect is supported by a number of well-designed human intervention studies using polyphenol-rich foods which have shown consistent effects on a number of intermediate markers for CVD. This suggests that there is a relation between the antioxidant activity of polyphenols and these health effects. So, is the antioxidant activity of polyphenols a reliable predictor for protection against CVD?

**110 - Fine chemical structures of dietary polyphenols and their importance in understanding their role in the prevention of diseases** Augustin Scalbert, Jara Perez-Jimenez, Joe Rothwell, Mathilde Touvier, Léopold Feuzeu, Pilar Galan. INRA, France; Univ. of Paris, France Polyphenols have been considered a group of related compounds sharing common free radical-scavenging properties. We realize today that they should instead be viewed as individual molecular entities, each with their own fine chemical structure and capacity to interact with receptors that play a key role in the prevention of disease. Once these receptors are identified, in silico approaches can be developed to predict polyphenol biological effects from dietary intake. We recently built Phenol-Explorer, a new database containing over 60,000 data points on the content of 502 polyphenols in foods ([www.phenol-explorer.eu](http://www.phenol-explorer.eu)). These data allowed us to determine for the first time the intake of 277 flavonoids, 108 phenolic acids and 120 other polyphenols in the SU.VI.MAX French cohort. Phenol-Explorer should contribute to the development of epidemiological studies on polyphenols. A new module on polyphenol metabolism and bioavailability is under construction and will be used to predict the extent of individual exposure to polyphenol metabolites and the resulting biological activities.

**111 - Cardiovascular health effects of plant polyphenols** Kevin D Croft. Univ. of Western Australia, The pathogenesis of chronic diseases such as atherosclerosis may involve elements of oxidative damage and inflammation. The role of dietary antioxidants to prevent chronic diseases has been suggested from population studies but results of intervention studies with specific antioxidants such as vitamin E have not been promising. While many plant derived polyphenols display potent antioxidant activity in vitro, the in vivo effects of these compounds is more likely the result of specific actions on key enzymes in the vasculature. Recent studies on the metabolic transformation of specific dietary flavonoids suggests that this can have a profound effect on antioxidant and anti-inflammatory activity<sup>1</sup>. The structural features required for antioxidant activity differ from those required for inhibition of inflammatory eicosanoids. Certain dietary flavonoids such as quercetin and epicatechin can acutely augment nitric oxide production and reduce endothelin in human volunteers<sup>2</sup>. Incorporation of quercetin into the diet of the apoE knock out mice can reduce lesion formation significantly by a combination of anti-inflammatory, antioxidant and improvements in vascular function over 26 weeks<sup>3</sup>. More recent studies suggest that the lignan sesamin, derived from sesame seeds, can specifically inhibit CYP450 4F2 in humans, an enzyme responsible for the production of 20-hydroxyeicosatetraenoic acid an important vasoactive eicosanoid associated with endothelial dysfunction<sup>4</sup>. This data suggest that cardiovascular protection by plant derived polyphenols can occur through a number of different pathways not necessarily related to antioxidant activity.

**112 - Food synergy and nutritional research** David R Jacobs. Univ. of Minnesota, US In the concept of “food synergy” food was once alive and consists of a harmonious biochemical constitution (due to evolution), suitable for the life of the organism eaten. Some aspects of that harmony survive digestion and becomes systemic in the eater. The health effect of eating food is synergistic, in the sense that the effect of the composite is greater than or equal to the sum of the effects of the constituents, were they eaten in isolation. Under the concept of food synergy, food should be more healthful than isolated constituents (supplements). The best bet for health is to eat food rich in biologically active constituents, prepared for maintaining maximal biological activity. The food synergy concept is supported by the differing health effects of whole cereal grains, where the majority of the biologically active constituents have been stripped from the refined grain. Further support is in the failure of randomized clinical trials of a wide variety of dietary supplements. In addition, the food synergy concept is supported by the apparent health effects of certain food patterns that are rich in diverse phytochemicals. A corollary is that focus on nutrients is reductionistic, and likely to lead to errors by focusing on overly simple and unrealistic pathways. Many of these assertions are difficult to prove because randomized clinical trials of food are difficult. Food is complex, unlike drugs, which are simple compounds. Food is difficult to mask, and therefore, unlike drugs, double blind trials are very difficult. Food supplies energy and studies of food are therefore studies of substitution of one food for another, unlike studies of adding, or not adding, ingestion of a drug. Food patterns are even more complex than foods. It is recommended that food studies occur at many levels, from patterns to individual foods to food constituents. Enhanced logic is necessary to arrive about conclusions about diet. At the population level, it is recommended that findings for nutrients be accepted only if the nutrient-health association is found across food groups, that is, independent of what food the nutrient arises from. In studies of foods and food patterns in relation to health, cohort studies are recommended, with a requirement for consistent findings across different investigators and population settings, in order to reduce the risk of residual confounding.

**113 - Berry intake ameliorates pro-inflammatory factors that increase risk of cardiovascular disease** Paul E Milbury, Wilhelmina Kalt. Tufts Univ., US; Agriculture and Agri-Food Canada, Canada Abdominal obesity, dyslipidemia, elevated blood pressure, insulin resistance, systemic inflammation, and a pro-inflammatory state define metabolic syndrome, which increases the risk of vascular diseases. In vitro data suggests phytochemicals from berries can mitigate processes involved in metabolic syndrome and CVD. However, clinical berry feeding trials have furnished conflicting results regarding effects on blood lipid levels and serum antioxidant status. Feeding mice for 8 weeks with 4% whole blueberry powder supplement, we were able to attenuate high fat diet induced up-regulation of inflammatory genes, oxidative stress, development of insulin resistance, and hyperglycemia. When pigs were fed 2% powdered blueberry in the diet for 8 weeks, anthocyanins were detected in tissues many hours after they had been cleared from plasma. Observed tissue levels suggest that anthocyanins are unlikely to effectively compete with endogenous antioxidants as radical quenchers. However, levels are sufficient to exert protective actions by modulating signal transduction and/or gene expression.

**114 - Direct detection of microbial mRNA by rolling circle amplification** Toshiro Kobori, Hirokazu Takahashi, Atsuko Matsumoto, Shigeru Sugiyama. National Agriculture and Food Research Org., Tsukuba, Japan Prevailing conventional microbial detection methods depend upon microbial cultivation in selective media. PCR-based methods, including quantitative reverse transcription PCR, are rapid methods for identification of target microbes although, for practical use, they still suffer from disadvantages such as contamination and cost. Here, RNA-primed rolling circle amplification (RPRCA) using phi29 DNA polymerase, a precircularized probe and SYBR Green II, achieved real-time detection of specific mRNA from living microbes. When in vitro transcribed green fluorescent protein (GFP) mRNA was used as a primer, RPRCA could specifically detect at least 1 fmol mRNA in the presence of a circular probe that had a sequence complementary to the 3'-end of mRNA without reverse transcription. This method could also detect expressed GFP mRNA present in 10 ng of total RNA isolated from *Escherichia coli*. This data suggests that RPRCA has the potential of a direct method for detecting microbial mRNA.

**115 - Post mortem changes in gene expression of fish muscle tissues** Masataka Saito, Tomoyuki Higuchi, Naoyuki Uchida, Hiramitsu Suzuki Laboratory of Food Science and Tech., Kagawa Nutrition Univ., Sakado, Saitama, Japan; Coll. of Bioresource Science, Nihon Univ., Fujisawa, Kanagawa, Japan The present study aimed to elucidate post mortem changes in fish muscle tissues by tracing changes in the gene expression of rainbow trout, *Oncorhynchus mykiss*, and Japanese jack mackerel, *Trachurus japonicus*. The fish were stored in ice for up to 5 days after death and the expression of the mRNA and specific cDNA in the ordinary muscle tissues was analyzed by a Real-time reverse transcriptase polymerase chain reaction analysis. Initial changes in the concentrations of freshness related biochemical constituents were also determined. The results showed that troponin I and glyceraldehyde-3-phosphate dehydrogenase mRNAs increased after 3h and 6h, respectively, and then they gradually decreased. On the other hand, ATP concentrations decreased simultaneously with the rise of gene expression. These results suggest that the increased mRNAs in fish muscle occurred by transcription immediately after death.

**116 - Tensile and solubility properties of calcium caseinate films cross-linked with genipin** Peggy M. Tomasula, Phoebe Qi. Eastern Regional Research Center, Dairy Processing and Products Research Unit, USDA, Wyndmoor, Pennsylvania, US Edible films made from dairy proteins have the potential to improve food quality and safety and reduce petrochemical-based packaging because of their excellent grease, aroma and oxygen barrier properties. However, most are soluble in water and sensitive to humidity which limits their use in many applications. In this work, genipin, isolated from the fruit of *Gardenia jasminoides* Ellis, was investigated as a cross-linking agent to reduce the solubility in water of calcium caseinate films plasticized with 30% glycerol. Films were made using solvent casting. Solutions were prepared at two levels of temperature and pH to which genipin in molar ratios of protein/genipin ranging from 1:200 to 1:10 was added. At 25°C and pH 10, addition of genipin reduced the solubility of the films by up to 50% without significantly affecting the tensile properties. The results show promise for the development of shelf-stable edible films for food and packaging applications.

**117 - Effect of estradiol-17 $\beta$  on embryos of the giant freshwater prawn, *Macrobrachium rosenbergii* (de Man)** Noppakun Pakdeenarong Dept. of Biology, Mahasarakham Univ., Kanthararawichai, Maha Sarakham, Thailand The objective of this study was to investigate the effect of different concentrations of estradiol-17 $\beta$  on lethal concentration, survival rate and amount of muscular tissue of giant freshwater prawn embryos. The embryos, 1 day, after spawning were treated with 15% artificial seawater (ASW) which served as a control. The treatments were 10, 50, 100 and 150  $\mu$ g/ml estradiol-17 $\beta$  for two days. The results showed that LC50 was more than 150  $\mu$ g/ml

estradiol-17 $\beta$ . The lowest of survival rate was 43.66 % observed in 150  $\mu$ g/ml estradiol-17 $\beta$ . The highest survival rate was 48.16 % observed in 50  $\mu$ g/ml estradiol-17 $\beta$ . Eyes were observed at day 8, 10, 12, 14, and 16 after spawning. The results showed that the eyes of embryos treated with 50  $\mu$ g/ml and 150  $\mu$ g/ml estradiol-17 $\beta$  were distinct and could be observed on day 12. The muscular tissue was studied on day 20 after spawning. The results showed that the muscle cells and bundles were gradually more compact with increasing of concentrations of estradiol-17 $\beta$ . The embryos treated with 50  $\mu$ g/ml estradiol-17 $\beta$  had larger and stronger bundles of muscles than the control. Moreover embryos which were treated with 150  $\mu$ g/ml estradiol-17 $\beta$  had larger bundles which were denser and stronger than under the other treatments. The data showed that estradiol-17 $\beta$  could be added to the food of farmed giant freshwater prawns.

**118 - Determination of chitosan in aqueous solutions** Svetlana Zivanovic, Robert Davis, Jiajie Li Food Science and Technology, Univ. of Tennessee, Knoxville, TN, US A simple spectrophotometric method was developed to quantify chitosan in the concentration range of 0.01 - 1%. The method is based on change in absorbance intensity of eosin due to alteration of the solution's pH with different concentrations of chitosan. The method is rapid, absorbance can be read between 30 minutes and 3 hours, but is dependent on the molecular weight and degree of acetylation of chitosan. The concentration-absorbance relationship is polynomial having R<sup>2</sup> values of over 0.99, with the exception of high molecular weight chitosan in the concentration range 0.1 - 1% where R<sup>2</sup> = 0.949, and water soluble chitosan in the concentration range 0.01 - 0.1% where R<sup>2</sup> = 0.935. The method may have application in experiments where chitosan solutions are filtered or differently manipulated prior to, for example, analysis of antimicrobial properties, film formation, electrospinning, and encapsulation.

**119 - Diterpenoids from the cultured soft coral *Klyxum simplex*** Bo-Wei Chen, Yi Lu, Jyh-Horng Sheu. Dept. of Marine Biotechnology and Resources, National Sun Yat-sen Univ., Kaohsiung, Taiwan Republic of China New eunicellin-based diterpenoids, klysimplexins I-T (1-12), and the unusual sulfur-containing derivatives, klysimplexin sulfoxides A-C (13-15), have been isolated from cultured specimens of the soft coral *Klyxum simplex*. Their structures were established by extensive spectroscopic analysis. Compounds 9 and 12 were shown to be cytotoxic toward a limited panel of cancer cell lines. Compounds 13-15 have been found to significantly inhibit the accumulation of the pro-inflammatory iNOS protein in LPS-stimulated RAW264.7 macrophage cells. Klysimplexin sulfoxide C (15) also showed marked anti-inflammatory activity in inhibiting the expression of COX-2 protein in the same cells.

**120 - Synthesis and biological evaluation of novel acylphloroglucinols** Chih-Shiang Chang, Chih-Hsin Tang, Ju-Fang Liu Graduate Inst. of Pharmaceutical Chemistry, Coll. of Pharmacy, China Medical Univ., Taichung, Taiwan Republic of China; Dept. of Pharmacology, Coll. of Pharmacy, China Medical Univ., Taichung, Taiwan Republic of China Hyperforin is a polyprenylated acylphloroglucinol derivative from *Hypericum perforatum* (St. John's wort). It exhibits antidepressant activity by a novel mechanism of action, antibiotic activity against gram-positive bacteria, anti-inflammatory, and antitumoral activity in vivo. Through simplifying the complicated skeleton of hyperforin, fifteen novel acylphloroglucinols were synthesized by Houben-Hoesch reaction of phloroglucinols with appropriate phenylacetonitriles. These compounds were subjected to screen in an assay based on the human chondrosarcoma cells. The results showed that appropriate introduction of substituted phenylacetyl group into the phloroglucinol core could elevate their anticancer activity. The most effective compounds possessed biological activity against chondrosarcoma and osteosarcoma.

**121 - Antibacterial properties of Baicalin (*Radix scutellariae*) and Berberine (*Rhizoma coptidis*) for *Staphylococcus aureus*, *Escherichia coli* and *Bacillus atrophaeus*** Ankit Shah, Shuwei Cai Dept. of Chemistry and Biochemistry, UMass Dartmouth, North Dartmouth, MA, US Several medicinal herbs, including *Radix scutellariae* and *Rhizoma Coptidis* have been used in Asia for thousands years to treat and prevent common colds and flu; these herbs have been reported to depict antibacterial and antiviral functions. In the current research, to validate the antibacterial activity of baicalin (*Radix scutellariae*) and berberine (*Rhizoma Coptidis*), their antibacterial activity were tested for three bacteria: *Staphylococcus aureus* (ATCC# 27217), *Escherichia coli* 0157:H7 (ATCC# 43888) and *Bacillus atrophaeus*. Minimum inhibition concentrations of baicalin and berberine for each of the three types of bacteria were determined via micro-broth dilution assay; ampicillin was used as a control. Overall, baicalin and berberine showed strong inhibition toward the gram positive bacteria (*S. aureus*/*B. atrophaeus*) and weak inhibition for the gram negative bacterium (*E. coli*).

**122 - Globospiramine, a new antituberculosis bisaspidospermidine indole alkaloid from *Voacanga globosa*** Allan Patrick G. Macabeo, Warren S. Vidar, Matej Barbic, Alicia M. Aguinaldo, Scott G. Franzblau, Geoffrey A. Cordell. Phytochemistry Laboratory, Research Center for the Natural Sciences, Univ. of Santo Tomas, Manila, Philippines; Institut für Organische Chemie, Universität Regensburg, Regensburg, Bayern, Germany; Institut für Organische Chemie, Universität Regensburg, Regensburg, Bayern, Germany; Dept. of Pharmacognosy and Medicinal Chemistry, Univ. of Illinois at Chicago, Chicago, Illinois, US Several plant species belonging to Apocynaceae are found to contain indole alkaloids that show inhibitory activity against *Mycobacterium tuberculosis* H37Rv. As part of a research effort targeted towards the isolation and identification of alkaloids from Apocynaceae plants displaying antituberculosis activity in vitro, this study aims to investigate the alkaloid/s in *Voacanga globosa* (Blanco) Merr. that may elicit an inhibitory effect against *M. tb.* H37Rv. The crude alkaloid extract obtained from the DCM-MeOH extract exhibited a 100% inhibition against *M. tb.* H37Rv at 128  $\mu$ g/mL using the Microplate Alamar Blue Assay (MABA). Chromatographic separation of the alkaloid extract resulted in fractions which showed 95-100% inhibition against the test bacillus. Silica gel column purification of the major compound in fraction 5 (100% at 64  $\mu$ g/mL) afforded an indole alkaloid which on spectral analysis using UV, IR, MS, 1D-NMR, (1H, 13C, DEPT-135, DEPT-90) and 2D-NMR (1H-1H COSY, HMQC, HMBC, ROESY) revealed a structure corroborating to a spirocyclic bisaspidospermidine indole alkaloid. Details on the structure elucidation of the bioactive compound will be presented in due course. Anti-TB susceptibility test of the alkaloid showed a 4  $\mu$ g/mL MIC indicating its potential as an antitubercular phytometabolite in vitro.

**123 - Studies of prenylflavonoids from the plant origin of Okinawan propolis** Shigenori Kumazawa, Mr. Noboru Momose, Ms. Masayo Murase, Toshiro Ohta, Syuichi Fukumoto. Dept. of Food and Nutritional Sciences, Univ. of Shizuoka, Shizuoka, Shizuoka, Japan; Products Research and Development Dept., Pokka Corporation, Kitanagoya, Aichi, Japan Propolis is a natural resinous product collected by honeybees from certain plants. It has gained popularity as a food and alternative medicine. However, the propolis from Okinawa, Japan, contains some prenylflavonoids not seen in other regions such as Europe and Brazil. We found that the plant origin of Okinawan propolis is

*Macaranga tanarius*. We carried out the quantitative analysis of prenylflavonoids in various parts of *M. tanarius* such as leaf, petiol, stem, leaflet, flower, and fruit. Fruits were further separated into seed, pericarp, and glandular trichome, the surface of the fruits of *M. tanarius*. Large amounts of prenylflavonoids were present in glandular trichome. Next we prepared ethanol extracts of *M. tanarius* and evaluated their antimicrobial and antiangiogenic activities. The extracts had significant antimicrobial activity against Gram-positive bacteria and also indicated the potent antiangiogenesis effects. Thus *M. tanarius* was proved to be an interesting plant with unique biological activities.

**124 - Preparation of bioactive peptides derived from wheat bran responsible for angiotensin I converting enzyme (ACE I) inhibition and nitric oxide (NO) produced acceleration and effects on hypertension** Yusuke Sauchi, Maya Sakashita, Minako Suga, Masaru Ochiai, Tatsuya Kon, Kohji Yamaguchi, Yasunari Ogihara Dept. of R&D, Pharma Foods International Co.,Ltd., Kyoto, Kyoto, Japan; FancI Research Inst., FANCL Corporation, Yokohama, Kanagawa, Japan; Kihara Inst. for Biological Research, Yokohama City Univ., Yokohama, Kanagawa, Japan Reported is the preparation of wheat bran (WB) hydrolyzate with potent angiotensin I-converting enzyme (ACE) inhibitory activity and nitric oxide (NO) produced acceleration activity. This successful hydrolyzate with the most potent ACE inhibitory activity, was obtained by 5.0 wt.%-3 h protease hydrolysis after 0.2 wt.%-16 h alpha-amylase treatment of WB (IC50; 77.54 ? g protein ml(-1); 2.5 fold of NO production vs. un-hydrolyzed WB). We then conducted experiments to determine an anti-hypertensive effect on spontaneous hypertensive rats (SHR). We carried out this work on 24 rats. The rats, weighting 252-284 g, were divided into 4 groups (n=6) with the body weight and systolic pressure (Control, WB3, WB8, and SP (Positive Control) groups). For 42 days, the rats of each group were given free access to the 4 diets; Control diet (CRF-1), 1.5% (w/w) WB3 mixed CRF-1 diet (WB3), 1.5% (w/w) WB8 mixed CRF-1 diet (WB8) or 1.5% (w/w) sardine peptides (Sardine peptide ? -1000N, Senmi Ekisu Co., Ltd, Ehime, Japan) mixed CRF-1 diet (IP). For the test periods, the dietary intake and rat body weights of the rats were monitored three times a week. At the end of the feeding period, all rats were sacrificed under diethyl ether anesthesia. As a result, WB8 group appeared to have a significant anti-hypertensive effect on hypertensive SHRs, but no adverse effects could be detected at all.

**125 - Head space solid phase microextraction (HS -SPME) gas chromatography mass spectroscopy (GC/MS) analysis of volatile components of garlic** Jack D. Williams, Jessica G. Clemente G. Clemente. Chemistry and Biochemistry, Mercyhurst Coll., Erie, PA, US We present preliminary results in our on-going studies of nutraceuticals found in garlic. Studies are being conducted to identify and quantify the presence of known nutraceuticals in a variety of garlic types using Gas Chromatography Mass-Spectroscopy. Sample introduction was made using the technique of Solid Phase Microextraction. Conditions for extraction and desorption were optimized for garlic samples to ensure maximum component concentration. Different garlic samples were compared with respect to the amount and identity of the analytes present. Preliminary results show that there appears to be significant differences in the volatile compounds present in commercial organic, homegrown organic and elephant garlic.

**126 - Flavor characteristics of Australian Botrytis Semillon** Conny E Hofmann, Andrew C Clark, Leigh M Schmitdke. Dept. of Agricultural and Wine Science, Charles Sturt Univ., Wagga Wagga, NSW, Australia Dessert wines made from grapes infected with noble rot (*Botrytis cinerea*) are produced worldwide. However research has focused on European wines, especially Sauternes from France. Australian *Botrytis Semillon*s show distinct aroma differences, which were analyzed by gas chromatography- olfactometry-mass spectrometry. A special emphasis was given to nutty, marzipan-like characters which can be evoked e.g. by benzaldehyde, as these dominate in the French wines. The results confirmed the differences in the preliminary sensory tests, so that future research will focus on possible reasons for this.

**127 - Enzymatic modification of wheat protein for the formation of pyrazines and other heterocyclic compounds through Maillard reaction** Sang Eon Lee, Young-Suk Kim. Dept. of Food Science and Engineering, Ewha Womans Univ., Seoul, Republic of Korea Wheat is a major cereal of relatively high protein level. In particular, it has high content of glutamine, which contains amide side chain in its structure. The amide side chain is easily hydrolyzed, leading to the release of free ammonia. The released ammonia can be a reactive precursor for diverse volatile components through Maillard reaction. In this study, the formation of pyrazines and other heterocyclic compounds from the thermal interactions of wheat protein hydrolysates with reducing sugars, such as glucose and fructose, was investigated. The wheat gluten hydrolysates were produced by enzymatic hydrolysis using protease/peptidase alone or in combination with glutaminase to convert glutamine into glutamic acid and ammonia. Volatile components were isolated by solvent extraction and analyzed by GC-MS. The major volatile components included pyrazines, pyrroles and thiazoles. This study showed that more volatile components could be produced when wheat protein was treated with both protease/peptidase and glutaminase.

**128 - Determination of the levels of polycyclic aromatic hydrocarbons (PAH) in US and Swedish smokeless tobacco products** Kevin G McAdam, Arif Faizi, Harriet Kimpton, Brad Rodu. Group Research & Development, British American Tobacco, Southampton, Hampshire, United Kingdom; Univ. of Louisville, Louisville, Kentucky, US IARC Monograph 89 identified 28 toxicants in smokeless tobaccos, including benzo(a)pyrene. A recent study of 23 PAHs in smokeless tobacco concluded PAHs were "one of the most prevalent groups of carcinogens". In 2010 WHO Study Group (TobReg) recommended a regulatory limit for smokeless benzo(a)pyrene of 5ng/g. We commenced a study in 2008 quantifying toxicant levels in 70 contemporary US and Swedish smokeless tobaccos, covering eight main product styles. An experienced contract laboratory measured 21 PAHs; BAT measured benzo(a)pyrene. We examined differences in and relative proportions of PAH levels, estimated interlab consistency and implications of the TobReg recommendation. Highest levels of individual PAHs were found with moist and dry snuff. Phenanthrene, naphthalene, fluoranthene and pyrene were present at greatest levels. Most US products sampled were above the benzo(a)pyrene limit, whereas most Swedish products were below. Interlab consistency in benzo(a)pyrene measurement was a major issue in assessing compliance with the limit.

**129 - Cytotoxic terpenoids from *Calocedrus macrolepis* var. *formosana*** Yueh-Hsiung Kuo Tsuzuki Inst. for Traditional Medicine, Coll. of Pharmacy, China Medical Univ., Taichung, Taiwan Republic of China Calocetriol (1), diacetylcalocediol (2), abeoabietalignol (3), labdanecaryophyllic acid (4), and ferrugimenthenol (5) were isolated from the bark of *Calocedrus macrolepis* var. *formosana*. Compounds 1 and 2 are secoabietane-type diterpenoids, and 3 with respective C30, C35, and C30 skeletons are novel meroterpenoids. Their structures

were characterized by spectroscopic analysis. Of these compounds identified, 35 exhibited significant cytotoxic activities against human oral epidermoid carcinoma KB cells with IC50 values of  $8.9 \pm 0.1$ ,  $9.2 \pm 0.4$ , and  $9.0 \pm 0.1$  mM, respectively.

**130 - Investigation on the flavor enhancing components in glutathione-Maillard reaction products using metabolomic approach** Sang Mi Lee, Goo Young Kwon, Prof Kwang-Ok Kim, Young-Suk Kim Dept. of Food Science and Engineering, Ewha Womans Univ., Seoul, Republic of Korea Glutathione ( $\gamma$ -L-glutamyl-L-cysteinylglycine, GSH) plays an important role in the formation of diverse flavor components through the Maillard reaction during the heating processing. In addition, both GSH and its Maillard reaction products (MRPs) were recently reported to have taste-enhancing ("kokumi") properties. In this study, GSH-MRPs were prepared by the thermal reaction of GSH with glucose, xylose or ribose under different conditions (temperatures and pHs). Descriptive analysis was used to evaluate sensory characteristics of beef stocks augmented with various GSH-MRPs. The trained panelists defined sensory attributes and evaluated the samples. The results indicated that the GSH-MRPs could enhance some flavor notes such as "beef flavor" in beef stock. The application of metabolomic techniques on volatile metabolites (compounds) of GSH-MRPs could provide correlations between individual flavor enhancing components and the sensory characteristics. Gas-chromatography coupled with time-of-flight mass spectrometry (GC-TOF/MS) and multivariate data analysis were employed to identify the flavor enhancing components of GSH-MRPs.

**131 - Effect of hot-water extraction on non-carbohydrate components of hardwoods** Mangesh J Goundalkar, Biljana Bujanovic, Thomas E Amidon. Dept. of Paper and Bioprocess Engineering, State Univ. of New York Coll. of Environmental Science and Forestry (SUNY-ESF), Syracuse, New York, US The results presented herein are an effort to assess the contribution of hot-water extracts (HWEs) in broadening the scope of the Environmental Science and Forestry biorefinery by generating value-added chemicals. The HWEs of three hardwood species were ultrafiltrated to remove insoluble solids or higher molecular weight fractions (HMWF) and the total lignin content and molecular weight distribution of each was determined. The clear permeates or the lower molecular weight fractions (LMWF) were analyzed by GC/MS and compared to extractives present in the respective native wood chips. Pronounced dissimilarity between organic compounds in LMWF and native extractives suggests lignin degradation during hot-water extraction. The two fractions were further analyzed to determine phenolic hydroxyl group content and potential antioxidant activity. Understanding the composition of these two fractions should give perspective on the nature of lignin after hot-water extraction and its subsequent commercial viability along with providing insight into usefulness of LMWF as platform chemicals.

**132 - Aroma profile comparisons of "Strawberry Festival" and "Florida Radiance" strawberries by GC-Olfactometry, odor activity values, and sensory evaluation** Xiaofen Du, Anne Plotto, Elizabeth Baldwin, Russell Rouseff Citrus Research and Education Center, Univ. of Florida, IFAS, Lake Alfred, FL, US; Citrus and Subtropical Products Research Laboratory, USDA-ARS, Winter Haven, FL, US; Citrus and Subtropical Products Research Laboratory, USDA-ARS, Winter Haven, FL, US; Citrus Research and Education Center, Univ. of Florida, IFAS, Lake Alfred, FL, US 'Florida Radiance', a new strawberry cultivar that produces consistently high yields and quality fruit in mild climates, and 'Strawberry Festival', the current major commercial cultivar in Florida, were evaluated for their aroma profiles over the 2010 harvest season. Fully ripe strawberries were collected at three harvest dates from January to late March. Volatile compounds were extracted by SPME and analyzed by GC-olfactometry and GC-MS. Major odorants were: propyl acetate, methyl 2-methylbutanoate, ethyl pentanoate, ethyl butanoate, ethyl hexanoate, methyl thioacetate, methyl thiobutanoate, hexanal, t-2-hexenal, 2-methylbutanoic acid, geraniol, linalool, mesifurane, Furanol, and  $\gamma$ -decalactone. Aroma patterns were similar between the two cultivars. Odor activity values mirrored the GC-O data. However, the total aroma content in 'Radiance' was 1.6 times of that in 'Festival'. 'Radiance' had 10 times more  $\gamma$ -decalactone and ethyl hexanoate than 'Festival'. Aroma profiles of both cultivars were also evaluated by 14 panelists using quantitative descriptive analysis. No significant difference was observed.

**133 - Effect of short passage time on the polishing and storage temperature of milled and cooked rice quality** Yejin Oh, Wooyoung Jeong, Hyoyoung Jeong. Dept. of food application center, CJ Cheiljedang Corporation, Seoul, Republic of Korea The passage time from polishing to input into the process is a very important control point in manufacturing cooked rice. To establish the maximum time needed before quality changes, the physicochemical properties of milled and cooked rice were compared over 1 week after polishing at different temperature (15/25/35 $^{\circ}$ C). The water content and transparency decreased at after 24 hours at 35 $^{\circ}$ C. Increase of colorimetric b value and change of bromothymol blue to yellow were observed after 24 hours at 35 $^{\circ}$ C. Free fatty acidity increased after 24 hours in all conditions. In cooked rice, texture analysis showed slow but continuous decrease of hardness. So, after the polishing process is finished, milled rice should be cooled below 35 $^{\circ}$ C, and spent as soon as possible, within 24 hour.

**134 - Metabolite profiling by gas chromatography-mass spectrometry (GC-MS) and principal component analysis (PCA) of Schizandra chinensis Baillon (omija fruits) according to their origins** Master candidate Hyun Jeong Lee, In Hee Cho, Young-Suk Kim. Dept. of Food Sci. and Engineering, Ewha Womans Univ., Seoul, NA, Rep. of Korea Metabolite profiling which applies principal component analysis (PCA) to GC-MS data sets, allowed dried Schizandra chinensis Baillon (omija fruits) of different origins, to be discriminated. Also, some volatile components that contributed to the discrimination were assigned. A total of 50 volatile compounds were identified in five dried omija fruits according to their origins (China, North Korea, and different parts of South Korea; Mungyeong, Jecheon, and Hoengseong). They could be separated in score plots by combining principal component 1 (PC 1) (78.1%) with PC 2 (14.2%). In particular, the dried omija fruits of Chinese and North Korean were differentiated from ones of South Korean by PC 2. The major volatile components contributing to the PC 1 dimension were germacrene D,  $\beta$ -amorphene,  $\beta$ -terpineol,  $\beta$ -selinene, and  $\beta$ -bourbonene. In contrast, the important components of the PC 2 dimension were  $\beta$ -terpineol, (E)- $\beta$ -farnesene, cubenene,  $\beta$ -amorphene, and (E)-sabinene hydrate.

**135 - Comparison of the volatile composition of pasteurized and unpasteurized makgeolli, a traditional Korean rice wine** Master candidate Hye Jung Park, Young-Suk Kim. Dept. of Food Science and Engineering, Ewha Womans Univ., Seoul, NA, Republic of Korea There has been an increase in the consumption of alcoholic beverages made from rice in Asian countries such as Korea and Japan. In particular, there is great demand for traditional Korean rice wine, makgeolli, which has its own characteristic odor notes. Commercial makgeolli is distributed in 2 forms, with or without heating for pasteurization (low temperature long time, LTLT). Pasteurized makgeolli has



longer self-life due to the elimination of yeasts and other microorganisms that produce gas or other by-products during storage. However thermal treatment can lead to changes in volatile composition of makgeolli. In this study the volatile components of 2 types makgeolli, extracted by solvent assisted flavor evaporation (SAFE), were analyzed using gas chromatography-mass spectrometer (GC-MS). 7 Alcohols [3-methyl-1-butanol, 2-methyl-1-butanol, 2,3-butanediol, 3-ethoxy-1-propanol, 3-(methylthio)-1-propanol, 2-phenylethanol, 3,6,9,12,15-pentaoxonadecan-1-ol], 5 esters (ethyl lactate, ethyl hexanoate, ethyl succinate, ethyl octanoate, ethyl decanoate), were found to have decreased in the pasteurized makgeolli compared to unpasteurized one.

**136 - Determination and comparison of Saponins in Black Panax ginseng** C.A. Mayer Shin Hae Cho, One Kyun Choi, Changkeun Sung. Dept. of pre-pharmacy, Univ. of Toledo, Toledo, OH, US; Dept. of chemical and environmental engineering, Univ. of Toledo, Toledo, OH, US; Dept. of Food Science and Technology, Chungnam National Univ., Daejeon, Chungnam, Republic of Korea Panax ginseng C. A. Meyer is a traditional herbal medicine in eastern Asia. It reportedly promotes increased energy, improves circulation, increases blood supply, revitalizes and aids recovery from weakness after illness, and stimulates the body. Ginsenosides, the ginseng saponins, are the main effective components responsible for their antidiabetic, anti-inflammatory, and antitumor activities. To date, more than 30 different ginsenosides have been isolated and characterized, and shown to have different pharmacological effects. Based on their aglycone moieties, ginsenosides can be classified into two categories: 20(S)-protopanaxadiol (ginsenosides Rb1, Rb2, Rc, Rd, Rg3, and Rs3) group and 20(S)-protopanaxatriol (ginsenosides Re, Rg1, and Rf) group. Ginseng is one of the most popular herbal medicines used as a dietary supplement in recent years. There are a variety of commercial ginseng products, including white ginseng red ginseng and black ginseng. White ginseng is produced from fresh ginseng by dehydration by sunlight, while red ginseng is manufactured by steaming fresh ginseng at 95-100 °C for 2-3 h. Black ginseng is produced from white ginseng by nine cycles of steaming at 98 °C for 3 h and 12 h. In this study, we determined the saponins in black ginseng and compared them to white and red ginsengs.

**137 - Insecticidal and antioxidant activities of abietane diterpenoids from Hyptis verticillata** Jacq Roy B. R. Porter, Duanne A. C. Biggs, Lawrence A. D. Williams Dept. of Chemistry, The Univ. of The West Indies, Mona, Kingston, Jamaica; Dept. of Chemistry, The Univ. of The West Indies, Mona, Kingston, Jamaica; Dept. of Natural Products, Scientific Research Council of Jamaica, Mona, Kingston, Jamaica Seven abietane diterpenoids were isolated from the roots of *Hyptis verticillata* (Labiatae). These are 7a-acetoxy-16-benzoxyabieta-8,12-diene-11,14-dione (1), 11,14 dihydroxy-12-methoxyabieta-8,11,13-triene-7-one (2), 11,14-dihydroxy-12-methoxy-(4?3)?-abieta-4(19),8,11,13-tetraene-7-one (3) 7a-acetoxy-12-methoxyabieta-8,12-diene-11,14-dione (4), royleanone (5), 7,6-dehydroroyleanone (6) and 7a-acetoxyhorminone (7). The seven compounds were evaluated for their insecticidal activity using the sweet potato weevil, *Cylas formicarius elegantulus* (Summers), while their antioxidant activity were evaluated using 1,1-diphenyl-2-picrylhydrazyl (DPPH) assay. Compounds 2, 5 and 6 displayed significant insecticidal activity while the quinols 2 and 3 exhibited antioxidant activity comparable to that of ascorbic acid.

**138 - Scopolamine-induced memory impairment in mice and antioxidant activities of aqueous antler extract** One Kyun Choi, Changkeun Sung, Shin Hae Cho. Dept. of Chemical and Environmental Engineering, Univ. of Toledo, Toledo, OH, US; Dept. of pre-pharmacy, Univ. of Toledo, Toledo, OH, US; Dept. of Food Science and Technology, Chungnam National Univ., Daeduck, Daejeon, Republic of Korea This study was performed to estimate ameliorating effect of aqueous antler extract (AAE) on memory impairments induced by scopolamine (SCOP, 2 mg/kg, i.p.). Tacrine (THA, 10 mg/kg, p.o.) was used as a positive control. The passive avoidance test and Y-maze test results showed that a single AAE (200 mg/kg, p.o.) administration significantly restored memory impairment. Moreover, AAE or THA treatment significantly reduced the escape latency prolonged by SCOP during trial sessions in the Morris water maze test. In vivo study, AAE significantly inhibited acetylcholinesterase activity ( $p < 0.001$ ), whereas choline acetyltransferase activity ( $p < 0.05$ ) was enhanced. In addition, SCOP elevated oxidative damage in the brain. However, treatment with AAE to the amnesic mice induced by SCOP considerably decreased malondialdehyde level ( $p < 0.01$ ) and restored the activities of superoxide dismutase ( $p < 0.01$ ) and glutathione peroxidase ( $p < 0.001$ ) approaching the control values. These results suggest that AAE showed the potential cognitive-enhancing activity by regulating cholinergic marker enzyme activities and promoting the antioxidant system.

**139 - Curcuminoids promote neuronal differentiation of PC12 cells through PKC-dependent phosphorylation of CREB protein** Kuo-Kai Liao, Kuei-Fang Lee, Ming-Juan Wu, Chi-Tang Ho, Jui-Hung Yen Dept. of Molecular Biology and Human Genetics, Tzu Chi Univ., Hualien, Taiwan Republic of China; Inst. of Medical Sciences, Tzu Chi Univ., Hualien, Taiwan Rep. of China; Dept. of Biotechnology, Chia-Nan Univ. of Pharmacy and Science, Tainan, Taiwan Rep. of China; Dept. of Food Science, Rutgers Univ., New Brunswick, NJ Curcuminoids are the major polyphenolic compounds in most curcuma species and possess the activity for anti-oxidation, anti-inflammation, anticancer, and the promotion of neurogenesis. In the present study, we found that curcuminoids significantly induced neurite outgrowth along with increased expression of the neuronal differentiation markers in PC12 cells. We further analyzed the cyclic-AMP response element binding protein (CREB) which may influence the neuronal cell differentiation by Western blot analysis. The immunoblot results show that curcuminoids increased the phosphorylation of CREB protein. While the addition of selective inhibitors for identifying the molecular signaling of curcuminoids-mediated neuronal differentiation, we found that the bisindolylmaleimide I (BIM), a highly selective PKC inhibitor, attenuated the portion of neurite-bearing cells and the levels of phospho-CREB protein. These above results suggest that PKC-dependent pathway coupling with CRE-mediated gene expression may contribute to curcuminoids-induced neuronal differentiation in PC12 cells.

**140 - Phytochemical composition and anti-fungal activity of extracts from cranberry cultivars (Vaccinium macrocarpon Ait.) that vary in resistance to plant pathogens** Melissa C. Nunnelley, Jessica L. Carpenter, Catherine C. Neto, Frank L. Caruso . Dept. of Chemistry and Biochemistry, Univ. of Massachusetts Dartmouth, North Dartmouth, MA, US; Cranberry Experiment Station, Univ. of Massachusetts Amherst, East Wareham, MA, US Cranberry cultivars grown in Massachusetts differ in resistance to pathogenic fungi causing fruit rot, upright dieback and other diseases that reduce productivity and fruit quality. The resistance observed in some cultivars may be due to phenolic secondary metabolites. Fruit and foliage from three varieties of *Vaccinium macrocarpon* differing in susceptibility were harvested at timepoints coinciding with infection. Crude extracts were prepared, fractionated, and analyzed for phytochemical composition by HPLC.

Extracts and fractions were bioassayed against four species of cranberry pathogens (*Coleophoma empetri*, *Phomopsis vaccinii*, *Colletotrichum acutatum*, *Fusicoccum putrefaciens*) using agar diffusion assays. Cultures were evaluated for growth inhibition and melanin production, a stress indicator. The fruit proanthocyanidin fractions induced melanin in most species. Proanthocyanidin content as determined by the DMAC method varied between cultivars. Fractions containing hydroxycinnamic acid derivatives inhibited fungal growth. The results suggest that cranberry proanthocyanidins and hydroxycinnamic acid derivatives may play a role in pathogen resistance.

**141 - Semi-continuous method for recovering anthocyanins and procyanidins from White Zinfandel (V. Vinifera) red grape pomace** using subcritical water Jeana Monrad, Luke R. Howard, Keerthi Srinivas, Jerry W. King, Andy Mauromoustakos. Food Science, Univ. of Arkansas, Fayetteville, AR, US; Chemical Engineering, Univ. of Arkansas, Fayetteville, AR, US; Agricultural Statistics Lab, Univ. of Arkansas, Fayetteville, AR, US A batch semi-continuous extraction system was constructed and used to optimize anthocyanin and procyanidin recovery from red grape pomace. Continuously flowing water was preheated to sub-critical conditions before being introduced to the pomace-filled cell, which was located outside the heated oven to minimize polyphenol thermal degradation. Extraction variables included sample moisture content (crude or dried), water flow rate (5, 10, 15 mL/min), oven temperature (60, 100, 140C), and sample mass (5, 15, 25 g). A response surface regression analysis of the variables impacting recovery of the polyphenols was applied to determine optimal conditions for both anthocyanin and procyanidin recovery from the grape pomace. These were 140C oven temperature, 5 mL/min flow rate, and 5 g crude pomace. Under these optimal conditions 78% of anthocyanins and 91% of procyanidins were extracted when compared to methanol-or acetone-based conventional extraction methods, respectively. This study moves us one step closer to an industrially applicable method for effectively extracting polyphenolics from grape by-products using an environmentally friendly processing method.

**142 - In vitro estimation of antioxidant activities in red and white cranberry extracts** Artemio Z Tulio, Jr., Indika Edirisinghe, Claire Chang, Joseph E. Jablonski, Ravi K. Tadapaneni, Britt Burton-Freeman, Lauren S. Jackson. Center for Food Safety and Applied Nutrition (CFSAN), U.S. FDA, Summit-Argo, IL, US; National Center for Food Safety and Technology, Illinois Inst. of Technology, Summit-Argo, IL, US; Oak Ridge Inst. for Science and Education (ORISE), U.S. FDA, Summit-Argo, IL, US This study was conducted to estimate in vitro antioxidant potential of red (RCE) and white cranberry extracts (WCE) using ORAC, ABTS, FRAP, and DPPH assays, and their ability to activate eNOS via redox sensitive PI3 kinase/Akt-mediated signaling pathway in vitro in human umbilical vein endothelial cells (HUVEC) using Phospho (ser-473) Akt assay. Total phenolics, and ORAC, ABTS, FRAP, and DPPH values were not significantly different in RCE and WCE. The total monomeric anthocyanin ratio of RCE/WCE was 22/1. Phosphorylated Akt levels were increased in response to RCE and WCE (1 mg/mL extract) in HUVEC by respective 7.5-fold and 7.9-fold compared to PBS-treated control. These results indicate the diversity in the phenolic profiles of RCE and WCE was not a factor for the antioxidant properties and biological activity as observed by the activation of PI3K/Akt kinase pathway in HUVEC. Extracts of red and white cranberry fruits are potent vasodilator agents.

**143 - Phenolic content, antioxidant activity, and anti-proliferative property of cold-pressed grape seed flours** Lena A Binzer, Rebecca L Brinsko, Jessica J Cha, Zao Chen, Sarah E Green, Kelly E Grob, Junjie Hao, Christina M Hitz, Laura J Li, Sowmya N Swamy, Maxim Y Wolf, Mengmeng Xu, Mary C Yanik. Gemstone Program, Univ. of Maryland, Coll. Park, Maryland, US Five varieties of defatted cold-pressed grape seed flour were extracted with three different solvents and analyzed for their total phenolic content (TPC), radical scavenging capacity (RSC), and anti-proliferative effect on HT-29 colon cancer cells. Chardonnay seed flour exhibited the highest TPC value, RSC against DPPH, peroxy and hydroxyl radicals, and anti-proliferative activity. Estimation of TPC, RSC, and anti-proliferation also depended on the extraction solvent used, and 50% acetone extractions consistently yielded the highest values. 50% acetone extractions of defatted chardonnay seed flour demonstrated a TPC value of 129.77 mg gallic acid equivalents (GAE)/g, DPPH RSC of 92.09 mmol trolox equivalents (TE)/g, ORAC of 1.86 mmol TE/g, and OH RSC of 2.21 mmol TE/g. These results demonstrate the potential to use cold-pressed grape seed flour, a by-product of cold-pressed grape seed oil production, in creating economical functional foods with high levels of antioxidants.

**144 - Chemical composition and antioxidant properties of cold-pressed grape seed oils** Lena A Binzer, Rebecca L Brinsko, Jessica J Cha, Zao Chen, Sarah E Green, Kelly E Grob, Junjie Hao, Christina M Hitz, Laura J Li, Sowmya N Swamy, Maxim Y Wolf, Mengmeng Xu, Mary C Yanik. Gemstone Program, Univ. of Maryland, Coll. Park, MD, US Five different cold-pressed grape seed oils were evaluated for their 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity, carotenoid and tocopherol contents, fatty acid composition, and oxidative stability. The Concord seed oil exhibited the highest DPPH radical scavenging at 123.1  $\mu$ mol trolox equivalents per gram of oil of the five oils tested. Concord seed oil also contained the lowest concentration of saturated fats and the highest concentration of polyunsaturated fats. The Norton seed oil contained the largest amount of beta-carotene at 34.1  $\mu$ g/g and White grape seed oil contained the most lutein at 41.7  $\mu$ g/g. Ruby Red seed oil contained the highest concentration of tocopherol at 87.1  $\mu$ g/g. The oxidative stability index (OSI) was also measured, and all grape seed oils, with the exception of Chardonnay seed oil, oxidized slower than a commercial canola oil, the control. The results from the study elucidate the health beneficial factors grape seed oil can contribute as a food ingredient.

**145 - Improved stability of blueberry juice anthocyanins by acidification and refrigeration** Luke R. Howard, Cindi Brownmiller, Ronald L. Prior. Food Science, Univ. of Arkansas, Fayetteville, AR, US; USDA-ARS, Arkansas Children's Nutrition Center, Little Rock, AR, US Methods are needed to improve the stability of anthocyanin pigments during processing and storage of blueberry juice. The objective of this study was to compare the effect of three pH's (2.1, 2.5, and 2.9) and four beta cyclodextrin (BCD) levels (0, 0.5, 1, and 3%) on the anthocyanin content and polymeric color of blueberry juice immediately following processing and over four months storage at 4 and 25C. Storage temperature had the greatest impact on anthocyanin stability with refrigerated juices having much higher anthocyanin levels and lower polymeric color values than juices stored at ambient temperature. Juices acidified to pH 2.1 had higher anthocyanin levels and lower polymeric color values than juices acidified to pH 2.5 and control juices (pH 2.9) during storage. BCD treatments did not affect anthocyanin content or polymeric color values. The combination of acidification and refrigeration can be used to stabilize blueberry juice anthocyanins.

**146 - Salvia fruticosa mediates protection against H2O2-induced DNA damage in HEK293 cells** Mr. Saleem A Bani hani MSc.. Dept. of Chemistry, Cleveland State Univ., Cleveland, Ohio, US *Salvia Fruticosa* (SF), native to the Eastern-Mediterranean basin, is widely used

as a medicinal herb for treatment of various diseases. In the present study, we investigated the in vitro protective effect of the water-soluble extract of SF leaves against H<sub>2</sub>O<sub>2</sub>-induced DNA damage in HEK293 cells. Dried leaves of SF were extracted in phosphate buffer saline (PBS); the extract was purified using both vacuum and high pressure filtrations. The antioxidant activity of the filtrate was evaluated using the reducing power assay and the phosphomolybdenum assay. The DNA damage protection activity was measured using flow cytometry. HEK293 cells were incubated with SF extract and exposed to 0.1 mM concentration of H<sub>2</sub>O<sub>2</sub>. Control assays were performed with HEK293 cells in the absence of the extract. The cells are then fixed, permeabilized, and the DNA damage is quantified using fluorescence upon FITC derivatization of 8-oxoguanine moieties, which result from oxidative DNA damage. Our results show that SF extract exerts potent antioxidant activity in which 10 µl of the extract were equivalent to 260 µmol L-ascorbic acid. In flow cytometry, cells treated with SF extract exhibit lower intensity of fluorescence than those without treatment, and thus lower DNA damage. In conclusion, the water-soluble extract of SF leaves exerts a strong protective effect against H<sub>2</sub>O<sub>2</sub>-induced DNA damage.

**147 - Phytochemicals in winged sumac (*Rhus copallinum*) fruit** Hang Ma, Liya Li, Navindra P. Seeram. Biomedical and Pharmaceutical Sciences, Coll. of Pharmacy, Univ. of Rhode Island, Bioactive Botanical Research Laboratory, Kingston, RI, US The sumac (*Rhus*) genus of plants consist of approximately 250 species and are widely distributed in North America where they are popularly cultivated as ornamental plants due to their attractive flowers and brightly colored fruits. Despite records of extensive use of *Rhus copallinum* (winged sumac or flame-leaf sumac) by Native Americans for a variety of medicinal purposes, its phytochemical constituents are yet to be identified. Therefore, our laboratory conducted the current study to isolate and identify phytochemicals in winged sumac berries collected on the Kingston campus of the Univ. of Rhode Island. Four compounds, including a terpenoid (betulinic acid), a phenolic acid (gallic acid), a flavonol (quercetin) and an anthocyanidin (peonidin), were isolated using a combination of chromatographic (XAD-16 resin, C-18, and silica gel columns) and spectroscopic (LC-MS and NMR) methods. This is the first reported phytochemical study of winged sumac berries.

**148 - Phytochemicals in Fraser's Marsh St. John's Wort (*Triadenum fraseri*)** Liya Li, Daniel Woolridge, John Jennings, Ritchie Saing Geneive E. Henry, Navindra P. Seeram. Biomedical and Pharmaceutical Sciences, Coll. of Pharmacy, Univ. of Rhode Island, Bioactive Botanical Research Laboratory, Kingston, RI, US; Susquehanna Univ., Dept. of Chemistry, Selinsgrove, PA, US A methanol leaf extract of Fraser's Marsh St. John's Wort (*Triadenum fraseri*) was subjected to a series of isolation procedures including silica gel and LH-20 column chromatography, and semi-preparative HPLC. Eight compounds were isolated and identified based on NMR and LC-MS data as myricetin-3-O- $\beta$ -D-glucoside (1), myricitrin (2), quercitrin (3), rutin (4), nicotiflorin (5), piceatannol-3'-O- $\beta$ -D-glucopyranoside (6), 3-p-coumaroylquinic acid (7), and myo-inositol (8). The antioxidant activities of the isolates were evaluated using the diphenylpicrylhydrazyl (DPPH) radical scavenging assay. Compounds 1-4, and 6 had IC<sub>50</sub> values of 77.22, 258.62, 51.86, 116.63, 270.94 µM, respectively. The commercial synthetic antioxidant, butylated hydroxytoluene (BHT), and vitamin C had IC<sub>50</sub> values of 3020 and 56.25 µM, respectively, in this assay. This is the first reported phytochemical investigation of *T. fraseri*.

**149 - Phytochemicals in blueberry (*Vaccinium corymbosum*) stems and roots** Amanda Cirello, Liya Li, Luke R. Howard, Navindra P. Seeram. Biomedical and Pharmaceutical Sci., Coll. of Pharmacy, Univ. of Rhode Island, Bioactive Botanical Res. Lab., Kingston, RI; Univ. of Arkansas, Food Science Dept., Fayetteville, AR, *Vaccinium corymbosum* plants bear blueberry fruit which have been extensively researched for their health properties and their phytochemical constituents. However there is limited knowledge on compounds present in other parts of the blueberry plant such as roots and stems. Methanol extracts of the dried stems and roots of blueberry plants were investigated for their antioxidant activities using the diphenylpicrylhydrazyl (DPPH) radical scavenging assay. The IC<sub>50</sub> values of the blueberry stem and root extracts were 173.9 and 750 ppm, respectively, while the commercial synthetic antioxidant, butylated hydroxytoluene (BHT), and vitamin C had IC<sub>50</sub> values of 583 and 10 ppm, respectively. The extracts were subjected to LH-20 column chromatography and preliminary HPLC analyses of the purified fractions indicated the presence of proanthocyanidins (PACs) with degrees of polymerization (DP), ranging from DP3 to DP9. The presence of PACs in blueberry stems and roots are not unusual considering that these compounds have also been reported in blueberry fruit. Our laboratory is currently pursuing the identification of other phytochemicals in these blueberry plant parts.

**150 - Compounds from *Eugenia jambolana* (Jamun) berries beyond anthocyanins** Raed Omar, Liya Li, Amanda Cirello, Navindra P. Seeram. Biomedical and Pharmaceutical Sciences, Coll. of Pharmacy, Univ. of Rhode Island, Bioactive Botanical Research Laboratory, Kingston, RI, US The purple berries of the native Indian plant *Eugenia jambolana* Lam., commonly known as Jamun, originated in India and have extensively been used in Ayurveda, the Indian traditional system of medicine. Our laboratory previously reported on the chemopreventive potential of a Jamun fruit extract and identification of its anthocyanins. However, little is known about Jamun fruit (pulp and seed) compounds beyond these pigments. Using a combination of chromatographic isolation (including XAD-16 resin, C-18, and silica gel columns; and semi-prep HPLC) and spectroscopic identification (LC-MS and NMR) methods, six non-anthocyanin compounds were identified including ellagic acid, gallic acid, valoneic acid dilactone (from seeds) and lupeol, oleanolic acid, and ursolic acid (from pulp). These compounds are currently being evaluated for their antioxidant (ability to scavenge DPPH free radicals) and cytotoxicity potential against a panel of human tumor cell lines.

**151 - Composition of flavonoids and other phenolics in foliage from cranberry cultivars (*Vaccinium macrocarpon*) that vary in susceptibility to cranberry tipworm and other pests** Eleni Yiantsidis, Christine Dao, Anne Averill, Sunil Tewari, Frank Caruso, Joshua Hicks, Kimberly Colson, K. Brian Killday, Catherine Neto. Dept. of Chemistry and Biochemistry, Univ. of Massachusetts Dartmouth, North Dartmouth, MA, US; Dept. of Pharmaceutical Sciences, Univ. of Rhode Island, Kingston, RI, US; Dept. of Plant, Soil and Insect Sciences, Univ. of Massachusetts Amherst, Amherst, MA, US; Bruker BioSpin, Billerica, MA, US; Cranberry Experiment Station, Univ. of Massachusetts Amherst, East Wareham, MA, US Insect pests including cranberry tipworm (*Dasineura oxycoccana*) prefer to feed on Howes cranberry leaves (*Vaccinium macrocarpon*) over other cultivars. Phenolic secondary metabolites in the foliage may lure or repel these insects. Comparison of phenolic and flavonoid composition among several cultivars and locations and between infested and un-infested Howes foliage was conducted to investigate the identity of possible feeding deterrents or promoters. Foliage samples were collected in 2009 from three different cultivars at several locations in Massachusetts. Tipworm-infested and un-infested Howes uprights were also collected.

Extraction and HPLC analysis showed variation in composition of several phenolic acid derivatives and flavonol glycosides between samples, including infested versus un-infested foliage. Foliage extracts were also subjected to NMR-based metabolic profiling to determine the extent of variation between cultivars and sites. NMR confirmed the presence of quercetin glycosides and catechins. Principal component analysis (PCA) of the <sup>1</sup>H NMR spectra demonstrates distinct patterns among different cultivars.

**152 - Pterocarpan and flavonoids from *Derris laxiflora* Benth** Shih-Chang Chien. Sch. of Chinese Medicine Resources, China Medical Univ., Taichung, Taiwan Republic of China Six compounds were isolated from *Derris laxiflora* Benth., including three new pterocarpan 7,6'-dihydroxy-3'-methoxypterocarpan (1), derrispisatin (2), derriscoumaronochromone (3) and three new flavonoids cis-3,4'-dihydroxy-5,7-dimethoxyflavan (4), derriflavanone B (5), iso-lupinenol (6). The structures of these compounds were determined by analysis of their spectroscopic data.

**153 - Biocatalytically polymerized flavonoids with enhanced antioxidant activity** Kalyani Daita, Sheila Tripathy, Subhalakshmi Nagarajan, Ramaswamy Nagarajan, Ferdinando F Bruno, Lynne Samuelson, Jayant Kumar Biomedical Engineering and Biotechnology, Univ. of Massachusetts Lowell, Massachusetts, Center for Advanced Materials, Univ. of Massachusetts Lowell, Massachusetts; Plastics Engineering, Univ. of Massachusetts Lowell, Lowell, Massachusetts, US; Physics, Univ. of Massachusetts Lowell, Lowell, Massachusetts, US; U.S.Army Research, Development, and Engineering Center, U.S.Army Natick Soldier RDECOM, Natick, Massachusetts, US Antioxidants play an important role in fighting oxidative stress. Flavonoids such as ellagic acid, quercetin, and epicatechin have been shown to possess a significant anti-oxidant activity in numerous in-vitro assays. However, the poor stability of the flavonoids at different pH conditions and high temperatures hamper further development of these compounds as anti-oxidants. Here we report the enzyme-catalyzed syntheses of polymeric flavonoids with enhanced anti-oxidant activity and stability. Using naturally occurring enzymes such as peroxidases as catalysts, ellagic acid, epicatechin and quercetin were polymerized at room temperature under predominantly aqueous conditions. The polymers obtained were water-soluble and thermally stable. The antioxidant activities of polymers were compared to that of monomers using well-established anti-oxidant assays (such as  $\beta$ -carotene, and TEAC assays). The poly (flavonoids) exhibit enhanced antioxidant activity as compared to the monomers. The synthesis, characterization, and antioxidant activities of the polymers will be presented.

**154 - Purification of homohexameric cruciferin from seeds of mutant *Arabidopsis thaliana*** Thushan Sanjeeva, Dwayne D. Hegedus, Xiao Qiu, Ms. Tara C. McIntosh, Janitha P.D. Wanasundara Agriculture and Agri-Food Canada, Saskatoon, Saskatchewan, Canada; Dept. of Food and Bioproduct Sciences, Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada Cruciferin is the predominant 11S storage protein of economically valuable Brassicaceae (Cruciferae) oilseeds such as canola and mustard; however, there is a paucity of structure-function information on cruciferin. Cruciferin exists as a hexamer and in wild type lines it is a heterogenous mixture of subunits encoded by multiple genes. Therefore, the physico-chemical properties of wild type cruciferin are a product of properties of individual subunits and their interactions with other subunits in the hexamer complex. Agriculture and Agri-Food Canada (AAFC) scientists have developed *A. thaliana* mutant lines that express cruciferin from a single gene (CRUA, CRUB or CRUC). Seeds of these plants provide an excellent model to study the structure and properties of cruciferins composed of the same homologous subunit. As the first in a series of studies on homo-hexameric cruciferins, this communication reports the isolation and purification of cruciferin from mutant *A. thaliana* seeds. Seeds were defatted and protein extraction was carried out to minimize phenolic interactions and proteases activities. A three-step chromatographic procedure consisting of desalting, cation exchange and size exclusion was utilized. Proteins were monitored at 214 and 280 nm and SDS-PAGE was used to confirm purity of the fractions and final product. Purified cruciferin from wild type *Brassica napus* was also obtained at >95% purity. The purified cruciferin containing homomeric subunits will be very useful in understanding the structure and function of the various forms of this protein and to guide breeding programs in developing germplasm with seed storage protein profiles tailored for specific applications.

**155 - Methods of identification of adulterated food products based on carbohydrate profiles by UPLC** Christopher Hudalla, Cheryl Boissel, Pamela Iraneta, Daniel Walsh, Kevin Wyndham CO - R&D, Waters Corp., Milford, MA, The chromatographic analysis of carbohydrates can aid in the identification of adulterated food products. In an effort to maximize profits, some food manufacturers have resorted to stretching raw material supplies with the inclusion of additives. Here, we present our research on adulterated food products using a BEH Amide column on the ACQUITY UPLC system utilizing ELS detection (ELSD). The versatility and robust nature of these columns enables fast, efficient separations of many simple and complex carbohydrates with the added advantages of extended column lifetimes, gradient compatibility, and lack of salt and other matrix interferences. The separation of saccharides is achieved using a high pH mobile phase, resulting in a carbohydrate profile that can be used to identify food products and potential adulterants. Milk, honey and maple syrup are presented as case studies.

**156 - Analysis of hormones and their conjugates in animal waste using QuEChERS method coupled with liquid chromatography-electrospray-tandem mass spectrometry** Jeong-Wook Kwon, Kevin L Armbrust, Kang Xia State Chemical Laboratory of Mississippi, Mississippi State Univ; Dept. of Chemistry, Mississippi State Univ., Mississippi State, MS, US Natural and synthetic hormones associated with manure from concentrated animal feed operations (CAFOs) are of concern for both surface and groundwater quality, driving the need to develop a sensitive analytical method for those compounds to better monitor their occurrence, input, and subsequent fate in the environment. The aim of this study was to develop a sensitive method for measurement of free hormones (estrone, 17 $\beta$ -estradiol, 17 $\beta$ -estradiol, estriol, and 17 $\beta$ -ethynylestradiol) and their glucuronide and sulfate conjugates in chicken litter and hog manure. For the free hormones, chicken litter and solid hog manure were extracted using the QuEChERS (Quick, Easy, Cheap, Effective, Rugged, and Safe) method. The extracted hormones were derivatized using dansyl chloride in order to increase ionization efficiency during later analysis using liquid chromatography-tandem mass spectrometry (LC/MS/MS) under electrospray positive ionization mode. Dansylation increased LC/MS/MS detection sensitivity for the target compounds up to 900 times compared to un-derivatized samples. For the conjugates analysis, the conjugates in the samples were first deconjugated using  $\beta$ -glucuronidase/sulfatase. The deconjugated hormones and free hormones (total hormones) were extracted, derivatized, and analyzed using the above described procedures for the free hormones. The levels of conjugated hormones were calculated based on the difference between the total and free hormones. Recoveries ranging from 85 to 98% were achieved for the target analytes in the animal waste samples. The limits of detection (LOD) for the samples varied from 0.48 to 0.73 ng/g. Our analysis has shown that estrone and

17 $\beta$ -estradiol, and their conjugates were detected in chicken litter samples at low ng/g range, while estrone, 17 $\beta$ -estradiol, and estriol were detected in hog manures at low ng/g range. The levels of conjugated hormones in those samples were more than 30 times higher than free hormones.

**157 - Photolysis of pesticides on alternate matrices compared to soil** Dr Meaghan C McGuire, Sarah B Hibler, Lucas R Marks Dept. of Agricultural Products, BASF Agricultural Solutions, Morrisville, North Carolina, US Pesticides degrade in the environment via biotic and abiotic processes. Biotic processes are aided by microbes present in soil, sediment, or water, whereas abiotic mechanisms are typically photolysis and hydrolysis. The combination of these effects can lead to varying rates of degradation and different degradation products. Photolysis studies on soil combine these factors and provide key information on the environmental fate of a pesticide. There are several disadvantages to photolysis studies conducted on soil, such as matrix effects that lead to difficulty in the isolation and characterization of products. Another disadvantage is that the rate of degradation in the presence of microbes is slow, leading to lengthy studies. The investigation of the photolytic degradation of fungicides on alternate matrices was explored. It was determined that in the absence of microbes the rate of degradation increases. The identification of photodegradation products using high performance liquid chromatography (HPLC) and mass spectrometry techniques improved on alternate matrices compared to soil. Lastly, it was determined that the pesticide degradation pathway on alternate matrices was similar to that on soil. The alternate matrices investigated are good model systems because they are easily standardized in comparison to soils, which have varying characteristics, such as microbial composition. Also the model systems can be utilized to study the photolytic degradation properties of other chemicals of environmental concern.

**158 - Fingerprint-based classification of a commercial odor database** Austin B. Yongye, Terry L. Peppard, Jose L. Medina-Franco, Karina Martinez-Mayorga. Torrey Pines Inst. for Molecular Studies, Port St Lucie, FL, US; Robertet Flavors, Inc., Piscataway, NY, US A fingerprint-based classification of a dataset comprising 4181 molecules taken from the commercially available Leffingwell & Associates (LF) database marketed as Flavor-Base Pro© 2010 was performed. The odor descriptors were referenced against a sensory lexicon (ASTM publication DS 66) comprising 662 odor descriptors. A 662 bit odor fingerprint was then constructed. Molecules fully described by terms in the lexicon and for which a chemical structure is available were selected for further analysis (1776 molecules). A total of 64% of the molecules were described by 3-5 descriptors, 20% by 1-2 descriptors and 16% by 6-9 descriptors. The most frequently used descriptors were: fruity (38.1%); sweet (30.0%) and green\_general (25.9%). Overall, 13.6% of the molecules contained both fruity and sweet, whereas 15.2% contained fruit and green\_general. Finally, 5.4% contained the descriptors sweet and green\_general. This analysis suggests that the odor information contained in databases, such as that used here can be analyzed following chemoinformatics-related methods.

**159 - Overview of sampling and analytical methodologies in the Food Safety and Inspection Service's National Residue Program** Doritza Pagan-Rodriguez Office of Public Health Science, USDA Food Safety and Inspection Service, Washington, DC The Nat'l Residue Program Scheduled Sampling Plan (NRPSSP), USDA, Food Safety Inspection Service (USDA/FSIS) is a risk based, analytical testing program for residues in meat, poultry, and egg products. Public health risk is the major criterion used for chemical residue selection. USDA/FSIS works with the Environmental Protection Agency and the FDA to accomplish the responsibilities under the NRPSSP. FDA establishes tolerances for veterinary drug residues. EPA establishes tolerance levels for registered pesticides residues. The process for determining the presence or absence of residues above tolerance in tissue samples includes analysis of the sample with a screening test. Samples with positive findings from screening tests are further analyzed using determinative and confirmatory methods. FDA and EPA provide determinative and confirmatory methods for veterinary drugs and pesticides respectively. FSIS is considering further enhancement of the NRPSSP.

**160 - Increased air pressure substantially reduces the time required to remove raffinose-series oligosaccharides from legumes** Richard Rakijian, Jonathon L Payne, Sarai Manzano, Marvin A Payne Dept. of Chemistry and Biochemistry, La Sierra Univ., Riverside, California, US; Dept. of Physics, La Sierra Univ., Riverside, California, US Flatulence results from foods containing oligosaccharides raffinose, stachyose and verbascose - raffinose series oligosaccharides (RSO). Humans lack enzymes that hydrolyze RSO. RSO are fermented in the colon, producing gases that cause distress and flatulence. We developed a process which removes RSO from legumes using hydration followed by treatment with solutions of varied osmotic strength (osmotic modulation). We investigated the relationship between increased air pressure and the time to >90% reduction in RSO in legumes. Legumes were hydrated at pressures from 1.0 atmosphere (atm) to 4.0 atm at 25°C. The hydration time was up to 6 fold less at elevated pressure. The total time to achieve >90% reduction in RSO was similarly reduced. This indicates that increasing air pressure caused an increase in the water potential of the experimental system which decreased the time to osmotic equilibrium. Osmotic modulation is likely the basis for removal of RSO in our process.

**161 - Vitis labrusca L.: Antioxidant and antiproliferative properties of its components** Marialuisa Gallicchio, Grazia D'Angelo, Severina Pacifico, Antonio Fiorentino, Brigida D'Abrosca, Pietro Monaco. Dept. of Life Sciences, Seconda Università degli Studi di Napoli, Caserta, Italy Several studies emphasize the association between diets based mainly on vegetables, and a reduced incidence of chronic illnesses such as proliferative, neurodegenerative and cardiovascular diseases.<sup>1,2</sup> Thus, the wide range of antioxidant compounds contained in fruits and vegetables appears to play an important beneficial role. *Vitis labrusca* L. (Vitaceae) is a climbing shrub, belonging to the grouping of American grapes known as strawberry grape. The species was divided in its components skin, pulp, seed, leaf and stalk and underwent an extent antioxidant and radical scavenging screening. The antiproliferative activity of the extracts on human HepG2 and A549 cell lines and the capability of the same matrices to inhibit intracellular ROS production were also determined. The obtained data showed that stalk, seed and leaf extracts were the most active components. Antimutagenicity of seed extract allowed to perform its phytochemical screening. The antiproliferative activity of pure metabolites underlined the peculiar phytocomplex efficacy.

**162 - What can we learn from massive docking?** Kong T. Nguyen, Michael M. Mysinger, Brian K. Shoichet, John J. Irwin Dept. of Pharmaceutical Chemistry, Univ. of California San Francisco, San Francisco, California, US Whereas molecular docking is the most practical approach to leverage structure for ligand discovery, questions remain about its performance and reliability. Here, we tackle three questions: 1) Is van der Waals scoring an adequate substitute for a full scoring function? 2) How does enrichment depend on the decoy

database, and what database provides the most useful assessment? 3) If many PDB structures are available for docking, which one is the best one to choose? Due to the recent improvement in docking calculation capacity and the availability of the ChEMBL database, an extensive collection of experimental data of small molecules binding to their corresponding molecular targets, it is now possible to systematically address these questions. Massive docking of compound libraries into a wide range of molecular targets reveals insights into docking performance that could only be estimated before. Results emerging from this study will be used to guide development of better docking protocols.

**163 - Lanostane triterpenoids and a degraded steroid from *Antrodia camphorata*** Associate Professor Hui-Chi Huang, Chair Yueh-Hsiung Kuo Sch. of Chinese Medicine Resources, China Medical Univ., Taichung, Taiwan Republic of China *Antrodia camphorata* (Polyporaceae, Aphyllophorales) which grows on the inner heartwood wall of the endemic and endangered species *Cinnamomum kanehirai* Hay (Lauraceae) in Taiwan. The fruiting bodies of *A. camphorata* are very expensive and rare in the wild which called "jang-jy" or "niu-chang-chih" in Taiwan as a medicine. It has been utilized in traditional Chinese medicine to treat abdominal pain, diarrhea, food and drug intoxication, hypertension, liver cancer, and pruritus. In the course of phytochemical investigations of the fruiting bodies and mycelia of solid culture of *Antrodia camphorata*, four new lanostane triterpenes, 3,7,11-trioxo-5 $\alpha$ -lanosta-8,24(E)-diene-26-oic acid (1), methyl 11 $\alpha$ -hydroxy-3,7-dioxo-5 $\alpha$ -lanosta-8,24(E)-diene-26-oate (2), methyl 3,7,11,12,15,23-hexaoxo-5 $\alpha$ -lanost-8-en-26-oate (3), ethyl 3,7,11,12,15,23-hexaoxo-5 $\alpha$ -lanost-8-en-26-oate (4), one new sterol, (14 $\alpha$ ,22E)-14-hydroxyergosta-7,22-diene-3,6-dione (5), and a new degraded sterol, camphosterol A (6) together with seven known compounds (7-13) were isolated. The <sup>1</sup>H and <sup>13</sup>C NMR spectra of all compounds were fully assigned using a combination of 2D NMR experiments, including COSY, HMQC, HMBC and NOESY sequences.

**164 - New mechanism for the generation of acyl radical in cigarette smoke** Na Hu, Sarah A. Green. Michigan Technological Univ., Houghton, MI It is well known that free radicals are present in cigarette smoke and can have a negative effect on human health. However, little is known about the population of the radicals and debate continues on the mechanism by which those radicals are produced. We propose a new mechanism involving reactions of NO<sub>2</sub> and aldehydes for the carbon-centered radicals in tobacco smoke, which contrasts with the long-surmised mechanism of reaction between NO<sub>2</sub> and dienes. Radicals were trapped from the gas phase using the 3-amino-2, 2, 5, 5-tetramethyl-proxyl (3AP) on solid support to form stable 3AP adducts for later analysis. The acyl radical CH<sub>3</sub>C(O)· was detected both in tobacco smoke and a model system consisting of air mixed with NO<sub>2</sub> and acetaldehyde, both of which are major components of smoke. This acyl radical was identified by high performance liquid chromatography with fluorescence detection (after derivitization by an amine-reactive fluorescent tag, naphthalenedialdehyde), mass spectrometry and liquid chromatography tandem mass spectrometry. Additional radicals derived from aldehydes may be produced by this mechanism, which provides insight into sources and fates of reactive species in smoke.

**165 - Determination the impact odorants of 'Hutai' icewine from Hu county (China) using headspace solid-phase microextraction** Hua Wang, Li Zhang Yanying Liang. Coll. of Enology, Northwest A& F Univ., Yangling, Shaanxi, China 'Hutai No.8' grape was selected in Xi'an by Xi'an Grape Research Inst. (Shaan Xi, China) from the sport of 'Black Olympia'(Kyogei×Kyohō), which is a French-American hybrid cultivar. According to the geographical and climatic features of the Qinling Mountains' northern foot in Shaanxi of China, it is used for icewine production. Headspace solid-phase microextraction (HS-SPME) has been used for determining the impact aromatic compounds in 'Hutai' icewine. The analytes was extracted from the headspace of the icewine by using polydimethylsiloxane/ Divinylbenzene (PDMS/DVB) coated fused-silica fibers in a SPME unit. Then, the fiber was inserted into the injector of a gas chromatograph and the analytes were thermally desorbed. 20 impact volatile compounds were identified in the 'Hutai' icewine totally, including higher alcohols, ethyl and acetate esters, fatty acids and so on. According to the content, the majority were ethyl acetate, 3-methyl-1-butanol, diisobutyl phthalate, 2,4-hexadienoic acid, benzenethanol, benzoic acid, 2-octanone, ethyl benzenecarboxylate, acetic acid, and dibutyl phthalate. Other minor compounds identified were octanoic acid, diethyl succinate, ethyl lactate, hexanoic acid, ethyl 2,4-hexadienoate, 2-phenylethyl acetate, ethyl hexadecanoate, decanoic acid and dibutyl pentanediate.

**166 - Detecting and predicting adulteration in Chinese garlic oil by gas chromatography analysis and chemometrics** David Bolliet. Kalsec, Kalamazoo, MI, US A few years ago, the demand for natural Chinese garlic oil far outweighed the available supply, resulting in some garlic oils being sold as 'natural' when in fact they were adulterated through the addition of various amounts of synthetic volatile compounds. The current methodology to test for adulteration in garlic oil consists of radionuclear analyses, i.e. <sup>14</sup>C and stable isotope ratio measurements. By detecting volatile compounds by GC-FID (flame ionization detection), and by using PCA (principal component analysis) and MLR (multiple linear regression) chemometric data processing, we developed a simple yet rugged way to measure adulteration level in garlic oil samples of Chinese origin. This new method showed good correlation with adulteration results from radionuclear assays, thus providing a cost-effective means of confirming the natural authenticity of garlic oils of Chinese origins. Our work indicated that adulteration occurred when synthetically prepared diallyl disulfide, diallyl trisulfide or diallyl tetrasulfide were either combined together or added in various amounts to a lower quality garlic oil.

## 167 - WITHDRAWN

**168 - Constituents of maple syrup residue, a waste/by-product of the maple syrup industry** Omotola Ashorobi, Liya Li, David Worthen, Navindra Seeram. Bioactive Botanical Res. Lab., Biomedical and Pharmaceutical Sci., Coll. of, Univ. of Rhode Island, Kingston, RI, Maple syrup is a popularly consumed natural sweetener obtained by concentrating the sap of certain maple trees including the sugar maple (*Acer saccharum*). During the processing of maple syrup, a substantial quantity of maple syrup residue (MSR) is produced which has not been previously investigated for its phytochemical constituents. By-products and waste products obtained from agricultural and food derived natural product industries offer immense potential for value added products as nutraceuticals and cosmeceuticals. Therefore, in the current study our laboratory focused our attention on MSR. The thick creamy substance, with a similar consistency of 'peanut-butter' (provided by the Canadian maple syrup industry), was exhaustively extracted with methanol, and then partitioned into various organic solvents. The resulting organic extracts were analyzed by HPLC, TLC, and certain functional-group specific colorimetric assays. Partitioning into lower alcohols and ethyl acetate afforded a number of detectable products, while the lower alcohol extracts were devoid of detectable

materials. This suggested that MSR comprised relatively polar substances. Further colorimetric assays revealed that MSR contained olefinics and phenolics, while a negative ninhydrin reaction suggested that MSR does not contain detectable amounts of free amino acids. These data suggest that MSR may be an important source of potentially useful phenolic phytochemicals similar to those reported in maple syrup. Further details on the identification of the phytochemicals in MSR and the similarities and/or differences with those found in maple syrup will be presented.

**169 - 1,1,6-Trimethyldihydronaphthalene: Effects of cluster light exposure timing and contribution to Riesling aroma** Gavin L Sacks, Terry E Acree, Justine E Vanden Heuvel, Misha T Kwasniewski, Lilia Karoui. Food Science & Tech., Cornell Univ., Geneva, NY; Dept. of Horticultural, Cornell Univ., Geneva, NY; Food Science, Univ. of Burgundy, Dijon, France Riesling winegrapes produce aromatically distinctive wines, but the key odorants responsible for Riesling typicity are not well established. Previous literature and gas chromatography olfactometry - mass spectrometry (GC-O/MS) studies by our group indicate that monoterpenes, volatile thiols, vinyl phenols, sugar degradation products, and 1,1,6 trimethyldihydronaphthalene (TDN, "petrol") alongside volatiles typical of alcoholic fermentation potentially contribute to Riesling typicity. Of the suprathreshold volatiles, only TDN is uniquely higher in Riesling than in other varieties and is typically at concentrations in excess of threshold. By comparison, monoterpenes (linalool, geraniol) in New York State Riesling rarely exceeded sensory threshold. Similar to other groups, we have observed a positive correlation between sunlight exposure and glycosidically-bound TDN. We applied three timings of fruit zone leaf removal to Riesling to understand the importance of exposure timing to precursor production. Significantly higher potential TDN was observed only with 33-days post-bloom leaf removal, while earlier and later treatments had no effect.

**170 - Headspace solid-phase dynamic extraction (SPDE) and GC-MS for distinguishing a) styles of South African Chenin Blanc wines and b) types of pot-distilled brandies from regions around the world** Vivian A Watts, Ingo Christ, Johan Stadler, Zelani Bellingan. KWV South Africa, Paarl, Western Cape, South Africa; Chromsys LLC, Alexandria, Virginia, US Several South African Chenin Blanc wines from two distinct price/style categories were analyzed using headspace Solid-Phase Dynamic Extraction (SPDE) and GC-MS. In SPDE, volatiles from the sample headspace are repeatedly aspirated into a 2.5 mL headspace syringe, the needle of which is coated on the inside with any of a number of polymeric stationary phases. After a pre-determined number of extraction strokes, the volatiles are desorbed into the GC inlet by flushing the volatiles from the needle with helium. The objective of this study was to use multivariate analysis (PCA and PLS) to find which, if any, volatile aroma compounds correlate with the more complex styles (typically costing much more) as opposed to simpler cheaper wines from this grape varietal. Although the higher-priced Chenin Blanc wines were mostly barrel-fermented, these wines could be distinguished from the rest using only non-oak volatiles. A similar study was undertaken to determine which volatile aroma compounds correlated with pot-distilled brandies from various price categories (ages) and regions such as Cognac, California, France, Spain and South Africa. Classes of volatiles analyzed included esters, aldehydes, higher alcohols, norisoprenoids, methylketones and more.

**171 - A little twist for wine aroma** Michael C. Qian. Dept. of Food Science and Technology, Oregon State Univ., Corvallis, OR, US The development of stir bar sorptive extraction (SBSE) allows for simple sample preparation to establish a volatile spectrum. Automated SBSE extraction coupled with gas chromatography-mass spectrometry (GC-MS) is a valuable technique to analyze a wide range of volatile aroma compounds in alcoholic beverages with minimum sample preparation. The PDMS phase is able to selectively extract esters, terpenoids, and C13-isoprenoids with high sensitivity and reproducibility in the presence of high concentrations of alcohols. By employing this technique, the impacts of grape maturity, deficit irrigation, foliar reflectant, and soil nutrients on the volatile composition of Pinot noir and Merlot wines were investigated. It was demonstrated that terpenoids and C13-isoprenoids increases rapidly in Pinot noir grapes at the final stage of maturity. Deficit irrigation during berry development had a consistent effect on Merlot wine volatile composition. The amount of ? - damascenone, citronellol, nerol, geraniol and their precursors were higher in deficit irrigated Merlot grapes and the ines. Deficit irrigation had no impact on the concentration of ? -ionone. Kaolin based foliar refractant did not affect Merlot wine volatile composition regardless of irrigation level. Soil nutrients had significant impact on volatile composition of Pinot noir grapes.

**172 - Fermentation and post-fermentation factors affecting accumulation and degradation of odour-active sulfur compounds during wine bottle storage** Maurizio Ugliano, Mariola Kwiatkowski, Paul A Henschke, Elizabeth J Waters. The Australian Research Inst., Australia Changes in the profile of volatile sulfur compounds of wines during bottle storage are of primary importance to the development of wine aroma during ageing. Excessive accumulation of certain low molecular weight sulfur compounds (LMWSCs), such as H<sub>2</sub>S and methyl mercaptan, can lead to the appearance of 'reductive' off-flavours. Conversely, accumulation of another LMWSC, dimethyl sulfide, can increase perceived fruitiness in red wines. In addition, polyfunctional thiols, including the powerful odorant 3-mercaptohexyl acetate can positively contribute to wine fruitiness and varietal character, but they tend to decrease during ageing, with potential loss of quality. This presentation will discuss the contribution of yeast, fermentation conditions, post-fermentation practices and post-bottling oxygen exposure to the evolution of different sulfur compounds during bottle ageing of red and white wines. Our observations suggest that certain winemaking practices aimed at either reducing initial concentrations of LWMSCs or increasing wine aroma shelf-life can promote the appearance of reductive off-flavours.

**173 - Impact of the oxygen exposure during bottling and oxygen barrier properties of different closures on wine quality during post-bottling** Paulo Lopes, Maria Araújo Silva MD, Miguel Cabral, Philippe Darriet, Pierre-Louis Teissedre, Denis Dubourdieu UMR1219 (Enologie, Faculté d'Enologie - ISVV, Villenave d'Ornon, France; Research & Development, Amorim & Irmãos, Mozelos, Portugal This work outlines the effects of oxygen exposure during bottling and oxygen barrier properties of different closures (cork, synthetic and screw caps) on wine quality after bottling. The combination of bottling conditions and oxygen transfer rates through closures had a significant effect on the compositional and sensory properties of Sauvignon Blanc during 24 months. High oxygen transmission rates, as displayed by synthetic closures, caused loss of fruit attributes and development oxidized aromas. Conversely, wines sealed hermetically as bottle ampoule or with closures with very low oxygen permeability as screw caps, are more favorable to the preservation of varietal aromas of Sauvignon Blanc wines, but also for the development of undesirable reductive compounds. Oxygen provided by cork stoppers seems to be enough to preserve

the fruit aromas and minimize reduced and oxidized characters. Moreover, oxygen barriers of closures have a strong impact on the permeation of atmosphere volatile contaminants into bottled wines.

**174 - Assessing smoke taint in grapes and wine** Kerry L Wilkinson, Renata Ristic, Kerry Dungey, Yoji Hayasaka Sch. of Agriculture, Food and Wine, The Univ. of Adelaide, Glen Osmond, SA, Australia; The Australian Wine Research Inst., Glen Osmond, SA, Vineyard smoke exposure has been reported in Australia and overseas, following the occurrence of forest fires in close proximity to grape-growing regions. It has now been established that grapevine smoke exposure significantly affects the chemical composition and sensory properties of wine, in some instances imparting a taint characterised by objectionable 'smoky' aroma and flavor attributes. Several volatile phenols have been identified in wines made from fruit of smoke-affected grapevines, of which guaiacol is most abundant. However, smoke-derived guaiacol has been shown to accumulate in grapes as mono- and diglycoside conjugates. To investigate the accumulation of guaiacol glycoconjugates in smoke-affected grapes, a quantitative stable isotope dilution analysis method using liquid chromatography-tandem mass spectrometry was developed. The [2H4]-labeled analogue of guaiacol b-D-glucopyranoside was synthesized for use as an internal standard. The method was subsequently applied to field trials, enabling compositional comparisons of smoke-affected grapes from different varieties to be determined.

**175 - Smoke taint aroma assessment in 2008 California grape harvest** Hui Hui Chong, E & J Gallo Winery, Modesto, California, US In 2008, the unprecedented wildfires in California, most notably in Northern California, caused considerable concerns in winemaking industry. Mendocino County, home to about 300 vineyards and 50 wineries experienced significant exposure. Wildfires cause pyrolysis which thermally degrades wood components and generates a mixture of volatile compounds. Volatile phenols such as guaiacol and 4-methylguaiacol contribute to the smoke-derived aroma, and are thus reported as principal chemical markers in smoke tainted grapes. The guaiacol and 4-methylguaiacol are regarded as negative characteristics in grapes and wines at higher concentrations. Smoke-derived taint in wines is characterized by objectionable 'smoky', 'dirty', 'burnt', 'ash' aroma. Our research confirmed that smoke taint marker compounds, guaiacol and 4-methylguaiacol, are bound to sugar in exposed berries. When the composition of bound sugar was analyzed, data clearly indicated that smoke taint compounds were bound to different types of sugars such as glucose, arabinose, rhamnose, galactose and xylose. The glucose bound compounds will likely be released by yeast glucosidase during fermentation, whereas those that are non-glucose bound may be released by acid hydrolysis throughout wine aging. A novel enzymatic hydrolysis method was developed to liberate the bound smoke-derived aroma and to quantify them via gas chromatography head space analysis. The proximity, intensity, and duration of wildfires are shown to be detrimental to grape quality.

**176 - Significance of extraction and spectral fingerprinting methodology for the assay of bioactive phytochemicals** Devanand Luthria, James Harnly Food Composition and Methods Development Laboratory, USDA-ARS-BHNRC, Beltsville, Maryland, US; Food Composition and Methods Development Laboratory, USDA-ARS-BHNRC, Beltsville, Maryland, US Plant derived products and their preparations have been used for centuries for the treatment of wide array of ailments. However accurate chemical characterization of plant derived products is a daunting task due to the wide array of phytochemicals that are present in multiple forms. In addition, the biosynthesis and stability of phytochemicals is influenced by genetic, environmental, storage, and post harvest processing conditions. This presentation will cover the significance of different sample preparation procedure on the assay of phenolic phytochemicals from different foods and dietary supplements. It will discuss the importance of optimization of different sample preparation parameters such as solvents, solid-to-solvent ratio, temperature, and particle size for the accurate assay of bioactive phytochemicals. Application of rapid spectral fingerprinting methodologies for the classification of foods grown in different environments will also be discussed. Accurate analysis of phytochemicals in plant derived products will improve the reliability and reproducibility of pharmacological and clinical research results that will ensure quality of products manufactured from plants.

**177 - Stability for extraction and analysis of acylated anthocyanins** Hiroshi Matsufuji Coll. of Bioresource Sciences, Nihon Univ., Fujisawa, Kanagawa, Japan There are increasing knowledge of the positive health effects of food anthocyanins (ANs), though some limitations restrict the use of ANs because of low stability. It is thought that acylation with aromatic acids makes the ANs more stable through intramolecular stacking of the aromatic acid to the anthocyanidin nucleus by hydrophobic interactions. There is, however, little information regarding the relationship between chemical structure of acylated ANs and stability. This study was designed to examine the stability of ANs for light, heat, H<sub>2</sub>O<sub>2</sub>, and solvents using acylated ANs from red radish. The characteristics, the number, and the binding site of intramolecular acyl units affect the stability of ANs to light, heat, or H<sub>2</sub>O<sub>2</sub>. Some solvents cause degradation of ANs in extractions; the H<sub>2</sub>SO<sub>4</sub> or CH<sub>3</sub>CN/H<sub>2</sub>O/TFA was the most efficient for extraction of anthocyanidins, its glycosides, and acylated anthocyanins. The HCOOH/CH<sub>3</sub>CN as a mobile phase in LC-MS analysis gave good separation of anthocyanidin mono- and di-glycosides, but its triglycosides and acylated ANs eluted in significantly broader peaks, and the peak strength were obviously lowered.

**178 - Determination of extractable and nonextractable food polyphenols** Luke R. Howard, Brittany L. White. Food Science, Univ. of Arkansas, Fayetteville, AR, US Polyphenols in foods are typically extracted with aqueous-organic solvent mixtures prior to HPLC analysis or determination of antioxidant capacity. In some foods significant quantities of polyphenols, especially hydrolysable and condensed tannins are entrapped or bound to cell wall polysaccharides and/or proteins and resist extraction with conventional extraction techniques. These nonextractable polyphenols, or their metabolites produced via microbial microflora, may play an important role in gastrointestinal health through antioxidant or other biological properties. The release of nonextractable polyphenols from food residues following conventional extraction can be performed using acid, alkali or enzymatic hydrolysis. A review of literature documenting levels of nonextractable polyphenols in foods will be discussed as well as advantages and disadvantages associated with the various hydrolysis techniques used to release the compounds. The potential implication of nonextractable polyphenols on gastrointestinal health will also be addressed.

**179 - Revising and redirecting the chemistry of antioxidant (antiradical) activity assays** Karen M. Schaich. Food Science, Rutgers Univ., New Brunswick, NJ, US Antioxidant (antiradical) activity assays developed for screening potential biological effects of natural extracts and their components have been reduced to the simplest possible procedures with limited measurements. These abbreviated



procedures lack standardization and ignore critical chemistry in the reactions, and thus can give erroneous or misleading results. This paper discusses key problem areas with the chemistry of ORAC, TEAC, and DPPH assays and suggests ways in which current assays may be usefully redirected to generate more definitive mechanistic and kinetic information about single compounds and to distinguish synergism or antagonism in mixtures. Modifying assay procedures and combining HAT, SET, and metal chelating assays can provide critical guidance in transposing applications from in vivo to foods, identifying key natural compounds to replace synthetic antioxidants, suggest combinations of foods to enhance stabilization without additives, and open possibilities for harvesting useful antioxidants from waste materials.

**180 - Luminescent molecular and nano probes for quantifying reactive oxygen species and the scavenging activity of dietary antioxidants** Dejian Huang. National Univ. of Singapore, Singapore Reactive oxygen species (ROS) act as signaling molecules but can lead to oxidative stress of a living system. Selectively sensing and quantifying their concentration is critical to understand ROS chemistry and develop effective ways to mitigate its harmful effects. In this talk, I will give an account on the latest results from our research group on developing novel luminescent molecular and nanosized probes for selectively and sensitively quantifying ROS and thus measuring the scavenging capacity of dietary antioxidants. Specifically, I will present a) novel organoselenium probes for sensing hypochlorite (ClO<sup>-</sup>) and their use sensing and imaging oxidative stress status of cells; b) semiconductor quantum dots (QDs) as luminescent probes in sensing ClO<sup>-</sup> and quantifying ClO<sup>-</sup> scavenging activity of dietary antioxidants, particularly organosulfur compounds found in garlic; c) molecularly engineered nanoprobe for selectively sensing nitric oxide and singlet oxygen and the scavenging capacity of dietary antioxidants.

**181 - Dietary modulation of oxidative stress in humans: Methodology, physiological meaning and value of the non enzymatic antioxidant capacity (NEAC)** Mauro Serafini. Head Antioxidant Research Laboratory, INRAN, Italy Non-Enzymatic Antioxidant Capacity (NEAC) represent a biomarker furnishing an indication of the non enzymatic antioxidant defence of the body. NEAC is object of an intense debate between the scientific community due to the strong concern about the real information provided by this marker. Under a methodological point of view a large number of assays measuring NEAC in biological matrixes have been developed. The "perfect" method does not exist and, to best fit the generally accepted principle that red-ox processes are multi-factorial, a battery of tests should be performed. At human level, the extent to which certain foods are able to tune plasma NEAC in vivo is a fundamental matter of debate. Selected intervention studies in vivo will be presented and the "weight" of variables such as the methodology and homeostatic control will be discussed in order to obtain a realistic portrait of the interactions between dietary and endogenous antioxidants.

**182 - Assays for scavenging capacities against hydroxyl and DPPH radicals** Prof Liangli (Lucy) Yu Nutrition and Food Science, Univ. of Maryland, Coll. Park, Maryland, US The development and validation of the two radical scavenging capacity assays, HOSC and RDSC, will be discussed. The advantages and the limitations of the two methods will also be reviewed. In addition, the application of the two methods in antioxidant investigation will be presented.

**183 - Challenges and issues with the ORAC assay** Ronald L. Prior . ACNC, USDA, ARS, Little Rock, AR, US The Oxygen Radical Absorbance Capacity (ORACFL) Assay has been widely used to assay antioxidant capacity in numerous nutraceuticals and foods. Data on antioxidant capacity using specific biologically relevant free radical sources (usually the peroxy radical) can be obtained. However, the validity of the data is limited strictly to the in vitro chemical context. Claims about bio-activity based solely on these in vitro assays would be out of context, as they do not measure in vivo bio-availability, stability, reactivity, retention or mechanisms of action. The primary objective in using these assays should not be to necessarily find the highest numerical value, but to identify antioxidant sources that will promote health based on additional in vivo studies. The in vitro nature of these assays should not compromise their value in guiding clinical research. On the contrary, a valid in vitro assay is an invaluable tool if combined with bio-availability data and valid biomarkers of oxidative stress.

**184 - Main and modified CUPRAC methods of antioxidant characterization** Resat APAK, Mustafa ÖZYÜREK, Res. Assist. Burcu BEKTASOĞLU, Assist. Kubilay GÜÇLÜ Dept. of Chem., Istanbul Univ., Turkey Antioxidants react with the CUPRAC (CUPric Reducing Antioxidant Capacity) reagent to produce Cu(I)-neocuproine (Nc) measured spectrophotometrically. The method was applied to various food extracts and human serum. Hydrophilic antioxidants in serum were measured after precipitation of proteins, while lipophilic were determined in dichloromethane. The probes of benzoate derivatives and salicylate were converted to CUPRAC reactive hydroxylation products in a Fenton system, and their hydroxyl radical scavenging rate constants were determined by competition kinetics. The redox cycling of polyphenolics was prevented with catalase. Lipophilic and hydrophilic antioxidants could be simultaneously assayed in acetone-water as methyl- $\beta$ -cyclodextrin complexes. The xanthine oxidase and hydrogen peroxide scavenging activity of polyphenolics were determined. CUPRAC in urea buffer also responded to thiol-containing proteins in food. With sensor and post-column HPLC applications on the way, the CUPRAC methodology is evolving into an "antioxidant measurement package" in food and biochemistry.

**185 - Cranberry phytochemicals: Potential benefits against disease and infection** Catherine C. Neto Dept. of Chemistry and Biochemistry, Univ. of Mass. Dartmouth, North Dartmouth, MA Cranberry fruit (*Vaccinium macrocarpon*) contains bioactive compounds that have been found to limit microbial infections, oxidative processes, inflammation, and cell proliferation. Dietary consumption of cranberries and cranberry products may therefore play a role in maintaining urinary tract and oral health, and may also protect against certain cancers and other diseases associated with aging. Bioactive constituents with the potential to contribute to these protective effects include flavonoids such as anthocyanins, flavonols and proanthocyanidins, substituted hydroxycinnamic acids and other organic acids, carotenoids, and triterpenoids such as ursolic acid. Because cranberries have a unique and diverse phytochemical composition, multiple protective mechanisms are possible. Recent studies employing both in vitro and in vivo models of human diseases will be discussed. These studies provide evidence that cranberry constituents counteract oxidative stress, decrease tumor cell growth, migration and proliferation, induce apoptosis, inhibit bacterial adhesion and biofilm formation, reduce growth of human fungal pathogens, and may modulate cellular pathways associated with disease.

**186 - Queen Garnet plum, a new plum variety rich in antioxidant compounds: First results from a pilot study with healthy human subjects** Michael Netzel, Kent Fanning, Gabriele Netzel, Dimitrios Zabaras, Dougal Russell, Roger Stanley. Dept. of Food and

Nutritional Sciences, CSIRO, Cannon Hill, Queensland, Australia; Dept. of Employment, Economic Development and Innovation, Innovative Food Technologies, Agri-Science Queensland, Hamilton, Queensland, Australia; Dept. of Food and Nutritional Sciences, CSIRO, North Ryde, New South Wales, Australia; Dept. of Employment, Economic Development and Innovation, Horticulture and Forestry Sciences, Agri-Science Queensland, Applethorpe, Queensland, Australia In recent years, there has been intense interest in the potential health benefits of dietary-derived plant polyphenols and antioxidants. A new variety of *Prunus salicina*, Queen Garnet plum (QGP), was developed as a high anthocyanin, high antioxidant plum, in a Queensland Government breeding program. Following consumption of 400 mL QGP juice (QGPJ; 1117 mg anthocyanins) by two healthy male subjects, QGP anthocyanins (cyanidin-3-glucoside and cyanidin-3-rutinoside) were excreted mainly as methylated and glucuronidated metabolites in urine (0.5% of the ingested dose within 24h). Furthermore, QGPJ intake resulted in a 3-fold increase in hippuric acid excretion (potential biomarker for total polyphenols intake and metabolite), an increased urinary antioxidant capacity, and a decreased malondialdehyde excretion (biomarker for oxidative stress) within 24h as compared with the polyphenol-/antioxidant-free control. Results from this pilot study suggest that metabolites, and not the native QGP anthocyanins/polyphenols, are most likely the bioactive compounds in vivo.

**187 - Anthocyanins: Disease preventing pigments with complex bioavailabilities** Janet A. Novotny Beltsville Human Nutrition Research Ctr, USDA, Beltsville, MD Anthocyanins are blue, red, and purple pigments found in leaves, fruits, vegetables, flowers, and grains. These compounds have a basic flavylum structure with varying hydroxyl and methoxyl groups, and O-glycosylations with different sugar and acyl groups. In plants, anthocyanins serve a number of functions, including photoprotection, scavenging of free radicals, and attraction of animals for pollination and seed dispersal. In human health, foods rich in anthocyanins are associated with a broad range of health benefits, including improved cardiovascular health, protection against cancer, and reversal of age-related neurodegenerative declines. To define optimal intake levels for anthocyanins, it is important to understand factors which influence bioavailability. We conducted a series of studies to show that anthocyanin bioavailability is influenced by dose, anthocyanidin structure, and the presence of acylation. Current challenges in furthering our understanding of anthocyanin bioavailability and metabolism translate to exciting opportunities for novel approaches in chemistry.

**188 - Food polyphenol consumption may reduce prevalence of hypertension in high cardiovascular risk population** Rosa M Lamuela-Raventos, Alexander Medina-Remón, Ramón Estruch, Cristina Andres-Lacueva Dept. of Nutrition and Food Science, Univ. of Barcelona. INSA. Pharmacy Sch., Univ. of Barcelona, Barcelona, Spain; CIBER CB06/03 Fisiopatología de la Obesidad y la Nutrición (CIBEROBN) and RETICS RD06/0045, Instituto de Salud Carlos III, Barcelona, Spain; Dept. of Internal Medicine, Hospital Clinic, IDIBAPS, Univ. of Barcelona, Spain. CIBER CB06/03 Fisiopatología de la Obesidad y la Nutrición (CIBEROBN) and RETICS RD06/0045, Instituto de Salud Carlos III, Spain; Nutrition and Food Science, Univ. of Barcelona. Ingenio-CONSOLIDER program, FUN-C-FOOD, Barcelona, Spain, Barcelona, Spain Food polyphenol consumption was analyzed by means of total polyphenol excreted (TPE) in urine, reliable biomarker of polyphenol intake. A cross-sectional substudy was performed in order to evaluate whether TPE is associated with average blood pressure (BP) and/or with the prevalence of hypertension in the frame of the PREDIMED study ([www.predimed.org](http://www.predimed.org)). The Mediterranean participants studied included 263 men and 326 women, at high cardiovascular risk. They were divided into quartiles according to their TPE. Participants in the highest quartile of urinary TPE had a reduced prevalence of hypertension compared to those in the lowest quartile (ORs=0.64; P=0.016). Systolic (? =-1.73, P=0.024) and diastolic (? =-1.26, P=0.003) BP were also inversely associated with urinary TPE after adjustment for potential confounders. TP intake, assessed via TPE in urine, shows better correlations with BP levels and the prevalence of hypertension than TP intake assessed by food frequency questionnaire.

**189 - Oral consumption of cranberry juice inhibits cellular adhesion and biofilm formation of uropathogenic bacteria** Yuanyuan Tao, Paola A Pinzon, Amy B Howell, Terri A Camesano. Chemical Engineering, Worcester Polytechnic Inst., Worcester, MA, US; Marucci Center for Blueberry Cranberry Research, Rutgers Univ., Chatsworth, NJ, US To examine the effects of cranberry juice cocktail (CJC) on uropathogenic *E. coli* adhesion, a volunteer was given 16 oz of CJC or water, and urine samples were collected in the 8 hours after consumption. Six clinical *E. coli* strains were tested for surface adhesion forces using atomic force microscopy (AFM) after incubation in urine samples. The adhesion force decreased in the clinical *E. coli* strains over the 8 hours following consumption, while adhesion forces were unchanged after water consumption. In a second clinical study, volunteers were given CJC or placebo, and urine samples were collected over 48 hours. Biofilm formation of *E. coli* CFT073, after growth in a mixture of urine and growth media, was quantified in a 96-well plate assay. Four out of six volunteers showed reduced biofilm formation after CJC consumption, compared to the placebo.

**190 - Effects of oral sea buckthorn (*Hippophaë rhamnoides*) oil on dry eye** Petra S Larmo, Riikka L Järvinen, Niko L Setälä, Baoru Yang, Matti H Viitanen, Janne R K Engblom, Raija L Tahvonen, Heikki P Kallio. Dept. of Biochem. and Food Chemistry, Univ. of Turku, Turku, Finland; Dept. of Ophthalmology, Univ. of Turku, Turku, Finland; Turku City Hospital, Turku, Finland; Turku Sch. of Economics, Turku, Finland; MTT Agrifood Research Finland, Jokioinen, Finland Dry eye is a common condition that can severely impair the quality of life. Sea buckthorn oil is rich in n-3 and n-6 fatty acids, carotenoids and tocopherols. We aimed to study the effect of oral sea buckthorn oil on dry eye. In this double-blind, randomized, parallel trial, 100 volunteers experiencing dry eye symptoms consumed 2 g of sea buckthorn oil or placebo oil daily for three months from autumn to winter. Clinical dry eye tests and symptom follow-ups were performed. Tear film hyperosmolarity is a focal factor in dry eye. There was an increase in the tear film osmolarity in both treatments, most likely due to drop of outdoor temperature. The increase was significantly milder in the sea buckthorn group. The maximum intensities of redness (all participants) and burning (compliant participants) were lower in the sea buckthorn group. In conclusion, sea buckthorn oil positively affected dry eye.

**191 - Thylakoids promote satiety in healthy humans: Metabolic effects and mechanisms** C. Erlanson-Albertsson Ph.D, P. A. Albertsson Ph.D, R. Köhnke Ph.D, M. Rayner Ph.D, S. Emek Ph.D, M. Landin-Olsson, Ph.D, B. Weström Ph.D, C. Montelius, K Gustafsson Ph.D, L. Svensson Ph.D, I Sjöholm Dept of Experimental Medical Science, BMC, B11,, Appetite control Unit, Lund Univ., Lund,, S-221 84 Lund,, Sweden Obesity is increasing worldwide, the main reason being the overeating of highly palatable food containing fat and sucrose. Basic appetite mechanisms are maladapted to this type of energy -rich diet, satiety signals being too weak postprandially to ensure energy balance. The gastrointestinal tract is the primary site for satiety signals. In principle satiety is promoted as long as intestinal

digestion is going on with the release of the satiety hormones cholecystokinin and enterostatin. Intestinal fat digestion is a highly efficient process performed by pancreatic lipase and its protein cofactor colipase. Hypothetically a reduced rate of fat digestion would promote satiety signalling. We found that chloroplast membranes (thylakoids, composed of hydrophobic proteins, galactolipids and pigments) efficiently reduced the rate of triglyceride hydrolysis by pancreatic lipase and colipase in vitro. We also found that these membranes when added to food in either mice or rat pellets significantly reduced food intake and body weight compared to control animals. The reduced food intake occurred through significantly elevated levels of the satiety hormone cholecystokinin and of enterostatin. At the metabolic level serum triglycerides were reduced as well as body fat. Glucose and insulin levels were also reduced suggesting a general reduction of absorption of nutrients by the gastrointestinal tract. There was no sign of steatorrhea, the chloroplast membranes eventually being digested by the intestinal and pancreatic enzymes with no rest side-product in the intestine. In single-meal experiments the effect of thylakoids were investigated in man. Healthy individuals of normal weight were offered a high-fat meal with and without the addition of thylakoids. Blood samples were taken 0 (prior to meal), 30, 60, 120, 180, 240, 300 and 360 min after the start of the meal. Blood samples were analysed for satiety and hunger hormones (CCK, leptin and ghrelin), insulin and blood metabolites (glucose and free fatty acids). The CCK level increased, in particular between the 120 min time-point and onwards, whereas the insulin levels and free fatty acid levels were reduced. The addition of thylakoids hence promotes satiety signals and reduces insulin response in man. The mechanisms for the effects will be further discussed.

**192 - Evidence for demethylation of 3-isobutyl-2-methoxy-pyrazine during maturation of bell pepper (*Capsicum annuum*) and winegrapes (*Vitis vinifera*)** Imelda Ryona, Dr Gavin Sacks. Dept. Food Science and Technology, Cornell Univ., Geneva, NY, US 3-isobutyl-2-methoxy-pyrazine (IBMP) is associated with "bell pepper" aromas in *V. vinifera* wines, especially those produced from Bordeaux cultivars. IBMP decreases in both winegrapes and bell peppers during ripening, but the fate of IBMP following degradation is unknown. We hypothesized that IBMP is demethylated to non-odorous 3-isobutyl-2-hydroxy-pyrazine (IBHP) during fruit ripening. IBMP and IBHP concentrations were quantified in bell peppers, in a high IBMP winegrape cultivar (Cabernet Franc), and in two cultivars known to have low IBMP (Riesling and Pinot noir). In bell pepper and Cabernet Franc, we observed an inverse correlation of IBMP vs. IBHP during ripening. In Cabernet Franc, IBMP decreased from 146 pg/mL pre-veraison to 2 pg/mL at harvest, with a corresponding increase in IBHP from 57 to 195 pg/mL. Negligible IBHP was detected in mature Pinot noir and Riesling. IBHP Level at harvest could potentially be used as a proxy for maximum pre-veraison IBMP in Bordeaux cultivars.

**193 - Free and potential aroma compounds and sensory profile in long-time grape skin macerated white wines** Giuseppe Versini, Bruno Fedrizzi, Roberto Ferrarini, Fabio Finato, Enrico Casarotti, Giancarlo Piubelli, Michela Cipriani. Viale del Lavoro 8, Italian Wine Union (UIV) Soc. Coop., 37135 Verona, Italy; Dept. of Chemical Sciences, Univ. of Padova, Italy; Dept. of Sci., Tech. and Markets of Vine and Wine, Univ. of Verona 70, Italy Traditional Georgian wines are produced using long-time skin contact, often in jars of clay in absence of sulfur dioxide and other adjuvants. Long-time skin maceration white wines are recently produced at industrial level in Italy to extract more antioxidant phenolic compounds, and to obtain a possible different taste and varietal flavour. The present research investigated various vinifications on prefermentative and varietal compounds such as C6-alcohols, monoterpenols, benzenoids and norisprenoids, and fermentation derived substances such as hydroxyalkyl ethyl esters, lactones, amides, furanols, aryl alcohols, HCT derived ethyl esters, and some sulfur compounds in Garganega wines. A significant increase of some of these compounds has been already observed in long-time skin fermented wines, and some of these variations can be correlated to sensorial nuances reported in the literature.

**194 - Assessing variability in the coopering process** Thomas S. Collins, Susan E. Ebeler Foster's Wine Estates Americas, St. Helena, CA, US; Dept. of Viticulture and Enology, Univ. of California, Davis, CA, In the final stages of the coopering process, the barrel is heated by fire or steam until its staves are hot enough to be bent readily. After bending, the barrel is further heated over additional wood fires to achieve the desired toasting level. In this study, wireless thermocouples were inserted into staves to assess the variability in the temperature profiles experienced by the staves during the bending and toasting process. Samples of the wood around the thermocouples were taken to assess the impact of heating on the profile of volatile compounds found in the wood. The thermocouples demonstrated that the wood received differing amounts of heat depending on proximity to the flames as well as the distance from the firepot itself. Varying chemical profiles resulted from the differential heating; depending in part on the origin of the volatiles, different patterns of formation and/or degradation were observed.

**195 - Bitter, twisted truth of the hop** Patrick L Ting, David Ryder Brewing & Research, MillerCoors, Milwaukee, Wisconsin, US Hop is an essential ingredient in beer to contribute aroma/flavor, bitterness, foam, and antimicrobial activity. The progress of chemistry and analysis of hops in beer has further improved quality, consistency, and economic benefit of brewing. The advent of liquid/supercritical CO<sub>2</sub> extraction renders an organic-solvent-free process for development of advanced hop products. The advanced hop products enhance and improve the bitterness quality, foam potential, light and flavor stability in beer. Hop b-glycosides as flavor precursors and polyphenols identified in the hop solids after CO<sub>2</sub> extraction impart the flavor and improve flavor stability in beer.

**196 - On the flavor of Bourbon Whiskey: How the manufacturing process influences the concentrations of its key aroma molecules** Peter H. Schieberle, Michael Vocke Dept. of Chemistry, Garching, Bavaria, Germany The first step in Bourbon Whiskey production is a yeast fermentation of a mash manufactured from corn, usually containing more than 50%, rye and barley. The fermented mash or beer is then distilled, and the distillate obtained is finally stored in charred oak barrels for a minimum of two years. Thus, three factors mainly influence the overall aroma of the final product: the raw materials used, the fermentation/distillation process and the aging in the wooden barrels. However, although several studies have been reported on the volatiles present in whiskey, data on the influence of the entire manufacturing process on the formation of key aroma compounds are scarcely available. In a previous study, the most important odor-active compounds of a Bourbon whiskey have been identified by us on the basis of approaches of molecular sensory science. Using authentic samples obtained from a whiskey producer, the aim of the present study was to characterize the aroma compounds in the beer, the distillate and the barrel aged whiskey from the same batch of cereals. Quantitative measurements using stable isotope dilution assays revealed the changes in the key whiskey odorants on their way from "corn to product". Finally, the most odor-active compounds in a Scottish barley whiskey were characterized in order to get a first insight into the molecular reasons for the differences in the overall unique aromas of both types of whiskey.

**197 - Aroma characterization of Chinese liquor: Yanghe Daqu, Wuliangye, Jiannanchun and Maotai** Michael C. Qian, Wenlai Fan, Yan Xu. Dept. of Food Science and Technology, Oregon State Univ., Corvallis, OR, US; Sch. of Biotechnology, Jiangnan Univ., Wuxi, Jiangsu, China Chinese liquor is one of oldest distillates in the world with an output of around 4 millions tons per year. It is typically made from grains and fermented with 'Daqu' in solid-state or 'Xiaoqu' in semi-solid-state. Aroma active compounds in "Yanghe Daqu", "Wuliangye", "Jiannanchun" and "Maotai" liquor were investigated with gas chromatography-olfactometry and mass spectrometry. The major aroma compounds have been identified to be ethyl hexanoate, ethyl butanoate, ethyl pentanoate, ethyl acetate, butyl hexanoate, methyl hexanoate, ethyl heptanoate, ethyl benzeneacetate, ethyl 2/3-methylbutanoate, ethyl octanoate, 1,1-diethoxy ethane, 1,1-diethyl-2-methylpropane, 1,1-diethoxy-3-methyl butane, 1,1,3-trimethoxypropane. Several pyrazines, including 2,5-dimethyl-3-ethylpyrazine, 2-ethyl-6-methylpyrazine, 2,6-dimethylpyrazine, 2,3,5-trimethylpyrazine and 3,5-dimethyl-2-pentylpyrazine were identified. The aroma contribution of alkylpyrazines varied with different brands of Chinese liquor, possibly responsible for the aroma difference. Aging process also had a major impact on aroma compounds. The aged liquor had much more intense aroma than the young liquor.

**198 - Characteristic aroma compounds of Chinese rice wine by gas chromatography-olfactometry and quantitative analysis using headspace solid phase microextraction gas chromatography-mass spectrometry** Wenlai Fan, Yan Xu. Sch. of Biotechnology, Jiangnan Univ., Wuxi, Jiangsu, China Aroma compounds in Chinese rice wines were studied by gas chromatography-olfactometry (GC-O) and quantitative analysis. 57 aroma compounds were identified by GC-O followed by GC-MS, among which 2-methylbutanol, 3-methylbutanol, butanoic acid, 3-methylbutanoic acid, 2-phenylethanol, phenol, 4-vinylguaiacol, furfural, and ?-nonalactone were identified with the highest aroma intensities. The quantitative analysis results shown 23 out of the quantified compounds were at concentrations higher than their corresponding odor thresholds in Chinese rice wines. On the basis of odor activity values (OAVs), the most potent odorants were dimethyl trisulfide. Other components, such as ethyl octanoate, ethyl butanoate, phenylacetaldehyde, ethyl hexanoate, 3-(methylthio)propanol, 2-phenylethanol, ?-nonalactone, and ethyl 2-methylpropanoate were also determined to be powerful odorants in Chinese rice wines.

**199 - Seed's protein and oil content, fatty acid composition, and growing cycle length of a single genotype of chia (*Salvia hispanica* L.)** as affected by environmental factors Eng. Ricardo Ayerza. Dept. of Arid Lands Studies, The Univ. of Arizona, Tucson, Arizona, US The objective of the present study was to determine the location effect on the growing cycle length, and seed's protein content, lipid content, and fatty acid profiles. One site was in Argentina (T5); one was in Bolivia (T4); and three in Ecuador (T3), (T2), (T1). Seeds from plants grown in T4 and in T3 contained significantly ( $P < 0.05$ ) more protein percentage than did seeds from the other three ecosystems. Seeds from T1 and T5 ecosystems, with 33.5 and 32.2% of oil content, respectively. Significant ( $P < 0.05$ ) differences in palmitic, stearic, oleic, linoleic and  $\alpha$ -linolenic fatty acids between oils from seeds grown in different ecosystems were detected, however. omega-6 linoleic fatty acid content was significantly ( $P < 0.05$ ) lower in oils of seeds produced in T1, and T2 than in those produced T3, T4, and T5 ecosystems; omega-3  $\alpha$ -linolenic fatty acid content was significantly ( $P < 0.05$ ) higher in seeds produced in T1,

**200 - Extra virgin olive oil increases uncoupling protein 1 content in brown adipose tissue, and enhances noradrenaline and adrenaline secretions in rats** Yuriko Oi-Kano Faculty of Home Economics, Kobe Women's Univ., Kobe, Hyogo, Japan The effects of extra virgin olive oil (EV-olive oil) on triglyceride metabolism were investigated by measuring the degree of thermogenesis in BAT. Rats were given an isoenergetic high-fat diet containing corn oil, refined olive oil or EV-olive oil. After 28 d, the body weight, perirenal adipose tissue, and epididymal fat pad and plasma triglyceride concentrations were the lowest in the rats fed EV-olive oil. The content of UCP1 in BAT and the rates of urinary noradrenaline and adrenaline excretions were the highest in the rats fed the EV-olive oil. The intravenous administration of the extract of the phenolic fraction from EV-olive oil significantly increased plasma noradrenaline and adrenaline concentrations, whereas that of hydroxytyrosol had no effect. These results suggest that phenols except hydroxytyrosol in EV-olive oil enhance thermogenesis by increasing the UCP1 content in BAT, and enhancing noradrenaline and adrenaline secretions in rats.

**201 - Inhibition of human NADPH oxidase by apocynin derived oligophenols** Juan M. Mora Pale, Seok-Joon Kwon, Michel Weiwer, Robert J. Linhardt, Jonathan S. Dordick. Chemical and Biological Engineering, Rensselaer Polytechnic Inst., Troy, NY, US Enzymatic oxidation of apocynin, which may mimic in vivo metabolism, affords a large number of oligomers (apocynin oxidation products, AOP) that inhibit vascular NADPH oxidase. In vitro studies of NADPH oxidase activity were performed to identify active inhibitors, resulting in a trimer hydroxylated quinone (IIIHyQ) that inhibited NADPH oxidase with an  $IC_{50} = 31$  nM. Apocynin itself possessed minimal inhibitory activity. NADPH oxidase is believed to be inhibited through prevention of the interaction between two NADPH oxidase subunits, p47(phox) and p22(phox). To that end, while apocynin was unable to block the interaction of his-tagged p47(phox) with a surface immobilized biotinylated p22(phox) peptide, the IIIHyQ product strongly interfered with this interaction (apparent  $IC_{50} = 1.6$   $\mu$ M). These results provide evidence that peroxidase-generated AOP, which consist of oligomeric phenols and quinones, inhibit critical interactions that are involved in the assembly and activation of human vascular NADPH oxidase

**202 - Antileishmanial, trypanocidal, antituberculosis and cytotoxic activities of targeted plant species from the Peruvian rain forest** zhuang jin, Dr Jose C Aponte, Prof Vaisberg A., M. Sauvain, RH Gilman, Prof GB Hammond. Dept. of Chemistry, Univ. of Louisville, Louisville, KY, US; Departamento de Microbiología y Laboratorios de Investigación y Desarrollo, Facultad de Ciencias y Filosofía,, Universidad Peruana Cayetano Heredia, Lima, Peru; UMR 152 IRD - Université de Toulouse III, Peru; Johns Hopkins University Sch. of Public Health, US Nature as a source for drugs and inspiration for the development of front-line-drugs is indisputable if one considers that more than 75% of the world's population, especially in developing countries, rely on medicinal plants as primary source of medicinal care, and that around 50% of the total new chemical entities launched onto the market in the last 25 years are natural products or natural products analogs. The bioassay-guided fractionation of the ethanolic extracts of selected medicinal plants used by the Aguaruna community living in the Peruvian rainforest will be presented. Among the extracts studied, *Plagiochila disticha* and *Ambrosia peruviana*, led to the isolation and characterization of three ent-2,3-secoaromadendrane-type sesquiterpenoids, named plagiochiline A (1), I (2), R (3) and two pseudoguaianolids, damsine (4) and confertin (5); which exhibited significant cytotoxic activity against a panel of human tumor cell lines.

Compounds 1, 4 and 5 were also investigated for their in vitro activity against, *Leishmania amazonensis* axenic amastigotes, *Trypanosoma cruzi* trypomastigotes and *Mycobacterium tuberculosis* sensitive and MDR strains respectively.

**203 - Phytochemical analysis and antioxidant efficacy of fruits produced in Italy** Dr Nikolaos Tsafantakis MD, Prof Severina Pacifico, Dr Monica Scognamiglio MD, Dr Simona Piccolella MD, Prof Brigida D'Ambrosia, Prof Antonio Fiorentino Dept. of Life Sciences, Seconda Università degli Studi di Napoli, Caserta, Italy It is currently believed that the combination of non-essential micronutrients and phytochemicals, present in fruits, plays a synergistic role in promoting human health. The analyses of the phytochemical composition of some edible fruits highly consumed in Mediterranean area have been carried out.1,2,3,4 The biological activity of each species, opportunely divided in its components, was assessed by several antioxidant methods. Thus, the bioactive matrixes were fractionated using chromatographic techniques. The structural features of isolated metabolites were elucidated by spectroscopic (UV/Vis and 1D and 2D NMR) analyses. Phytochemicals present in the investigated species belong to different classes of secondary metabolites such as flavonoids, triterpenes, C6C3 alcohols or acids derivatives. All the compounds were tested for their antioxidant and radical scavenging capabilities. The results underlined different antioxidant effects of the isolated natural products emphasizing the enormous complexity of the mechanisms of action of antioxidants and the variability of the action/interaction processes.

**204 - Transcriptional control of alkaloid biosynthesis by methyl jasmonate in *Catharanthus roseus* hairy root cultures** Sheba Goklany, Ralph H. Loring, James Glick, Carolyn W.T. Lee-Parsons. Northeastern Univ., Boston, MA, The *Catharanthus roseus* plant produces the anti-cancer drugs, vincristine and vinblastine, and other pharmaceutical compounds from a class of alkaloids known as terpenoid indole alkaloids (TIAs). Due to low yields from whole plants and complexity of the synthetic route, plant cell cultures are being investigated as a potential source for these drugs. The generation of TIAs from *C. roseus* cultures occurs under conditions of stress and is under transcriptional control. In this study, the transcriptional regulation of TIA biosynthesis by methyl jasmonate (MeJA), a plant stress hormone, was investigated. *C. roseus* hairy root cultures treated with MeJA showed increased alkaloid production (i.e. secologanin, strictosidine, and tabersonine) and altered expression levels of TIA biosynthetic pathway genes and transcription regulators. Increased TIA production was correlated with increased expression of specific genes. Genetic engineering of these genes is being targeted as a strategy for enhancing TIA production.

**205 - Molecular cloning and characterization of a novel down-regulated TOM20 gene associated with the onset of tapping panel dryness (TPD) syndrome from the inner bark tissues of rubber tree (*Hevea brasiliensis* Muell. Arg.) by mRNA differential display** Venkatchalam Perumal Dept. of Biotech., Periyar Univ., Salem, Tamil Nadu, India In rubber tree (*Hevea brasiliensis*), tapping panel dryness (TPD) syndrome is considered as a complex physiological disorder which affects latex biosynthesis. To understand the molecular basis of TPD, we performed mRNA differential display reverse transcriptase polymerase chain reaction (DDRT-PCR) analysis using inner bark samples to identify differentially expressed genes between healthy and TPD affected trees. After DD-RT-PCR, 10 differentially expressed cDNA fragments in which six were down-regulated and four were up-regulated in TPD affected tree were cloned and sequenced. Among these, one cDNA encoding a putative TOM20 like protein was identified. The cDNA (1024bp), corresponding to the HbTOM20 gene (*Hevea brasiliensis* TRANSLOCASE of the outer mitochondrial membrane; GenBank accession number DQ529238), contained an open reading frame of 606 bp coding for 202 amino acid protein with a theoretical pI value of 9.5 and the calculated protein MW was 23.5 kDa. The predicted amino acid sequence contained conserved domains of TOM20 like proteins in the N-terminal half. The protein HbTOM20 has 27 and 26% similarity to *Solanum* TOM20 and *Arabidopsis* TOM20 respectively. In phylogenetic analysis, HbTOM20 was classified into the cluster consisting TOM20 proteins known to be involved in import of nuclear encoded proteins into mitochondria. Both RT-PCR and Northern blot results revealed that the HbTOM20 expression was significantly down-regulated in TPD affected trees compared to healthy one. Accumulation of HbTOM20 mRNA transcripts was significantly higher in the bark tissues collected from healthy region than that of partially affected by TPD (partially dried) portion while barely detectable in completely TPD affected (dried) area. Differential expression pattern was noticed among three clones representing various degrees of TPD tolerance. These results together suggest that down-regulation of HbTOM20 in TPD affected tree may play an important role in alteration of mitochondrial metabolism and impaired latex biosynthesis.

**206 - Relating in vitro research on the antioxidant impact of crucifer components to dietary redox regulation** Elizabeth Jeffery. Univ. of Illinois, US Mechanistic studies in cell culture describe the impact of specific nutrients and phytochemicals on antioxidant pathways. Translating studies to the whole animal permits studies that are prolonged and that compare bioactivity of individual compounds with that of the whole foods from which they are derived. Like many vegetables, crucifers are a rich source of antioxidant vitamins and polyphenols; they also accumulate selenium, important for glutathione peroxidase. In addition, crucifers are renowned for their content of glucosinolate-derived isothiocyanates, able to upregulate glutathione and thioredoxin synthesis, potentially altering redox within the body. Supported by USDA/NIFA 2009-02961

**207 - Too much of a good thing: Risk of over-antioxidation** X.G. Lei. Cornell Univ., US While selenium is widely considered to protect against diabetes, a number of major human studies have recently shown pro-diabetic, hyperglycemic, and hyperlipidemic effects of selenium supplements. Cellular glutathione peroxidase-1 (GPX1) was the first identified and is the most abundant selenium-dependent protein in mammals. Strikingly, mice overexpressing GPX1 developed hyperglycemia, hyperinsulinemia, insulin resistance, and obesity at 6 months of age. Overproduction of GPX1 activity in islets diminished intracellular reactive oxygen species, and dys-regulated functional expressions of pancreatic duodenal homeobox-1 (PDX1) and uncoupling protein-2 that regulate  $\beta$  cell growth, insulin synthesis, and glucose-stimulated insulin secretion. The global overexpression of GPX1 disturbed insulin-stimulated phosphorylation of insulin receptor and Akt in liver and muscle. Diet restriction reversed all the type 2 diabetes-like phenotypes except for hyperinsulinemia. Although dietary Se deficiency did not fully rescue hyperinsulinemia in these mice, it exerted a strong effect ( $p < 0.05$ ) on mRNA and(or) protein levels of 14 molecules involved in islet insulin synthesis, insulin secretion, and hepatic lipogenesis. In conclusion, our results reveal a dual role of Se and GPX1 in diabetes and metabolic syndrome, and argue against blind antioxidant supplementation in food or medical treatment for protecting the public from unknowingly potential health risk.

**208 - Regulation of the iron storage protein ferritin by the antioxidant responsive element** Korry J Hintze. Utah State Univ., US  
Antioxidant protection is generally considered to be the absorption of a free electron or the activation of genes that do the same. However, another component of antioxidant protection is the synthesis of proteins that sequester oxidation reaction catalysts. Ferritin belongs in the latter category as it concentrates and compartmentalizes cellular iron to protect against oxidative stress. Cellular iron increases ferritin protein synthesis by two distinct mechanisms, increased mRNA translation and DNA transcription. Heme-iron increases both ferritin DNA transcription and mRNA translation and the combined ferritin translational and transcriptional response to heme-iron is synergistic. Mechanistically, heme-iron increases ferritin transcription through the antioxidant responsive element via interactions with the transcriptional repressor Bach1. Transcriptional regulation of ferritin by the ARE emphasizes the importance of iron sequestration in protection against oxidative stress and demonstrates the diversity genes involved in the phase II antioxidant response.

**209 - Antioxidant adaptation and signaling in response to physical exercise** Li Li Ji. Univ. of Wisconsin, US  
There is increasing evidence that reactive oxygen and nitrogen species (RONS) are not merely damaging agents inflicting random destruction to the cell structure and function, but within physiological range serve as useful signaling molecules to regulate growth, differentiation, proliferation, and remodeling. Redox-sensitive signaling pathways such as nuclear factor (NF)  $\kappa$ B, and mitogen-activated protein kinase (MAPK) and peroxisome proliferator-activated receptor  $\gamma$  co-activator-1 $\alpha$  (PGC-1 $\alpha$ ) play an important role in regulating and coordinating antioxidant defense, mitochondrial biogenesis and other cell functions crucial for oxidant-antioxidant homeostasis. The current communication will review available data regarding the adaptive response, molecular mechanism and gene targets for some of the redox signaling pathways in response to muscle contraction at various stages of life and their potential role health, disease prevention and aging.

**210 - Dietary antioxidants: From activating Nrf2 signaling to genomics in prevention of cancer** Ah-Ng Tony Kong. Rutgers University, US  
Recent scientific studies have provided compelling evidence on the ability of diverse dietary phytochemicals in preventing diseases including cancer. These dietary "antioxidants", upon entering the cells, could trigger cellular signaling events including "protein thiol modification" leading to gene expression of either beneficial effects, but sometime also unwanted cytotoxicity. Our laboratory has been studying dietary polyphenolic antioxidants and isothiocyanates, which are effective against many animal carcinogenesis models. These compounds modulate phosphatases/kinases, activate the Nrf2 signaling, and induce cellular defense genes HO-1, GST, NQO1, and GCS. Using Nrf2 $^{-/-}$  mice coupled with Affymetrix microarray bioinformatic analyses, many other categories of genes including electron transport, ubiquitination, cell growth and apoptosis, cell adhesion, kinases/phosphatases, and transcription factors are also Nrf2-dependent, leading to the overall cellular protective effects against oxidative or carcinogenic damages. Integration of signaling, genomics, biomarkers and blood/tissue levels of phytochemicals would yield better insights into their beneficial health effects. (Supported by NIH grants)

**211 - Application of small molecule microarrays in high-throughput screening of protein targets** Asst Mahesh Uttamchandani  
Defence Medical and Environmental Research Inst., DSO National Laboratories, Singapore, Dept. of Chemistry, National Univ. of Singapore, Singapore, Singapore, Singapore  
I will herein present advances in microarray technologies that facilitate the study of enzymes and their properties in a high-throughput manner. We have over the last decade introduced and developed a variety of such enabling platforms for several classes of enzymes including kinases, phosphatases and proteases. For each of these different protein targets, specific design considerations are required to develop the appropriate chemical tools to characterize each class. These tools include activity-based probes and chemical compound libraries, which are rapidly assembled using efficient combinatorial synthesis or click chemistry strategies. The resulting molecular assortments may then be screened against the target enzymes in high-throughput using peptide/small molecule microarrays, offering a powerful means to study, profile and also discover potent small molecules with which to modulate protein activity and function.

**212 - Plant antimicrobial peptides: Thionins as nature's invention for weapons of mass protection** Assoc. Svetlana Oard, Tamara Chouljenko, Nakul Maiti, Frederick Enright. AgCenter Biotechnology Laboratory, Louisiana State Univ., Baton Rouge, La, US  
Thionins have broad spectrum antibacterial and antifungal activities. We showed that thionin excels several renowned antimicrobial peptides in ability to inhibit fungal pathogens in vitro and in planta. Substitutions in the thionin precursor revealed that the signal peptide protects plant cells from thionin lytic activity. The MS analysis indicated step-wise cleavage of signal peptides. The thionin signal peptide C-terminus is conserved and negatively charged and can block the positively charged phospholipid-binding site protecting plant cells. Membrane-permeabilizing activity is associated with a broad-range antimicrobial activity of thionins. Using high-precision molecular dynamics simulations, we showed that thionin presents a water channel. Our molecular modeling revealed formation of a water-permeable pore running through the thionin  $\alpha$ -helix core. The pore constriction sites resemble that of aquaporines. The structural and dynamic properties elucidated using molecular modeling offer details which provide a consistent scheme of the mechanism for membrane permeabilization that explains seemingly controversial experimental data.

**213 - Results of a double blind randomized, multi-center phase-II clinical trial of geno pep, a topical cream in the treatment of burn wounds** Jesse M Jaynes, V. Siva Rami Reddy MD, MS, MCh, P. Ramesh MD, MS, MCh. Integrative Biosciences, Tuskegee Univ., Tuskegee, AL, US; Plastic Surgery, Osmania Medical Coll., Hyderabad, India  
The loss of the skin's protective barrier as the result of burns fosters the susceptibility to bacterial infection, invasion, and sepsis. Infection remains the leading cause of death among patients who are hospitalized for burns. Current standards of treating the burned tissue have severe limitations and inherent risks of complications. Based upon the principles discovered in naturally occurring peptides, recent designs of synthetically engineered antimicrobial peptides have demonstrated increased potency and efficacy/tolerability, enhanced specificity, and reduced toxicity in comparison. These peptides termed as designed antimicrobial peptides (dAMP), are resistant to such effects of high solute levels and demonstrate even greater antibacterial activity than traditional antibiotics. One such peptide, GENOPEP, has shown and accelerated wound healing. The impact of this would improve patient survival or quality of life and reduce costs to the patient, their family, hospital and society.

**214 - Effect of transgenic cotton plants transformed with antimicrobial synthetic peptide D4E1 on cotton seedling disease, soil microbial diversity, and enzymatic activity** LaKisha J. Odom, Ramble O. Ankumah, Jesse Jaynes, Conrad Bonsi, Jeffery W. Cary,

Marceline Egnin, Desmond Mortley, Lanell Ogden, Kanniah Rajasekaran Dept. of Agriculture and Environmental Science, Tuskegee Univ., Tuskegee, AL, US; Southern Regional Research Center, USDA, New Orleans, LA, US D4E1 is a synthetic antimicrobial peptide which has been shown in vitro and in planta to have broad spectrum antimicrobial action against many fungal orders. Genetic modification has been used in cotton to attempt disease resistance to the two fungal pathogens associated with Cotton Seedling Disease in Alabama, (*Rhizoctonia Solani* and *Pythium*). In a completely randomized designed field trial, over two planting seasons, test plots were assigned either a control with GUS reporter gene, a non-transgenic parent variety, or one of 3 isogenic lines of cotton seed transformed with D4E1 (designated 357, 358, and 373). Evidence of disease symptoms was evaluated and the soil was then randomly sampled and composited and subjected to pyrosequencing and phosphatase enzyme assays. Those treatments containing D4E1 showed increased resistance to cotton seedling disease and no difference between the control and treatments in microbial diversity or phosphatase enzyme activity.

**215 - Transformation of antimicrobial peptides from frog skin into therapeutically valuable anti-infective agents** Prof J. Michael Conlon D.Phil., Dept. of Biochemistry, United Arab Emirates Univ., Al-Ain, United Arab Emirates Cationic, amphipathic  $\alpha$ -helical peptides that are synthesized in the skins of several frog species, particularly those belonging to the *Hylidae* and *Ranidae* families, show broad-spectrum antimicrobial activity and are active against pathogens that have developed resistance to conventional antibiotics. Their therapeutic potential is often limited by low potency against microorganisms, high toxicity against eukaryotic cells, and short half-life in the circulation. Growth inhibitory potency of a particular peptide against bacteria and fungi may be enhanced, and its cytolytic activity against human cells reduced, by appropriate amino acid substitutions that produce selective increases in cationicity concomitant with decreases in hydrophobicity and helicity. Approaches to preparing long-acting analogs of naturally occurring peptides involve incorporation of D-amino acids, coupling to fatty acids and, in cyclic peptides, replacing cystine residues by a hydrocarbon bridge. Peptide-based antimicrobial agents show potential for treatment of infections caused by multidrug-resistant bacteria such as MRSA and *Acinetobacter baumannii*.

**216 - Caffeine: Health benefits and safety concerns** Associate Professor Elvira Gonzalez de Mejia, Dept. of Food Science and Human Nutrition, Univ. of Illinois, Urbana, IL, US Caffeine ranks as one of the top most commonly consumed dietary ingredients throughout the world. Total daily intake, as well as the leading source of caffeine, varies throughout the world. Human studies have demonstrated that moderate (< 400 mg/day) caffeine consumption poses no significant health risks to most consumers. Caffeine acts mainly upon the central nervous system, stimulating wakefulness, facilitating ideas association and decreasing the sensation of fatigue. Although coffee intake slightly increases blood pressure, and plasma concentrations of homocysteine and cholesterol, there is no association with the incidence of hypertension or promoting the development of atherosclerosis in the general population. Additionally, caffeine intake at varying higher levels is linked to a number of potential health benefits as well as to some health concerns in children and pregnant women. Positive effects include a strong negative association with the incidence of type 2 diabetes, as well as assisting in weight management and potential weight loss.

**217 - On the circumstances which modify the action of caffeine: The scope of science since Runge's discovery until nowadays** Jorge G Weil MD, Dept. of Science, Yerba Mate Association of the Americas, Brooklyn, NY, US Caffeine is one of the most widely consumed active food ingredient throughout the world, extensively studied regarding human health and performance. As one of the most-researched substances, caffeine has a long history of safe use, and when consumed in moderation, caffeine has no harmful effects. Since Runge's discovery, in 1819, thousands of papers have been published, including Fischer's work, who achieved caffeine's synthesis, awarded with the Nobel Prize in 1902. Claude Bernard believed that "it is by investigating the exceptions to any rule, that we are most likely to arrive at the truth." In that last decade more than 7,500 papers have been indexed by MEDLINE regarding caffeine. Has the scientific community found "the truth"? The author analyzes a number of papers where, studying "exceptions", give the impression to be ruling research.

**218 - Energy drinks: An assessment of their ingredient profile and functionality** Melanie Heckman, Elvira Gonzalez de Mejia, Dept. of Food Science and Human Nutrition, Univ. of Illinois, Urbana, IL, The energy drink (ED) market is increasing worldwide fueling the need to enhance product health functionality. The objective was to develop a functional tea-based ED high in antioxidants which incorporated novel caffeine sources from green coffee byproducts and yerba mate tea (MT). Antioxidant capacity (AC), total polyphenols (TPC) and in vitro lipid inhibition were analyzed. Blend (50/50) GC1 and MT resulted in  $22 \pm 0.5\%$  lipid reduction. AC for the beverage prototype was  $10889 \pm 263 \mu\text{M}$  Trolox equivalents (eq.) and had a TPC of  $2405 \pm 39 \mu\text{M}$  gallic acid (GA) eq., significantly higher compared to mainstream energy drinks which averaged  $1275 \mu\text{M}$  Trolox eq. ( $286$  to  $3393 \mu\text{M}$  Trolox eq.) and TPC was  $673 \mu\text{M}$  GA eq. ( $309$  to  $1498 \mu\text{M}$  eq. GA). It was concluded that incorporating MT and GC1 into beverage formulations would provide a natural source of caffeine and potentially aid in long-term weight maintenance

**219 - Rapid determination of pungent compounds of ginger by a combination of chromatography and vanilloid receptor (VR1) assay** Ying Yang, Sonia Liu, Neelima Mannava, Research and Development, International Flavors & Fragrances Inc., Union Beach, NJ, US A method for the determination of pungent constituents in ginger was developed by using HPLC isolation and assessing pungent properties with VR1 assay. The ginger extract was fractionated and gave 30 pungent hits as determined by the VR1 assay. Through the VR1 assay, the degrees of pungency of these chemicals were evaluated by their EC50 values as well. In addition, the structures of these pungent chemicals were identified by HPLC/APCI/MS. Thus, the correlation of active chemical structures with their pungency activity was further illustrated.

**220 - Natural components in yerba mate tea and coffee byproducts enhance antioxidant capacity, inhibit lipid synthesis, and suppress body fat and lipogenic genes** Elvira Gonzalez de Mejia, Melanie Heckman, Univ of Illinois Urbana Obesity is an important public health problem in the US. Yerba mate tea (*Ilex paraguariensis*, MT) and green coffee (*Coffea arabica*) processing byproducts (GC) are high in caffeine. Caffeine, in addition to its stimulatory effect, also influences lipid metabolism. We evaluated the effect of caffeine extracted from MT and GC byproducts (GC1, GC2, GC3 and GC4) on lipid metabolism, in vitro and in vivo. Lipid accumulation inhibition was highly correlated with caffeine concentration ( $R^2 = 0.88$ ). MT and GC1 similarly suppressed lipid accumulation, when compared to synthetic caffeine (SC), epigallocatechin gallate and Orlistat, by inhibiting lipoprotein lipase and fatty acid synthase (FAS). Also, byproducts containing polyphenols, showed antioxidant capacity ( $19.4 \pm 0.2$  to  $1550.2 \pm 19.2$  Trolox  $\mu\text{M}$  eq.). Animals fed diets with 0.1% caffeine from these sources lowered body fat ( $p < 0.05$ ) and FAS expression. Natural sources of caffeine can suppress body fat accumulation by

suppressing lipogenic genes. Thus, the incorporation of MT and GC1 to beverages or food formulations could contribute to the prevention of obesity

**221 - Antioxidants in black rice bran** Zhimin Xu, Sungjoon Jang Xiaohua Yue. Dept. of Food Science, Louisiana State Univ., Baton Rouge, LA, US Numerous epidemiological and clinical studies have conclusively demonstrated that  $\gamma$ -tocotrienol and oryzanol found in brown rice bran provide antioxidant protection against cardiovascular diseases. Studies have also reported that anthocyanins in berries help reduce obesity and chronic inflammation. Our study found that the bran of black rice is significantly richer in both of the lipophilic and hydrophilic antioxidants. The content of anthocyanins in the black rice bran was equivalent to the levels found in most wild berries. However, the anthocyanin in the bran was not distributed evenly. The level of anthocyanins in the inner bran fraction was 8 times higher than that in the outer bran fraction. The lipophilic extract from the inner bran fraction showed a higher level of total tocopherols and  $\gamma$ -tocopherols, while the levels of  $\gamma$ -oryzanol in both fractions were similar. Thus, black rice bran would be a unique and economical material which would deliver health promoting antioxidants. It could be used for functional foods, such as extruded snacks, breakfast cereals, and baked cakes.

**222 - Soybean antioxidant properties affected by food processing and in vitro digestion** Zhou Kequan Zhou. Nutrition and Food Science, Wayne State Univ., Detroit, MI, US Soybean antioxidant properties and isoflavone release during the cooking and simulated digestion were evaluated using an in vitro digestive model. Both raw and cooked soybean samples were separated into soluble (bioaccessible) and insoluble (indigestible) fractions during gastric and intestinal digestion. The samples were also treated with heat-denatured enzyme as a control to minimize nonspecific interferences. Isoflavones were quantified by high performance liquid chromatography and the total phenolic content (TPC), oxygen radical absorptive capacity (ORAC), and DPPH radical scavenging activity were determined on soluble and insoluble fractions collected from each digestion step. Our results showed that the cooking process significantly reduced soybean TPC and ORAC values but not its DPPH radical scavenging activity. In addition, the cooking process significantly increased the release of daidzein, genistein, daidzin, and genistin but reduced malonylgenistin availability in the soybean sample. For both soluble and insoluble fraction of the soybean samples, the gastrointestinal (GI) digestion significantly improved their TPC and ORAC but not DPPH radical scavenging activity. After the GI digestion, daidzin and genistin were the major isoflavones, accounting for over 90% of total detected isoflavones in the soybean soluble fraction. The GI digestion improved the bioaccessibility of the total soybean isoflavones by 300%. In summary, our results suggest that both the cooking process and GI digestion improve the bioaccessibility of soybean antioxidants in particular soybean isoflavones.

**223 - Health effects of natural antioxidants from the selected edible botanical materials** Prof Liangli (Lucy) Yu Nutrition and Food Science, Univ. of Maryland, Coll. Park, Maryland, US Natural antioxidants from the selected botanical materials including wheat grains were investigated for their health effects. These natural antioxidants were able to suppress oxygen diffusion-concentration product in liposomes and reduce the mRNA levels of the key enzymes involved in cholesterol biosynthesis and metabolism in cultured rat hepatocytes. The selected natural antioxidants also showed anti-proliferative activities against cancer cells. In addition, some natural antioxidant preparations may have anti-inflammation activity. For instance, wheat antioxidants could down-regulate the mRNA of HMG-CoA reductase, the key enzyme for cholesterol biosynthesis. Some of the health beneficial effects may be independent to their antioxidant properties.

**224 - Catechin/Epicatechin metabolism and excretion in rats fed different berries** Ramesh Khanal, Samuel E. Wilkes, Theodore J. Rogers, Luke R. Howard, Ronald L. Prior Dept. of Food Science, Univ. of Arkansas, Fayetteville, AR, US; Arkansas Children's Nutrition Center, Little Rock, AR, US; USDA, ARS, Little Rock, AR, US Epi/catechins are associated with many health benefits in humans, however, data on their bioavailability, and pattern of excretion and extent of conjugation is limited. Two experiments, using HPLC/MS/MS, were conducted to investigate the urinary excretion of (epi)catechins after feeding different types of berries (freeze-dried whole cranberry (CB), blueberry (BB), or black raspberry (BRB) powder, (50 g/kg diet) or different levels of a cranberry concentrate powder (3.3, 6.6, and 33 g/kg diet) in rats. Both catechin and epicatechin were excreted in the urine largely in methylated, free and conjugated forms. Excretion of epicatechin, including methylated forms, ranged from 30 to 47% of the ingested amount, while that of catechin, including methylated forms, ranged from 9 to 31%. Urinary excretion of (epi)catechins was dose dependent and increased with the amount of (epi)catechins present in the diet. Based on excretory pattern of (epi)catechins in the urine, the bioavailability of epicatechin may be higher than catechin.

**225 - Antioxidant activity of lutein and its protective effects on ischemia-hypoxia injury in cultured rat cortical neurons** Mingchen Wang Rong Tsao. Dept. of Biochemistry and Molecular Biology, Sch. of Basic Medical Sciences, Zhengzhou Univ., Zhengzhou, Henan, China; Guelph Food Research Centre, Agriculture & Agri-Food Canada, Guelph, Ontario, Canada Lutein is a carotenoid compound found in many commonly consumed fruits and vegetables. It is a strong antioxidant and has been found to play important roles in reducing risks of chronic diseases such as cancer and age-related macular degeneration. On the other hand, hypoxic-ischemic brain damage (HIBD) is a common disease with high rate of mutilation and fatality. Antioxidants have shown protective role in risk reduction of HIBD. This study seeks to elucidate the protective effects of lutein on cerebral hypoxic-ischemic damage and its possible mechanisms. Lutein was extracted from the marigold flower and purified using chromatographic techniques. The antioxidant activities were measured using in vitro models (DPPH, PCL). The hypoxic-ischemic injured model derived with embryonal rat cortical neurons was made by N<sub>2</sub> and glucose-deprived Earle's solution in vitro. Different concentrations of lutein were added to the cultured hypoxic-ischemic injured neurons, and the morphological changes and survival rates of injured neurons were investigated. The activities of lactate dehydrogenase (LDH) in the supernatant of cultured neurons were measured by LDH assay kit. RT-PCR was adopted to analyze the mRNA expression of N-Methyl-D-aspartate (NMDA) receptor subunit 1 (NR1) in hypoxic-ischemic injured neurons and non-injured neurons after treated with different concentrations of lutein. Our results showed that the survival rate of injured neurons increased significantly ( $P < 0.05$ ) in a dose dependent manner after being treated with different concentrations of lutein (50 - 150  $\mu$ g/ml). The activities of LDH in treated groups were significantly lower than those of hypoxic-ischemic injury group. RT-PCR analyses showed that the mRNA levels of N-Methyl-D-aspartate (NMDA) receptor subunit 1 (NR1) were significantly lower than those of hypoxic-ischemic injury group. These results suggest that lutein possesses a good neuroprotective effect, and the mechanism may be mediated by down-regulating the mRNA expression of NR1, whereby reducing the synthesis of NMDA receptor and diminishing the corresponding excitotoxicity.



**226 - Influence of extraction methodology on the assay of antioxidant phenolic compounds** Devanand Luthria. Food Composition and Methods Development Laboratory, USDA-ARS-BHNRC, Beltsville, Maryland, US Epidemiological studies have suggested that regular consumption diet rich in fruits and vegetables is associated with reduced risk of cardiovascular and other neurodegenerative diseases along with certain types of cancers. This beneficial effect is partially attributed to phenolic phytochemicals that are ubiquitously distributed throughout plant kingdom. Over several thousand different phenolic compounds belonging to various subgroups have been identified and described in literature. The optimum extraction of phenolic phytochemicals from permeable solid plant materials using solvents of different polarity constitutes a critical step in the manufacture of phytochemical enriched products. The structural diversity of phenolic phytochemicals along with their interactions with sample matrix further complicates the challenges for developing an efficient procedure for optimum extraction. Accurate analysis of phenolic phytochemicals in different plant matrices is essential for accurate quantification of bioactive phenolic phytochemicals and their antioxidant activity. This will allow researchers to provide better regulatory guidelines. This presentation will provide an overview of the issues related to extraction of phenolic compounds as described in our currently published peer-reviewed literature and other recent reviews.

**227 - NMR structural insights on the function of antimicrobial peptides** Ayyalusamy Ramamoorthy, Univ. of Michigan, Ann Arbor, MI Recent studies have shown that it is important to understand the modes of membrane-peptide interactions and structure for a better assessment of the prospects of antimicrobial peptides as substitutes to antibiotics in the control of human disease. However, obtaining high-resolution structures of antimicrobial peptides in membranes that are essential to understand their function has been lacking due to the challenging nature of the problem. Our structural studies on the mechanism of membrane disruption by a variety of antimicrobial peptides including LL-37 (a human antimicrobial peptide) and pexiganan will be presented. NMR experiments were used to determine the secondary structure, dynamics and topology of these peptides in lipid bilayers. Similarities and difference in the cell-lysing mechanism, and their dependence on the membrane composition, of these peptides will be discussed. Our studies showed that MSI-594 exists monomers while MSI-78 forms anti-parallel helical dimers in membranes. Interestingly, MSI-78 (or pexiganan) and magainin2 form similar dimers but MSI-78 is a highly potent peptide. High-resolution structures of monomeric MSI-594 and dimeric MSI-78 (shown below) will also be presented. Modes of binding of AMPs to LPS and the mechanism of outer-membrane permeation in Gram-negative bacteria will also be discussed.

**228 - Synthetic antimicrobial peptides as novel pesticides for plant disease control** Emilio Montesinos. Inst. of Food and Agricultural Technology, Univ. of Girona, Spain Antimicrobial peptides (AMPs) are the first barrier of defense in animals and plants and play a role in antibiosis in microorganisms. AMPs offer great potential as plant disease protection products. However, natural AMPs are produced at low concentrations, may be toxic or have low activity, and are difficult and costly to extract and purify. Synthetic AMPs can be obtained by developing small truncated compounds, sequence analogs, chimeric constructions, and de novo sequences. Compounds can be improved using combinatorial chemistry to optimize leads based on higher activity, and to minimize toxicity and protease susceptibility. Controlled environment and greenhouse trials against several plant pathogens have been successful, but the main limitation is the high cost of the chemical synthesis. This can be improved using molecular farming with microorganisms and plants. Several examples will be presented based on a CECMEL11 peptide library and the future trends of this technology will be discussed.

**229 - Antimicrobial and immunomodulatory peptides for combating infections** Professor Robert E.W. Hancock. Dept. of Microbiology and Immunology, Univ. of British Columbia, Vancouver, BC, Canada Antibiotics are the underpinning of all modern medicine, but are being undermined by an explosion of (multidrug) resistance, and a dearth of new antibiotics. We are developing novel therapeutics for antibiotic resistant bacteria. Cationic host defence (antimicrobial) peptides are produced by virtually all organisms, ranging from plants and insects to humans, as a major part of their innate defences against infection. Cationic antimicrobial peptides with direct antimicrobial activity are being designed based on peptide array and QSAR approaches. It was recently demonstrated that host defence peptides also modulate innate immunity. Microarrays, sophisticated bioinformatics, and pathway and transcription factor studies have demonstrated that these peptides stimulate innate immunity/inflammation in a unique fashion, boosting protective immunity while suppressing harmful inflammation/sepsis. Using this principle of selective boosting of innate immunity we have developed novel small peptides with no direct antibacterial activity, that can protect against diverse infections in animal models, providing a new concept in anti-infective therapy.

**230 - Transgenic expression of lytic peptides for elimination of mycotoxins in food and feed crops** Kanniah Rajasekaran, Jeffrey W Cary, Jesse M Jaynes, Deepak Bhatnagar, Thomas E Cleveland. SRRC, USDA, ARS, New Orleans, LA, ; Tuskegee Univ., Tuskegee, AL, Transgenic crops are widely cultivated in several countries to control crop losses due to insects and weeds. However, disease resistant transgenic crops that can withstand infections due to fungal and bacterial pathogens are not yet available due to several reasons. The primary reasons are 1) host plant-pathogen interaction is a very complex phenomenon and it is often crop/variety or pathogen/strain-specific; 2) natural antimicrobial proteins and peptides are unstable, lack specificity and may be toxic to non-target species; 3) large scale production of antimicrobial proteins and peptides are very expensive and 4) microbial pathogens can develop resistance to natural proteins and peptides. Recent advances in combinatorial chemistry and automated peptide synthesis have paved the way for rational design of stable, potent, and novel synthetic peptides with target-specific biological activity. Some of these lytic synthetic peptides have been already expressed in transgenic plants with varying degrees of success towards control of fungal and bacterial plant pathogens including some fungal pathogens that cause contamination of food and feed crops with mycotoxins. In our laboratory, transgenic cotton plants expressing a synthetic peptide, D4E1, have been shown to control several phytopathogens including *Aspergillus flavus*, the source of aflatoxin contamination in cottonseed meal. Our research results on the effective use of synthetic lytic peptides in transgenic plants with an objective of controlling crop losses due to microbial phytopathogens and mycotoxin producing fungi such as *Aspergillus* and *Fusarium* will be presented.

**231 - In vitro effects of two newly designed lytic peptides LHRH conjugates on prostate cancer.** Starlette M. Sharp. Biology, Tuskegee Univ., Tuskegee, Alabama, Prostate cancer is the second leading cause of cancer deaths among men. To investigate the anti-tumor effects of this class of peptides we designed two novel peptide sequences JCH and JC21 linked with modified LH sequence, to maximize the structure/function of the single amino acid sequences to increase tumor activity and selectivity. Our results indicate that JCH and JC21 are

lethal (IC50) to prostate cancer cell lines LnCaP, DU-145, and PC-3 cells at concentrations 8-10  $\mu$ M., and the addition of LH sequence increased activity by 2-3  $\mu$ M. This was further supported with results that 24hr of JCHLH and JC21LH pretreatment was sufficient to inhibit the growth PC-3 cells over multiday period. In conclusion, JCHLH and JC21LH both have significant anti-tumor activity, and low toxic effect on normal prostate cells. Thus, these novel peptides could serve as new therapies for the treatment of aggressive prostate cancer.

**232 - Activation energy measurements of cheese** Michael H. Tunick. Eastern Regional Research Center, Dairy Processing & Products, USDA, Agricultural Research Service, Wyndmoor, PA, US Temperature sweeps of cheeses using small amplitude oscillatory shear tests produced values for activation energy of flow (Ea) between 30 and 44°C. Soft goat cheese and Queso Fresco, which are high-moisture cheeses and do not flow when heated, exhibited Ea values between 30 and 60 kJ/mol. The semi-hard cheeses Cheddar, Colby, whole milk Mozzarella, and low-moisture part-skim Mozzarella do flow upon heating, and their Ea values were in the 100-150 kJ/mol range. Parmesan, a low-moisture cheese, has a rigid structure that takes longer to soften with heat, leading to an Ea value > 180 kJ/mol. Protein and moisture content were highly correlated with Ea. The determination of Ea allows a number to be assigned to the extent at which a cheese sample melts with heat, and together with elastic modulus, viscous modulus, and complex viscosity provides a picture of the behavior of cheese as it is heated. This information will allow manufacturers to have a better idea of the functionality of their products.

**233 - Impact of electrostatic deposition of anionic biopolymers on the stability of lactoferrin-coated oil droplets** Tanushree Tokle MS, Uri Lesmes, Julian McClements. Dept. of Food Science, Univ. of Massachusetts, Amherst, Amherst, Massachusetts, US Multilayered emulsions were prepared by electrostatic deposition of anionic biopolymers (sodium alginate, low methoxy pectin (LMP), high methoxy pectin (HMP) and sodium caseinate (SC)) onto cationic lactoferrin (LF)-coated lipid droplets. Alginate, LMP and HMP formed polysaccharide layers around the droplets, whereas SC displaced LF from the droplet surfaces. The stability of the emulsions to heating, pH and ionic strength were examined. LMP, HMP and SC improved the thermal stability of the LF-coated lipid droplets (30 to 90 oC). LF-SC emulsions had good pH stability (pH 2 to 9), whereas LF-polysaccharide emulsions aggregated at low and high pH values due to weakening of electrostatic interactions. All emulsions had good NaCl-stability, but only LF-HMP and LF-SC emulsions had good CaCl<sub>2</sub>-stability. Overall, the LF-SC emulsions were the most resistant to environmental stresses. These results have important implications for the design of emulsion-based delivery systems for encapsulating pharmaceuticals and nutraceuticals.

**234 - Comparison of molecular and aggregation properties of soy proteins treated with various endopeptidases** Myong J Cho, Dave Ryan, Partha Ghosh Solae, LLC, St. Louis, MO, US Commercially available soy proteins treated with various endopeptidases are compared in protein solubility, aggregation property measured by FTIR, and peptide sequence measured by LC-MS. The soy protein treated with a microbial enzyme (E1) having a cleaving specificity toward lysine (Lys) and arginine (Arg) shows a very unique solubility profile with improved solubility at acidic pH region while maintaining high solubility at neutral pH compared to the untreated intact soy protein. On the other hand, the soy proteins treated with a neutral plant based enzyme (E2) and an alkaline microbial enzyme (E3) has decreased solubility at neutral pH while exhibiting increased solubility at acidic pH. The protein aggregation property based on the secondary structure of the inter-molecular beta-sheet is also discussed in relative to its solubility characteristic. The peptide sequence analysis confirms the Lys-Arg specificity of E1 compared to E2 and E3 with random cleavages across various amino acid sites.

**235 - Development of a sodium-free salt for food applications** Mr. Darryl L. Holliday, /Research Associa Alfredo Prudente., John W. Finley. Dept. of Food Science, Louisiana State Univ. AgCenter, Baton Rouge, Louisiana, US Sodium Chloride plays a role in many functions within the body. However, excessive sodium intake can lead to many health concerns including hypertension. Metallic salts such as KCl or CaCl<sub>2</sub> along with nucleotides have been utilized as sodium replacers but their use is limited because of off-flavors. The use of Mogroside blends at levels ranging from 150-300 ppm can mask these off-flavors allowing for increased use Potassium and Calcium as a sodium replacer. Additionally, the use these metallic salts allow for increased dietary intake of these needed nutrients. Blends of NaCl, KCl, and CaCl<sub>2</sub> ranging from 0-100% each were formulated and the optimal blends were determined from multiple uses in foods. When Mogroside blends were added, increased levels of KCl and CaCl<sub>2</sub> were acceptable. The results demonstrated that Mogroside blends facilitate sodium replacement with KCl and CaCl<sub>2</sub>; including the creation of a sodium-free "table salt" and salty snack topical applications.

**236 - Foliage extracts of conifers as potential sources for isolation of shikimic and quinic acids, precursors to Tamiflu®** Ms. Lakmali Nilmini Gedivinne Vithanage, Barbara J.W. Cole, Raymond C. Fort Jr., Joseph M. Genco, Alex Shaffer, Mark Rowe. Dept. of Chemistry, Univ. of Maine, Orono, Maine, US; Dept. of Chemical & Biological Engineering, Univ. of Maine, Orono, Maine, US Shikimic acid, the precursor to the important antiviral drug Tamiflu®, and quinic acid, an alternative precursor for the synthesis of Tamiflu®, are important intermediates in the biochemical pathway of the aromatic amino acids in higher plants. Production of Tamiflu® is limited due to the availability of shikimic acid resources. In this study, foliage and bark of the Pinus, Picea, and Abies species were investigated for high potential pharmaceutical compounds including shikimic and quinic acids. Foliage and bark samples were extracted with water and ethanol using different extraction techniques such as soxhlet extraction, accelerated solvent extraction (ASE), ultrasound assisted, and microwave assisted extraction. Extracts were analyzed with GC/MS and HPLC/UV. Foliage of Pinus and Picea are high in these acids. Foliage of Abies, is a good source for quinic acid but it is low in shikimic acid. These acids are less abundant in the bark of the same species. In addition to shikimic and quinic acids, extracts are rich with fructose, glucose, and myo-inositol. Both water and ethanol are efficient in the extraction of shikimic acid, however ethanol was determined to be less efficient for extraction of quinic acid. Microwave assisted extraction is the most rapid and simple way to extract these acids even though the yield is slightly low compared to ASE. Compared to microwave assisted extraction and ASE, the soxhlet extraction and ultrasound assisted extraction techniques are less efficient. Foliage of Pinus and Picea is a good source for the isolation of shikimic acid to produce Tamiflu®.

**237 - Efficacy of Ichthyophthirius vaccines in channel catfish against white spot disease** Dehai Xu, Phillip Klesius, Craig Shoemaker Aquatic Animal Health Research Laboratory, USDA, Agricultural Research Service, Auburn, AL, US Ichthyophthirius (Ich) is a protozoan that causes white spot disease in many cultured fish and lead to severe losses in aquaculture. Two trials were conducted to determine the efficacy and serum antibody response of different formulation of Ich vaccines in channel catfish. In trial I, catfish were immunized with: 1)

1% formalin-inactivated trophonts, 2) 3% formalin-inactivated trophonts, 3) freeze-thawed trophonts, 4) live theronts (positive control) and 5) 5% bovine serum albumin (BSA) as negative control). In trial II, catfish were immunized with sonicated trophonts at doses of 1) 5 trophonts/g of fish, 2) 10 trophonts/g of fish, 3) 20 trophonts/g of fish, and 4) 5% BSA as the control. The results showed that doses of sonicated Ich trophonts vaccines, but not the formulation affected fish antibody responses and survival. Immunize with the live Ich theront and the sonicated Ich trophont vaccines stimulated serum antibody responses and protection in channel catfish against Ich.

**238 - Pterostilbene reduces colon tumor multiplicity and inflammatory markers in animal models of colon cancer** Agnes M Rimando, Shiby Paul, Nanjoo Suh Agricultural Research Service, USDA, Univ., MS, US; Ernest Mario Sch. of Pharmacy, Rutgers, The State Univ. of New Jersey, Piscataway, NJ, US In our earlier studies, we have shown that pterostilbene, a naturally-occurring analog of the wine polyphenol resveratrol, reduced the incidence and multiplicity of azoxymethane (AOM)-induced formation of aberrant crypt foci (ACF) in male F344 rats when given pterostilbene-enriched diet (40 ppm). We have extended our investigation with pterostilbene in a long-term colon tumorigenesis studies, and determined its inhibitory effects on colonic tumor formation in F344 rats continuously fed pterostilbene diet (40 ppm) for 45 weeks. Pterostilbene reduced colon tumor multiplicity of non-invasive adenocarcinomas ( $p < 0.05$ ). Similar to earlier study, proliferating cell nuclear antigen (PCNA, a cell proliferation marker) was lower in pterostilbene-fed rats compared to the controls ( $p < 0.05$ ). Our data showed significant inhibition of the expression of iNOS and COX-2 proteins within the crypts in the adenocarcinomas from the pterostilbene-fed animals, as well as nuclear staining for phospho-p65, a key molecule in the NF- $\kappa$ B pathway. Pterostilbene also down-regulated the expression of  $\beta$ -catenin and cyclin D1, and decreased mucosal levels of the pro-inflammatory cytokines, TNF- $\alpha$ , IL-1 $\beta$  and IL-4. Overall, our data suggest pterostilbene as a potential natural colon cancer preventive agent.

**239 - Multifunctional branched gold nanoparticle for prevention of cancer cells** Professor Paresh C Ray. Chemistry, Jackson State Univ., Jackson, MS, US Cancer has been described in early medical texts from antiquity, but till now it remains the second leading cause of death in our world. The key to the effective and ultimately successful treatment of diseases such as cancer is an early and accurate diagnosis and therapy. Here we will discuss our recent report on selective diagnosis and therapy of several cancer cells selectively and simultaneously using multifunctional branched gold nanoparticle.

**240 - Chitosan grafted with phenolics to promote antioxidant activities** Stephanie B Schreiber, Professor/ Svetlana Zivanovic Dept. of Food Science and Technology, Food Biopolymers, Univ. of Tennessee, Knoxville, Tennessee, US Chitosan is one of the most abundant polysaccharides in the world and has film forming and metal chelating abilities. One of the strategies to introduce direct antioxidant capabilities is grafting of phenolics on chitosan. Chitosan was used as purified or further deacetylated, and gallic and caffeic acids were grafted to various extent. The reaction was carried out with EDC and NHS to promote amide and ester linkages. Extent of grafting was assessed using FTIR, reducing power, DPPH radical scavenging capacity and total phenolics assays. Grafted gallic acid has stronger antioxidant properties than caffeic, but time of reaction does not appear to increase phenolics. The reducing power of chitosan modified with gallic acid was more than 10 folds higher than unmodified chitosan, while modified deacetylated chitosan further increased its reducing power to 37%. This has promising properties to be used as a multi-functional food additive or active, biodegradable food packaging.

**241 - Bioassay-guided isolation and EPR-assisted antioxidant evaluation of two valuable compounds from mango peels** Liyan Jiang, Shan He, Yuanjiang Pan Dept. of Chemistry, Zhejiang Univ., Hangzhou, Zhejiang, China Bioassay-guided HPLC/ESI-MS2 analysis of the ethyl acetate extract of mango peels (MPE) led to the isolation of two major valuable compounds, ethyl gallate (2) and penta-O-galloyl-glucoside (5). In this work, EPR spin-trapping technique was utilised for their antioxidant evaluation on the level of reactive oxygen species. Results demonstrated MPE, 2 and 5 possessed potent scavenging effects on hydroxyl radicals ( $\cdot$ OH), superoxide anions ( $O_2^{\cdot-}$ ) and singlet oxygen ( $^1O_2$ ). With respect to  $\cdot$ OH, 5 has much stronger inhibitory activity than 2, owing to more galloyl groups and the occurrence of intramolecular reactions in 5. Synergistic effects could be observed and explained the strongest scavenging property of MPE ( $IC_{50} = 4.08 \mu$ g/ml,  $k_A = 3.51 \times 10^{15} M^{-1} S^{-1}$ ) in terms of more potent inhibition of 5, which was caused by the inhibitory effects of 2 on 5 consumption. Regarding  $^1O_2$ , 2 has a stronger quenching activity than 5, partially revealing that gallate type compounds quenched  $^1O_2$  with different mechanisms from those proposed against  $\cdot$ OH.

**242 - Urinary excretion of phenolic acids in rats fed cranberry, blueberry, or black raspberry** Ramesh Khanal, Samuel E. Wilkes, Theodore J. Rogers, Luke R. Howard, Ronald L. Prior Dept. of Food Sci., Univ. of Arkansas, Fayetteville, AR; Arkansas Children's Nutrition Ctr, Little Rock, AR; USDA, Little Rock, AR Procyanidins and other polyphenolics can be converted into smaller phenolic acids (PAs) by the microorganisms in the colon. Phenolic acids can then be absorbed, and may contribute to some of the health benefits associated with the parent compounds. The urinary excretion of 18 phenolic acids and their conjugates were studied, using HPLC/MS/MS, in rats fed a control diet, high fructose (HF), or HF with 5% (dry weight basis) of cranberry (CB), blueberry (BB), or black raspberry (BRB). The greatest increase in the excretion of PAs with berry feeding was observed with hippuric acid, 4-hydroxycinnamic acid, 4-hydroxyphenyl acetic acid for CB; chlorogenic acid, 3,4-dihydroxycinnamic acid, and ferulic acid for BB; and 3-hydroxyphenyl propionic acid, 3-hydroxybenzoic acid and 3-hydroxycinnamic acid for BRB. A majority of the PAs were also detected in conjugated form with some exceeding 80% of the total excreted, suggesting that conjugated PAs, not just the free PAs, need to be taken into account while determining their excretory pattern.



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