

## Symposium Introduction

---

# Advances in berry research: The sixth Biennial Berry Health Benefits Symposium<sup>1</sup>

Navindra P. Seeram<sup>a,\*</sup> and Barbara Shukitt-Hale<sup>b,\*</sup>

<sup>a</sup>*Bioactive Botanical Research Laboratory, Department of Biomedical and Pharmaceutical Sciences, College of Pharmacy, University of Rhode Island, Kingston, RI, USA*

<sup>b</sup>*USDA-ARS, Human Nutrition Research Center on Aging at Tufts University, Boston, MA, USA*

**Abstract.** Studies to advance the potential health benefits of berries continue to increase as was evident at the sixth biennial meeting of the Berry Health Benefits Symposium (BHBS). The two and a half-day symposium was held on October 13–15, 2015, in Madison, Wisconsin, United States. The 2015 BHBS featured new and emerging research further bolstering the positive biological effects of berry consumption on human health, performance, and disease prevention. The papers presented at the 2015 BHBS consisted of invited papers from an international group of leading berry researchers, as well as poster abstracts. Oral sessions were organized around themes including heart health, cancer prevention, gut health/gut microflora, brain aging, metabolism, and berry compositional chemistry. These thematic health areas, while not exhaustive, encompass the more prominent research success stories on berries, the vast majority of which are backed by published animal and human studies. Similar to the past meetings, the research findings at the 2015 BHBS primarily focused on blackberries, blueberries, black raspberries, cranberries, red raspberries, and strawberries. However, research on other berry fruits, including chokeberry (aronia berry), cloudberry, blue honeysuckle berry, bilberry, jamun berry, and elderberry, was also featured as was data on major classes of berry polyphenols/phytochemicals including anthocyanins and other flavonoids and their *in vivo* derived metabolites. The BHBS continues to be a leading forum for interactions between scientists and berry industry stakeholders. The cluster of papers in this issue represents a snapshot of presentations at the 2015 BHBS which support the positive biological effects of berries on human health and diseases.

Keywords: Berries, biological effects, health, disease

The Berry Health Benefits Symposium (BHBS) had its sixth biennial meeting in Madison, Wisconsin, United States (see website: <http://www.berryhealth.org>) from October 13–15, 2015. Similar to the past five meetings, spanning over a decade [see References 1–4 for introduction articles for the previous BHBS], an international group of researchers presented their scientific findings centered around themes including heart health, cancer prevention, gut health/gut microbiota, brain aging, metabolism, and berry compositional chemistry. There was

---

<sup>1</sup>Part of the 2015 Berry Health Benefits Symposium.

\*Corresponding author: Navindra Seeram, Bioactive Botanical Research Laboratory, Department of Biomedical and Pharmaceutical Sciences, College of Pharmacy, University of Rhode Island, Kingston, Rhode Island, USA. Tel./Fax: +1 401 874 9367/5787; E-mail: nseeram@uri.edu and Barbara Shukitt-Hale, USDA-ARS, Human Nutrition Research Center on Aging at Tufts University, Boston, Massachusetts, USA. Tel./Fax: +1 617 556 3118/3299; E-mail: barbara.shukithale@ars.usda.gov.

also a poster session with 26 scientific abstracts. While the presentations largely focused on the major North American cultivated and consumed berry crops, including blackberries, blueberries, black raspberries, cranberries, red raspberries, and strawberries, research was also presented on other berries including chokeberry (aronia berry), cloudberry, blue honeysuckle berry, bilberry, jamun berry, and elderberry. In addition, data was presented on the major polyphenol sub-classes found in berry fruits, including anthocyanins and other flavonoids as well as their *in vivo* derived metabolites. The scientific sessions culminated with a dinner and presentation titled ‘*Cranberry: To the bladder and beyond*’ from keynote speaker, Amy Howell (Marucci Blueberry and Cranberry Research and Extension Center of Rutgers University, NJ, USA).

Preceding the scientific sessions was a half-day ‘non-scientific/lay-friendly’ session including talks on ‘*Berryology 101*’ by Navindra Seeram (College of Pharmacy, The University of Rhode Island, Kingston, RI, USA), ‘*Communicating Berry Research to the Dietary Guidelines for Americans*’ by Britt Burton-Freeman (Institute for Food Safety and Health, Illinois Institute of Technology, Bedford Park, IL, USA) and David Stuart (Food & Nutrient Impact, LLC, Hershey, PA, USA), and ‘*Translating Science into Consumer Friendly Messaging: A Registered Dietitians’ Perspective*’ by Frances Largeman-Roth and Victoria Retelny who are both registered dietitians based in the United States. The scientific sessions culminated with a Wisconsin Cranberry Harvest Tour with visits to two local cranberry farms/bogs, as well as of processing and historical sites.

The 2015 BHBS was supported by the National Berry Crop Initiative (based in the United States) with sponsorship (in alphabetical order) from: Artemis International, the California Strawberry Commission, Cott, the Cranberry Institute, Chilean Blueberry Committee, Complete Phytochemical Solutions, Driscoll’s, Dole, Florida Strawberry Growers Association, Fruit D’Or Nutraceuticals, Journal of Berry Research, National Processed Raspberry Council, Naturipe Farms, New England Vegetable and Berry Growers Association, North American Raspberry and Blackberry Association, North American Strawberry Growers Association, Ocean Spray, Oregon Raspberry & Blackberry Commission, SunBelle, US Highbush Blueberry Council, Wild Blueberry Association of North America, Wisconsin State Cranberry Growers Association and Wyman’s of Maine.

The invited oral papers were presented in six thematic sessions, each with a chair who, similar to the past BHBS, presented a brief overview of their session as follows: Session 1, ‘*Berries and Heart Health*’, chaired by Britt Burton-Freeman (Institute for Food Safety and Health, Illinois Institute of Technology, Bedford Park, IL, USA); Session 2, ‘*Berries and Gut Health/Gut Microflora*’, chaired by Jess Reed, (Department of Animal Sciences, University of Wisconsin-Madison, Madison, WI, USA), Session 3, ‘*Berries and Brain Aging*’, chaired by Barbara Shukitt-Hale (USDA-ARS Human Nutrition Research Center on Aging at Tufts University, Boston, MA, USA), Session 4, ‘*Berries and Cancer*’, chaired by Ramesh Gupta, (University of Louisville, Kentucky, USA), Session 5, ‘*Berry Compositional Chemistry and Biological Effects*’, chaired by Navindra Seeram (College of Pharmacy, The University of Rhode Island, Kingston, RI, USA) and Session 6, ‘*Berries and Metabolism*’, chaired by Ronald Prior (Department of Food Science, University of Arkansas, Fayetteville, AR, USA). The poster session was chaired by Luke Howard (Department of Food Science, University of Arkansas, Fayetteville, AR, USA). A list (with accompanying topic) of the speakers in each of the oral sessions is provided below.

Session 1 which focused on ‘*Heart Health*’ had the following speakers all presenting data accumulated from *in vivo* (animal and human) studies: Aedin Cassidy from the University of East Anglia, on ‘*Berry Anthocyanins and Cardiometabolic Health*’, Arpita Basu from Oklahoma State University on ‘*Berries and Lipids in Cardiovascular Disease: Observations and Recommendations*’, Dorothy Klimis-Zacas from the University of Maine on ‘*Wild Blueberries Attenuate Risk Factors of the Metabolic Syndrome*’, and finally, Indika Edirisinghe from the Institute for Food Safety and Health in Illinois on ‘*Berry Consumption and Cardiometabolic Disease*’.

Session 2 on ‘*Gut Health/Gut Microbiota*’, a newer theme at the BHBS, featured the following speakers: Alan Crozier from the University of California, Davis on ‘*Microbial and Mammalian Mediated Metabolism of Dietary Flavonoids in the GI tract: Impact on Bioavailability*’, Federico Rey from the University of Wisconsin on ‘*Interactions between Gut Microbes and Dietary Anthocyanins*’, Andre Marette from Laval University on ‘*Berries to Fight the Metabolic Syndrome: What are the Mechanisms?*’, and Simone Guglielmetti from the University of Milan on ‘*The Role of Microbes in the Relationship between Berries and Human Health*’.

Impressively, all of the studies in Session 3 on 'Brain Aging' have been conducted in humans supporting that moderate-term berry fruit supplementation can improve cognitive functions. The speakers included: *Robert Krikorian* from the University of Cincinnati Academic Health Center on 'Berry Supplementation to Mitigate Neurocognitive Decline', *Carol Cheatham* from the University of North Carolina on 'The Effect of Blueberry Consumption on Cognitive Abilities in 65- to 79-year Olds: a 6-month Randomized Controlled Trial', *Marshall Miller* from Tufts University on 'Effects of Berry Supplementation on Mobility and Cognition among Older Adults' and, *Claire Williams* from the University of Reading on 'Effects of Flavonoid-Rich Blueberry Interventions on Cognitive Behavior in 10 Year Old Children'.

Session 4 on *Cancer* continues to be one of the major areas in which berry research has advanced steadily over the past meetings, with a combination of data collected from human and animal studies. The speakers included: *Steve Clinton* from The Ohio State University on 'Crops to the Clinic: Cancer Prevention Research with Berries', *Farrukh Aqil* from the University of Louisville on 'Cancer Prevention and Therapeutic Efficacy of Berry Bioactives', *Laura Kresty* from the Medical College of Wisconsin on 'Black Raspberries in Clinical Studies: Past, Present, and Future' and finally, *Luc Biedermann*, University Hospital of Zurich on 'Bilberry in IBD: Just Getting Bluer or Better?'.

Session 5, *Berry Compositional Chemistry and Biological Effects* included presentations from: *Christian Krueger* from the University of Wisconsin-Madison on 'The Modern Analytic Toolbox for Authentication, Standardization and Efficacy Evaluation of Natural Products', *Maurizio Battino* from the Università Politecnica delle Marche in Italy on 'The Effects of Strawberry Bioactive Compounds on Human Health: A Possible Clue on the Molecular Mechanisms Involved in the Prevention of Different Chronic Diseases' and, *Liwei Gu* from the University of Florida on 'Bioavailability and Bioactivity of Phytochemicals in Cranberries'. The last presentation in this session from *David Rowley* of the University of Rhode Island focused on the identification of carbohydrates, an underexplored class of chemical constituents in berries, and was titled 'Digging Deeper into the Anti-Infective Chemistry of Cranberry'.

Session 6, *Berries and Metabolism* had presentations from: *Colin Kay* from the University of East Anglia on 'Newly Discovered Bioactive Metabolites of Berry Anthocyanins: Potential Health Effects and Implications for Future Research', *Ana Rodriguez-Mateos* from the University of Dusseldorf on *Berries and Cardiovascular Health: Is It Really the Anthocyanins?*, *Daniele Del Rio* from the University of Parma on 'Raspberry Ellagitannin Metabolites in Models of Chronic Disease' and finally, *Emilie Fromentin* from Naturex-DBS on 'Aronia: An Up and Coming Healthy Berry'.

In conclusion, the 2015 BHBS was yet another successful meeting further bolstering the positive impact of berry consumption on human health and diseases. We look forward to the next BHBS and would like to thank the *Journal of Berry Research*, all of the donors and participants of the 2015 BHBS symposium, as well as authors who have contributed to the cluster of papers presented here.

## References

- [1] Seeram NP. Berry fruits: Compositional elements, biochemical activities and the impact of their intake on human health, performance and disease. *J Agric Food Chem.* 2008;56:627-9.
- [2] Seeram NP. Recent trends and advances in berry health benefits research. *J Agric Food Chem.* 2010;58:3869-70.
- [3] Seeram NP. Emerging research supporting the positive effects of berries on human health and disease prevention. *J Agric Food Chem.* 2012;60:5685-86.
- [4] Seeram NP. Berries and human health: Research highlights from the fifth biennial berry health benefits symposium, *J Agric Food Chem.* 2014;62:3839-41.