Table of Contents

Message from Centre Leader ................................................................. 1

List of Members .......................................................................................... 3

Michelle Alfa ............................................................................................... 7

Michel Aliani .............................................................................................. 13

Hope Anderson ........................................................................................... 18

Harold Aukema .......................................................................................... 23

Heather Blewett .......................................................................................... 29

Dan Brown ................................................................................................. 34

Randolph Guzman ...................................................................................... 39

Mohammed Moghadasian ......................................................................... 40

Thomas Netticadan .................................................................................... 45

Karmin O ..................................................................................................... 47

Grant Pierce ................................................................................................. 51

Chris Siow .................................................................................................... 55

Carla Taylor ................................................................................................. 61

Peter Zahradka ............................................................................................ 71
Message from the Centre Leader

This was the 10th year of operation of Centre and in late 2015 we were very busy preparing for an anniversary celebration and conference scheduled for early 2016. The Therapeutic Applications of Functional Foods and Bioactives Conference is scheduled for April 21 and 22, 2016 at the St Boniface Hospital Albrechtsen Research Centre and will feature some 20 speakers, many being PIs and Affiliates of CCARM, reporting on their work on functional foods and health benefits. The 14 Principal Investigators led their respective groups as reported in the last three years but we were very pleased to have nine new affiliate members of CCARM be appointed under our restructured formal Affiliate Program. We very enthusiastically welcome:

Dr Rotimi Aluko, Dept. of Human Nutritional Sciences, University of Manitoba
Dr. Nancy Ames, RCFFN, Agriculture and Agri-Food Canada
Mr. Morag Graham, Dept. of Medical Microbiology, University of Manitoba
Dr. Edmund Lui, Dept. of Physiology and Pharmacology, Western University
Dr. Casey Sayre, College of Pharmacy, University of Manitoba
Dr. Garry Shen Dept. of Internal Medicine University of Manitoba
Dr. Miyoung Suh, Dept. of Human Nutritional Sciences, University of Manitoba
Mr. Alphonsus Utioh, Research & Development Manager, Food Development Ctr
Dr. Gary Van Domselaar, National Microbiology Laboratory, Public Health Agency of Canada

During 2015, the 14 laboratories were very active as evidenced by the receipt of 76 different competitive operation, equipment and salary grants totalling $2,789,286 from a wide range of sources. These resources along with support from St Boniface Hospital, St Boniface Hospital Foundation, Agriculture and Agri-Food Canada and the University of Manitoba supported some 97 students, postdoctoral fellows, and staff in addition to the 14 Principal Investigators at the Centre in 2015. There are some very exciting reports described in the individual laboratory outlines along with individual publication, funding and staffing details. I would like to draw attention to just a few of the highlights for 2015.

**Dr. Michelle Alfa** reported on a MSPrebiotic clinical study on the gut of elderly adults and found that the inclusion of a resistant starch prebiotic in their diet altered the microbiome of these elderly adults to be more similar to that of younger healthier adults.

**Dr. Hope Anderson** was the 2015 recipient of the prestigious Leslie F. Buggey professorship in Pharmacy and benefited by a $100,000 boost to her research program.

**Dr. Heather Blewett** was announced as part of a new cross sectional multidisciplinary study entitled “The Manitoba Personalized Lifestyle Research (TMPLR) Program” which was one of only two large grants awarded by Research Manitoba in 2015. Dr. Blewett will lead the nutritional component of TMPLR.

**Dr. Grant Pierce** continued his outreach activities with twelve invited talks at national and International venues and was awarded the Laufberger Medal from the Czech
Physiological Society and the Czech Medical Society in recognition of scientific excellence and contributions to the enhancement of international scientific collaboration. A press release by Agriculture and Agri and Agri-Food Canada on Dr. Chris Siow, “Lure of the Lingonberry: Win-Win for Northern Agriculture and Heart Health” generated a cascade of other follow up articles and interviews on the potential of Lingonberry for Heart Health.

Dr. Carla Taylor, “Manitoba Grown Talent-Dr. Carla Taylor” and “Foods that Target Inflammation”, received considerable popular press coverage and interviews on her research work and clinical trials with Dr. Peter Zahradka on the development cardiovascular health.

Dr. Erin Goldberg (with Dr. Michel Aliani) won the 2015 NSERC Science, Action! Award for her video on eggs and omega-3 fatty acids. Crystal Acosta (PhD Student with Dr. Hope Anderson) received a Research Manitoba Studentship and the 2015 JG Fletcher Fellowship for Research in Functional Foods and Nutraceuticals from the University of Manitoba. Melissa Gabbs (MSc Student with Dr. Harold Aukuma) received a 2015 CIHR Canada Graduate Scholarship along with a Tri-Council Top-up Award from the University of Manitoba. Ariful Islam (MSc Student with Dr. Harold Aukuma) received a University of Manitoba Graduate Fellowship. PhD Student, Kabo Masisi, is a winner of the 2015-2016 BMO Financial Group Research Scholarship for Excellence (co-supervised by Drs. Mohammed Mogadesian and Trust Beta). PhD Student, Pema Raj supervised by Dr. Thomas Netticadan, is also a recent winner of the BMO Financial Group Research Scholarship for Excellence. and a “Have a Heart” Travel Bursary from the 2015 Canadian Cardiovascular Congress. Victoria Sid (PhD Student with Dr. Karmin 0) received the CSATVB Young Investigator Award at the 2015 Canadian Cardiovascular Congress in October. PhD Student, Jaime Clark received a University of Manitoba Graduate Fellowship in support of her studies (co-supervised by Drs. Carla Taylor and Peter Zahradka). Youjia Du (PhD Student with Drs. Peter Zahradka and Carla Taylor) received a MITACS award in support of her studies. Dr. Azadeh Yeganeh received the Janice Dodd Award for Excellence in Endocrine Physiology, University of Manitoba (co-supervised by Dr. Peter Zahradka and Carla Taylor). Cara Isaak (PhD with Dr. Chris Siow received a Research Manitoba PhD studentship award. Stephanie Caligiuri (PhD with Drs. Grant Pierce and Michel Aliani) received a CIHR Doctoral research award and Research Manitoba Scholarship. Thomas Hedley (MSc with Dr. Grant Pierce) received a GETS and MSc Studentship Award and Riya Ganguly (supervised by Dr. Grant Pierce) received a Research Manitoba Scholarship.

Congratulations to all the CCARM staff and students for a very productive and successful 2015.

Dan Brown
Principal Investigator and CCARM Centre Leader
# List of Members

## A. Principal Investigators

<table>
<thead>
<tr>
<th></th>
<th>Member Name</th>
<th>Position and Affiliation</th>
<th>Funding Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Michelle Alfa, PhD</td>
<td>Professor, Department of Medical Microbiology, University of Manitoba</td>
<td>$308,316</td>
</tr>
<tr>
<td>2</td>
<td>Michel Aliani, PhD</td>
<td>Associate Professor, Department of Human Nutritional Sciences, University of Manitoba</td>
<td>$139,100</td>
</tr>
<tr>
<td>3</td>
<td>Hope. Anderson, PhD</td>
<td>Associate Professor &amp; Graduate Chair, College of Pharmacy, University of Manitoba; Adjunct Professor, Department of Pharmacology and Therapeutics, University of Manitoba</td>
<td>$247,629</td>
</tr>
<tr>
<td>4</td>
<td>Harold Aukema, PhD</td>
<td>Professor, Department of Human Nutritional Sciences, University of Manitoba</td>
<td>$295,031</td>
</tr>
<tr>
<td>5</td>
<td>Heather Blewett, PhD</td>
<td>Research Scientist, Agriculture and Agri-Food Canada; Adjunct Professor, Departments of Human Nutritional Sciences &amp; Physiology and Pathophysiology, University of Manitoba</td>
<td>$219,086</td>
</tr>
<tr>
<td>6</td>
<td>Dan Brown, PhD</td>
<td>Centre Leader, Canadian Centre for Agri-Food Research in Health and Medicine, Research Scientist, Agriculture and Agri-Food Canada; Adjunct Professor, Department of Biology, University of Western Ontario; Adjunct Professor, Department of Human Nutritional Sciences, University of Manitoba</td>
<td>$245,216</td>
</tr>
<tr>
<td>7</td>
<td>Randolph Guzman, MD, FRCSC, FACS, RVT, RPVI</td>
<td>Professor of Surgery and Head, Section of Vascular Surgery, University of Manitoba; Regional Lead, Section of Vascular Surgery, WRHA; Site Medical Manager, Department of Surgery, St. Boniface Hospital</td>
<td>$0</td>
</tr>
<tr>
<td>8</td>
<td>Mohammed Moghadasian, PhD</td>
<td>Professor, Department of Human Nutritional Sciences, University of Manitoba; Adjunct Professor, Faculty of Pharmacy, University of Manitoba</td>
<td>$67,500</td>
</tr>
<tr>
<td>9</td>
<td>Thomas Netticadan, PhD</td>
<td>Research Scientist, Agriculture &amp; Agri-Food Canada; Adjunct Professor, Department of Physiology and Pathophysiology, University of Manitoba</td>
<td>$141,822</td>
</tr>
<tr>
<td>10</td>
<td>Karmin O, PhD</td>
<td>Professor, Department of Animal Science, University of Manitoba; Adjunct Professor, Department of Physiology and Pathophysiology, University of Manitoba</td>
<td>$36,000</td>
</tr>
<tr>
<td>11</td>
<td>Grant Pierce, PhD</td>
<td>Executive Director of Research, St. Boniface Hospital; Professor, Department of Physiology and Pathophysiology, University of Manitoba</td>
<td>$566,311</td>
</tr>
</tbody>
</table>
12. **Chris Siow, PhD:** Research Scientist, Agriculture and Agri-Food Canada; Adjunct Professor, Department of Physiology and Pathophysiology, University of Manitoba  
   $137,388

13. **Carla Taylor, PhD:** Professor, Department of Human Nutritional Sciences, University of Manitoba; Adjunct Professor, Department of Physiology and Pathophysiology, University of Manitoba  
   $250,543

14. **Peter Zahradka, PhD:** Professor, Departments of Physiology and Pathophysiology & Human Nutritional Sciences, University of Manitoba; Chair, Endocrinology and Metabolic Disease Group, University of Manitoba  
   $135,344

**TOTAL FUNDING RECEIVED IN 2015:**  
$2,789,286
LIST OF MEMBERS

B. Affiliates
1. Rotimi Aluko, PhD: Professor, Department of Human Nutritional Sciences, University of Manitoba
2. Nancy Ames, PhD: Research Scientist, Agriculture & Agri-Food Canada, Richardson Centre for Functional Foods and Nutraceuticals & Adjunct Professor, Department of Human Nutritional Sciences, University of Manitoba
3. Morag Graham, PhD: Adjunct Professor, Department of Medical Microbiology, University of Manitoba
4. Edmund Lui, PhD: Associate Professor, Scientific Director, Ontario Ginseng Innovation and Research Consortium, Ontario Research Excellence Program, Ministry of Research and Innovation & Adjunct Professor, University of Western Ontario
5. Casey Sayre, PhD: Assistant Professor, College of Pharmacy, University of Manitoba
6. Garry Shen, PhD: Professor, Section of Endocrinology and Metabolism, Department of Internal Medicine, University of Manitoba
7. Miyoung Suh, RD, PhD: Associate Professor, Department of Human Nutritional Sciences, University of Manitoba
8. Alphonsus Utioh, MSc: Research and Development Manager, Food Development Centre (Portage la Prairie)
9. Gary Van Domselaar, PhD: Chief, National Microbiology Laboratory, Public Health Agency of Canada

C. Visiting Scientists
1. Danielle Stringer

D. Research Associates
1. Caroline Alibin
2. Elena Dibrov
3. Kimberley O’Hara
4. Zongjun Shao

E. Graduate Students
1. Crystal Acosta
2. Bolanle Akinwumi
3. Basma Aloud
4. Sirini Amarakoon
5. Md Ariful Islam
6. Aakangchhya Bhusal
7. Stephanie Caligiuri
8. Li Chen
9. Jaime Clark
10. Cristiana da Costa Luciano
11. Youjia Du
12. Andrea Edel
13. Ala’a Eideh
14. Jennifer Enns
15. Adewale Esan
16. Afroza Ferdouse
17. Melissa Gabbs
18. Riya Ganguly
19. Nora Ghazzawi
20. Erin Goldberg
21. Jessay Gopuran
22. Jennifer Grant
23. Breanne Head
24. Thomas Hedley
25. Lena Hong
26. Naser Ibrahim
27. Cara Isaak
28. Danielle Lee
29. Shan Leng
30. Tara Loader
31. Yan Lu
32. Maira Marques Ribeiro
33. Kabo Masisi
34. Shyamchand Mayengbam
35. Md Monirujjaman
36. Adriana Mudryj
37. John Onuh
38. Pema Raj
39. Colleen Rogers
40. Amalia Santiago
41. Lindsei Sarna
42. Yvette Shang
43. Victoria Sid
44. Linda Siemens
LIST OF MEMBERS

45. Le Wang
46. Pengqi (Peggy) Wang
47. Azadeh Yeganeh
48. Ruiyin Zhou

F. Technical Staff
1. Alex Austria
2. David Bray
3. Debbie Brisson
4. Patricia DeGagne
5. Danielle (Hanke) Perera
6. Khuong Le
7. Thane Maddaford
8. Sasanda Nimalgoda
9. Nancy Olson
10. Jay Petkau
11. Suvira Prashar
12. Li Ren
13. Shiva Shariati
14. Jo-Ann Stebbing
15. Leslee Tworek
16. Tanja Winter
17. Brenda Wright
18. Liping Yu

G. Research Nurses
1. Wendy Weighell
2. Angela Wilson

H. Undergraduate Students
1. Lucien Cayer
2. Kevin Chaboyer
3. Melissa Kenneth
4. Amy Klann
5. Graham Maddaford
6. Thushara Mohan
7. David Nelson
8. Jordan Nelson
9. Tamara Paetsch
10. Chelsea Penner
11. Ryan Ramjiawan
12. Nikhil Sidhu
13. Melissa Wong
14. Ruiyin Zhou

I. Volunteer Research Assistants
1. Rokiatou Kone Berethe
2. Sarah Landry
3. Sean Prairie
4. Katie Wilson
5. Erika Lee

J. Administrative Staff
1. Tracy Ewonchuk
2. Susan Zettler
This was the year we completed the MSPrebiotic clinical study! The objective was to study the gut microbiome of elderly adults (individuals 70 years and older) compared to younger adults who were 30 to 50 years of age and determine if a resistant starch prebiotic (MSPrebiotic) could alter the microbiome in the elderly so that it was more similar to that of healthy younger adults. This project was funded through MSPrebiotic Inc. and we could not have had better industry contacts for this project than Derek and Earl McLaren. The serum data analysis and the short chain fatty acid (SCFA) analysis have been completed and there are some very exciting data being generated that will be the basis for potential future clinical studies. The National Microbiology Laboratory has completed the pyrosequencing data for the baseline (week 0) and final stool samples (week 14) from all study participants. We have identified a number of microbiome shifts that are found only in the MSPrebiotic cohorts and will await the statistical analysis of these changes.

This year we bid farewell (and congratulations) to David Bray who had decided to undertake his Ph.D. at Boston University in the area of bio-informatics. David contributed a major impact to our MSPrebiotic study as he was totally dedicated, almost “unflappable”, and has lots of computer skills making him an outstanding addition to our laboratory. We wish him luck in his Ph.D. program!

We also welcomed two Ph.D. students from Brazil, Maira Marques Ribeiro and Cristiana da Costa Luciano, who started their experimental research program in March of this year (we have never seen two young ladies more excited about seeing snow!). They are both in a sandwich program involving their home university and the University of Manitoba. Maira was with us from March to July 2015 and Cristiana was with us from March to December 2015. Their projects were both aimed at investigating the role of biofilm in flexible endoscopes.

We also welcomed back Pat DeGagne who has agreed to re-join our research laboratory after her retirement from DSM. Pat was the original research technologist in this laboratory when it was established within the St. Boniface Research Centre in 1988 by Dr. Kevin Forward. We are excited to have someone with such excellent research skills as Pat in the laboratory.

In 2015 we completed the multi-country project to look at environmental cleanliness in ICUs. The support from the St Boniface Hospital ICUs, Infection Prevention and Control as well as Housekeeping was outstanding. We are the only Canadian site involved in this study and are excited as we are the first site to complete Phase I of the study.
before the end of 2014. An abstract on the Phase 1 data from the Canadian and Netherlands sites was presented at the Infectious Disease Week conference in San Diego.

This year a major effort was undertaken as a training site for KARL STORZ with respect to cleaning validation testing for flexible endoscopes. There were five KS staff from various key roles at KS who undertook a one-week training program in our laboratory. The reviews of this training session were excellent and credit goes to Nancy Olson for her excellent training skills. In addition we took on a major endoscope cleaning validation project funded by KARL STORZ. This project will provide KS with important data as they revise their endoscope cleaning instructions for submission to the Food and Drug Administration (FDA).

### Funding

<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3M</td>
<td>M. Alfa</td>
<td>Multisite evaluation of environmental cleanliness of high-touch surfaces in ICU patient rooms in hospitals in five countries</td>
<td>$30,929</td>
</tr>
<tr>
<td>McPharma Neutraceuticals</td>
<td>M. Alfa &amp; D. Strang</td>
<td>Impact of MSPrebiotic on gut health in the elderly</td>
<td>$61,190</td>
</tr>
<tr>
<td>KARL STORZ</td>
<td>M. Alfa</td>
<td>Cleaning validation of KARL STORZ flexible endoscopes</td>
<td>$110,431</td>
</tr>
<tr>
<td>American Society of Gastroenterology &amp; Endoscopy (ASGE)</td>
<td>M. Alfa &amp; H. Singh</td>
<td>Prevention of biofilm formation in duodenoscopes</td>
<td>$29,156</td>
</tr>
<tr>
<td><strong>EQUIPMENT:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL FUNDING:</td>
<td></td>
<td></td>
<td>$308,316</td>
</tr>
</tbody>
</table>
### Collaborative Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Activity/project title/system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Morag Graham &amp; Dr. Gary VanDomselaar</td>
<td>National Microbiology Lab</td>
<td>Pyrosequencing for MSPrebiotic study</td>
</tr>
<tr>
<td>Dr. Rodrigo Franca</td>
<td>U of Manitoba, School of Dentistry</td>
<td>Surface analysis for organic residuals on reprocessed surgical instruments</td>
</tr>
<tr>
<td>Dr. Lisa Lix</td>
<td>U of Manitoba, Bioinformatics</td>
<td>Statistical analysis pyrosequencing data</td>
</tr>
</tbody>
</table>
Fellows/Students Mentored/Supervised

Graduate Students Supervised

**PhD**
Cristiana da Costa Luciano
Maira Marques Ribeiro

**MSc**
Breanne Head

Service on Graduate Student Committees

**PhD**
Amarnath Pisipati
Jessica Forbes
Yanan Wang

Honors & Awards

Best Oral Presentation: Comparison of disposable wipes and reusable cloths for surface disinfection in the healthcare environment, June 15, 2015 at Infection Prevention and Control Canada, Victoria, B.C.
Professional Service

Committee member for Canadian Standards Association; Z314-8

FDA, committee member for establishing validated testing protocols for clinical diagnostic laboratories related to sampling flexible duodenoscopes

Reviewer for - American Journal of Infection Control, Infection Control and Hospital Epidemiology, Journal of Clinical Microbiology, Antimicrobial agents and Chemotherapy & Zentral Sterilization

Outreach Activity

2015 St. Boniface Research Centre Radioathon
Guest on the “Health Report” on CJOB
Presenter at the Research Foundation Donor Breakfast Session in 2015

Publications

Peer-Reviewed Articles


Invited Presentations

Dissecting endoscope infection outbreaks, Manitoba CSGNA Conference, Winnipeg, April 18, 2015.

Dissecting ERCP endoscope outbreaks, IAHCSMM, Fort Lauderdale, May 3, 2015.


Unresolved issues in the SGNA Endoscope reprocessing guideline, Round Table at SGNA Conference, Baltimore, May 18, 2015.


Reducing the environmental reservoir risk for HAIs through: Product, protocol & compliance, Association for Professionals in Infection Control and Epidemiology Annual Conference, Nashville, June 27, 2015.

Keynote Speaker: “Special Evening with Dr. Michelle Alfa” organized by SRACA conference organizers. Two presentations: Medical device reprocessing: Can we ban the biofilm? and To clean…or not too clean?, Melbourne, Sept 7, 2015.

I have been on research leave from Jan to July 2015 with no teaching assignments. We were very active in developing the methods required for biological fluids for nutritional metabolomics research. The metabolomics studies conducted in our laboratories has attracted many groups both in Canada and abroad. I continued to receive funding from NSERC Discovery Grant (2014-2019). 3 PhD students have been graduated in 2015. We published 10 papers in peer reviewed journals.

Shiva Shariati-levari, Ruiyin Wang, Dr. Michel Aliani, Le Wang, Amalia Santiago
## Funding

<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSERC Discovery</td>
<td>M. Aliani</td>
<td>Elucidating the role of low molecular weight peptides (&lt; 1 KDa) as Maillard reactant flavour precursors in selected cooked white and red meats using a flavouromics approach</td>
<td>$26,200</td>
</tr>
<tr>
<td>Manitoba Agri-Health Research Network</td>
<td>M. Aliani, C. Taylor &amp; P. Zahradka</td>
<td>Urinary and plasma metabolomics studies of fully characterized Saskatoon berry powder (SBP) fortified yogurt in healthy individuals</td>
<td>$16,900</td>
</tr>
<tr>
<td>Agri-Food Research and Development Initiative (ARDI)</td>
<td>M. Aliani, M. Eskin, P. Zahradka &amp; J. Wigel</td>
<td>Genetic Markers for Flavour Selection in Pork</td>
<td>$84,000</td>
</tr>
<tr>
<td><strong>SALARY:</strong></td>
<td>A Santiago</td>
<td></td>
<td>$12,000</td>
</tr>
<tr>
<td>University of Manitoba Graduate Fellowship Studentship</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL FUNDING:</strong></td>
<td></td>
<td></td>
<td><strong>$139,100</strong></td>
</tr>
</tbody>
</table>

## Collaborative Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Activity/project title/system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Lisa Noelle Cooper, PhD</td>
<td>Department of Anatomy and Neurobiology, NEOMED, Rootstown, OH, USA</td>
<td>Investigating the age of wild bats and a developed method in my metabolomics laboratory will be used to detect potential markers for age in bats.</td>
</tr>
</tbody>
</table>
Fellows/Students Mentored/Supervised

Graduate Students Supervised

PhD
Andrea Edel (co-supervised with G. Pierce)  Jennifer Grant (co-supervised with C. Taylor)
Ala’a Eideh  Shyamchand Mayengbam
Erin Goldberg  John Onuh

MSc
Amalia Santiago (co-supervised with H. Blewett)  Ruiyin Zhou
Le Wang (co-supervised with C. Taylor)

Students Graduated

PhD
John Onuh

Service on Graduate Student Committees

PhD
Jaime Clark  Ethendhar Rajendiran
Cara Isaak  Fatemeh Ramezani Kapourchali
Sunday Malomo  Victoria Sid
Ifeanyi Nwachukwu  Kun Wang

MSc
Aakangchhya Bhusal  Tara Loader
Nazia Chaity  Mark Pinder
Yu Ming Chen  Umar Rassoul
Olena Kloss  Japandeep Sethi
Ying W. Lao  Melissa Tiessen-Dyck
Michelle Leaf  Jennifer Vencuran

Professional Service

External NSERC Discovery Grant reviewer
Member, Institute of Food Technology (IFT)
Member, Metabolomics Society
Member, Analytical Chemistry
Publications

Peer-Reviewed Articles


Abstracts

Mayengbam S, House JD & Aliani M (2015) A non-targeted metabolomics approach to identify potential plasma lipophilic-biomarkers of inadequate vitamin B\textsubscript{6} status, induced by low B\textsubscript{6} intake, exposure to the anti-B\textsubscript{6} factor 1-amino D-proline, or their interaction, in a rat model. Experimental Biology, Boston.

Mayengbam S, House JD & Aliani M (2015) A non-targeted metabolomics approach to identify potential plasma lipophilic-biomarkers of inadequate vitamin B\textsubscript{6} status, induced by low B\textsubscript{6} intake, exposure to the anti-B\textsubscript{6} factor 1-amino D-proline, or their interaction, in a rat model. Canadian Nutrition Society, Winnipeg.


Dr. Hope Anderson
Vascular Biology Laboratory

Dr. Hope Anderson is an Associate Professor and Graduate Chair of Pharmacy with a cross-appointment in the Department of Pharmacology and Therapeutics in the College of Medicine. The goal of her research program is to understand how risk factors for cardiovascular disease, especially hypertension (high blood pressure), cardiac hypertrophy (abnormal growth of the heart), and diabetes promote the development of heart failure. Her ultimate aim is to identify new therapies, perhaps from a nutritional perspective, that prevent or slow the onset of heart failure. To achieve this aim, Dr. Anderson’s laboratory at the St. Boniface Hospital Albrechtsen Research Centre uses several models of cardiovascular disease of escalating complexity ranging from cultured heart muscle cells, to isolated hearts and arteries, to hearts and arteries in vivo.

2015 research in Dr. Anderson’s laboratory focused on the following:

• Protective effects of stilbene derivatives on the cardiovascular system. Stilbenoids refer to a family of bioactive polyphenols, and resveratrol (trans-3,5,4’-trihydroxystilbene) is a representative stilbenoid with salutary effects. There are other stilbenoid compounds with therapeutic potential. Gnetol (trans-3,5,2’,6’-tetrahydroxystilbene) is a structural analog of resveratrol from the genus Gnetum. Gnetum species are used in Asian traditional medicine, and Gnetum extracts are widely used as natural health products. Pterostilbene (trans-3,5-dimethoxy-4’-hydroxystilbene) is a dimethylated analog of resveratrol found in grapes and blueberries, and is used in Ayurvedic medicine to treat coronary heart disease. The effects of pterostilbene and gnetol in the brain circulation, heart, and microvasculature were investigated by Crystal Acosta (Ph.D. student), Bolanle Akinwumi (Ph.D. student), and Danielle Lee (M.Sc. student). These students are supported through the University of Manitoba Faculty of Graduate Studies Graduate Enhancement of Tri-Council Stipends program. Manuscripts reporting the results from these studies are in preparation.

• Elucidation of novel signaling mechanisms underlying cardiac hypertrophy. A specific example includes regulation of heart muscle cell growth by endocannabinoids. These are bioactive lipids that include amides, esters and ethers of long chain polyunsaturated fatty acids and occur naturally within our bodies. Ms. Yan Lu (Ph.D. student) is studying drugs that activate the endocannabinoid system, and their ability to protect against cardiac hypertrophy. Indeed, Ms. Lu has identified distinct effects of a peripherally-restricted CB1/CB2 receptor agonist, and is currently investigating how it affects cardiac myocyte mitochondria. This research project is supported by the Canadian Institutes of Health Research. Ms. Lu is currently writing her Ph.D. thesis. A manuscript reporting the results from her mitochondrial studies is in preparation.
## Funding

<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canadian Institutes of Health Research</td>
<td>H. Anderson</td>
<td>Protective mechanisms of endocannabinoids in cardiac hypertrophy</td>
<td>$125,296</td>
</tr>
<tr>
<td><strong>EQUIPMENT:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leslie F. Buggey</td>
<td>H. Anderson</td>
<td>Professorship in Pharmacy award</td>
<td>$100,000</td>
</tr>
<tr>
<td><strong>SALARY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research Manitoba</td>
<td>Crystal Acosta</td>
<td></td>
<td>$6,000</td>
</tr>
<tr>
<td>JG Fletcher Fellowship for Research in</td>
<td>Crystal Acosta</td>
<td></td>
<td>$14,000</td>
</tr>
<tr>
<td>Functional Foods and Nutraceuticals</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faculty of Graduate Studies - Graduate</td>
<td>Danielle Lee</td>
<td></td>
<td>$2,333</td>
</tr>
<tr>
<td>Enhancement of Tri-Council Stipends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL FUNDING:</strong></td>
<td></td>
<td></td>
<td><strong>$247,629</strong></td>
</tr>
</tbody>
</table>
# Collaborative Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Activity/project title/system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chris Anderson</td>
<td>University of Manitoba</td>
<td>Aberrant neurovascular coupling during hypertension</td>
</tr>
<tr>
<td>Paul Fernyhough</td>
<td>University of Manitoba</td>
<td>Effects of cannabinoid receptor antagonism on cardiac myocyte</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mitochondrial bioenergetics cardiac myocyte mitochondrial</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bioenergetics</td>
</tr>
<tr>
<td>Neal Davies</td>
<td>University of Manitoba</td>
<td>Cardioprotective actions of stilbenoid polyphenols</td>
</tr>
</tbody>
</table>

Zongjun Shao, Caroline Albin, Danielle Lee, Yan Lu, Bolanle Akinwumi, Crystal Acosta

# Teaching Activity

Natural Products PHRM 3430 College of Pharmacy  
Pharmacy Seminar I PHRM 7160 College of Pharmacy  
Pharmacy Seminar II PHRM 7170 College of Pharmacy  
Drugs in Human Disease II PHAC 4040 Pharmacology & Therapeutics
HOPE ANDERSON – Vascular Biology Laboratory

Fellows/Students Mentored/Supervised

Graduate Students Supervised

**PhD**
- Crystal Acosta
- Bolanle Akinwumi
- Yan Lu

**MSc**
- Danielle Lee

**Undergraduate Students Supervised**
- Kevin Chaboyer

Service on Graduate Student Committees

**PhD**
- Jamie Clark
- Andrea Edel
- Yongbo She

Honors and Awards

Leslie F. Buggey Professorship in Pharmacy ($100,000)
Professional Service

Member, University of Manitoba, Faculty of Health Sciences Research Advisory Committee
Member, University of Manitoba Senate Committee on Academic Review
Member, Appeals Committee, Faculty of Graduate Studies
Member, University of Manitoba Internal Grants Peer Review Committee
Member, Program Evaluation Committee, College of Pharmacy
Member, Faculty Council, Faculty of Graduate Studies
Chair - Graduate Studies Committee, College of Pharmacy
Member, Executive Committee, Faculty of Graduate Studies
Member, College of Pharmacy Curriculum Program Subcommittee (Clinical and Applied Sciences Stream)
Internal Review Committee Member, Canadian Institutes of Health Research Doctoral Awards.

Publications

Peer-Reviewed Articles


Bioactive lipids in health and disease
Our laboratory has been examining the role of bioactive lipids in normal and diseased tissues and cells. In particular, we study bioactive metabolites of fatty acids called oxylipins. Prostanoids are one class of oxylipins that are blocked by common drugs such as aspirin. Our current work is demonstrating that early dietary interventions (such as with fish oil and soy protein) alter the levels these bioactive compounds. We have developed comprehensive targeted lipidomic analysis in our laboratory and expanded this work from prostanoids to include over 150 oxylipins. This analysis has led to the discovery of novel compounds in response to dietary interventions (e.g. unique oxylipins produced from dietary flax and canola oil feeding) and unique oxylipin patterns in several types of disorders (e.g. kidney disease, peripheral artery disease, diabetes, obesity) and in response to diet (e.g. dietary lipid and protein). This work also illustrates that fatty acid composition does not necessarily reflect bioactive lipid levels. This has implications for dietary recommendations for fatty acids because they have been based in part on fatty acid composition without knowledge of bioactive lipids.

Dietary interventions in early kidney disease
The laboratory also examines the roles of dietary interventions in the early progression of kidney disease. This includes nutritional, functional food and pharmacological interventions in several types of kidney disease, including polycystic kidney disease (using conditional knockout models), obesity related renal disorders and pediatric forms of renal cyst disease. These studies are being carried out in collaboration with investigators at Fujita Health University in Japan.

High protein diets in obesity and normal weight
Our work on the effects of dietary proteins on normal kidney physiology has implications for the dietary recommendations for dietary protein. Findings in both rat and pig models suggest that, despite the potential benefit of high protein diets on body composition, long-term intakes of protein at the upper limit of the dietary recommendations may compromise renal health. We have also found that high dietary protein ameliorates insulin resistance and hepatic steatosis independent of its effect of reducing obesity, but that the effect of high protein diets on these metabolic syndrome parameters depends on the protein source in the high protein diet.
### Funding

<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canadian Institutes of Health Research</td>
<td>H. Aukema, P. Zahradka &amp; C. Taylor</td>
<td>Effects of dietary essential fatty acids on octadecanoid production and biological actions in obesity-induced inflammation: implications for dietary requirements</td>
<td>$134,793</td>
</tr>
<tr>
<td>Natural Sciences and Engineering Research Council of Canada</td>
<td>H. Aukema</td>
<td>Effects of diet on oxylipins</td>
<td>$40,000</td>
</tr>
<tr>
<td>Canada-Manitoba Agri-Food Research and Development Initiative</td>
<td>H. Aukema</td>
<td>Effect of dietary flaxseed on alpha-linolenic acid (ALA) metabolism</td>
<td>$28,021</td>
</tr>
<tr>
<td>Canada Foundation for Innovation</td>
<td>H. Aukema</td>
<td>Infrastructure Operating Funds</td>
<td>$23,200</td>
</tr>
<tr>
<td><strong>SALARY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research Manitoba/Children’s Hospital Research Institute of Manitoba</td>
<td>Md Monirujjaman</td>
<td></td>
<td>$17,850</td>
</tr>
<tr>
<td>Canadian Institutes of Health Research</td>
<td>Melissa Gabbs</td>
<td></td>
<td>$17,500</td>
</tr>
<tr>
<td>Tri-Council Top-up award from FGS</td>
<td>Melissa Gabbs</td>
<td></td>
<td>$5,000</td>
</tr>
<tr>
<td>University of Manitoba Graduate Fellowship</td>
<td>Md Ariful Islam</td>
<td></td>
<td>$5,000</td>
</tr>
<tr>
<td>Graduate Enhancement of Tri-Council Stipends</td>
<td>Afroza Ferdouse</td>
<td></td>
<td>$4,167</td>
</tr>
<tr>
<td>Graduate Enhancement of Tri-Council Stipends</td>
<td>Youjia Du</td>
<td></td>
<td>$9,000</td>
</tr>
</tbody>
</table>
Collaborative Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Activity/project title/system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shizuko Nagao</td>
<td>Fujita Health University</td>
<td>Models of polycystic kidney disease</td>
</tr>
<tr>
<td>Matt Picklo</td>
<td>Grand Forks Human Nutrition Research Centre</td>
<td>Dietary studies in experimental models</td>
</tr>
<tr>
<td>Stefan Somlo/Jing Zhou</td>
<td>Yale University/ Harvard University</td>
<td>Establishing the Yale PKD Research Core Center (NIH P30 Core Center Grant)</td>
</tr>
</tbody>
</table>

Fellows/Students Mentored/Supervised

**Graduate Students Supervised**

**PhD**
- Jessay Gopuran
- Naser Ibrahim
- Md Monirujjaman
- Adriana Mudryj (co-supervised with N. Yu)

**MSc**
- Md Ariful Islam
- Afroza Ferdouse
- Melissa Gabbs
- Shan Leng

**Undergraduate Students Supervised**
- Lucien Cayer
- Chelsea Penner
- Nikhil Sidhu

**Students Graduated**

**PhD**
- Naser Ibrahim
Service on Graduate Student Committees
PhD
Pengqi Wang

MSc
Alaleh Boroomand  Qian Li
Youjia Du        Rachel Serle
Lena Hong        Mihiiri Witharana
Alie Johnston

Professional Service

CIHR Nutrition, Food and Health Peer Review Committee
CIHR College of Reviewers
NSERC External Reviewer
Chair of Membership Committee for the Canadian Nutrition Society
Chair of Fort Garry Animal Care Committee
Mitacs Grant reviewer
Lipids Associate Editor
Organizing committee, Northern Great Plains Lipids Conference

Outreach Activity

Poster judge for Child Health Research Day, October
Session Chair, Annual Meeting of the Canadian Nutrition Society
Reviewer of BMO scholarships for CCARM
Gave presentations to PSYC 4520 on animal ethics at the U of M
Pre-review of 2 NSERC grants – Taylor, Myrie
Chair PhD exam
Board member for CanU, a Winnipeg-based charity that runs an after-school program for children from priority schools in Winnipeg and surrounding areas

Publications

Peer-Reviewed Articles


Abstracts


**Invited Presentations**

* Dietary seed oil effects on kidney oxylipins reveal surprising effects of fatty acids, American Oil Chemists’ Annual Meeting, Orlando, 2015.
Dr. Heather Blewett was on maternity leave during March 2015-2016. Science education started early for Madelyn Blewett with blocks showing the elements of the periodic table.

Data collection was completed for the following trial in November 2015: “A dose response, randomized, controlled, double-blind, cross-over trial to determine the LDL cholesterol lowering effects of ground flaxseed in adults with above optimal plasma LDL concentrations”. Analysis of the food records and blood/urine samples for fatty acid composition, mammalian enterolignans and various other metabolites is ongoing. We welcomed Heidi Pylypjuk into the lab in August 2015 as the coordinator for the following project: A randomized, controlled, cross-over trial examining the effect of peas on post-prandial glucose response in healthy adults. This trial is divided into 2 arms. Arm 1=rice vs. peas; Arm 2=potato vs. peas. A total of 24 participants will complete each arm of the trial. Recruitment began in October 2015 and is expected to be completed by December 2016.
The food product for the following project was changed from bannock to waffles: “Development of high beta-glucan barley bannock and clinical trial testing of its effect on postprandial glucose and appetite control.” The regulatory approvals are in place and recruitment into the postprandial glucose trial is expected to begin in summer 2016.

Through collaboration with the Netticadan lab as part of the project titled, “Examination of the in vivo cardio-protective potential of the berry anthocyanin, cyanidin 3-O-glucoside (C3G).” the Blewett lab measured the effect of C3G on T-cell activation in spontaneously hypertensive rats in August-September 2014. We are currently analyzing the data and hope to have some exciting results to report.

We have been working on getting an apoptosis assay (programmed cell death) up and running on our flow cytometer for our collaboration with Chris Siow’s lab as part of the project titled, “Lingonberry: Characterization and preserving an emerging bioresource for Canada”.

Dr. Blewett is part of a collaborative research team working on a project titled, “The Manitoba Personalized Lifestyle Research (TMPLR) Program”. The objective is to bring together a team of Manitoba researchers to implement a cross-sectional study spanning multiple health and scientific disciplines. This program will identify the complex interactions that exist between lifestyle, genetics and gut microbiota and explore how these relate to risk factors for chronic conditions in Manitoba. The interdisciplinary team is managed by Dr. Peter Jones as the Senior Director and Dr. Meghan Azad as the Junior Director. The research program will be centred on five components: Nutrition (Project lead Dr. Blewett), Physical activity (Project lead Dr. Duhamel), Sleep (Project lead Dr. McMillan), Genetics (Project lead Dr. Eck) and Gut microbiota (Project lead Dr. Khafipour).

In collaboration with the other CCARM AAFC research scientists (with Dan Brown as the PI) a project on ginseng berries was approved in 2015. Blewett’s role in the project will be screening ginseng varieties for their immune modulating health benefits.
## Funding

<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada</td>
<td>C. Siow et al.</td>
<td>Ligonberry: Characterization and preserving an emerging bioresource for Canada</td>
<td>$1,000</td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada</td>
<td>H.J. Blewett, N. Ames &amp; S. Ludwig</td>
<td>Development of high beta-glucan barley bannock and clinical trial testing of its effect on postprandial glucose and appetite control</td>
<td>$17,500</td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada</td>
<td>D. Ramdath, H.J. Blewett, S. Tosh, Q. Liu, R. Cao, M. Aliani, &amp; A. Duncan</td>
<td>Blood glucose attenuation and satiety levels in humans following consumption of whole lentil and yellow pea and their food products; effect of processing and starch fractions.</td>
<td>$90,000</td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada</td>
<td>T. Netticadan, J. McCallum, C. Kirby, H.J. Blewett &amp; J. Wigle</td>
<td>Examination of the in vivo cardio-protective potential of the berry anthocyanin, cyaniding 3-o-glucoside</td>
<td>$12,500</td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada</td>
<td>D Brown, C Siow, T Netticadan, H Blewett</td>
<td>Characterization of Heritage Ginseng</td>
<td>$9,000</td>
</tr>
<tr>
<td><strong>SALARY:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada Salary Support</td>
<td></td>
<td></td>
<td>$89,086</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL FUNDING:</strong></td>
<td></td>
<td></td>
<td>$219,086</td>
</tr>
</tbody>
</table>
### Collaborative Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Activity/project title/system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peter Jones, Meghan Azad, Peter Eck, Sharon Bruce, Jared Carlberg, Amir Ravandi, Ehsan Khafipour, Todd Duhamel, Navdeep Tangri, Semone Myrie, Lisa Lix, Diana McMillan, Kristy Wittmeier</td>
<td>University of Manitoba</td>
<td>The Manitoba Personalized Lifestyle Research (TMPLR) Program</td>
</tr>
<tr>
<td>Dan Ramdath</td>
<td>AAFC, Guleph</td>
<td>Blood glucose attenuation and satiety levels in humans following consumption of yellow pea and their food products; effect of processing and starch fractions</td>
</tr>
<tr>
<td>Nancy Ames</td>
<td>AAFC, RCFFN</td>
<td>Development of high beta-glucan barley waffles and clinical trial testing of its effect on postprandial glucose and appetite control</td>
</tr>
<tr>
<td>Sora Ludwig</td>
<td>St. Boniface Hospital</td>
<td>Barley and pea postprandial glucose response trials</td>
</tr>
</tbody>
</table>

### Fellows/Students Mentored/Supervised

**Graduate Students Supervised**

**PhD**

Basma Aloud (co-supervised with T. Netticadan)

**MSc**

Amalia Santiago (co-supervised with M. Aliani)

**Service on Graduate Student Committees**

**MSc**

Adrianne Cardillo

Danielle Lee
Professional Service

Member of the SBGH-Research General Safety and Bio-Safety Sub-Committee
Member of AAFC’s Human Research Ethics Committee.
Associate Editor for the journal Applied Physiology, Nutrition, and Metabolism.
Adjunct Professor in the Departments of Physiology & Pathophysiology and Human Nutritional Sciences

Publications

Peer-Reviewed Articles


In 2015, work in the laboratory was supported by three different research operating grants and four equipment grants and was focussed on three different crops; that is, Lingonberries, North American ginseng, and Prunus sp.. The research on lingonberry with Dr. Chris Siow was part of the MSc. thesis work of Ms. Aakangchhya Bhusal and showed that Northern Manitoba-grown fruit had extremely high anti-oxidant levels as compared to Newfoundland greenhouse-grown fruit and the fruit was composed of some 4000 separate compounds based on a metabolomics screen done in cooperation with Dr. Michel Aliani of CCARM. Based on these and other novel findings in the laboratory of Dr. Chris Siow, a new research proposal was prepared under the lead of Dr. Chris Siow (and subsequently funded) to look at the potential health benefits of these fruits with respect to ischemia/reperfusion protection.

Work on evaluating the tremendous compositional and bioactivity variation observed in the North American Ginseng (Panax quinquefolius) crop continued in 2015 with the completion of a 4-year field trial with the Ontario Ginseng Growers Association and C and R Atkinson Farms of St Williams, Ontario. The cooperation with commercial growers was an important and unique aspect of the work in being able to sample not only experimental material but also commercial material grown under the care and protocols used by commercial growers. Preliminary analysis of the compositional data from the field trial showed that previously observed variability in ginsenoside levels (a measure used to track quality) in commercial material varied by 5-fold between individual clonal lines but did not vary much within clonal lines in the controlled plots. This strongly indicated that ginsenoside content is a genetic trait and can be one criteria used for germplasm improvement and a strong candidate for focus in efforts to stabilize and improve crop quality and subsequent bioactive activity. Work with the laboratories of Dr. Thomas Netticadan and Dr. Chris Siow also showed that phenolics fraction from ginseng berries has strong ischemia/reperfusion protection and the variation in anti-oxidant bioactivity was correlated with the presence and content of five separate compounds in the phenolic fraction. Work will continue on these two aspects of bioactivity.

The laboratory completed another long term project that has been on going with the Agriculture and Agri-Food Canada London Research and Development Centre as part of a national program on the development of resistance to Plum Pox Virus in Prunus sp. This nationally coordinated project was generously supported for over 15 years by the Canadian Food Inspection Agency and was very capably led since 2011 by Dr. Aiming Wang of the London AAFC Centre. The induction of resistance by use of small interfering RNA species generated by simultaneously targeting the 5’ and 3’ conserved
genomic regions of the virus was demonstrated in plum and was an extension of our much earlier work, reported in 2006, that showed the approach was feasible using the model *N. benthamiana* system. A second approach to generating resistance to this virus by using mutagenesis of *in vitro*-produced seedlings was also reported on in 2015. Our research work was communicated by three peer reviewed publications and three conference presentations in national and international venues as well as through local interviews, numerous visiting tours at the Centre and through radio discussions on CJOB’s Health Report.

Dr. Miyoung Suh (Affiliate), Dr. Michel Aliani, Dr. Chris Slow, Aakangchhya Bhusal, Dr. Dan Brown
## Funding

<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPERATING:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food</td>
<td>C. Siow &amp; D. Brown</td>
<td>Lingonberry: Characterisation and preserving an emerging bioresource for Canada</td>
<td>$15,590</td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food</td>
<td>D. Brown et al.</td>
<td>Control of PPV through development of Genetic and Induced Innate Resistance</td>
<td>$62,500</td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food</td>
<td>D. Brown, C. Siow, T.</td>
<td>Characterization of Heritage Ginseng</td>
<td>$59,119</td>
</tr>
<tr>
<td>Canada</td>
<td>Netticadan, H. Blewett</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EQUIPMENT:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food</td>
<td>D. Brown</td>
<td>Osmometer</td>
<td>$7,944</td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food</td>
<td>D. Brown</td>
<td>UPS battery system</td>
<td>$6,091</td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food</td>
<td>D. Brown</td>
<td>HPLC Autosampler and column</td>
<td>$18,379</td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food</td>
<td>D. Brown</td>
<td>Analytical Balance</td>
<td>$3,737</td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SALARY:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food</td>
<td>EG Research Technician</td>
<td></td>
<td>$71,856</td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL FUNDING:</td>
<td></td>
<td></td>
<td>$245,216</td>
</tr>
</tbody>
</table>
## Collaborative Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Activity/project title/system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ed Lui</td>
<td>University of Western Ontario</td>
<td>Immune regulation / Characterization of Heritage Ginseng</td>
</tr>
<tr>
<td>Carl Atkinson</td>
<td>Atkinson Farms</td>
<td>Field study, ginseng clonal lines</td>
</tr>
<tr>
<td>Dr. Aiming Wang</td>
<td>London Research and Development Centre, Agriculture and Agri-Food Canada</td>
<td>Virus infection in <em>Prunus</em> sp.</td>
</tr>
</tbody>
</table>

### Fellows/Students Mentored/Supervised

#### Graduate Students

**MSc**
Aakangchhya Bhusal (co-supervised with C. Siow)

#### Undergraduate Students

Cindy Yan

### Professional Service

- Member, St. Boniface Hospital Research Enterprise Committee
- Member, CCARM Program Committee
- Co-Chair, St. Boniface Hospital Research Centre, Safety Committee
- Member, St. Boniface Hospital Research Centre, Support Committee
- Director, Manitoba Agri-Health Research Network
- Center Leader, CCARM

### Publications

**Peer-Reviewed Articles**


Abstracts


Dr. Randolph Guzman
Vascular Surgery Research
Professor of Surgery and Head, Section of Vascular Surgery
University of Manitoba
Regional Lead, Section of Vascular Surgery, WRHA
Site Medical Manager, Department of Surgery
St. Boniface Hospital

Dr. Randolph Guzman MD, FRCSC, FACS, RVT, RPVI is the Director of the Vascular Clinical Research Program at the Asper Clinical Research Institute, St. Boniface Hospital which consists of a full time Clinical Research Nurse/Coordinator and two part-time Research Assistants. His experience has included various clinical research trials with the vascular/vascular surgery population including outpatient and inpatient pharmaceutical trials, surgical and endovascular interventions and diagnostic imaging on a local, national, and international level. Dr. Guzman has been a principal investigator for 42 research studies and a co-investigator for 25 research studies. Currently, there are eight clinical trials and two research projects ongoing.

For more information, see his webpage:  http://www.sbrc.ca/ccarm/faculty/dr-randy-guzman/
We continued to establish cardiovascular and metabolic benefits of wild rice, Saskatoon berries, Chinese germinated brown rice and corn fractions. We completed our previous investigation of combination of wild rice and phytosterols on prevention of atherosclerosis in LDL-R-KO mice. A manuscript was generated and submitted to the Journal of Nutritional Biochemistry. We have plans to continue our investigation of possible mechanisms of anti-atherogenic activities of wild rice. We will study metabolic activities of okra. I will apply for URGP and other sources for funding. I will accept new graduate students and post-doctoral fellows. We will conclude our project on Chinese germinated brown rice. Nora Ghazzawi will complete her MSc program. Kabo Masisi will complete his experiments and start writing up his thesis for 2017 graduation. We will submit new manuscripts for publication.
## Funding

<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Sciences and Engineering Research Council</td>
<td>M. Moghadasian</td>
<td>Mechanisms of anti-atherogenic activities of wild rice</td>
<td>$28,000</td>
</tr>
<tr>
<td>Government of Saudi Arabia</td>
<td>M. Moghadasian &amp; N. Ghazzawi</td>
<td>Investigation of cardiovascular benefits of Chinese brown rice</td>
<td>$5,000</td>
</tr>
<tr>
<td>Huazhong Agricultural University, China</td>
<td>M. Moghadasian &amp; L. Chan</td>
<td>Lipid profile of seabuckthorn</td>
<td>$4,000</td>
</tr>
<tr>
<td>ARDI/INR</td>
<td>M. Moghadasian</td>
<td>Anti-diabetic effects of Saskatoon berries</td>
<td>$26,000</td>
</tr>
<tr>
<td><strong>SALARY:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Sciences and Engineering Research Council</td>
<td>Tamara Paetsch</td>
<td></td>
<td>$4,500</td>
</tr>
<tr>
<td><strong>TOTAL FUNDING:</strong></td>
<td></td>
<td></td>
<td>$67,500</td>
</tr>
</tbody>
</table>
## Collaborative Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Activity/project title/system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garry Shen</td>
<td>University of Manitoba</td>
<td>Cardiovascular benefits of Chinese germinated brown rice</td>
</tr>
<tr>
<td>Trust Beta</td>
<td>University of Manitoba</td>
<td>Cardiovascular benefits of corn fractions</td>
</tr>
<tr>
<td>Rita Rezzani</td>
<td>University of Brescia, Italy</td>
<td>Aging processes in experimental animals</td>
</tr>
<tr>
<td>Charles O. Olaiya</td>
<td>University of Ibadan, Nigeria</td>
<td>Cardiovascular benefits of okra</td>
</tr>
</tbody>
</table>

![Khuong Le](image)
Teaching Activity

Functional Foods and Nutraceuticals HNSC/FOOD Sc 4540 Human Nutritional Sciences, Agricultural and Food Sciences
Nutrition for Health and Changing Lifestyles HNSC 1210 Human Nutritional Sciences, Agricultural and Food Sciences
Nutrition Through the Life Cycle HNSC 2130 Human Nutritional Sciences, Agricultural and Food Sciences
Seminars in nutrition HNSC 7200 HNS, Human Nutritional Sciences, Agricultural and Food Sciences

Fellows/Students Mentored/Supervised

Graduate Students Supervised

PhD
Esan Adewale
Kabo Masisi
Li Chen

MSc
Nora Ghazzawi

Undergraduate Students Supervised
Hiba Khawar
Rokiatou Kone
Tamara Paetsch

Service on Graduate Student Committees

PhD
Ala’a Eideh
Jennifer Grant
Kabo Masisi
Vitoria Ndolo

MSc
Manoj Mohan
Anthonia Olatinsu
Hui Xu

Professional Service

We continued to provide histological services to our colleagues at SBHRC.
Editorial Board member for Molecular and Cellular Biochemistry plus Transplant Research and Risk Management
Reviewer for journal articles for several journals
Chair, Graduate Studies Committee in HNS
Outreach Activity

We continued to help with CCARM-related activities including Ag in the City, meeting with visitors, participating in seminars, etc.

Publications

Peer-Reviewed Articles


Abstracts


In 2015, we examined the cardioprotective effects of the bioactives, cyanidin glucoside and resveratrol in an animal model of hypertensive heart disease and ischemic heart disease, respectively, as well as in an in vitro model of heart disease – diseased adult rat cardiomyocytes. In addition, we also examined the protective effects of conjugated linoleic acid in our in diseased adult rat cardiomyocytes. The molecular mechanisms underlying the effects of these bioactives were examined in a cell culture model of heart disease and in the heart tissues from the animal models. In 2015, we also collaborated with Dr. Michel Aliani on his project examining the antioxidant effects of chicken skin peptides, and with Dr. Harold Aukema on his project examining the cardioprotective effects of dietary proteins and oils in an animal model of chronic kidney disease.

### Funding

<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada</td>
<td>T. Netticadan, J. McCallum, H. Blewett &amp; J. Wigle</td>
<td>Examination of the in vivo cardioprotective effect of the berry anthocyanin cyanidin 3-O-glucoside in an animal model of heart disease</td>
<td>$33,172</td>
</tr>
<tr>
<td><strong>SALARY:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada Salary Support</td>
<td></td>
<td></td>
<td>$68,000</td>
</tr>
<tr>
<td>St. Boniface Hospital Foundation Studentship</td>
<td>Pema Raj</td>
<td></td>
<td>$22,650</td>
</tr>
<tr>
<td>Libyan Program for International Education Scholarship</td>
<td>Basma Aloud</td>
<td></td>
<td>$18,000</td>
</tr>
<tr>
<td><strong>TOTAL FUNDING:</strong></td>
<td></td>
<td></td>
<td><strong>$141,822</strong></td>
</tr>
</tbody>
</table>
Fellows/Students Mentored/Supervised

Graduate Students Supervised

PhD
Basma Aloud (co-supervised with H. Blewett) Pema Raj

Service on Graduate Student Committees

PhD
Shivika Gupta Raghu Nagalingam

MSc
Danielle Lee

Professional Service

Served as the Chair of the "Cardioprotection with Phytochemicals" session in the International Symposium on Phytochemicals in Medicine and Food held in Shanghai, China in June 2015.

Chair, Local Animal User Committee, St. Boniface Hospital Research Centre

Outreach Activity

Coordinator, CCARM Food for Thought Seminar Series

Publications

Peer-Reviewed Articles

Invited Presentations
Our current research mainly focuses on the molecular mechanisms of metabolic disorders, ischemia-reperfusion induced acute kidney injury (AKI) and health related benefits of agriculture products in humans and animals. Specifically, we investigate molecular mechanisms and cellular targets in multi-experimental models including (1) antioxidant properties using the in vitro and in vivo assays, (2) inflammatory responses by measuring biomarkers to detect inflammation in humans and livestock at the molecular, protein and gene levels, (3) regulation of lipid metabolism, and (4) functional evaluation including blood parameters, lipoprotein profile, enzyme activities, cardiovascular, liver and kidney functions. Understanding the molecular mechanisms that are responsible for abnormalities in blood vessels and multiple organs is important in developing effective strategies for treatment and prevention of cardiovascular disease and renal dysfunction associated with a single or multiple risk factors i.e. hyperhomocysteinemia, obesity, dyslipidemia, fatty liver disease, kidney ischemia-reperfusion injury. Functional evaluation including blood parameters, lipoprotein profile, enzyme activities, cardiovascular, liver and kidney functions. Understanding the molecular mechanisms that are responsible for abnormalities in blood vessels and multiple organs is important in developing effective strategies for treatment and prevention of cardiovascular disease and renal dysfunction associated with a single or multiple risk factors i.e. hyperhomocysteinemia, obesity, dyslipidemia, fatty liver disease, kidney ischemia-reperfusion injury.
Funding

<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPERATING:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Sciences and Engineering Research Council</td>
<td>K. O</td>
<td>Regulation of cystathionine-beta-synthase (CBS) mediated hydrogen sulfide (H2S) production and its biological function</td>
<td>$36,000</td>
</tr>
</tbody>
</table>

| TOTAL FUNDING: | $36,000 |

Teaching Activity

Special Physiology PHGY7030 Physiology and Pathophysiology, Faculty of Medicine
Advanced Applied Animal Nutrition ANSC 7540 Animal Science, Agricultural and Food Sciences
Advanced Animal Science Seminar ANSC7390 Animal Science, Agricultural and Food Sciences
Cell Biology IMED7090 Physiology and Pathophysiology, Faculty of Medicine

Fellows/Students Mentored/Supervised

Graduate Students Supervised

PhD
Lindsei Sarna (co-supervised with C. Siow)  Victoria Sid
Yvette Shang  Pengqi (Peggy) Wang

MSc
Sirini Amarakoon

 Undergraduate Students
Melissa Wong (co-supervised with C. Siow)

 Students Graduated
Lindsei Sarna (PhD) (co-supervised with C. Siow)  Pengqi (Peggy) Wang (PhD)
Service on Graduate Student Committees

**PhD**
Jessay Devassy  
Andrea Edel  
Yan Lu  
Shyamchand S. Mayengbam

**MSc**
Dorothy Moseti  
Sara Raposo  
Ruiyin Zhou

**Honours and Awards**
Original paper (Sid et al 2015, Am J Physiol Regul Integr Comp Physiol 309:R1215-R1225) was selected as one of the 8 best original research papers (APSselect Dec 2015) published by the American Physiological Society. This article was selected from the most outstanding recently published papers from the ten research journals that are published by the American Physiological Society.
Publications

Peer-Reviewed Articles


Abstracts


I am pleased to report that we have had another successful year of research in 2015. Our research focus on flaxseed has resulted in 3 more peer reviewed papers. Another paper on trans fats continues our interest in the deleterious effects of this nutritional component on our cardiovascular health. In two more publications, the molecular mediators of cardiovascular disease have been discussed as well as the mechanism whereby cells become aware of their environment and stresses and respond appropriately under both healthy and disease conditions. I am proud of the work done by our team to generate these findings. Our students in particular have been recognized for their contributions in research with 12 awards last year alone. Their dedication and enthusiasm for science is what keeps me motivated and ready for yet another year of discovery and advancements in medical research. My thanks to the infrastructure provided by the University of Manitoba, Agriculture and Agri-Food Canada, St Boniface Hospital and St Boniface Hospital Foundation as well as the many funding organizations which directly contribute to our work and make it all possible. Without the incredible support staff we have throughout the research enterprise at St Boniface Hospital, we could not complete a fraction of the work that we do. THANK YOU ALL!!
### Funding

<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canadian Institutes of Health Research</td>
<td>G. Pierce</td>
<td>Regulation of nuclear protein import in cardiovascular states</td>
<td>$107,415</td>
</tr>
<tr>
<td>Canadian Institutes of Health Research</td>
<td>G. Pierce</td>
<td>The anti-hypertensive action of dietary flaxseed in hypertensive patients</td>
<td>$124,916</td>
</tr>
<tr>
<td>Canadian Institutes of Health Research</td>
<td>G. Pierce</td>
<td>The use of flaxseed as a dietary intervention to modify cardiovascular disease</td>
<td>$140,565</td>
</tr>
<tr>
<td>Agri-Food Research and Development Initiative (ARDI)</td>
<td>G. Pierce</td>
<td>The effect of dietary flaxseed on patients with high blood pressure</td>
<td>$45,387</td>
</tr>
<tr>
<td>Western Grains Research Foundation</td>
<td>G. Pierce</td>
<td>The effect of dietary flaxseed on patients with high blood pressure</td>
<td>$52,195</td>
</tr>
<tr>
<td>SaskFlax</td>
<td>G. Pierce</td>
<td>The Hyperflax Trial</td>
<td>$50,000</td>
</tr>
<tr>
<td><strong>SALARY:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CIHR Doctoral Research Award</td>
<td>Stephanie Caligiuri</td>
<td></td>
<td>$23,333</td>
</tr>
<tr>
<td>Research Manitoba Scholarship</td>
<td>Stephanie Caligiuri</td>
<td></td>
<td>$6,000</td>
</tr>
<tr>
<td>GETS and MSc Studentship Award</td>
<td>Thomas Hedley</td>
<td></td>
<td>$10,500</td>
</tr>
<tr>
<td>Research Manitoba Scholarship</td>
<td>Riya Ganguly</td>
<td></td>
<td>$6,000</td>
</tr>
<tr>
<td><strong>TOTAL FUNDING:</strong></td>
<td></td>
<td></td>
<td>$566,311</td>
</tr>
</tbody>
</table>
Teaching Activity

Hemodynamics and Atherosclerosis, Dept. of Physiology and Pathophysiology

Fellows/Students Mentored/Supervised

Graduate Students Supervised

PhD
Stephanie Caligiuri
Andrea Edel
Riya Ganguly

MSc
Thomas Hedley

Undergraduate Students Supervised

Melissa Kenneth
Graham Maddaford
David Nelson
Jordon Nelson

Service on Graduate Student Committees

PhD
Crystal Acosta
Pema Raj

MSc
Tara Loader
Rachel Searle
Victoria Sid

Professional Service

Member, Board of Directors of the Manitoba Medical Service Foundation
Member, Board of Directors of the International Academy of Cardiovascular Sciences
Member, Board of Directors, Diabetes Research and Treatment Centre
Member, Genome Prairie Board of Directors
Member, Executive Council, International Academy of Cardiovascular Sciences.
Member, Board of Directors of Friends of CIHR
President, International Academy of Cardiovascular Sciences, North American Section

Honors & Awards

Laufberger Medal from the Czech Physiological Society and the Czech Medical Society in Recognition of Scientific Excellence and Contributions to the Enhancement of International Scientific Collaborations.
Publications

Peer-Reviewed Articles


Invited Presentations
Society for Clinical Research Associates Annual Meeting, Denver, USA
2015 Canadian Hypertension Congress, Mississauga, Ontario, Canada
XI World Congress of the International Society for Adaptive Medicine, Yonago, Japan
European Section Meeting of the International Academy of Cardiovascular Sciences, Belgrade, Serbia
Advances in Cardiovascular Research from Bench to Bedside, International Symposium, Congress Center of the Slovak Academy of Sciences, Bratislava, Slovakia
Plenary Speaker, Natural Products Expo West, Anaheim Convention Center, Anaheim, California, USA
25th Scientific Forum of the Saint Francis of Assisi Cardiovascular Foundation – Servcor, Vitoria, Brazil
Plenary Speaker, 3rd Postdoctoral Joint Meeting, Buenos Aires, Argentina
Plenary Speaker, Grainworld 2015, Canada’s Annual Ag Outlook Forum Winnipeg, Manitoba, Canada
Cardiac Signalling Center, Regenerative Medicine and Cell Biology, University of South Carolina, Charleston, USA
The Bures Lecture, Czech Academy of Sciences, Prague, Czech Republic
The 2nd Annual Joint Cellular and Molecular Medicine / Neuroscience Research Day, University of Ottawa, Ottawa, Canada
The research focus of our laboratory remains to be Evidence-Based Agri-Food with the aims to study how agri-food and herbal medicinal products exert their effects and to develop innovative strategies for disease prevention and management.

Three AAFC-funded projects were in progress this fiscal year. In the first project (Lingonberry: Characterization and Preserving an Emerging Bioresource for Canada), the health benefits of Northern Manitoba lingonberry was characterized and the results published. In the second project (Developing innovative technologies to accelerate industry transition from “wild” to cultivated cool climate berry crop production systems), a study on the effects of blueberry extracts on oxidative stress in H9c2 cells was conducted. Twelve blueberry cultivar samples were extracted and tested for their ability to reduce oxidative stress induced by simulated ischemia-reperfusion. None of the samples were found to significantly reduce intracellular oxidative stress. In the third project initiated this year, it was proposed to discover new health attributes and bioactives that will be used to establish a stable and superior ginseng germplasm for Canadian grown ginseng to ensure the future sustainable production and sales of this high quality crop. The approach can be used as a model for the application of genomics and targeted germplasm improvement for valued attributes associated with human health.

Following an AAFC news release entitled “Lure of the Lingonberry: Win-Win for Northern Agriculture and Heart Health” from the Public Affairs Branch of AAFC on the lingonberry research conducted by my team, there was a tremendous response from print and online media. Following subsequent news report in regional and local print media and live radio interviews there have been several enquiries from growers in Quebec and Manitoba. Additionally, listeners of the radio interviews have complimented our team in bringing the ‘ground-breaking” research to the public domain and making known the health benefits of the lingonberries (known as low-bush cranberry in northern Manitoba/Saskatchewan or mossberry in Lynn Lake) to the northern communities. Callers from Churchill, Thompson and Lynn Lake, Manitoba and from Creighton, Saskatchewan have commented that they have seen lots of these berries in the wild and some did not even know the proper name for them until they have associated what they have heard from my radio interviews and the picture that was posted online by the radio show host. Dave Buck, a retired manager of the Northern Forest Diversification Centre in Manitoba, later emailed me that he was excited about the opportunities for northern communities, both economically and nutritionally and made suggestions for potential developments to both provincial and federal officials. My PhD student, Cara Isaak, was also invited to write a chapter entitled, “Lingonberry: A superfood for Canada’s climate” in the book, The 2016 Prairie Garden. Our laboratory was also involved in engaging the public through our exhibit at the 100th Anniversary of Morden Research Station. Thus, through the research on lingonberry by my team, we have
brought awareness, from general to specific knowledge, of this emerging bioresource to the Canadian public and touched the lives of many.

The laboratory also had a returning summer research student to assist in its research activities: Melissa Wong, is an undergraduate B.Sc. (Genetics) student from Western University.

## Funding

<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPERATING:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada</td>
<td>C. Siow et al.</td>
<td>Lingonberry: Characterization and Preserving an Emerging Bioresource for Canada</td>
<td>$17,310</td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada</td>
<td>S. Debnath et al.</td>
<td>Developing innovative technologies to accelerate industry transition from “wild” to cultivated cool climate berry crop production systems</td>
<td>$10,000</td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada</td>
<td>D Brown, C Siow, T Netticadan, H Blewett</td>
<td>Characterization of Heritage Ginseng</td>
<td>$17,500</td>
</tr>
<tr>
<td>SALARY:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research Manitoba PhD Studentship</td>
<td>Cara Isaak</td>
<td></td>
<td>$17,850</td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada</td>
<td>Technical Assistant</td>
<td></td>
<td>$74,728</td>
</tr>
</tbody>
</table>

**TOTAL FUNDING:** $137,388
### Collaborative Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Activity/project title/system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samir Debnath</td>
<td>Atlantic Cool Climate Crop Research Centre, St John’s, NL</td>
<td>Bioactivity/lingonberry cultivars from Atlantic Canada, Europe</td>
</tr>
<tr>
<td>Kelly Ross</td>
<td>Pacific Agri-Food Research Centre, Summerland, BC</td>
<td>Bioactivity/Lingonberry-derived polysaccharides</td>
</tr>
</tbody>
</table>

Visit from Dr. Brian Gray (Assistant Deputy Minister, Science & Technology Branch, AAFC)  
Suvira Prashar, Cara Isaak, Melissa Wong, Dr Brian Gray & Dr. Chris Siow

### Teaching

Fundamentals of Medical Physiology PHGY 1030 Physiology & Pathophysiology/Health Sciences  
Physiology & Pathophysiology for Physician Assistants I PAEP 7000 Physiology & Pathophysiology/Health Sciences  
Neurosciences: Neurotransmission & Neurotransmitters PGY- PGY-4 Didactic Seminar Series Psychiatry/Health Sciences
Fellows/Students Mentored/Supervised

Graduate Students Supervised

PhD
Cara Isaak
Lindsei Sarna (co-supervised with K O)

MSc
Aakangchhya Bhusal (co-supervised with D Brown)

Undergraduate Students
Melissa Wong (co-supervised with K O)

Students Graduated

PhD
Lindsei Sarna (co-supervised with K O)

Service on Graduate Student Committees

PhD
Victoria Sid

MSc
Amalia Santiago
Le Wang

Outreach Activity

Ag in the City
Winnipeg Free Press (March 31, 2015) interview for article “Superfruit even more super grown here”.
CBC Radio One’s Noon Show (April 1, 2015 hosted by Janet Stewart ) live interview on “Lingonberry research for Northern Manitoba”
The Western Producer (May 14, 2015) interview for article, “Growers wanted to test lingonberry hybrids”.  
CBC Radio One’s Weekend Morning Show (May 9, 2015 hosted by Terry MacLeod) live interview on “Lingoberry research shows Manitoba berries much higher in super food properties”
Manitoba Co-operator (June 24, 2015) interview for article, “Wild or farmed? Lingonberries seek place in Manitoba agriculture”.


Publications

Peer-Reviewed Articles


This article was selected as one of the 8 best original research papers (APSselect Dec 2015) published by the American Physiological Society. This article was selected from the most outstanding recently published papers from the ten research journals published by the American Physiological Society.

Abstracts


Invited Presentations
Carleton Breakfast Club, Manitoba Legislature
Dr. Carla Taylor  
Metabolic Nutrition Laboratory

The Metabolic Nutrition Laboratory focuses on the investigation of dietary components and their effects on metabolism, particularly in the context of obesity and insulin resistance as these are key factors leading to the development of type 2 diabetes and cardiovascular disease. The scientific approach uses dietary interventions in both animal models and human studies, and investigates their effects at the whole body to molecular levels. Research in progress this year included the investigation of plant-based versus marine-based omega-3 fatty acids in a model of obesity and insulin resistance, effects of conjugated linoleic acid using cultured adipocytes and a mouse model of obesity, effects of dietary fatty acids and their oxylipin metabolites on endothelial cells, and application of metabolomics to elucidate biomarkers of obesity and biomarkers associated with the positive effects of pulses on blood pressure and large artery remodelling in rodent models. Several human studies were in progress, including those investigating canola oil in individuals with metabolic syndrome, bioavailability of compounds present in dried beans and lentils, glycemic index and bioavailability of compounds in Saskatoon berry frozen yogurt, and identifying blood biomarkers present in peripheral artery disease. Recruitment was completed at our site for our involvement in a multi-site trial (Richardson Centre for Functional Foods and Nutraceuticals, Laval University, University of Toronto and Pennsylvania State University) investigating effects of canola oil on body composition and lipid metabolism in participants with metabolic syndrome. Our site and Penn State conducted an assessment of vascular function known as flow-mediated dilatation (FMD); we received valuable training in this procedure from our colleagues at Penn State and hope to apply it in future studies at CCARM.

Several multi-year grants, as principal investigator (PI) and co-investigator (Co-I), were in progress. As Co-I, new funding was obtained to continue our research on buckwheat (Agri-food Research Development Initiative) and pulses/dried beans (Manitoba Pulse Growers Association), and blood biomarkers of disease (MITACs).

This was a very good year for publications: 11 refereed publications and 1 commentary; each of these publications represents long-standing multi-disciplinary collaborations. The publications include both animal models and human studies and report on the effects of conjugated linoleic acid, zinc, high protein diets, or barley tortillas in relation to metabolic disease as well as stability of blood biomarkers and metabolomics markers for obesity, and the diets of older marathon runners. There were 3 refereed papers in Nutrition Review, a high impact journal (IF=6.1) for the nutrition field. The research program and key findings were communicated to the public via articles in Growing News 2015 (Manitoba Grown Talent-Dr. Carla Taylor, and Foods that Target Inflammation) and the Fall issue of Believe magazine, St. Boniface Hospital.
(Taking the pulse of vascular health: Research points to the health benefits of Manitoba crops) as well as being interviewed on CJNU Radio about our clinical studies.

The laboratory is also very active in training. In 2015, there were 5 MSc students (of whom 2 defended) and 5 PhD students (of whom 2 defended) who were in co-supervised multi-disciplinary programs where I provide the metabolism and nutritional sciences expertise. In addition, there were technical staff, including our research nurse and study coordinators. Several of the trainees had scholarship funding from the Food Advancement through Science and Technology (FAST) program, a NSERC CREATE grant held by the University of Manitoba and Laval University, and are gaining additional experiences and skills through conference planning and participation, workshops, etc. The trainees were active presenting their research at local, national and international conferences (19 abstracts). Lena Hong was selected as one of 8 graduate students from across Canada to participate in the graduate student oral competition at the Canadian Society for Nutrition (CNS) Annual Meeting. Two other trainees (supervised by others) who were provided tissues or completed their animals studies with our group were also selected to participate in the oral and poster competitions at CNS.

Overall, it has been a very successful year and we look forward to continued success next year.
### Funding

<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPERATING:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canadian Institutes of Health Research (CIHR)</td>
<td>H. Aukema, P. Zahradka &amp; C. Taylor</td>
<td>Effects of dietary essential fatty acids on octadecanoid production and biological actions in obesity-induced inflammation:</td>
<td>$134,793 (included in funding total for H. Aukema)</td>
</tr>
<tr>
<td>Natural Sciences and Engineering Research Council of Canada (NSERC)</td>
<td>C. Taylor</td>
<td>Metabolic and immune functions of zinc</td>
<td>$33,000</td>
</tr>
<tr>
<td>Manitoba Energy, Science and Technology</td>
<td>C. Taylor et al</td>
<td>&quot;Foods for Health&quot; portfolio of functional food products: Effects on blood glucose and lipid management in individuals with pre-type 2 diabetes mellitus</td>
<td>$100,000</td>
</tr>
<tr>
<td>Manitoba Pulse Growers Association</td>
<td>P. Zahradka &amp; C. Taylor</td>
<td>Characterization of bioactive compound absorption and excretion, and relationship to improvements in cardiovascular function</td>
<td>$20,000 (included in funding total for P. Zahradka)</td>
</tr>
<tr>
<td>Agri-Food Research and Development Initiative (ARDI)</td>
<td>P. Zahradka &amp; C. Taylor</td>
<td>Effects of black and navy beans on blood vessel function and remodeling</td>
<td>$44,922 (included in funding total for P. Zahradka)</td>
</tr>
<tr>
<td>Agriculture and Agri-Food Canada/Canola Canada-Canola Science Cluster</td>
<td>C. Taylor &amp; P. Zahradka</td>
<td>Effects of Canola Oil on Body Composition and Lipid Metabolism in Participants with Metabolic Syndrome/Canola Oil Multi-Centre Intervention Trial 2 (COMIT II)</td>
<td>$72,876</td>
</tr>
<tr>
<td>MAHRN</td>
<td>M Aliani Col: C Taylor, P Zahradka, C Siow, D Brown</td>
<td>Canadian climate advantage (CCAD) validation - Urinary and plasma metabolomics studies of fully characterized Saskatoon berry powder (SBP) fortified yogurt in healthy individuals</td>
<td>$30,667</td>
</tr>
</tbody>
</table>
CARLA TAYLOR – *Metabolic Nutrition Laboratory*

**St Boniface Hospital Research Foundation**
- P. Zahradka & C. Taylor
- Gift from Dr. K. Clark
  - $9,300 (included in funding total for P. Zahradka)

**Agri-Food Research and Development Initiative (ARDI)**
- P. Zahradka & C. Taylor
- Breeding of buckwheat varieties with novel characteristics and health benefits
  - $6,747 (included in funding total for P. Zahradka)

**SALARY:**
- University of Manitoba Graduate Fellowship
- Jaime Clark (co-supervised with P. Zahradka)
  - $14,000

**TOTAL FUNDING:**
- $250,543
## Collaborative Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Activity/project title/system</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. Bell, L. McCargar, C. Chan, S. Proctor, J. Ozga, D. Wishart</td>
<td>University of Alberta</td>
<td>Substantiating a health claim for pulses (beans and peas) and cholesterol-lowering</td>
</tr>
<tr>
<td>D. Ramdath, T. Wolever &amp; C. Siow</td>
<td>AAFC, Guelph, University of Toronto/Glycemic Index Testing &amp; CCARM</td>
<td>AAFC Science Substantiation Project on lentils</td>
</tr>
<tr>
<td>J. Buckley, et al</td>
<td>University of South Australia, Adelaide, South Australia</td>
<td>Impact of Pulse-enriched Foods on Cognitive Function and Cardiometabolic Health in Obese Adults</td>
</tr>
<tr>
<td>E. Klodas &amp; S. Kopecky,</td>
<td>Mayo Clinic, Rochester, MN, USA</td>
<td>&quot;Foods for Health&quot; portfolio of functional food products</td>
</tr>
<tr>
<td>J. Wigle</td>
<td>University of Manitoba</td>
<td>Sex-dependent effects of adiponectin on metabolic disease risk</td>
</tr>
<tr>
<td>S. West &amp; P. Kris-Etherton</td>
<td>Penn State University</td>
<td>Vascular Function for Effects of Canola Oil on Body Composition and Lipid Metabolism in Participants with Metabolic Syndrome / Canola Oil – Multi-Centre Intervention Trial (COMIT-II)</td>
</tr>
<tr>
<td>H. Aukema</td>
<td>University of Manitoba</td>
<td>Roles of dietary fatty acids and oxylipins in obesity and inflammation</td>
</tr>
<tr>
<td>M. Aliani</td>
<td>University of Manitoba</td>
<td>Metabolites associated with pulse consumption and with obesity</td>
</tr>
</tbody>
</table>
Teaching

Cell Biology of Nutrient Responses HNSC 7560
Seminar in Foods and Nutrition Research (M.Sc.) HNSC 7200
Advanced Seminar in Human Nutritional Sciences (Ph.D.) HNSC 7200
Macronutrients and Human Health HNSC 3310

Fellows/Students Mentored/Supervised

Graduate Students Supervised

PhD
Jaime Clark (co-supervised with P. Zahradka)  Jennifer Enns (co-supervised with P. Zahradka)
Youjia Du (co-supervised with P. Zahradka)  Jennifer Grant (co-supervised with M. Aliani)
Azadeh Yeganeh (co-supervised with P. Zahradka)

MSc
Lena Hong (co-supervised with P. Zahradka)  Linda Siemens (co-supervised with P. Zahradka)
Tara Loader (co-supervised with P. Zahradka)  Le Wang (co-supervised with M. Aliani)
Colleen Rogers

Students Graduated
Jennifer Enns (PhD) (co-supervised with P. Zahradka)  Lena Hong (MSc) (co-supervised with P. Zahradka)

Service on Graduate Student Committees

PhD
Stephanie Caligiuri  Nanan Yang
Andrea Edel

MSc
Jutika Datar  Md Monirujjaman
Kristen Fleet  Sara Raposo-Blouw
Amy Ludwig  Haonan Zhouyao
Professional Service

Administration
Program Committee for Human Nutritional Sciences
Committee Member, Faculty Curriculum Committee, Faculty of Agricultural and Food Sciences
Chair, Appeals Panel, Faculty of Agricultural and Food Sciences
Selection Committee for Marion Campbell Community Nutrition Award, Faculty of Graduate Studies
Committee Member, Undergraduate Program Review for Department of Food Science, University of Manitoba

Editorial
Associate Editor, Lipids
Associate Editor, British Journal of Nutrition

Membership in Professional Organizations
Canadian Nutrition Society
American Nutrition Society
International Society for the Study of Fatty Acids and Lipids
Canadian Diabetes Association
American Diabetes Association
American Oil Chemists Association

Outreach Activity

Media interviews
Growing News 2015, Manitoba Grown Talent - Dr. Carla Taylor, and Foods that Target Inflammation
CJNU Radio, interview on our clinical studies
Believe magazine (St. Boniface Hospital), Fall 2015 issue, Taking the Pulse of Vascular Health: Research points to the health benefits of Manitoba crops

Knowledge Translation to Community Group
Public presentation on healthy food choices “What's Up with Fat, Sugar and Salt?” at Northern Light Prince Rupert’s Lodge
Publications

Peer-Reviewed Articles


Commentary

Abstracts
Rogers C, Salamon E & Taylor CG (2015) Vitamin D deficiency is frequent in a group of pregnant women with T2DM. International Diabetes Federation.


Hong L, Zahradka P & Taylor CG (2015) Increasing hepatic DHA levels through dietary supplementation with DHA, but not EPA or ALA, prevents hepatic steatosis in fa/fa Zucker rats. Canadian Nutrition Society Annual Conference, Winnipeg. (Note: Lena was 1 of 8 students selected to participate in the CNS Oral Graduate Student Competition)

Datar J, Regassa A, Kim W-K, Taylor CG, Zahradka P & Suh M (2015) Effects of different dietary fats on lipid profile and expression of genes involved in testes function in Zucker (fa/fa) rats. Canadian Nutrition Society Annual Conference, Winnipeg. (Note: Jutika was 1 of 8 students selected to participate in the CNS Oral Graduate Student Competition)


Murali M, Taylor C, Zahradka P & Wigle JT (2015) Adiponectin deficient mice have reduced fat mass on a control diet but not when challenged with a high fat diet. Canadian Nutrition Society Annual Conference, Winnipeg. (Note: Megha was selected to participate in the CNS Poster Competition for Graduate Students)


Invited Presentations
New approaches for determining the efficacy of dietary lipids in clinical settings, Canadian Nutrition Society Post-Conference Workshop, Winnipeg.
Our laboratory continues to focus on the beneficial effects of Manitoba crops on vascular health. This provides a broad area for our research, which encompasses specific studies examining how the functional properties of arteries are affected by age or specific disease conditions or the foods we include in our diet. We are also in a unique position to have strength in both basic and applied clinical research, which enables us to investigate the translatableability of our findings from the lab bench to the bedside. We are also active in conducting research to understand the molecular mechanisms by which insulin regulates the cellular processes associated with gene expression. We have been fortunate to receive, either directly or via our collaborators, funding from a variety of agencies to support our research program. It is with great satisfaction to be able to point out that some of this funding is coming from organizations such as the Manitoba Pulse and Soybean Growers who see our work as having strong potential to assist them with marketing their products. Additionally, training programs such as FAST, a joint Laval University-University of Manitoba scholarship funded by NSERC, and various scholarships to our students have also helped in supporting our efforts.

The year’s publications provide a good overview of the lab’s activities. For example, a simple idea was brought to fruition by Dr. Moghadasian, and the result was a publication revealing that Manitoba fish are good sources of omega-3 fats. This is a good news story since the information obtained through this study can be used to enhance the demand for Manitoba fish products. In short, we can improve our intake of omega-3 fats through consumption of locally obtained fish such as pickerel and in this way reduce our reliance on ocean fish such as salmon.

Analysis of tissue and biological fluids obtained during the course of animal studies completed in previous years reaped a number of interesting findings. In particular, it was observed that the type of protein used in a high protein diet influences the effectiveness of such a diet on insulin responsiveness and accumulation of lipid by the liver. The effectiveness of a high protein diet on the detrimental effects of obesity was also compared to that of caloric restriction, and it was shown that they have distinct physiological outcomes. The first study to link consumption of conjugated linoleic acid, which supposedly aids weight loss, and the oxylipin profile in obesity was completed. The effect of obesity on the metabolite profile of rats was also investigated and serves as a baseline for future studies. These collaborative projects, by linking very diverse research themes, add considerably to the output of individual researchers and supports the concept that there is strength in numbers, even in research, as was originally envisaged when CCARM was proposed.
In addition to the basic research that has been undertaken, a number of clinical studies have been ongoing. One study recently completed in collaboration with Nancy Ames examined the effect of increased barley consumption on glucose handling. Ongoing studies are also looking at the several aspects of how eating beans can affect vascular function. We are also looking at identifying circulating markers that may be clinically useful for detecting arterial dysfunction at very early stages. The next few years will likely provide some very exciting results and I look forward to describing them in future reports.

The ability to publish these very stimulating results are due to the huge efforts of a wonderful team. And as part of every educator’s burden, some team members leave when their projects are finished. In the year that just passed, we were able to celebrate the graduation of Jennifer Enns and Lena Hong. They contributed solidly to our understanding of how obesity affects the performance of key tissues involved in metabolic control. We wish them both well as they move forward in their careers. At the same time, I am happy that the rest of the team is ready to continue their hard work so that we may continue to pursue our quest to understand and translate the research findings we will produce over the next year.

Jaime Clark, Youjia Du, Azadeh Yeganeh, Lena Hong
<table>
<thead>
<tr>
<th>Name of Granting Agency</th>
<th>Names of Investigators</th>
<th>Project Title</th>
<th>Funding Amount for Current Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPERATING:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Sciences and Engineering Research Council of Canada</td>
<td>P. Zahradka</td>
<td>Hormonal mechanisms of gene regulation</td>
<td>$45,000</td>
</tr>
<tr>
<td>Canadian Institutes of Health Research (CIHR)</td>
<td>H. Aukema, P. Zahradka &amp; C. Taylor</td>
<td>Effects of dietary essential fatty acids on octadecanoid production and biological actions in obesity-induced inflammation:</td>
<td>$134,793 (included in funding total for H. Aukema)</td>
</tr>
<tr>
<td>Manitoba Pulse Growers Association</td>
<td>P. Zahradka &amp; C. Taylor</td>
<td>Characterization of bioactive compound absorption and excretion, and relationship to improvements in cardiovascular function</td>
<td>$20,000</td>
</tr>
<tr>
<td>Agri-Food Research and Development Initiative</td>
<td>P. Zahradka &amp; C. Taylor</td>
<td>Breeding buckwheat varieties with novel characteristics and health benefits</td>
<td>$6,747</td>
</tr>
<tr>
<td>Agri-Food Research and Development Initiative (ARDI)</td>
<td>P. Zahradka &amp; C. Taylor</td>
<td>Effects of black and navy beans on blood vessel function and remodelling</td>
<td>$44,922</td>
</tr>
<tr>
<td>Mathematics of Information Technology and Complex Systems (MITACS)</td>
<td>P. Zahradka &amp; C. Taylor</td>
<td>Identification of blood biomarkers for diagnosis of peripheral arterial disease</td>
<td>$9,375</td>
</tr>
<tr>
<td>St Boniface Hospital Research Foundation</td>
<td>P. Zahradka &amp; C. Taylor</td>
<td>Gift from Dr. K. Clark</td>
<td>$9,300</td>
</tr>
<tr>
<td>SALARY:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Manitoba Graduate Fellowship</td>
<td>Jaime Clark</td>
<td>夆</td>
<td>$14,000 (included in funding total for C. Taylor)</td>
</tr>
</tbody>
</table>

**TOTAL FUNDING:** $135,344
## Collaborative Activity

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Activity/project title/system</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. Bell, L. McCargar, C. Chan, S. Proctor, J. Ozga, D. Wishart</td>
<td>University of Alberta</td>
<td>Substantiating a health claim for pulses (beans and peas) and cholesterol-lowering</td>
</tr>
<tr>
<td>D. Ramdath, T. Wolever &amp; C. Siow</td>
<td>AAFC Guelph, University of Toronto/Glycemic Index Testing &amp; CCARM</td>
<td>AAFC Science Substantiation Project on lentils</td>
</tr>
<tr>
<td>J. Buckley, et al</td>
<td>University of South Australia, Adelaide, South Australia</td>
<td>Impact of Pulse-enriched Foods on Cognitive Function and Cardiometabolic Health in Obese Adults</td>
</tr>
<tr>
<td>J. Wigle</td>
<td>University of Manitoba</td>
<td>Sex-dependent effects of adiponectin on metabolic disease risk</td>
</tr>
<tr>
<td>H. Aukema</td>
<td>University of Manitoba</td>
<td>Roles of dietary fatty acids and oxylipins in obesity and inflammation</td>
</tr>
<tr>
<td>M. Aliani</td>
<td>University of Manitoba</td>
<td>Genetic markers for flavor selection in pork; Metabolites associated with pulse consumption and with obesity</td>
</tr>
<tr>
<td>E. Klodas &amp; S. Kopecky,</td>
<td>Mayo Clinic, Rochester, MN, USA</td>
<td>&quot;Foods for Health&quot; portfolio of functional food products</td>
</tr>
</tbody>
</table>

## Teaching Activity

Endocrine Physiology & Pathophysiology PHGY 7240  
Course Coordinator for Endocrine Physiology & Pathophysiology PHGY 7240  
Readings in Nutritional Sciences HNSC 7560
Fellows/Students Mentored/Supervised

Graduate Students Supervised

**PhD**
Jaime Clark (co-supervised with C. Taylor)  
Youjia Du (co-supervised with C. Taylor)  
Azadeh Yeganeh (co-supervised with C. Taylor)  
Jennifer Enns (co-supervised with C. Taylor)

**MSc**
Lena Hong (co-supervised with C. Taylor)  
Tara Loader (co-supervised with C. Taylor)  
Linda Siemens (co-supervised with C. Taylor)

**Students Graduated**
Jennifer Enns (PhD) (co-supervised with C. Taylor)  
Lena Hong (MSc) (co-supervised with C. Taylor)

Service on Graduate Student Committees

**PhD**
Andrea Edel

**MSc**
Melissa Gabbs  
Bhavya Sharma

Professional Service

Administration
Member, Graduate Program Committee, Department of Physiology & Pathophysiology, University of Manitoba  
Chair, Division of Endocrinology and Metabolic Disease, Department of Physiology and Pathophysiology, University of Manitoba  
Member, Research Manitoba Mid-Career Operating Grants Committee  
Member, American Heart Association  
Member, Canadian Nutrition Society  
Reviewer, The Israel Science Foundation Grants  

Editorial
Associate Editor, Canadian Journal of Physiology and Pharmacology  
Subject Editor, FACETS
Back Row: Dr. Peter Zahradka, Jaime Clark, Leslee Tworek, Dr. Carla Taylor
Front Row: Tara Loader, Youjia Du

Back Row: Leslee Tworek, Megha Murali, Youjia Du
Front Row: Jaime Clark, Tara Loader
Publications

Peer-Reviewed Articles


**Abstracts**


