RESEARCH PLAN: The Morbidity Contribution of Micronutrient and Polyunsaturated Fatty Acid Deficiencies to Growth faltering and Neurocognitive Disorder in Perinatally HIV-exposed and Unexposed Ugandan Children.

1.1 SIGNIFICANCE: HAART has positively transformed pediatric HIV but evidence of typical development is equivocal. Increasing access to highly active antiretroviral therapy (HAART) for persons living with HIV/AIDS (PLWHA) in low and middle income countries (LMIC) has resulted in large reductions in number of perinatally HIV (PHIV) infected children,[1-4] and earlier time of HAART initiation for current PHIV compared to their pre-HAART era peers.[5] At same time, at least 1.5 million children per year are perinatally HIV exposed but uninfected (HEU). [6] Majority of HEU are exposed to HAART during highly sensitive developmental windows -including the first one thousand days of life, with poorly understood long-term consequences.[6] Perinatal HIV exposure and punctuated/chronic HAART exposure for children of female PLWHA will persist for the foreseeable future and large numbers of these HIV-affected children are expected to survive into adulthood.[1, 3] The evidence that these vulnerable children are developing/thriving in the long-term, particularly with respect to neurodevelopment and quality of life (QOL), is limited.[1, 2, 7-9]

1.2 Impaired Growth and neurodevelopment is common in LMIC youth; HIV-infection/exposure magnifies this risk. That all children survive and thrive with appropriate developmental outcomes is a goal of UNAIDS and several NIH centers.[10-12] Successful growth, neurocognitive development and function is a cornerstone of thriving across the lifecourse and the most important determinant of adult productivity.[1, 7, 13, 14] Unfortunately, high rates of child morbidity and mortality is typical in Uganda where an estimated 30% of children are stunted, 15.7% of children exhibit impaired or delayed cognitive development, 26.3% exhibit impaired/delayed socioemotional development and as much as 36.8% are delayed/impaired in either or both developmental dimensions.[13] Against this background of high stunting and neurodevelopmental impairment, HIV-infection and exposure represents an additional set of determinants that may act additively or synergistically with risk factors applicable to HIV unexposed uninfected (HUU) to further impair growth and neurocognitive function in HIV-exposed/infected children. HIV-associated neurocognitive disorder (HAND) - i.e. spectrum of neurocognitive dysfunction observed in PLWHA still affects between 25% to 60%.[15] HAART has successfully reduced the most severe form of HAND, i.e. HIV-associated dementia (HAD), but the prevalence of mild and asymptomatic cognitive deficits has increased in PLWHA.[16]

The dearth of robust comparative growth and neurodevelopmental information for school-aged, adolescent and older perinatally HIV-affected relative to HUU community controls is widely recognized.[2] With few exceptions,[17-21] studies in the pre-HAART era found diminished motor, memory, and verbal functions in PHIV compared to HIV-negative controls.[20, 22-24] The vast majority of children in these early studies were ≤5 years old. This knowledge gap is compounded by limited specific studies of the survival experience of vulnerable PHIV, HEU and HUU and partly reflects the relative recency of multi-decade survival of PHIV infected children from LMIC.[22, 25] Our team has enrolled and followed for 12 months 305 6-10 years old Ugandan children with and without perinatal HIV infection/exposure and their caregivers as part of recently completed field work. We are now enrolling another 300 Ugandan adolescents and their caregivers as part of an ongoing NIH supported R21 research program. The goal of the investigations for the AAP supported post-doctoral fellow will investigate the role of nutrition in long-term child growth and neurocognitive function as illustrated in figure 1.

1.3 Optimal nutrition is protective and may mitigate growth faltering and neurocognitive impairment/HAND. Substantial evidence exists for the beneficial effects of vitamins B-complex, C, and E for immunity and that sufficiency in these micronutrients alleviates high level of inflammation, improves several aspects of immune function and reduces morbidity.[26-31] Vitamin D’s role in optimal growth and skeletal health is well defined.[32-35] Likewise, vitamin D sufficiency has been linked with proper immune function and a range of cardiometabolic health benefits.[36-41] In addition, an emerging body of work has linked vitamin D sufficiency to lower prevalence of a range of mental health problems including depressed mood,[42-44] anxiety,[45] atypicality and externalizing behavioral disorders.[46] More recently, vitamin D’s role in brain health and neurocognitive development has been theorized.[46-48] Epidemiologic data also confirms a high prevalence of vitamin D insufficiency in broad segments of children and adults with HIV and without chronic HIV. However, there remains substantial gaps in our understanding of its relevance for cognitive function and quality of life (QOL) among children/adolescents with and without chronic HIV infection.
Polysaturated fatty acids (PUFA), including omega-3 and omega-6, have salutary impacts on immune function, heart health and the central nervous system through regulation of membrane fluidity, intra-cellular signaling and gene expression and down modulation of inflammatory responses.[65-71] In addition to salutary impacts on cardiac metabolic functions, [72-77] certain PUFA (e.g. arachidonic acid,) have structural roles in the brain and combine with the docosahexaenoic acid (an omega-3 PUFA) as essential co-factors for normal brain development and function.[70] Optimal intakes of omega-3 PUFAs are essential for optimal visual, neural, and behavioral development among infants.[19] Beyond infancy, optimal omega-3 PUFA intake has been associated with improvements in attention, learning, and behavioral disorders throughout the lifecourse.[73-89]

High or low ferritin - a biomarker of bio-available iron[90] - anemia and other facets of impaired hematologic status (IHS) are common and often persistent in African children/adolescents[81-94] and in PLWHA in spite of HAART treatment.[95-100] The dynamic interactions between HIV and iron create a positive feedback loop that increases the risk of iron overload, onset and persistence of non-iron deficiency anemia and may partly mediate HIV persistence and rebound.[80, 99, 101] Persistent immune activation typical in HIV infection contributes to anemia of chronic disease.[102] Anemia, regardless of etiology, predicts sub-optimal immune recovery[103] and mortality[104] in persons living with HIV/AIDS. High serum ferritin has been associated with sub-optimal immune recovery and mortality in PLWH[101, 102, 105, 106] and represents anemia of chronic disease typified by limited bio-availability of iron. Low serum ferritin on the other hand results from impaired gastrointestinal nutrient absorption and is associated with folate deficiency, iron deficiency anemia[104, 107-109], fatigue and depressed mood.[110] Hence low ferritin, regardless of HIV status, is expected to impair QOL and cognitive performance. Understanding the possible roles of IHS could be an important strategy for slowing HIV disease progression[111] and improving functional outcomes in nutritionally depleted children and adolescents.

2.0 Specific Research Project: We will work with postdoctoral fellow to quantify the modifiable role of key nutritional variables on sub-optimal long-term growth and impaired neurodevelopment/HAND in this vulnerable population. In this cohort (n=500 caregiver child pairs enrolled to date), HIV-infection/exposure presents a heightened risk of both growth faltering and impaired neurocognitive development as noted in conceptual Model (Figure 1). [14, 46, 112-115] These risk factors which may act in additive or synergistic manner to impair growth and neurocognitive development, in addition to the interplay of other environmental, demographic, medical, and lifestyle factors.[116, 117]

- **Specific Aim #1:** To quantify PUFA, vitamin D and vitamin B-12 related differences in growth trajectory over 12 months in Ugandan children 6 – 10 years old.
- **Specific Aim #2:** To determine PUFA, Vitamin D and vitamin B-12 related differences in change in neurocognitive function and neurocognitive disorders over 12 months in Ugandan children 6-10 years.

### Table 1: Nutritional Indices vary substantially by perinatal HIV status among early School-aged Ugandan children with and without Perinatal HIV infection/exposure

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>PHIV (Mean (SD))</th>
<th>HEU (Mean (SD))</th>
<th>HUU (Mean (SD))</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin D (ng/mL)</td>
<td>21.75 (6.7)</td>
<td>21.24 (9.1)</td>
<td>20.48 (7.40)</td>
<td>0.504</td>
</tr>
<tr>
<td>Total n3</td>
<td>2.97 (1.25)</td>
<td>2.80 (1.06)</td>
<td>2.92 (2.11)</td>
<td>0.635</td>
</tr>
<tr>
<td>Omega-3 Index</td>
<td>3.38 (1.58)</td>
<td>3.15 (1.23)</td>
<td>3.29 (1.49)</td>
<td>0.600</td>
</tr>
<tr>
<td>Total HUFA</td>
<td>16.10 (3.36)</td>
<td>14.40 (2.94)</td>
<td>14.82 (2.85)</td>
<td>0.001</td>
</tr>
<tr>
<td>T/T ratio</td>
<td>0.009 (0.01)</td>
<td>0.007(0.00)</td>
<td>0.007 (0.00)</td>
<td>0.003</td>
</tr>
<tr>
<td>Palmitoleic acid</td>
<td>0.08 (0.05)</td>
<td>0.07 (0.04)</td>
<td>0.07 (0.04)</td>
<td>0.080</td>
</tr>
<tr>
<td>Serric acid</td>
<td>11.92 (2.07)</td>
<td>10.42 (1.99)</td>
<td>10.72 (2.05)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Linoleic acid</td>
<td>35.40 (5.42)</td>
<td>37.74 (5.08)</td>
<td>37.13 (5.34)</td>
<td>0.014</td>
</tr>
<tr>
<td>Linolenic acid</td>
<td>0.010 (0.01)</td>
<td>0.006 (0.01)</td>
<td>0.006 (0.01)</td>
<td>0.026</td>
</tr>
<tr>
<td>GLA</td>
<td>0.07 (0.06)</td>
<td>0.05 (0.04)</td>
<td>0.06 (0.05)</td>
<td>0.029</td>
</tr>
<tr>
<td>Arachidonic acid</td>
<td>0.02 (0.06)</td>
<td>0.16 (0.07)</td>
<td>0.19 (0.07)</td>
<td>0.011</td>
</tr>
<tr>
<td>DGLA</td>
<td>0.73 (0.26)</td>
<td>0.45 (0.19)</td>
<td>0.49 (0.18)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>DGLA</td>
<td>0.11 (0.07)</td>
<td>0.07 (0.04)</td>
<td>0.07 (0.04)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Arachidonic acid</td>
<td>12.50 (2.40)</td>
<td>11.31 (2.23)</td>
<td>11.57 (2.09)</td>
<td>0.002</td>
</tr>
<tr>
<td>Nervonic acid</td>
<td>0.75 (0.24)</td>
<td>0.80 (0.25)</td>
<td>0.85 (0.25)</td>
<td>0.020</td>
</tr>
</tbody>
</table>

**PHIV = Perinatally HIV infected, HEU = Perinatally HIV Unexposed Uninfected, HUU = Perinatally HIV Unexposed Uninfected.**

Nutritional Biomarkers. Serum assessments of hemoglobin, vitamin-D, ferritin and PUFA is made at baseline using standard methodology for each. In brief, hemoglobin is measured as part of complete blood count and used to define anemia per WHO age-sex thresholds as follows: <11.5 g/dl if ≤11 years, <12 g/dl if male or female 12 – 14 years or non-pregnant female aged >15 years and >13.0 g/dl if male ≥15 years old.[118] Vitamin-D will be measured as 25-hydroxyvitaminD [25(OH)D] by high performance liquid chromatography tandem mass spectrometry.[119] Categories based on the concentration (in nmol/L) of 25(OH)D are defined as follows: highly sufficient (>70), sufficient (50–70), insufficient (25–50) and deficient (<25). These may be collapsed based on distribution to create sufficient, insufficient vs low 25(OH)D level.[120] Serum ferritin will be measured using enzyme-linked immunosorbent assays (ELISA).[121, 122] Per prior precedent, low ferritin was defined as <30ng/L.[121] High ferritin was defined at >200 ng/L for males and >150 ng/L for females.[121]

**Outcome Measures:** We have two main outcome measures for this study – growth, neurocognitive function and quality of life (QOL). Growth measures include: height for age, weight for age and body-mass-index for age. Cognitive measures include: executive function and socio-emotional adjustment measured using the behaviour rated inventory of executive function and behaviour assessment system for children. QOL is measured using the Pediatric Quality of Life Inventory (PedsQL) questionnaire. All outcomes are multi-dimensionally assessed in both caregivers and children. Locally relevant relative measures in Ugandan children/adolescents will be derived by internally standardizing raw scores for each respondent to derive a z-score. Z-scores correspond to the deviation in respondents score above or below the mean score for adolescents of same age and sex specific in the sample as follows: \( Z = \frac{(X_{raw} - X_{sample \ age, sex \ mean})}{SD_{age, sex}} \). Scores warranting clinical vigilance are defined as scores ≥1.5 standard deviations in the direction of risk relative sample age/sex mean score per principles firmly established in prior work[120] and applied in context of our cognition studies in Ugandan children/adolescents.[8]
3.0 STATEMENT BY MENTORING TEAM AND ENVISIONED MENTORING PLAN

To provide trainee with scientific and logistic tools needed to move forward in this exciting area of research, this team has assembled a mentoring team that includes myself-Dr. Jenifer Fenton as primary mentor, Dr. Amara Ezeamama as MSU co-mentor, Dr. Ezekiel Mupere as and Dr. Sarah Zalwango as Ugandan co-mentors. Each contributor’s expertise and how they articulate with and complement each other in mentoring the AAP post-doctoral fellow is further described in mentoring plan.

3.1 MSU MENTORING TEAM: Jenifer Fenton, PhD, MPH (Primary), Amara E. Ezeamama, PhD (co-mentor);

Trainee will gain proficiency in the following competencies from her/his interaction with the MSU based mentoring team over 12 months: 1) systematic evaluation of macro and micronutrient status in children, 2) ethical and scientifically sound methods of establishing and maintaining a research cohort, 3) strategies for enrolling, and tracking large amounts of data from the study participants with the least amount of disruption to both participants and the study enrollment site, 4) reliable assessment of neurocognitive measures via direct and proxy reports, 5) methods of systematically evaluating the quality of caregivers and environmental quality for child rearing which may confound or modify the primary relationships of interest and 6) mentoring on manuscript development and grant strategy to ensure support for future work that will emerge naturally from the activities begun as part of this fellowship.

3.2 MAKERERE UNIVERSITY TEAM: Ezekiel Mupere, MBChB, PhD; Sarah Zalwango, MS, MBBS

Respectively Senior Lecturer and Chair, Department of Pediatrics, Makerere University School of Medicine, Kampala, Uganda & Director of Medical Services, Directorate of Public Health and Environment, Kampala City Council Authority. Dr. Mupere is a pediatric infectious disease specialist and current Department Head/Chair in the Department of Pediatrics, Makerere School of Medicine. Dr. Zalwango brings expertise as a physician with specialization in Pediatrics and expertise in the implementation of clinical epidemiologic studies of HIV, TB and childhood diseases. She is the local principal investigator leading enrolment and recruitment efforts for the study cohort. She has more than ten years of experience in epidemiologic studies of TB/HIV in Kampala, Uganda. Drs Mupere and Zalwango will contribute expertise in clinical management of pediatric HIV/AIDS and will mentor trainee on identifying, measuring and interpreting metabolic complications expected to influence neurologic development, psychosocial adjustment and quality of life in this vulnerable population.

MENTORING PLAN

<table>
<thead>
<tr>
<th>Proficiency Area</th>
<th>Mentors Involved</th>
<th>Format</th>
<th>Frequency</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomarker and Anthropometric methods for assessing growth and nutritional quality</td>
<td>Fenton, Ezeamama</td>
<td>Face to face meetings, e-mail or teleconferences, and response to trainee initiated inquiries</td>
<td>As needed (PRN) and in the context of conference calls to discuss research progress.</td>
<td>PRN</td>
</tr>
<tr>
<td>Analysis and interpretation of functional deficits &amp; detangling confounding effects of functional measures by HAART, coincident micronutrient deficits and HIV</td>
<td>Fenton, Ezeamama</td>
<td>Face to face meetings while in the field, e-mail or teleconferences, and response to trainee initiated inquiries</td>
<td>As needed with multiple weekly interactions</td>
<td></td>
</tr>
<tr>
<td>Ethical Conduct of Human Subjects Research</td>
<td>Fenton, Mupere, Ezeamama, Zalwango</td>
<td>Face to face meetings while in the field, e-mail or teleconferences, and response to trainee initiated inquiries</td>
<td>PRN and via weekly conference calls to discuss research progress particularly in early phases of study</td>
<td>~1-2 hours per week particularly in early study phase</td>
</tr>
<tr>
<td>Implementation of epidemiologic study in resource constrained setting</td>
<td>Fenton, Ezeamama, Zalwango, Mupere</td>
<td>Face to face meetings while in the field, e-mail or teleconferences, and response to trainee initiated inquiries</td>
<td>PRN and in the context of weekly/bi-weekly conference calls to discuss research progress</td>
<td>~2 – 3 hrs per week</td>
</tr>
<tr>
<td>Grant writing and manuscript preparation</td>
<td>Fenton, Ezeamama, Mupere</td>
<td>Face to face meetings, PRN research meetings and e-mails</td>
<td>PRN</td>
<td>~15-20 hours per week</td>
</tr>
<tr>
<td>Managing and balancing the demands of conducting high impact science, service and teaching in an academic research career track</td>
<td>Fenton, Ezeamama, Mupere</td>
<td>Experiential learning and response to trainee initiated specific queries</td>
<td>PRN and weekly via designated research meeting time in the Fenton or Ezeamama research group.</td>
<td>~1 hour per month</td>
</tr>
<tr>
<td>Research Dissemination through conferences and Networking with other investigators</td>
<td>Fenton, Ezeamama, Mupere, Zalwango</td>
<td>Telephone, e-mails and face to face meetings</td>
<td>PRN and monthly in the context of designated study progress report meetings</td>
<td>~1 – 2 hours per month</td>
</tr>
</tbody>
</table>

DELIVERABLES OVER 1 YEAR OF SUPPORT: 2 peer-reviewed publications (submitted) and developed research proposal in mutually agreed research direction by July 2020. Strength of Mentoring Team & Team’s Ideal Position to Mentor Future Leaders in African Research and Practice: This team has a strong track record in Uganda resulting in solid infrastructure that provides us access to relevant study populations and already collected data to support the post-doctoral trainee. In addition, the team has demonstrated experience evaluating the role of nutritional indices in HIV-related outcomes. Lastly, the investigator team has solid history of productively mentoring students in the implementation of cutting edge nutritional and epidemiologic research and are ideally situated to facilitate the training of the AAP trainee as part of this fellowship program.
REFERENCES


43. Hogberg G, Gustafsson SA, Hallstrom T, Gustafsson T, Klawitter B, Petersson M. Depressed adolescents in a case-series were low in vitamin D and depression was ameliorated by vitamin D supplementation. *Acta Paediatr* 2012; 101(7):779-783.


64. Cashman KD. Vitamin D Requirements for the Future-Lessons Learned and Charting a Path Forward. Nutrients 2018; 10(5).


86. Milte CM, Parletta N, Buckley JD, Coates AM, Young RM, Howe PR. **Increased Erythrocyte Eicosapentaenoic Acid and Docosahexaenoic Acid Are Associated With Improved Attention and Behavior in Children With ADHD in a Randomized Controlled Three-Way Crossover Trial.** J Atten Disord 2015; 19(11):954-964.

87. Kean JD, Camfield D, Sarris J, Kras M, Silberstein R, Scholey A, et al. **A randomized controlled trial investigating the effects of PCSO-524, a patented oil extract of the New Zealand green lipped mussel (Perna canaliculus), on the behaviour, mood, cognition and neurophysiology of children and adolescents (aged 6-14 years) experiencing clinical and sub-clinical levels of hyperactivity and inattention: study protocol ACTRN12610000978066.** Nutr J 2013; 12:100.


CURRICULUM VITAE  
Jenifer Imig Fenton, PhD, MPH MS  
https://www.canr.msu.edu/people/jenifer_fenton

Current Position: Associate Professor  
Dept. of Food Science and Human Nutrition  
Joint Appointment College of Osteopathic Medicine  
469 Wilson Rd, 208B Trout Food Science Building  
Michigan State University  
East Lansing, MI 48823  
Phone: (517)-353-3342  Fax: (517)-355-8936

EDUCATION:  
2001 - 2003  
University of Michigan, Ann Arbor, MI  
M.P.H. (Epidemiology). Thesis Advisor: MaryFran Sowers, Ph.D.  
Thesis: Relationship between biomarkers of inflammation and obesity: NHANES analysis.

1995 - 1999  
Michigan State University East Lansing, MI  
Ph.D. (Nutrition and Physiology). Dissertation Advisor: Michael Orth, Ph.D.  
Thesis: Role of Glucosamine in the prevention of osteoarthritis in horses.

1993 - 1995  
University of Missouri, Columbia, MO  
M.S. (Reproductive Physiology). Thesis Advisor: Duane Keisler, Ph.D.  
Thesis: Role of ovine interferon tau in pregnancy in sheep.

1989 - 1993  
University of Missouri, Columbia, MO  

POSTDOCTORAL TRAINING:  
2002 - 2002  
Department of Food Science and Human Nutrition, Michigan State University East Lansing, MI.  
Postdoctoral Training. Advisor: Norman G Hord, PhD, MPH, RD  
Research Focus: The role of nutrition in colon cancer prevention.

2003 - 2007  
Cancer Prevention Fellowship Program, National Cancer Institute, Bethesda, MD  
Postdoctoral Training. Advisor: Stephen Hursting, PhD, MPH.  
Research Focus: The role of obesity and inflammation in colon cancer prevention.

ACADEMIC POSITIONS:  
Associate Professor: Michigan State University. 2014-current  
Assistant Professor: Michigan State University. 2008-2014  
Visiting Assistant Professor: Michigan State University. 2004-2007  

PROFESSIONAL HONORS:
MSU Honors College Award for Distinguished Contributions to Honors Students 2018.
Paul Roberts Award for Distinguished Service in Study Abroad Programs MSU CANR Award. 4-2017.
Presenter and Panelist: Learn at Lunch: Academic Freedom vs. Ideology in the Classroom. 2-2107.
Invited Presentation: Learning Outcomes and Assessment in CANR Workshop:
Session Chair. Diet and Cancer mini symposium. Experimental Biology Annual ASN Meeting. 2015. Boston, MA.
Diet and Cancer; Fat versus Fiber in colon cancer: opposite in the end.
External PhD Defense Opponent. The National University Hospital of Iceland, 2014.
Invited Speaker. Landspitali - The National University Hospital of Iceland Dept of Immunology and Centre for Rheumatology Research, 2014.
Executive Committee. Diet and Cancer Research Interest Section for ASN, 2013-14
Session Chair. Diet and Cancer Molecular Targets mini symposium. Experimental Biology Annual ASN Meeting. 2013. Boston, MA.
Invited Speaker. Session Chair and Member of Faculty United European Gastroenterology Week Meeting. Amsterdam 2012 “Adipokines and colorectal carcinogenesis”.
Chair. Diet and Cancer Research Interest Section for ASN, 2012-13 (Elected)
Invited Platform Presentation. Sonia Wolf Wilson Lectureship “Leptin and Adiponectin: Key adipokines in inflammation and colon cancer”, University of Texas, Austin. 2007.
Michigan State University, Animal Science Doctorate Student of the Year ‘99 University of Missouri Deans List: 1992-1993
Undergraduate Research Scholarship: 1992-1993

PROFESSIONAL SOCIETIES & MEMBERSHIPS:
American Society for Nutrition: Member since 2001
American Society of the Advancement of Science: Member since 2001
The Obesity Society: Fellow member since 2009
American Society for Mass Spectrometry: Member 2015-2017
PUBLICATIONS:
According to Google Scholars, Dr. Fenton’s papers have been cited a total of 1870 times item resulting in a h-index of 25. The h-10 index is 36 (the number of manuscripts with 10+ citations). Students mentored by Dr. Fenton underlined. As a point of reference, it is convention in this field of science for the PI (laboratory that the scholarly works resulted from) of the student to be in the last author (senior author) position.

Submitted-2:

Published-Selected from 65 publications:


18) Fenton JI, Gurzell EA, Davidson EA, and Harris WS. Red blood cell PUFAs reflect the phospholipid PUFA composition of major organs. Prostaglandins Leukot Essent Fatty Acids. 2016. Sep;112:12-23. PMID: 27637336


24) Teague H, Harris M, Whelan J, Comstock SS, Fenton JI, and Shaikh SR. Short-term consumption of n-3 PUFAs increases murine IL-5 levels, but IL-5 is not the mechanistic link between n-3 fatty acids and changes in B cell populations. J Nutr Biochem. 2016. Feb;28:30-6. PMID: 26878780


FUNDING:
Current Grant Funding:
PI: Rowntree, Jason; Co-Is Fenton, Jenifer, Hodbod, Jennifer, McKendree, Melissa, Schweihofe, Jeannine
Sponsor: MSU-Michigan Alliance for Animal Agriculture
Title: Enhancing healthfulness and demand of Michigan produced beef
Pending: $143,629.00
PI: Rowntree, Jason; McKendree, Melissa; Cassida, Kimberly; Fenton, Jenifer; Cho, Sungeun Schweihofner, Jeannine
North Central Region Sustainable Agriculture Research and Education (NCR-SARE) Program
Title: Enhancing healthfulness and demand of Upper Midwestern, locally produced beef
Project Coordinator: Jason Rowntree
Funded: $199,149

PI: Pestka, James; Harkema, Jack; Fenton, Jenifer (co-I)
Title: Dietary Lipids and Silica-Triggered Autoimmunity
Funded: $2,700, 286.00

PI: Pestka James, Harkema, Jack; Fenton, Jenifer (co-I)
Direct Grantor: Lupus Foundation of America Inc
Title: PREVENTION OF SILICA-TRIGGERED LUPUS BY LIPIDOME MODULATION
Funded: $104,981.00

Co-Investigator: Fenton, JI
Agency for International Development. Title: Food and Nutrition Technical Assistance - FANTA III. 3,976,303.00

**Past Grant Funding:**
PI: Fenton, Jenifer Project Director: Pickens, Charles
Title: Tandem Mass Spectrometry to Identify Novel Lipid Biomarkers of Obesity
Direct Grantor: USDA
Funded: $78,960

Pls: Fenton, Jenifer and Mary Adjepong
Direct Grantor: University of California Davis
Project Amount Requested: $19,991.50
Prime Grantor: US Agency for Intl Development; LEAP proposal

Clinical and Translation Sciences Institute, MSU. Title: Mass spectrometry to identify lipid and proteomic biomarkers of colon polyp risk.
PI: Fenton, JI
Funded: $28,000

National Cancer Institute, NIH: Cancer Prevention Research Small Grant Program (R03): Cancer Cause and Prevention.
Title: Effect of dietary omega 3 fatty acids on colitis and colon cancer development in SMAD3-/- mice. Funded- (9-1-11 to 8-31-13)
R03CA162427; $153,500
PI: Fenton, JI (10% effort)

Clinical and Translation Sciences Institute, MSU
Title: Novel Biomarker Detection for Obesity, Inflammation, and Colon Cancer Risk (Suppl)
Funded- (8-1-09 to 7-31-10); $17,890
PI: Fenton, JI

National Cancer Institute, NIH: Cancer Prevention Research Small Grant Program (R03): Cancer Cause and Prevention Research. Title: Biomarkers of Obesity, Inflammation and Colon Cancer
Funded- (8-1-09 to 12-31-11)
R03CA142000; $153,000
PI: Fenton, JI
National Cancer Institute, NIH: Cancer Prevention Research Small Grant Program (R03): Cancer Cause and Prevention Research. Title: Adipokines regulate colon epithelial cell homeostasis. Funded- (7-1-07 to 6-30-09) R03CA130033; $152,000.

PI: Jenifer Fenton
IRGP New Investigator Award-Michigan State University
Title: Novel Biomarker Detection for Obesity, Inflammation, and Colon Cancer Risk
$40,000

Other Funding (Undergraduate research funding):

Fenton, Jenifer Imig (Co-Principal), Vanessa Tan (Co-Principal), "Max Gozenbach & Dale Romsos Undergraduate Research Scholarship," Sponsored by FSHN, Michigan State University, $3,500.00. (Fall 2017)

Fenton, Jenifer Imig (Co-Principal), Carlos Diola (Co-Principal), "Max Gozenbach Undergraduate Research Scholarship," Sponsored by FSHN, Michigan State University, $3,000.00. (Fall 2017)

Fenton, Jenifer Imig (Co-Principal), Kelly Valentini (Co-Principal), "Max Gozenbach FSHN Undergraduate Research Scholarship," Sponsored by FSHN, Michigan State University, $3,000.00. (Fall 2016)

Fenton, Jenifer Imig (Co-Principal), Kelly Valentini (Co-Principal), "CANR Undergraduate Research Scholarship," Sponsored by CANR, Michigan State University, $2,000.00. (Fall 2015; Spring 2016).

Fenton, Jenifer Imig (Co-Principal), Emily Davidson (Co-Principal), "Max Gozenbach Undergraduate Research Scholarship," Sponsored by FSHN, Michigan State University, $2,000.00. (2015 – 2016).
Fenton, Jenifer Imig (Co-Principal), Emily Davidson (Co-Principal), "CANR Undergraduate Research Scholarship," Sponsored by CANR, Michigan State University, $2,000.00. (2014 – 2015 summer and Fall).

Fenton, Jenifer Imig (Co-Principal), Emily Davidson (Co-Principal), "Max Gozenbach Undergraduate Research Scholarship," Sponsored by FSHN, Michigan State University, $2,000.00. (2014 – 2015).

Fenton, Jenifer Imig (Co-Principal), Diana Xu (Co-Principal), "CNS Undergraduate Research Scholarship," Sponsored by FSHN, Michigan State University, $1,000.00. (2014).

Fenton, Jenifer Imig (Co-Principal), Diana Xu (Co-Principal), "CNS Undergraduate Research Scholarship," Sponsored by FSHN, Michigan State University, $1,000.00. (2014).

Fenton, Jenifer Imig (Co-Principal), Emily Davidson (Co-Principal), "Dale Romsos Undergraduate Research Scholarship," Sponsored by FSHN, Michigan State University, $1,500.00. (2013 – 2014).

Fenton, Jenifer Imig (Co-Principal), Sophia Hemmrich (Co-Principal), "Rachel Schemmel Undergraduate Research Scholarship," Sponsored by FSHN, Michigan State University, $1,500.00. (2012 – 2013).

Fenton, Jenifer Imig (Co-Principal), Gopalakrishnan, Anita (Co-Principal), "CANR Undergraduate Research Scholarship," Sponsored by CANR, Michigan State University, $1,800.00. (December 2010 – May, 2011).

Fenton, Jenifer Imig (Co-Principal), Gopalakrishnan, Anita (Co-Principal), "CANR Undergraduate Research Scholarship," Sponsored by CANR, Michigan State University, $1,620.00. (September 2010 – December, 2010).

Fenton, Jenifer Imig (Co-Principal), Coffman, Andrea (Co-Principal), "CANR Undergraduate Research Scholarship Program," Michigan State University, $2,000.00. (September 2009 - December 2010).

Fenton, Jenifer Imig (Co-Principal), Woodworth, Hillary L (Co-Principal), "CNS Undergraduate Research Scholarship," Sponsored by College of Natural Science, Michigan State University, $1,000.00. (January 2010 - May 2010).
Fenton, Jenifer Imig (Co-Principal), Gopala, Anita (Co-Principal), "Lyman Briggs Undergraduate Research Scholarship," 
Sponsored by CANR, Michigan State University, $1,000.00. (January 2010 - May 2010).

Fenton, Jenifer Imig (Co-Principal), Gopalakrishnan, Anita (Co-Principal), "CANR Undergraduate Research Scholarship," 
Sponsored by CANR, Michigan State University, $2,000.00. (January 2010 - May 2010).

Fenton, Jenifer Imig (Co-Principal), Woodworth, Hillary Lauren (Co-Principal), "CNS Undergraduate Research Scholarship," 
Sponsored by College of Natural Science, Michigan State University, $1,000.00. (October 1, 2009 - December 15, 2009).

Fenton, Jenifer Imig (Co-Principal), Woodworth, Hillary (Principal), "Honors College Travel Grant," Sponsored by Honors 
College, Michigan State University, $825.00. (November 2009).

Fenton, Jenifer Imig (Co-Principal), Fitzgerald, Brenna (Co-Principal), "CANR Undergraduate Research Program (URP)," 
Michigan State University, $800.00. (August 2008 - May 2009).

Fenton, Jenifer Imig (Co-Principal), Woodworth, Hillary (Co-Principal), "CNS Undergraduate Research Support 
Scholarship," Sponsored by College of Natural Science, Michigan State University, $1,000.00. (February 13, 2009 - May 1, 2009).

ACADEMIC SERVICE:
Reviewed for over 40 journals.

EDITORIAL POSITIONS:
Editorial Board Member. Nature Scientific Reports. 2018-current
Editorial Board Member. PlosOne. 2018-current
Guest Editor for Special Issue of Nutrients. 2017-2018
Associate Editor. Journal of Nutritional Biochemistry. 2016-current
Associate Editor. World Journal of Gastroenterology. 2010-current

GRANT PANEL LEADERSHIP AND SERVICE:
Panel Member. American Cancer Society Grant Program. 2017-current; 6-2018
Ad Hoc Reviewer Florida Department of Health. 12-2016, 12-2017, 1-2019
Panel Member. USDA-NIFA. 6-2016.
Ad Hoc reviewer. Israeli Ministry of Health "Food and Nutrition Implications on Human Health" program. 4-2016
Ad Hoc Reviewer Florida Department of Health 12-2015, 12-2016, 12-2018
Ad Hoc Reviewer Paracelsus Medical University's Review Board for Research Funding, Salzburg/Austria (1 proposal). 8-2014
Ad Hoc Reviewer CDP study section (NCI), NIH. 12-2013 (3 proposals)
Ad Hoc Reviewer Pennsylvania Department of Health Final Performance Review 10-2013
Ad Hoc Reviewer National Cancer Institute Study Section. 10-2013 (3 proposals)
Ad Hoc Reviewer World Cancer Research Fund. 3-2013. (1 proposal)
Ad Hoc Reviewer Pennsylvania Department of Health Final Performance Review 8-2012
Special Emphasis Panel 2012/05 ZCA1 SRLB-9 (M1) Provocative Questions (R01) 3-2012 (3 proposals)
Special Emphasis Panel 2012/05 ZCA1 SRLB-D (M1) Provocative Questions (R21) 3-2012 (1 proposal)
Peer Reviewed Medical Research Program (PRMRP) FY12 Visionary Postdoctoral Fellowship Applications. Teleconference Scientific Reviewer. 01-12 (1 proposal)
Peer Reviewed Medical Research Program (PRMRP) FY10 Inflammatory Bowel Disease Concept Award pre-proposals grant program. Reviewer. 06-10 (7 proposals)
Peer Reviewed Medical Research Program (PRMRP) FY10 Inflammatory Bowel Disease Concept Award grant program. Reviewer. 05-10 (5 proposals)
Ad Hoc Reviewer Broad Foundation. Reviewer for continuation funding of one proposal. 8-10.
Medical Research Scotland, ad hoc Reviewer, Grant Proposal 7-09
Peer Reviewed Medical Research Program (PRMRP) FY09 Inflammatory Bowel Disease grant program. Reviewer. 06-09 (6 proposals)
Peer Reviewed Medical Research Program (PRMRP) FY08 Inflammatory Bowel Disease grant program. Reviewer. 09-08 (6 proposals)

SUPERVISOR (SUMMARY):
8 Graduate Students-mentor
5 Visiting Research Assistant Professor
15 Guidance committees-member
39 Undergraduate and/or other students with research projects in my laboratory

GRADUATE STUDENTS:
Thesis Advisor: Tatum Goldufsky, Masters Student Human Nutrition. Graduated 5-2018
Thesis Advisor: Zhe Yin, Masters Student Human Nutrition. Graduated 5-2018
Dissertation advisor: Mary Adjepong, Doctoral Student Human Nutrition. Graduated. 5-2018
Ghana BHEARD fellowship recipient; LEAP grant recipient
Position: CEO and Nutrition Consultant at Diet-trust foods and Nutrition Consult, Kumasi, Ghana
Dissertation advisor: Austin Pickens, Doctoral Student Human Nutrition. Graduated 5-2017
2103-2014 AAGA Fellowship Recipient
Position: Data Scientist, CDC
USAID Fellowship Recipient
Position: Senior Lecturer, Sokoine University of Agriculture
Graduate Student Study Abroad Fellowship Program Recipient (SU 2013)
Dissertation Completion Fellowship recipient 2014.
Position: Visiting Assistant Professor, Western Illinois University
Thesis advisor: Sarah McCaskey, Masters Student Human Nutrition. Graduated 8-2010
Position: Research Coordinator MSU COM
Position: Research Technician

VISITING SCIENTISTS (Postdoctoral students):
Lei Wan, PhD. 2015. Position: Research Assistant, U of M.
Sarah Comstock, PhD. 2012-2014. Position: Research Assistant Professor, MSU
Elizabeth Rondini, PhD, RD. 2010-2012. Position: Research Scientist, U of M
Jennifer Gray, PhD. 2008 Position: Toxicologist, State of Michigan

GRADUATE COMMITTEE MEMBERSHIP:
Liz Hudson, PhD committee-Epidemiology 2018-current
Ryan Walker, PhD Committee- Human Nutrition-2014-current
Alison Boss, MS committee-Human Nutrition 2016-current
Sara Bronkema, MS committee-Animal Science 2016-2018
Melissa Bates, PhD committee—Food Science 2013-2018
Tyler Becker, PhD committee—Human Nutrition 2014-2016
Yueli Liu, PhD committee—Chemistry 2011-2015
Glory Mhalu, MS Committee—Human Nutrition 2012-2014
Ryan Walker, MS Committee—Food Science 2011-2013
Sarah Mattmiller, MS committee—Comparative Medicine & Integrative Biology 2011-2014
Brooke Roman, MS Committee—Human Nutrition 2011-2013
Jon Clinthorne, PhD Committee—Human Nutrition 2009-2013
Lori Houghton-Rahrig, PhD committee—College of Nursing 2009-2012
Brenna Flannery, PhD Committee—Food Science 2009-2012
Amanda Metz, MS committee—Human Nutrition 2006-2008

UNDERGRADUATE STUDENT RESEARCH PROJECTS:
Srikar Kesammeni—Professorial Assistant (Fall-current)
Selin Sergin—Professorial Assistant (Fall 2018-current)
Travis Gooden—Professorial Assistant (Fall 2017-current)
Carlos Diola—Undergraduate Research Assistant (Fall 2017-Spring 2019)
William Yakah—Undergraduate Research Assistant (Fall 2016-Spring 2019)
Vanessa Tan—Undergraduate Research Assistant (Fall 2016-Fall 2018)
Raghav Jain—Professorial Assistant (Summer 2016-Fall 2018)
Max Gonzenbach Research Scholarship (Fall 2016-Fall 2018)
ULAF HNF250; Outstanding Biochemistry Senior Award
Board of Trustee Scholar
Lovan Ngngs Ndayishimiye—Undergraduate Research Assistant (Fall 2016-Spring 2016)
Lauren Bernhardt—Professorial Assistant (Fall 2015-Spring 2016)
Kelly Valenti—Professorial Assistant (Fall 2013-Summer 2017)
ULAF HNF250
Dale Rompos Research Scholarship (2016-2017)
CANR Research Scholarship (2015-2016)
Diana Xu—Professorial Assistant (Fall 2012-Spring 2016)
Professor Richard L. Anderson Endowed Undergraduate Research Prize (2014)
CNS Undergraduate Research Scholarship (Fall 2014)
Emily Davidson—Undergraduate Research Assistant (Spring 2013-Summer 2016)
Dale Rompos Research Scholarship (2013-2014)
CANR Research Scholarship (2014-2015)
Karen Matsuo—Undergraduate Research Assistant (Summer 2014-Summer 2015)
Ami Lane-Elliot—Undergraduate Research Assistant (Spring 2014-Summer 2015)
Samantha Hahn—Undergraduate Research Assistant (Spring 2014-Summer 2015)
Mariana de Fatima Albuquerque Periera
Brazil Americas Fellow (semester abroad)
Avery Clinton—Undergraduate Research Assistant (Summer 2014)
Catherine Belcher—Undergraduate Research Assistant (Spring 2013-Summer 2014)
Amanda Martin—Undergraduate Research Assistant (Spring 2013)
Aamir Bandagi—Undergraduate Research Assistant (Spring 2013-Summer 2014)
Jeremy Ratiu—Undergraduate Research Assistant (Spring 2010-Spring 2014)
Markita Lewis—Summer Research Opportunities Program (SROP) (2013)
Nominated for 2013 Exemplary Summer Research Citation
Belinda Trinh—Summer 2013 Future Scientist Program (2013)
Taylor Nordberg—Undergraduate Research Assistant (Spring 2012-Summer 2013)
Erin Person—Undergraduate Research Assistant (Summer 2013)
Sophia Hemmerich-FSHN Research Scholarship F-S’2011, 2013 (Spring 2010-Summer 2013)
Ryan Kelly- Undergraduate Research Assistant (Spring 2012)
Katy Patten-Undergraduate Research Assistant (Fall 2011-2012)
Rachel Plawecki-Professorial Assistant (Fall 2009-Spring 2010)
Andrea Coffman-CANR Research Scholarship (2008- 2009)
Anita Gopalakrishnan-CANR Research Scholarship S’10 (2008-2012)
Hillary Woodworth-CNS Research Scholarship-3 semesters (Fall 2007-2010)
Brenna Fitzgerald-CANR Research Scholarship (Fall 2008- 2009)
Hanna Webb- Professorial Assistant (2008-2009)
Roberto Antonio-Brandao-Undergraduate Research Assistant (2007-2008)
Camille Secor-Independent study (Fall 2007-Spring 2008)
Michelle Mercer-Undergraduate Research Assistant (2006-2008)
Jennifer Wilson-Medical student summer research project (summer 2008)
Christine Lockwood- Undergraduate Research Assistant (outstanding undergraduate employee of 2008)

TEACHING (Michigan State University):
Human Nutrition and Chronic Disease (HNF 840): Co-instructor 2019 Fall. 3cr.
Contemporary Issues in Human Nutrition (HNF 250): Lead Instructor 2019 Fall. 3cr.
Study Abroad Faculty Coordinator and Instructor. Mediterranean Diet and Health. Greece - Summer 2019. 3cr
Food Laws Study abroad. Co-Instructor. Spring 2019. 4 cr
Independent Study Research (HNF 490) Spring 2019. 3cr.
Contemporary Issues in Human Nutrition (HNF 250): Lead Instructor. Fall 2018. 3cr. (Significant course development-increase from 2 to 3 cr)
Independent Study Research (HNF 490) Spring 2018 and Fall 2018. 3cr.
Contemporary Issues in Human Nutrition (HNF 250): Lead Instructor 2017. 2cr. (Significant course development-3 section increase from 2016 to 5 sections total)
Obesity and Chronic Disease (HNF 826): Lead Instructor. 1cr. Spring 2013, 2014, 2015, 2016, 2017, 2018
Study Abroad Faculty Coordinator and Instructor. Mediterranean Diet and Health. Italy - Summer 2017. 3cr
Contemporary Issues in Human Nutrition (HNF 250): Lead Instructor 2016. 2cr. Fall 2016 (New course development)
Study Abroad Faculty Coordinator and Instructor. Mediterranean Diet and Health. Italy - Summer 2016. 3cr (New course development)
Study Abroad Faculty Assistant. Sustainable Food, Environment & Social Systems in Australia - Summer 2015. 6cr
Advanced Human Nutrition: Carbohydrate, Lipid Protein Metabolism (HNF461) Coordinating Instructor (3cr) Fall 2014
Nursing Research Practicum (NUR-940) Summer 2009. 1cr.
Introduction to Human Nutrition (HNF 150) Instructor Section 001. Spring ‘07