Jordan E. Bisanz

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Current Research Interests

- **Does the microbiome affect drug transport and metabolism?** Using combinations of *in vivo* and *in vitro* models to examine the effect of microbes on drug transport (PGP) and uncover novel microbial metabolism of xenobiotics. Sequenced new collection of gut Actinobacteria with combination Illumina/PacBio technology and successfully applied comparative genomics/transcriptomics to identify microbial effectors.
- **How does extreme caloric restriction affect the gut microbiome?** Using multi 'omics approaches on human datasets informed by gnotobiotic animal models to uncover the functional consequences of microbiome 'starvation'. Uncovered new potential effects on microbial pathogenicity and its potential impacts on weight loss.
- **Do gnotobiotic mouse models recapitulate human communities and can they be improved?** Using meta-analysis and multi-donor colonized animals combined with high-resolution DNA approaches to examine microbial transplantation efficiency and methods for improving efficiency.
- **CRISPR: Finding predators and prey in metagenomes** With an eye towards engineering applications, using combinations of metagenomes and isolates to identify naturally occurring CRISPR targets in metavirome samples to identify potential vectors and understand basic biology of type 1-C systems.

Professional Appointments and Education

- **University of California San Francisco** — **San Francisco, USA**
  Postdoctoral Scholar/Fellow — *2015-current*
  Supervisor: Peter Turnbaugh
- **University of Western Ontario** — **London, CA**
  PhD: Department of Microbiology and Immunology — *2010–2015*
  Dissertation: Clinical and mechanistic insights into novel probiotic functions and formulations. Available online here: ir.lib.uwo.ca/etd/2962
  Supervisor: Dr. Gregor Reid
- **University of Western Ontario** — **London, CA**
  BMSc: Honors Specialization in Microbiology and Immunology with distinction — *2006–2010*

Technical Expertise

- **Bioinformatic Approaches:** I have worked on a variety of multi 'omics datasets, both in their generation and analysis using a variety of approaches. In the microbiome field, I have analyzed >**25 16S rRNA gene datasets** while following new trends and tools in the field. At the current moment, my preferred pipeline is entirely in R leveraging Dada2 and a set of my own tools that I have **developed as an R package** (MicrobeR). I also apply tools including as DESeq2, ALDEx2, ANCOM, and Lmer for handling differential feature abundance in longitudinal study designs. I

also have extensive experience with Phyloseq, QIIME1/2 and UParse, but I prefer the freedom of the open R environment for data analysis to leverage approaches such as **machine learning** in R via randomForest. I have used similar approaches for **shotgun metagenomics** leveraging tools such as mOTU, MetaPhlAn2, Kraken, Kaiju, and SortMeRNA for taxonomic composition.
For RNAseq and metatranscriptome analysis, I have applied tools including Bowtie1/2 as well as *de novo* assembly using Trinity with differential expression analysis carried out using DESeq2 and ALDEx2 using databases such as KEGG for functional analysis.
At this point, I have also sequenced **30+ prokaryotic genomes** (including 24 personally taken directly from agar plate through to sequencer setup and computational analysis) and experimented with multiple assemblers. My own testing has shown SPAdes to be superior for my applications in high GC-content organisms. For subsequent processing I have applied Prokka, RAST and PHAST. I have conducted comparative genomics analysis of these genomes using tools such as OrthoMCL, Proteinortho5, Roary, and custom code.
Given that I am performing analysis often with 100s of Gb (or Tb) of data, I accomplish much of my processing via a **grid engine computing cluster** using arrayed jobs for parallel computing. Via data I have generated, and data from meta-analyses, I have analyzed data from Illumina, PacBio, 454, and SOLiD sequencers. I routinely document my code making use of **markdown documents for reproducibility** and sharing with collaborators while leveraging **visualization tools** such as Plotly and DT for interactive documents for data exploration. I have also developed **Shiny applications** for interactive data analysis: ElenMatchR (a comparative genomics tool for *Eggerthella lenta*), and AbstractReviewR(a tool for crowd sourcing abstract reviews for meta-analysis).

- **Programming Languages:** Proficient in: R/MRO, Perl, Bash, Markdown, and LaTeX (which generated this document). Also basic ability with: Python, C++, html5 (see jbisanz.github.io), and visual basic.
- **Gnotobiotic Models:** During the course of my postdoctoral studies, I have acquired significant experience with gnotobiotic mouse models including mono-colonized, defined community, and humanized models. I have consulted for the UCSF Gnotobiotic Core Facility on approaches for microbe detection and elimination while carrying out meta-analyses of humanization experiments to better understand transplantation efficacy and factors that affect it. I have applied these models to look at pharmacokinetics, pathogenicity, and adiposity.
- **Molecular Biology:** In addition to common microbiology and cell culture skills, I have succeeded in gene knockout and heterologous expression in low-competency organisms such as *Lactobacillus spp*. With mentorees, I have designed new shuttle vectors for genetically intractable organisms for CRISPR-based gene engineering. I considerable experience with RNA work in both prokaryotic and eukaryotic sources, both for traditional, microarray, and **NGS** libraries using NEBNext and NexteraXT reagents. I routinely carry out qPCR and have designed **custom assays** both with SYBR green chemistry and multiplexed double-dye probes for gene expression and microbe detection/quantification. I established the Earth Microbiome Project protocols for high-throughput DNA extraction (96-well MoBio Power Soil) in my previous lab and personally set up an automated liquid handling system (Beckman Coulter Biomek) for all pre-PCR work and multiplexing. I have currently established and validated a new and improved high-throughput pipeline that goes from DNA extraction to sequence analysis for the Turnbaugh lab at UCSF.
- **Clinical Trials:** I have considerable experience with clinical trials and have been directly involved in 2 randomized open-label trials, and a double-blinded clinical trial with an industry sponsor

(Kimberly Clark) conducted through a CRO. I have completed necessary documents for ethical approval from multiple institutional review boards as well as trials registration on clinicaltrials.gov.

Fellowships and Awards

- **Postdoctoral Fellowship**
  Natural Sciences and Engineering Research Council of Canada *2015–2017*
  Proposal: Programming of host immunity by the microbiota at birth.
- **Alexander Graham Bell Doctoral Canada Graduate Scholarship**
  Natural Sciences and Engineering Research Council of Canada *2012–2015*
  Proposal: Comparative genomics to identify the mechanisms through which lactic acid bacteria detoxify environmental compounds.
- **Ontario Graduate Scholarship**
  Ontario Ministry of Training, Colleges and Universities *2012–2013*
  Declined in favour of NSERC CGS-D award
- **Ontario Graduate Scholarship**
  Ontario Ministry of Training, Colleges and Universities *2011–2012*
- **Wellcome Trust Travel Bursary**
  Wellcome Trust Foundation *2013*
  Abstract: Mechanisms by which lactic acid bacteria act on environmental toxins and the potential for fermented foods to reduce toxin adsorption.
- **Students for Development Grant**
  Canadian International Development Agency *2012*
  Proposal: Efficacy of probiotics in reducing toxin levels in mothers and children.
- **African Mobility Fund Grant**
  The Africa Institute at Western University *2012*
  Proposal: Investigating the effects of probiotic yogurt on reducing the levels of environmental toxins among school children in Mwanza, Tanzania.
- **FW Luney Travel Award**
  UWO Department of Microbiology and Immunology *2011–2014*

Selected Publications

Bisanz JE, MK Enos, J Mwanga, J Changalucha, JP Burton, GB Gloor and G Reid. 2014. The influence of probiotics and the gut microbiome on toxic metal levels in Tanzanian pregnant women and school children: a randomized open-label pilot study. mBio. 5(5):e01580-14. DOI: 10.1128/mBio.01580-14

Bisanz JE, MK Enos, G PrayGod, S Seney, JM Macklaim, S Chilton, D Willner, R Knight, C Fusch, G Fusch, GB Gloor, JP Burton and G Reid. 2015. The microbiota at multiple body sites during pregnancy in a rural Tanzanian population and the effects of Moringa supplemented probiotic yogurt. Applied and Environmental Microbiology. 81(15):4965-4975. DOI:10.1128/AEM.00780-15

Bisanz JE, P Suppiah, M Thomson, T Milne, N Yeoh, A Nolan, G Ettinger, G Reid, GB Gloor, JP Burton, M Cullinan and S Stebbings. 2016. The oral microbiome of patients with axial spondyloarthritis compared to healthy individuals. PeerJ. 4:e2095. DOI:10.7717/peerj.2095

Bisanz JE, P Suppiah, M Thomson, T Milne, N Yeoh, A Nolan, G Ettinger, G Reid, GB Gloor, JP Burton, M Cullinan and S Stebbings. 2014. Published abstract: Comprehensive analysis of the oral microbiome in axial spondyloarthritis reveals associations with disease activity and periodontitis. Annals of the Rheumatic Diseases. 73:422-443. DOI:10.1136/annrheumdis-2014-eular.3406

Bisanz JE, S Seney, A McMillan, R Vongsa, D Koenig, GB Gloor, M Sumarah, B Ford, D Herman, JP Burton and G Reid. 2014. A systems biology approach investigating the effect of *Lactobacillus rhamnosus* GR-1 and *L. reuteri* RC-14 on the vaginal microbiome and host responses in a double blind, placebo-controlled clinical trial of postmenopausal women with intermediate Nugent scores. PLoS ONE. 9(8):e104511. DOI:10.1371/journal.pone.0104511

Bisanz JE, JM Macklaim, GB Gloor and G Reid. 2014. Bacterial metatranscriptome analysis of a probiotic yogurt using a RNA-Seq approach. International Dairy Journal. 39(2):284-292. DOI: 10.1016/j.idairyj.2014.07.010

Bisanz JE, and G Reid. 2011. Unraveling how probiotic yogurt works. Science Translational Medicine. 3(106):106ps41

Bisanz JE*, R Hummelen*, JM Macklaim*, JA Hammond, A McMillan, R Vongsa, D Koenig, GB Gloor, and G Reid. 2011. Vaginal Microbiome and epithelial gene array in post-menopausal women with moderate to severe dryness. PLoS ONE. 6(11):e26602 **Equal contributions*

Koppel N, **JE Bisanz**, PJ Turnbaugh, and EP Balskus. 2017. Published Abstract: Characterization of a cardiac drug-inactivating enzyme from the prominent human gut microbe, *Eggerthella lenta*. FASEB Journal. 31(1):31:608.3

Harvie RM, AW Chisholm, **JE Bisanz**, JP Burton, P Herbison, K Schultz, and M Schultz. 2017. Long-term irritable bowel syndrome symptom control with reintroduction of selected FODMAPs. World Journal of Gastroenterology. 23(25): 4632–4643.

McMillan A, S Rulisa, M Sumarah, JM Macklaim, J Renaud, **JE Bisanz**, GB Gloor and G Reid. 2015. A multi-platform metabolomics approach identifies highly specific biomarkers of bacterial diversity in the vagina of pregnant and non-pregnant women. Scientific Reports. 5:14174. DOI:10.1038/srep14174

Trinder M, **JE Bisanz**, JP Burton and G Reid. 2015. Probiotic lactobacilli: a potential prophylactic treatment for reducing pesticide absorption in humans and wildlife. Beneficial Microbes. 6(6):841-847.

Trinder M, **JE Bisanz**, JP Burton and G Reid. 2015. Bacteria need "sleep" too? Microbiome circadian rhythmicity, metabolic disease and beyond. University of Toronto Medical Journal. 92(3):52-55.

Reid NSJ, **JE Bisanz** M Monachese, JP Burton and G Reid. 2013. The rationale for Probiotics improving reproductive health and pregnancy outcome. American Journal of Reproductive Immunology. 69:558-566.

Macphee RA, R Hummelen, **JE Bisanz**, WL Miller and G Reid. 2010. Probiotic strategies for the treatment and prevention of bacterial vaginosis. Expert Opinion on Pharmacotherapy. 11(18):2985-2995.

Patents

Bisanz JE*, G Reid, M Monachese, JET Van Hylckama Vlieg, T Smokvina, and JP Burton. Lactobacillus rhamnosus CNCM I-4716 food grade bacteria. US Patent 9,540,609 **Primary Inventor*

Bisanz JE, G Reid, M Monachese, JET Van Hylckama Vlieg, T Smokvina, and JP Burton. Food Grade Bacteria for the Removal of Toxic Compounds. Application April 5, 2013. WO2013149333

Teaching Experience

- **Tutorial Leader (BMS270/BMI219 The Human Microbiome)**
  Biomedical Science/Biological and Medical Informatics Programs, UCSF, San Francisco, USA2017–2018
  Prepared and administered a 4-hour hands-on tutorial for analyzing 16S rRNA gene data emphasizing current approaches for going from raw fastq sequencing data to biological interpretation. The tutorial is available here: jbisanz.github.io/BMS270_BMI219.
- **Lecturer/Teaching Assistant (Microbiology for Nursing 3820A)**
  Department of Microbiology and Immunology, Western University, London, Canada 2013–2014
  Delivered 1 hour lectures on prevention, diagnosis, and treatment of *Neisseria spp.*, *Chlamydia spp.* and Spirochetes for a 3rd year undergraduate course of 302 students. Prepared, administered and graded randomized case studies comprising 25% of final grade.
- **Teaching Assistant (Introduction to Biology 1002B)**
  Department of Biology, Western University, London, Canada 2014
  Delivering 2 hour lectures combined with facilitating student discussion groups covering concepts in general scientific literacy.
- **Teaching Assistant (Genetics 2581A)**
  Department of Biology, Western University, London, Canada 2013
  Delivering 1.5 hour tutorial lectures on basic concepts in genetics and answering student questions.
- **Teaching Assistant (Biology of Prokaryotes Lab Course)**
  Department of Microbiology and Immunology, Western University, London, Canada 2011
  Teaching basic bacteriology lab skills such as culture, media preparation and traditional identification approaches such as API-20E strips.

Additional Training

- **Macromolecular Informatics 9545S**
  Department of Biochemistry, Western University 2011
  Course topics: Perl, Shell Scripting, R, mapping and determining differential expression in RNASeq datasets.
- **International Development Short Course**
  Canadian International Development Agency 2012

Relevant Employment History

- **Laboratory Assistant**
  Lawson Health Research Institute, Duties: processing samples for RNAseq and microarray. 2010
  Supervisors: Wayne Miller and Gregor Reid

- **Laboratory Assistant**
  London Public Health Laboratory (Ontario Public Health Agency) *2009*
  Duties: Processing and testing of private/public water samples for fecal coliform and *E. coli* levels, media preparation and quality control, and data entry. Supervisor: Christine Fry
- **Laboratory Assistant**
  London Public Health Laboratory (Ontario Ministry of Health) *2008*
  Duties: Processing and testing of private/public water samples for fecal coliform and *E. coli*levels, media preparation and quality control, and data entry. Supervisor: Abdul Chagla

Invited Talks

Bisanz JE. The effects of very low-calorie diet on gut microbiome composition and function. 2017. UCSF Research in progress seminars: San Francisco, CA, USA.

Bisanz JE. The microbiome influences drug absorption in the intestine. April 2016. Charité Research Hospital: Berlin, Germany.

Bisanz JE. Mechanistic studies on the role of microbes in host toxic metal uptake. 2015. Institut Pasteur, Lille, France.

Bisanz JE. Identifying mechanisms through which lactic acid bacteria act on environmental toxins and the role of microbes in host toxin uptake. 2013, University of Reading: Whiteknights Campus, Reading, United Kingdom.

Bisanz JE. Understanding and manipulating the human microbiome: probiotics for men, women and children. 2012. National Institute for Medical Research: Mwanza, Tanzania.

Conference Oral Presentations

Bisanz JE. The Gut Microbiome Affects the Uptake and Metabolism of Drugs. Anaerobe 2018. Las Vegan, NV, USA.

Bisanz JE. The microbiome influences drug absorption in the intestine. 2016. Berchtesgaden Microbiome Science Days: Berchtesgaden, Germany.

Bisanz JE. Developing novel probiotic approaches to detoxification of environmental pollutants. March 2015. Beneficial Microbes Conference. The Hague, The Netherlands.

Bisanz JE, J Mwanga, J Changalucha, M Enos, JP Burton, T Smokvina, J van Hylckama Vlieg, GB Gloor and G Reid. Mechanisms by which lactic acid bacteria act on mercury and the potential for fermented foods to reduce toxic metal uptake. Joint International Union of Microbiological Societies and Canadian Society of Microbiologists conference. July 2014. Montreal, Quebec, Canada.

Bisanz JE. Mercury Rising. Gut Microbiology: from Sequence to Function. Joint INRA/Rowett and International Association for Probiotics and Prebiotics Meeting. June 2014. Aberdeen, Scotland.

Bisanz JE, M Monachese, N Nduti, J Mwanga, J Changalucha, M Enos, JP Burton, T Smokvina,

J van Hylckama Vlieg, GB Gloor and G Reid. Identifying mechanisms through which lactic acid bacteria act on environmental toxins and the efficacy of fermented foods in reducing host toxin uptake. Exploring Human Host-Microbiome Interactions in Health and Disease: July 2013. Cambridge, United Kingdom.

Bisanz JE, JM Macklaim, A Fernandes, A McMillan, J Younes, H Busscher, H Van Der Mei, GB Gloor, and G Reid. Lactobacillus in vaginal health. Canadian Society of Microbiologists Conference: June 2011. St. John's, Newfoundland, Canada.

Conference Poster Presentations

Bisanz JE, Jumpertz von Schwartzenberg R, Lyalina S, Spanogiannopoulos P, Ang QY, Cai J, Dickmann S, Turnbaugh JA, Patterson AD, Pollard KS, Mai K, Spranger J and PJ Turnbaugh. Diet-induced shifts in the human gut microbiome contribute to weight loss via expansion of enteric pathogens. Keystone Microbiome Symposium. March 2018. Banff, AB, Canada.

Bisanz JE, M Trinder, JP Burton, T Smokvina, JET van Hylckama Vlieg, GB Gloor and G Reid. Developing novel probiotic approaches to counter dietary toxic metal exposure. Annual International Society of Probiotics and Prebiotics annual meeting. May 2013. Washington DC, USA.

Bisanz JE, J Mwanga, J Changalucha, M Enos, J Burton, T Smokvina, JET van Hylckama Vlieg, GB Gloor and G Reid. Identifying mechanisms through which lactic acid bacteria act on environmental toxins and the efficacy of fermented foods in reducing host toxin uptake. Probiotics, Prebiotics, and the Host Microbiome: The Science of Translation: June 2013. New York Academy of Sciences, New York, USA.

Bisanz JE, J Mwanga, J Changalucha, M Enos, J Burton, T Smokvina, JET van Hylckama Vlieg, GB Gloor and G Reid. Identifying mechanisms through which lactic acid bacteria act on environmental toxins and the efficacy of fermented foods in reducing host toxin uptake. London Health Sciences Research Day: March 2013. London, Ontario Canada.

Bisanz JE, JET van Hylckama Vlieg, T Smokvina, GB Gloor, WL Miller and G Reid. 2011. Identification of probiotic strains and mechanisms to carry out detoxication of environmental toxins. Lawson Research Day: March 2011. London, Ontario, Canada.

Bisanz JE, JM Macklaim, A McMillan, R Hummelen, GB Gloor, and G Reid. The "Interactome" approach to understanding the role of the microbiota in vaginal health and disease. Microbes for Health 2nd International Symposium. December 2011, Paris, France.

Hummelen R, JM Macklaim, **JE Bisanz***, R Macphee, JA Hammond, A McMillan, GB Gloor and G Reid. The vaginal Microbiome of post-menopausal women: What is it telling us? International Human Microbiome Congress: March 2011. Vancouver, British Columbia, Canada. **Presenting Author*

Bisanz JE, JET van Hylckama Vlieg, T Smokvina, GB Gloor, WL Miller and G Reid. 2011.

Identification of probiotic strains and mechanisms to carry out detoxication of environmental toxins. Lawson Research Day: March 2011. London, Ontario, Canada

Bisanz JE, JET van Hylckama Vlieg, WL Miller and G Reid. 2010. Uncovering the mechanisms through which probiotics may protect against environmental carcinogens. Infection and Immunity Research Forum: November 2010. London, Ontario, Canada

LEADERSHIP/SERVICE

- **Reviewer/Referee**
  Ad hoc reviewer: *2014–Present*
  Applied and Environmental Microbiology (ASM), Microbiome (BMC), Environmental Science and Technology (ACS), International Journal of Food Microbiology (Elsevier), Nutrients (MDPI), Nutrition Research (Elsevier), Beneficial Microbes (Wageningen Academic), PLoS One, and International Journal of Environmental Research and Public Health (MDPI)
- **Panelist**
  London Public Library, ON, CA *2014*
  Part of an expert panel at a showing of Microbirth to answer audience questions about the human microbiome and probiotics.
- **Students and Fellows Association Executive**
  International Scientific Association for Probiotics and Prebiotics *2013–2015*
  Conference organization (Aberdeen 2014, Washington DC 2015) and recruiting.
- **Lawson Association of Students and Fellows Co-president**
  Lawson Health Research Institute *2012–2013*
  Organizing networking events and holiday party with 100+ attendees.
- **M&I Social Committee Co-chair**
  Microbiology and Immunology Department *2011–2012*
  Organizing networking events and holiday party with 100+ attendees.
- **Canada-Wide Science Fair Judge**
  Seneca College, Toronto, Canada *2011*
  Evaluating and ranking the senior high-school finalists.
- **Science Fair Judge**
  Lucas Secondary School, London, Canada *2010*
  Evaluating junior high-school projects on green technologies.
- **Student Executive Member**
  Western Heads East *2007-2010*
  Coordinating student fund-raising.

Professional Affiliations

- **Canadian Society of Microbiologists**
  General Member *2011-Present*
  Presented at annual meetings in 2011 and 2014.