The Microbial Multiverse Symposium
September 14-16, 2023

Proceedings
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Dear colleagues and friends,

It is with great pleasure that we extend a warm welcome to the 2023 Microbial Multiverse Symposium hosted by the Microbial Systems Initiative. We are excited to have you join us for this celebration of our vibrant research community.

The Microbial Multiverse Symposium is a testament to the broad scope and diversity of microbial topics that are being studied at the University of Illinois. As you peruse the abstracts, you will encounter a mosaic of research topics, methodologies, and perspectives, highlighting the interdisciplinary nature of microbial systems research. The symposium’s presentations and discussions will undoubtedly foster collaboration, inspire new ideas, and advance our understanding of the microbial world.

Too often research is conducted in isolated silos, much like the multiverse refers to the coexistence of numerous separate worlds. The Microbial Systems Initiative aims to dismantle these divisions by encouraging interconnectedness and collaboration. The Microbial Multiverse Symposium offers an ideal chance to gather, foster connections, and cultivate a supportive and innovative microbiology community. The relationships formed here will bridge gaps, paving the way for promising collaborations. Together, we can make UIUC feel more connected and accessible.

We would like to extend our sincere gratitude to all the participants, presenters, organizers, and sponsors who have made this event possible. Your dedication to the advancement of microbiology is truly commendable, and we look forward to the contributions and discussions that will enrich this symposium.

Warm regards,

Paola Mera and Chris Gaulke
Microbial Multiverse Symposium Planning Chairs
Microbial Systems Initiative

About the Microbial Systems Initiative
The Microbial Systems Initiative (MSI) is a research community founded in 2018 with the goal of strengthening our robust international profile in microbial sciences research and education. MSI has grown to a community of over 400 members representing over 60 campus units. We have built a collegial, collaborative community through efforts to connect across disciplinary boundaries, to recruit and retain the next generation of microbial sciences faculty, and to support high quality education and professional development experiences for trainees. With institutional recognition and support, MSI is poised to broaden the scope of our impact.

Cari Vanderpool
Director

Shannon Sirk
Associate Director

Sara Ressing
Assistant Director

Maggie Berg
Research Development Director

The Microbial Multiverse Symposium is co-hosted by the Department of Microbiology, the Institute for Genomic Biology, the School of Molecular and Cellular Biology, the College of Veterinary Medicine, and the Personalized Nutrition Initiative and made possible by the Olga G. Nalbandov Lecture Fund.
Thursday, September 14
Alice Campbell Alumni Center
601 S. Lincoln Avenue, Urbana

Welcome
Alice Campbell Alumni Center Ballroom
Cari Vanderpool, Director of the Microbial Systems Initiative
Gene Robinson, Director of the Carl R. Woese Institute for Genomic Biology

Public Lecture
Alice Campbell Alumni Center Ballroom
Margaret McFall-Ngai, Director and Senior Staff Scientist at Carnegie’s Biosphere Sciences and Engineering Division

Reception
Richmond Family Gallery

Keynote
The power of ‘maiki’ – How Vibrio fischeri shapes the biology of the Hawaiian bobtail squid Euprymna scolopes

Margaret McFall-Ngai
Staff Scientist, Carnegie Institution for Science
Faculty Associate, California Institute of Technology

Recent research has demonstrated that symbioses between animals and microbes [maiki – Hawaiian, the invisible force] are fundamental to the biology of most, if not all, animal species. The mutualistic association between the Hawaiian bobtail squid, Euprymna scolopes, and its luminous bacterium, Vibrio fischeri, is a powerful model to investigate signaling between the host and its microbial partner. In this system, symbiotic bacteria are acquired by horizontal transmission within hours of hatching. This presentation will focus on what we know about the mechanisms underlying the establishment and maintenance of the symbiotic state.
Friday, September 15
Beckman Institute
405 N Mathews Ave, Urbana

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<th>Time</th>
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<tr>
<td>8:30-9:00 a.m.</td>
<td><strong>Breakfast and Registration</strong> - Beckman Room 1005</td>
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<tr>
<td>9:00-9:15 a.m.</td>
<td><strong>Opening Remarks</strong> - Beckman Room 1025- Auditorium</td>
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| 9:15-10:45 a.m.| Session 1: Microbes and the Environment  
**Beckman Room 1025- Auditorium**  
Chair: Katy Heath  
Presenters:  
Maggie Wagner, University of Kansas  
Shreya Arya, PhD student in O'Dwyer lab in the Department of Plant Biology  
Tony Yannarell, Natural Resources & Environmental Sciences  
Sierra Raglan, PhD student in Angela Kent's lab, Natural Resources & Environmental Sciences |
| 10:45-11:00 a.m.| **Coffee Break** - Beckman Room 1005                                                                            |
| 11:00-12:30 p.m.| Session 2: Microbe-microbe Interaction  
**Beckman Room 1025- Auditorium**  
Chair: Asma Hatoum-Aslan  
Presenters:  
Dominique Limoli, University of Iowa  
Angad Mehta, Chemistry  
Ido Golding, Physics  
Christopher Brooke, Microbiology |
| 12:30-1:30 p.m.| 12:30-1:30 p.m. - **Lunch break** - Beckman Room 1005                                                          |
| 1:30-3:00 p.m.| Session 3: Microbes and Nutrition  
**Beckman Room 1025- Auditorium**  
Session chair: Sharon Donovan  
Presenters:  
Suzanne Devkota, Cedars Sinai  
Sharon Donovan, Food Science & Human Nutrition  
Hannah Holscher, Food Science & Human Nutrition  
Jacob Allen, Kinesiology and Community Health |
| 3:00-3:30 p.m.| **Coffee Break** - Beckman Room 1005                                                                            |
| 3:30-5:00 p.m.| Session 4: Microbes and the Brain  
**Beckman Room 1025- Auditorium**  
Chair: Adrienne Antonson  
Presenters:  
Helen Vuong, University of Minnesota  
Brett Loman, Animal Sciences  
Elisa Caetano-Silva, Postdoctoral student in Jacob Allen’s Lab  
Adrienne Antonson, Animal Science |
| 5:00-6:30 p.m.| **Poster Session and Refreshments** - Beckman Center Atrium  
Even number posters presented 5:00-5:45 p.m.; odd number posters presented 5:45-6:30 p.m. |
## Microbial Systems Initiative

**Microbial Multiverse Symposium**  
**Sept 14-16, 2023**

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### Saturday, September 16  
**Beckman Institute**  
**405 N Mathews Ave, Urbana**

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<tr>
<td>9:00-9:30 a.m.</td>
<td><strong>Coffee and Registration</strong> - <em>Beckman Room 1005</em></td>
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| 9:30-11:00 a.m.| **Session 5: Harnessing Microbial Activities**  
*Beckman Room 1025- Auditorium*  
Chair: Shannon Sirk  
Presenters:  
- Erica Majumder, University of Wisconsin-Madison  
- Brenda Wilson, Microbiology  
- Asma Hatoum-Aslan, Microbiology  
- Na Wei, Civil & Environmental Engineering |
| 11:00-12:30 p.m.| **Microbes in Society Panel Discussion**  
*Beckman Room 1025- Auditorium*  
Moderators: Pamela Martinez and Becky Smith  
Presenters:  
- Monica Green, Author and Historian  
- Jodi Schneider, Informatics  
- Jacinda Dariotis, Family Resiliency Center  
- Pamela Martinez, Microbiology  
- Sang-Hwa Oh, Department of Advertising |
| 12:30-1:45 p.m.| **Closing Remarks** - *Beckman Room 1025- Auditorium*                                           |

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**Poster Session**

This session showcases the innovative research conducted by early career researchers at the University of Illinois. From environmental impacts, therapeutic applications and innovative approaches, the posters provide insight into the collaborative nature of microbial systems research. These 40 posters represent 17 departments/units across campus.

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<tr>
<th>Poster Number</th>
<th>Presenter</th>
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<tr>
<td>1</td>
<td>Saeed Ahmad</td>
<td>Microbial bead technology as a co-culture platform to study host-microbe interaction – androgenicity of urinary tract microbiomes on prostate cancer cells</td>
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<tr>
<td>2</td>
<td>Zainab Alzoubi</td>
<td>Chemotherapy-induced changes in gut microbial composition disrupt entero-hepatic bile acid metabolism.</td>
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<td>3</td>
<td>Anubhav Basu</td>
<td>Raffinose family oligosaccharide utilization by <em>Bacteroides thetaiotaomicron</em></td>
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<tr>
<td>4</td>
<td>Sierra Bedwell</td>
<td>Exploring the diversity of rhizobia in and out of mutualism</td>
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<td>5</td>
<td>Sara Belchik</td>
<td>A veterinary gastrointestinal low-fat diet affects fecal characteristics, metabolites, bile acids, and microbiota concentrations of antibiotic-treated dogs</td>
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<td>6</td>
<td>Mitchell Bryant</td>
<td>Microbial delivery of antibodies to combat porcine respiratory disease complex</td>
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<td>7</td>
<td>Izan Chalen-Paredes</td>
<td>Evaluating fetal corticogenesis in germ-free mice in response to maternal IL-17a administration</td>
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<td>8</td>
<td>Hunter Cobbley</td>
<td>Characterization of the evolutionary and ecological impact of rhizobiophages</td>
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<tr>
<td>9</td>
<td>Paola Corea</td>
<td>Heat transfer model for milk temperature for predicting quality of milk shared in different school lunch service and storage conditions</td>
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<td>10</td>
<td>Luoyan Duan</td>
<td>Quantifying the impacts of zinc malnutrition on host-microbiota interactions</td>
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<td>11</td>
<td>Allison Higgins</td>
<td>Crimson and Clover: Methylobacterium and clover fitness</td>
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<tr>
<td>12</td>
<td>Ezza Khan</td>
<td>The role of chromosome replication initiator in regulation of cell size</td>
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<tr>
<td>13</td>
<td>Morgan Letzkus</td>
<td>The role of the polar protein, TipN, in chromosome segregation in <em>Caulobacter crescentus</em></td>
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<td>14</td>
<td>Junya Li</td>
<td>The impact of non-pharmaceutical interventions on the transmission of human respiratory viruses in Chile</td>
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<td>15</td>
<td>Adam Markowicz</td>
<td>Imaging biofilms and anti-microbial treatment effects with optical coherence tomography</td>
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### Posters continued

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<tr>
<td>16</td>
<td>Breanna Metras</td>
<td>In vitro fermentation characteristics of dietary fibers using fecal inoculum from dogs consuming commercial or traditional kefir</td>
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<tr>
<td>17</td>
<td>Guillermo Monroy</td>
<td>Development of Cold microplasma point of care system to treat otitis media – advancements in a preclinical small animal model</td>
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<tr>
<td>18</td>
<td>Lydia Okyere</td>
<td>Zebrafish: An emerging model of the interplay between vertebrates, gut microbiota, and bile acids</td>
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<tr>
<td>19</td>
<td>Ashley Otero</td>
<td>Influenza A virus during pregnancy disrupts the downstream maternal intestinal immune and microbial landscape in a dose- and time-dependent manner</td>
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<td>20</td>
<td>Sumashini Pagaldevatti</td>
<td>Figs, fungi and forests: The role of seed-fungal interactions in shaping the coexistence of closely related tree species in a tropical forest ecosystem</td>
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<tr>
<td>21</td>
<td>Stephanie Puentes</td>
<td>To let go or not to let go: how ParA can impact the release of the chromosomal anchoring in Caulobacter crescentus</td>
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<td>22</td>
<td>Megan Ringling</td>
<td>Helicobacter pylori vacA's binding region and its potential as a clinical gastric disease risk marker</td>
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<td>23</td>
<td>Joel Rivera Cardona</td>
<td>Characterization of strain differences in ISG antagonism during influenza A virus infection through single-cell level analyses</td>
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<td>24</td>
<td>Alexander Shuppara</td>
<td>Flow patterns bacterial growth by modulating spatial H2O2 gradients</td>
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<td>25</td>
<td>Janet Sorrells</td>
<td>Label-free optical metabolic imaging of bacteria and biofilms with high spatiotemporal resolution using multiphoton autofluorescence microscopy</td>
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<td>26</td>
<td>Laura Sutenfield</td>
<td>CRISPR-Cas mediated drivers of Pseudomonas aeruginosa lysogen diversity</td>
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<td>27</td>
<td>Mark Tarabey</td>
<td>In vivo production and delivery of biotherapeutics against respiratory pathogens</td>
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<td>28</td>
<td>Ivan Valishev</td>
<td>Psychological stress depletes microbiota-derived aryl-metabolites in parallel to heightened host IDO1 activity</td>
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<td>29</td>
<td>Adriana Velasquez</td>
<td>Optimizing bioactive metabolites in a whole food matrix (yogurt) by the addition of LABs and metabolic co-factors</td>
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<td>30</td>
<td>David Vereau Gorbiltz</td>
<td>Patterns of plasmid inheritance and diversity within core and variable elements of Rhizobium leguminosarum genomes</td>
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<td>31</td>
<td>Zihan Wang</td>
<td>The ecological consequences of microbial metabolic strategies in fluctuating environments</td>
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<td>32</td>
<td>Jeremiah Wanyama</td>
<td>Novel insights into the biogeography and functional potential of the zebrafish microbiome</td>
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<td>33</td>
<td>Sofia Wilson</td>
<td>Effects of dietary fiber and biotic supplementation on fecal characteristics, metabolites, and microbiota of healthy adult dogs</td>
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<td>34</td>
<td>Amanda Wong</td>
<td>Nannizziopsis guarroi infection trial in six adult bearded dragons (Pogona vitticeps)</td>
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<td>35</td>
<td>Jiaying Wu</td>
<td>Aggregative soil sampling using boot covers compared to soil grabs from commercial romaine fields shows similar indicator organism and microbial community recovery</td>
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<td>36</td>
<td>Zifan Xie</td>
<td>Harnessing Endogenous Type II-A CRISPR System to Do Genome Editing in Lactocaseibacillus rhamnosus GG</td>
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<td>37</td>
<td>Lufan Yang</td>
<td>A neonatal piglet model reveals interactions between nasal microbiota and influenza A virus pathogenesis</td>
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<td>38</td>
<td>Yu-Hsuan Yeh</td>
<td>Engineering protein secretion of Bacteroides species</td>
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<td>39</td>
<td>Fu Yu</td>
<td>Sparse identification of bacterial transcriptional regulation</td>
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<tr>
<td>40</td>
<td>Changyi Zhang</td>
<td>Novel insight into the infection mechanisms of archaeal viruses</td>
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Session 1: Microbes and the Environment

*Friday, September 15, 9:15 – 10:45 a.m*

*Beckman Institute Room 1025 – Auditorium*

Chair: Katy Heath

**PRESENTERS:**

- Adaptation of plants and microbial neighbors to shared abiotic stress
  Maggie Wagner, Department of Ecology and Evolutionary Biology, University of Kansas

- Sparsity of higher-order interactions enables learning and prediction for microbiome
  Shreya Arya, PhD student in O’Dwyer lab in the Department of Plant Biology, University of Illinois

- Causal microbes: what microbial ecologists can learn from causal graphs
  Tony Yannarell, Natural Resources & Environmental Sciences, University of Illinois

- Roots of Change: understanding the influence of bioenergy sorghum breeding on the root metabolome and microbiome
  Sierra Raglin, PhD student in Angela Kent’s lab, Natural Resources & Environmental Sciences, University of Illinois
Session 2: Microbe-microbe Interaction

*Friday, September 15, 11:00 – 12:30 p.m.*
*Beckman Institute Room 1025 – Auditorium*
*Chair: Asma Hatoum-Aslan*

The symbiotic and antagonistic relationships that microorganisms share with each other play vital roles in microbial survival and evolutionary trajectory. Investigating these intricate interactions is essential not only for understanding microbial population dynamics, but also for discerning their influence on a myriad of environmental and biological processes, including ecosystem dynamics and human health and disease. Speakers in this session will delve into the complex interactions between diverse microorganisms and highlight their far-reaching impacts, ranging from the emergence of disease to the development of new biotechnologies.

**PRESENTERS:**

- **War and Peace: Polymicrobial interactions in cystic fibrosis airway disease**
  Dominique Limoli, Department of Microbiology and Immunology, University of Iowa

- **Engineering microbial “cell within cell” systems to study evolution**
  Angad Mehta, Department of Chemistry, University of Illinois

- **Co-infecting phages impede each other’s entry into the cell**
  Ido Golding, Department of Physics, University of Illinois

- **Collective dynamics within influenza virus populations**
  Christopher Brooke, School of Molecular & Cellular Biology, University of Illinois
Session 3: Microbes and Nutrition

Friday, September 15, 1:30 – 3:00 p.m.
Beckman Room 1025 – Auditorium
Chair: Sharon Donovan

Diet and nutrition have a substantial influence on human health and wellbeing. The gut microbiome also plays a fundamental role in human health and diet is one of the most effective modulators of gut microbiota composition and metabolic function. This session will highlight: (1) how diet affects microbial colonization and host-microbe interactions in early life, and (2) how diet and fermented foods interact with the microbiome to influence metabolic and immune outcomes.

PRESENTERS:

Compensatory actions of the gut microbiome during times of chronic nutritional stress
Suzanne Devkota, Cedars-Sinai Division of Gastroenterology

Factors influencing establishment of the microbiota in the first 1000 days of life – Implications for child outcomes
Sharon Donovan, Department of Food Science and Human Nutrition, University of Illinois

Diet, the gut microbiota, and metabolic health
Hannah Holscher, Department of Food Science and Human Nutrition, University of Illinois

Optimizing bioactive microbial metabolites in fermented food to support human immune function
Jacob Allen, Department of Kinesiology & Community Health, University of Illinois
Session 4: Microbes and the Brain  
*Friday, September 15, 3:30 – 5:00 p.m.*  
*Beckman Room 1025 – Auditorium*  
Chair: Adrienne Antonson

It has become increasingly apparent that endogenous microbes contribute to host brain development and function throughout the lifespan. Similarly, cues from the central nervous system influence microbial physiology at the cellular and community level. This bidirectional communication between the microbiome and the central nervous system is regulated through various neuronal, endocrine, chemical, and immune signaling pathways, each of which can be disrupted by exogenous stimuli. This session will highlight: (1) how microbes regulate early brain development during health and disease, and (2) how psychological stress can disrupt intestinal physiology and microbial homeostasis.

**PRESENTERS:**

- **Towards understanding the role of the microbiota in fetal development**  
  Helen Vuong, Department of Pediatrics, University of Minnesota

- **Implications of diet and stress on microbiota-host neurotransmission**  
  Brett Loman, Department of Animal Sciences, University of Illinois

- **Stress hormone signaling modify epithelial layer physiology**  
  Elisa Caetano-Silva, post doc in Allen Lab, Department of Kinesiology, University of Illinois

- **Exogenous and endogenous microbes influence prenatal brain development through immune signaling**  
  Adrienne Antonson, Department of Animal Sciences, University of Illinois
Recent years have seen a growing appreciation and understanding of the fundamental and powerful roles that microbes play in countless processes across human, animal, and environmental health. Researchers studying these microscopic organisms have uncovered countless insights into their behavior, metabolism, and community interactions, establishing the foundations to move beyond discovery, toward application. Speakers in this session will share the diverse approaches they have taken to exploit and expand this substantial body of microbial knowledge, and describe the innovative ways in which they aim to harness microbial activities to address unmet needs in human health and environmental sustainability.

PRESENTERS:

Mechanisms of microbe-contaminant interactions and their applications in environmental health
Erica Majumder, Department of Bacteriology, University of Wisconsin-Madison

Harnessing bacterial toxin diversity: Learning from modularity, domain swapping, and evolutionary fine-tuning
Brenda Wilson, School of Molecular & Cellular Biology, University of Illinois

Harnessing bacterial viruses to combat antibiotic-resistant pathogens
Asma Hatoum-Aslan, School of Molecular & Cellular Biology, University of Illinois

Engineering microbes for environmental sustainability
Na Wei, Civil & Environmental Engineering, University of Illinois
Microbes in Society Panel Discussion

*Saturday, September 16, 11:00 – 12:30 p.m.*

*Beckman Institute Room 1025 – Auditorium*

Moderator: Becky Smith

This panel will discuss the intersection of microbial and social sciences, featuring speakers from a wide range of health-related research areas outside microbiology. Discussion will highlight how work across these disciplines can push the boundaries of what is possible.

**PANEL:**

Monica Green, Author and Historian  
Jodi Schneider, School of Information Science  
Jacinda Dariotis, Human Development and Family Studies, Family Resiliency Center  
Pamela Martinez, School of Molecular & Cellular Biology  
Sang-Hwa Oh, Department of Advertising
Panel Keynote:
When Microbes Become Visible: Plague, SARS-CoV-2, and the History of Human-Animal-Microbe Connections

Monica Green

A long-standing problem in the field of history of medicine has been the challenge of reconstructing disease histories in the pre-microscopic age. Before the advent of modern bacteriology (and later, virology), infectious diseases could be known only by reports of their symptoms, usually just in human patients. Even readily visible diseases might not be systematically reported. And records of historical zoonotic transmissions hardly exist at all.

As the world has learned from the rapid reconstruction of the origins of the COVID-19 pandemic, genetics (which can track the pathogen itself) is now a powerful tool for inferring human-animal connections that underlie a number of major infectious diseases. That power is also being used to reconstruct the history of historical pandemics. For historians, this presents the opportunity to return to historical records and reconstruct a microbial world that would have been invisible to past populations. Although most work must remain at the level of inference, by mapping evidence drawn from a variety of disciplinary approaches, it is becoming increasingly possible to perceive human-animal-microbial connections of which we were previously unaware. This talk will take recent results from the history of the Black Death (whose origins are being pushed back nearly a century and a half) and show how expanded chronologies and geographies of pandemics also show us ways to think more broadly about humans’ roles in microbial proliferation.

Monica H. Green is a historian of medicine specializing in the history of the premodern period and the comparative history of global health. Trained in the History of Science at Princeton University, she has taught and held fellowships at leading institutions such as Duke University, the Institute for Advanced Study, and All Souls College. Both her research and her teaching have been honored by top prizes, and she was recently recognized by having a prize named in her honor by the Medieval Academy of America. She is currently completing The Black Death: A Global History, which melds new insights from genetics with a reinterrogation of the documentary record of the world’s most devastating pandemic. She can be followed on Twitter at @monicaMedHist.