Center for Emerging, Zoonotic, and Arthropod-borne Pathogens

Distinguished Speaker Seminar Series in Infectious Disease
SPRING 2021

February 2, 2021:

Tom Ewing, CLAHS

Wear a mask or go to Jail: Infectious Disease, Health Mandates, and Social Behavior during the 1918 Influenza Epidemic

Recorded Seminar / Presentation Slides / Flu Mask Project

February 16, 2021:

Cassidy Rist, CVM

A One Health approach to malaria, will we do the Fandango?

Recorded Seminar

February 23, 2021:

Rana Ashkar, COS

Biomimetic Lipid Membranes in Viral Infections and Therapeutics

Recorded Seminar

March 2, 2021:

Michael Schulz, COS

Antiviral Polymers: Challenges and Opportunities

Recorded Seminar

March 9, 2021:

Amy Pruden, CEE

Manipulating Treatments, Water Chemistry, and System Design to Limit Proliferation of Pathogens and Antibiotic Resistance in Water Systems: A Microbiome Perspective

Recorded Seminar

March 16, 2021:

Jason Kaelber, Rutgers University

How colicin E1 stoppers the multidrug efflux pump TolC

March 23, 2021:

Juhong Chen, CALS / COE

Phage-based biosensors to detect pathogens

Recorded Seminar

March 30, 2021:

Kathy Alexander, CNRE

Transforming Landscapes and the Ecology of Scale - Understanding Disease Emergence at the Human-Wildlife-Environmental Interface

Recorded Seminar

April 13, 2021:

Brandon Jutras, CALS

Exploring the biology and pathogenesis of Borrelia burgdorferi, the Lyme disease spirochette

April 20, 2021:

Juliana Cassataro, San Martín National University, Argentina

Discovery of new adjuvants for oral vaccines

April 27, 2021:

Song Li, CALS

Developing culture-free, early plant disease detection methods using hyperspectral sensing, nanopore sequencing and machine learning

Recorded Seminar

May 4, 2021:

Sonia Altizer, University of Georgia

Seminar Title: Food for contagion: Host–parasite responses to resource shifts in human-dominated environments

Recorded Seminar

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CeZAP
Center for Emerging, Zoonotic, and Arthropod-borne Pathogens

Dr. Thomas Ewing

Professor of History and Associate Dean
in the College of Liberal Arts and Human Sciences

Wear a Mask or Go to Jail: Infectious Disease, Health Mandates, and Social Behavior during the 1918 Influenza Epidemic

The 1918 influenza epidemic provides historical insights into the effectiveness of public health measures designed to contain the spread of infectious disease. This presentation examines masks as a tool to prevent disease transmission, mask mandates as public health policy, and mask wearing as a form of collective as well as individual behavior. The title comes from a photograph, taken in November 1918, showing a row of several young adults, all with masks, with one woman wearing a small placard that reads: "Wear a mask or go to jail." More information about the flu mask project is available online: https://sites.google.com/vt.edu/flumasks/home.

CeZAP Distinguished Speaker Seminar Series

Tuesday Feb 2, 2021 at 12 Noon

https://virginiatech.zoom.us/j/83890036483

VIRGINIA TECH

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Center for Emerging, Zoonotic, and Arthropod-borne Pathogens

Dr. Cassidy Rist

Assistant Professor
Center for Public and Corporate Veterinary Medicine
Department of Population Health Sciences

A One Health approach to malaria, will we do the Fandango?

Usually danced by couples, the Fandango is a Spanish dance that begins slowly, with the rhythm marked by castanets, clapping of hands, snapping of fingers, and the stamping of feet; the speed gradually increases. It requires coordination and harmony between the two partners to achieve its splendor – very much like the coordination efforts required between animal and human health stakeholders to implement a One Health approach to malaria. In this presentation, I will discuss BOHEMIA (Broad One Health Endectocide-based Malaria Intervention in Africa), an ongoing clinical trial to assess the safety and efficacy of delivering ivermectin to people and livestock as a novel vector control tool in the fight against malaria. Results will be particularly important if the use of ivermectin significantly reduces cases of malaria, as the implementation of the intervention across human and livestock populations will require economic resources from both public health and agricultural sectors. If successful, our One Health approach to data collection and analysis will provide information on how costs (and benefits) are allocated across these sectors, which can inform how local and national-level ivermectin delivery strategies would be best employed, and will be influential in acquiring funding and buy-in from governments and international organizations. The BOHEMIA trial provides an excellent example of One Health in action – from study design, to implementation, to data analysis and in assessing cost-effectiveness for policy recommendation.

CeZAP Distinguished Speaker Seminar Series

Tuesday Feb 16, 2021 at 12 Noon

https://virginiatech.zoom.us/j/89917075487

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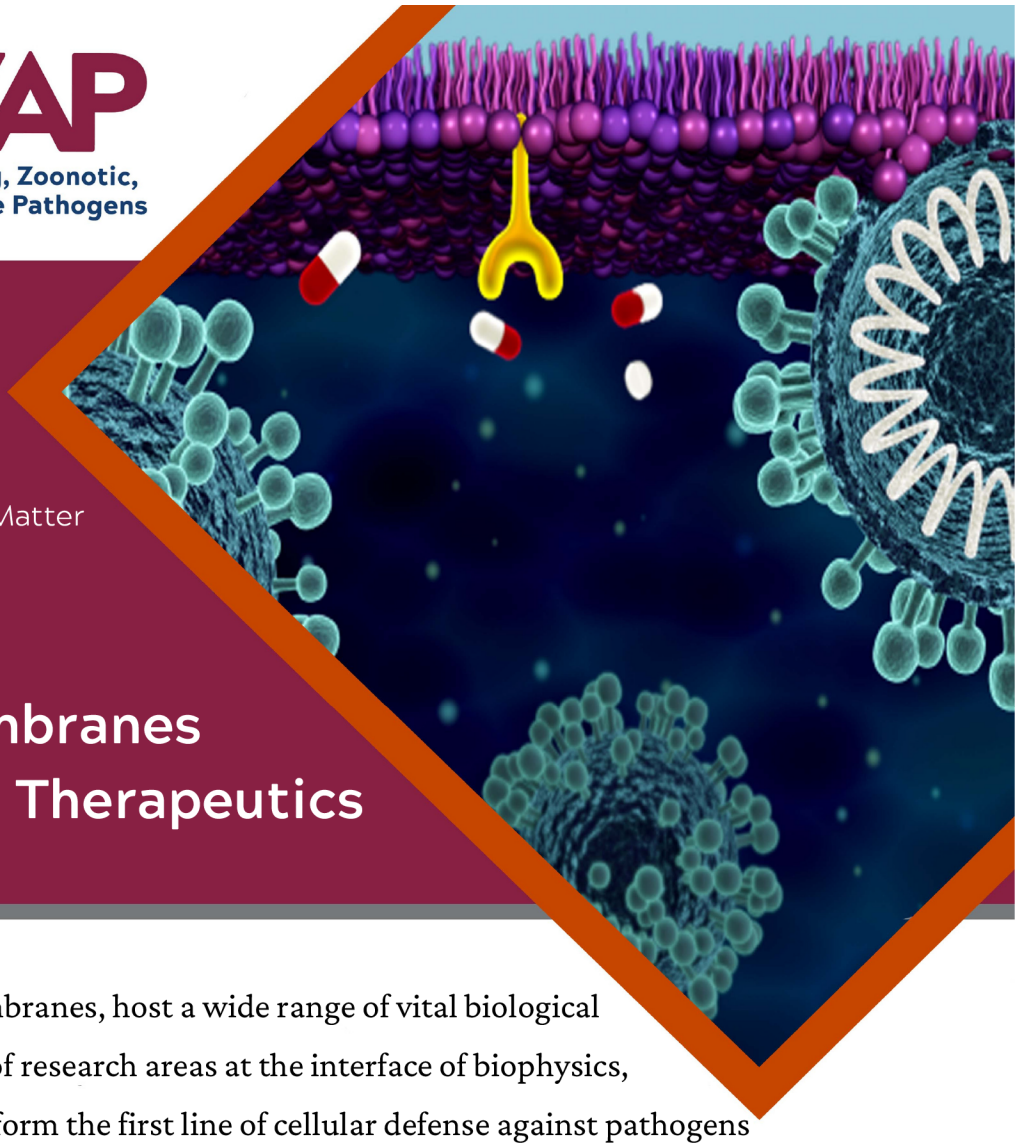

Dr. Rana Ashkar

Department of Physics & Center for Soft Matter and Biological Physics, Virginia Tech

Biomimetic Lipid Membranes in Viral Infections and Therapeutics

Lipid bilayers, the main matrix of cell membranes, host a wide range of vital biological processes and are ubiquitous in a variety of research areas at the interface of biophysics, health care, and biotechnology. They also form the first line of cellular defense against pathogens and they moderate the cell's immune responses to viruses, such as the recent coronavirus (SARS-COV-2).

To enable functional control in lipid membranes and to fully utilize their potential in pharmaceutical and biotechnological applications, it is imperative to understand the biophysical phenomena that underlie key membrane functions, including membrane stabilization, the interactions of membranes with viral proteins, and the response of membranes to additives such as cholesterol and drug molecules.

This talk will focus on synergistic applications of neutron scattering and MD simulations to interrogate membrane structures and dynamics on mesoscopic scales over which membrane-pathogen interactions and other membrane functions occur.

CeZAP Distinguished Speaker Seminar Series

Tuesday Feb 23, 2021 at 12 Noon

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Dr. Michael Schulz

Assistant Professor
Department of Chemistry, Virginia Tech

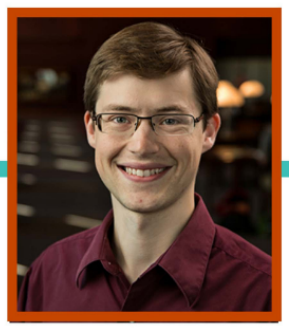
Antiviral Polymers: Challenges and Opportunities

CeZAP Distinguished Speaker Seminar Series

Tuesday March 2, 2021 at 12 Noon

The need for effective antiviral countermeasures has been thrown into sharp relief by the current pandemic, and numerous approaches to mitigating viral infections are being actively investigated. Antiviral polymers are one such approach. Polymers—large molecules made up of many repeating units—possess properties not found in small-molecule drugs. In particular, polymers can be designed to have “polyvalency”, meaning that multiple repeat units or pendant ligands on the polymer can simultaneously bind to multiple complementary receptors on a biological target. Ubiquitous in biology, such polyvalent interactions are typically much stronger than monovalent binding because multiple ligand-receptor interactions act synergistically. Thus, synthetic polymers can be designed to bind to a virus surface and block its ability to bind to and subsequently infect cells.

In this talk, I will present an overview of the field of antiviral polymers, followed by a discussion of the challenges and opportunities that lie ahead.



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Dr. Amy Pruden

W. Thomas Rice Professor
Department of Civil & Environmental Engineering

Distinguished Speaker Seminar Series in Infections Diseases

Tuesday March 9, 202 1 at 12 Noon

Manipulating Treatments, Water Chemistry, and System Design to Limit Proliferation of Pathogens & Antibiotic Resistance in Water Systems: A Microbiome Perspective

While most existing technologies and regulations focus on the removal of pathogens of fecal origin (e.g., E. coli and Salmonella), next generation battlefronts in combating waterborne disease are emerging. Opportunistic pathogens (e.g., Legionella and non-tuberculous mycobacteria) are a major challenge because they establish and proliferate in the biofilms of water systems, as is antibiotic resistance, which can be shared among bacteria via the mobilization of antibiotic resistance genes (ARGs). New engineering and regulatory paradigms for pathogen control are required to address these public health threats. Here we apply a microbiome perspective towards understanding how various manipulations in water treatment, chemistry, and system design can be manipulated to reduce colonization, survival and proliferation of opportunistic pathogens and ARGs.

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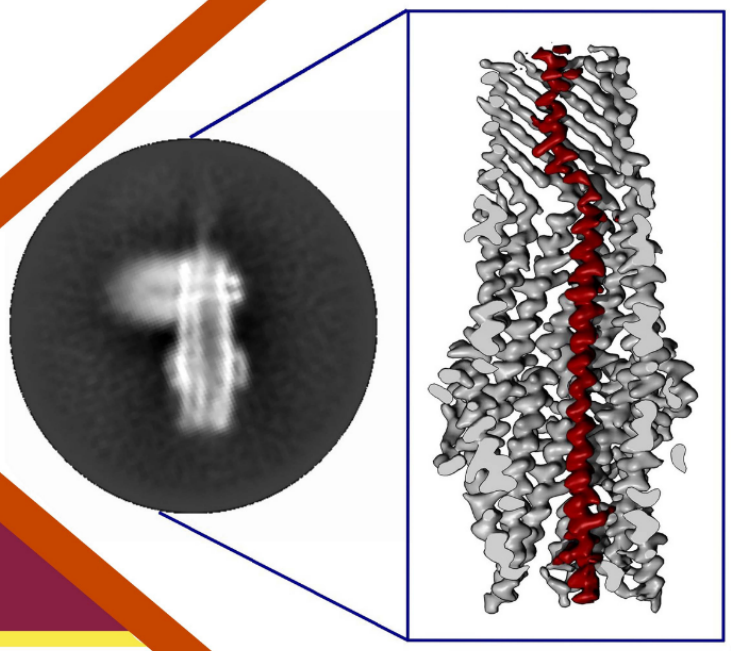

Dr. Jason Kaelber

Rutgers University

Director, Rutgers CryoEM & Nanoimaging Facility
Institute for Quantitative Biomedicine

Distinguished Speaker Seminar Series in Infections Diseases

Tuesday March 16, 202 1 at 12 Noon

How colicin E1 stoppers the multidrug efflux pump TolC

Colicins (and related bacteriocins) are produced by some bacterial strains to kill or inhibit growth of closely-related strains. They are thought to first bind a cognate receptor, then pass through an outer membrane transporter by means of an N-terminal helical hairpin “translocation domain,” and finally execute a cytotoxic effector function in the periplasm. We trapped colicin E1 engaged with its outer membrane transporter, the multidrug efflux pump TolC, and revealed its structure by cryoEM. The N-terminal helical hairpin scissors open and its hinge recognizes a binding site inside the TolC barrel; colicin E1 plugs the efflux pump and blocks antibiotic transport. Only a small part of colicin E1 passes through TolC to the periplasm; we propose the cytotoxic domain enters by another route. The structure resolves contradictions between competing models for colicin E1 action.To solve the structure of the TolC/colicin E1 complex, we modified the hardware of our electron microscope to increase the throughput by a factor of 4.

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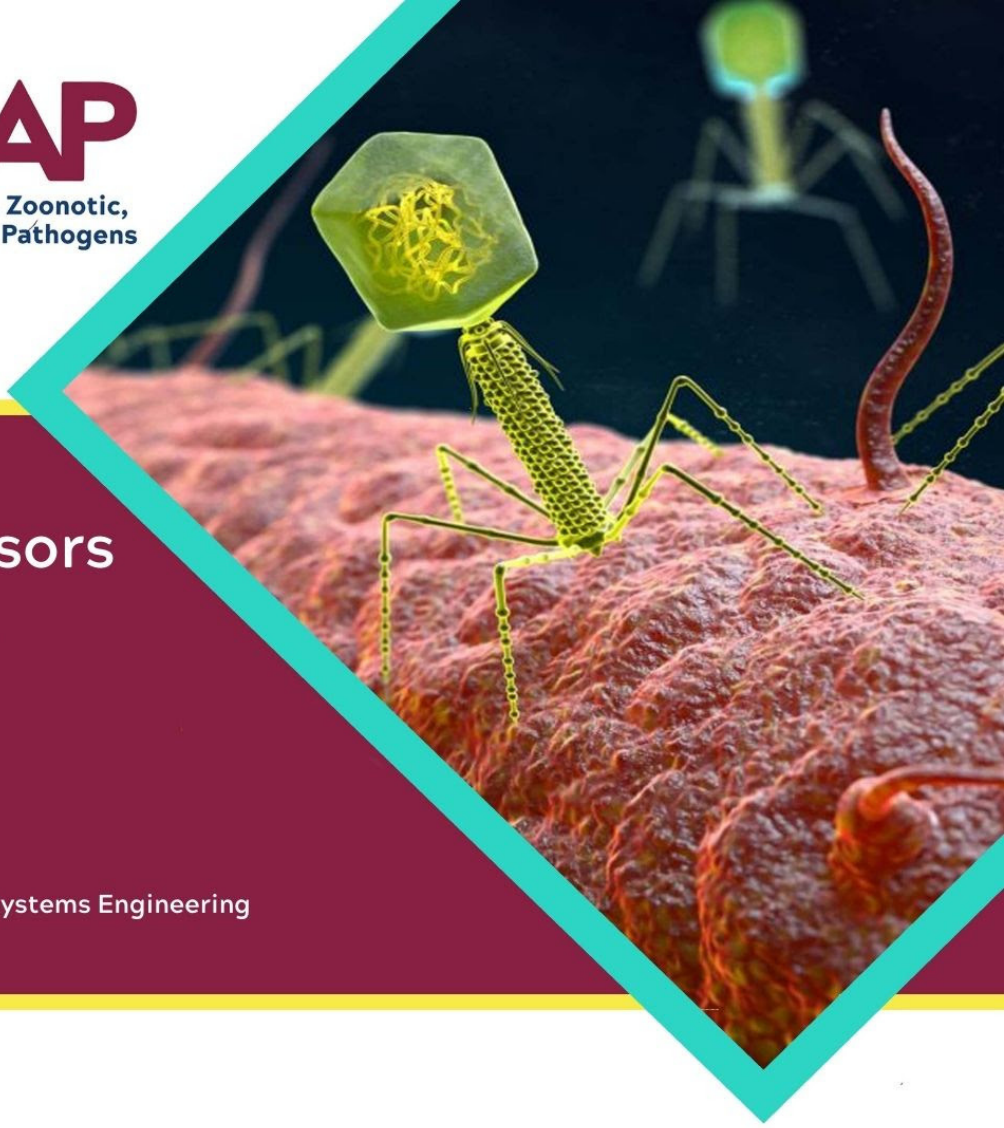

Phage-based biosensors to detect pathogens

Dr. Juhong Chen

Assistant Professor, Department of Biological Systems Engineering

Bacteriophages, also known simply as phages, are viruses that infect specific bacterial cells. Phages, varying in size but typically ranging from 24 to 200 nm in length, can bind to a bacterium, infect it, and lyse it. Afterward, hundreds to thousands of phage replicates are produced. Due to the specific recognition of target bacteria cells, phages have shown a promise to detect pathogens. In this seminar, several phage-based strategies have been developed to detect pathogens, including phage-conjugated magnetic nanoparticles, genetically engineered phages, and phage-derived CRISPR.

Distinguished Speaker Seminar Series in Infections Diseases

Tuesday March 23, 202 1 at 12 Noon

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Chobe Research Institute

CARACAL
Centre for Conservation of African Resources: Animals, Communities and Land use

Distinguished Speaker Seminar Series in Infections Diseases

Exploring the dynamics of pathogen transmission at the human, animal, and environmental interface in Africa

Dr. Kathleen Alexander DVM PhD

William E. Lavery Professor, Fisheries and Wildlife Conservation, Virginia Tech

Director/Chobe Research Institute Kasane Botswana

Board President/CARACAL

Tuesday March 30, 202 1 at 12 Noon

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Distinguished Speaker Seminar Series in Infections Diseases

Dr. Brandon Jutras

Assistant Professor
Fralin Life Sciences Institute
Department of Biochemistry

Exploring the biology and pathogenesis of Borrelia burgdorferi, the Lyme disease spirochete

We lack an understanding of how Borrelia burgdorferi—the Lyme disease agent—performs basic physiological tasks. Here, you will learn how the Jutras lab takes a holistic approach to uncover the fundamental mechanisms of B. burgdorferi biology and how this information is leveraged to understand, diagnose, and cure Lyme disease.

Tuesday April 13, 202 1 at 12 Noon

https://virginiatech.zoom.us/j/89917075487

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Dr. Juliana Cassataro

Instituto de Investigaciones Biotecnológicas

San Martín National University
Argentina

Discovery of new adjuvants for oral vaccines

Oral delivery is the natural choice not only for drugs, but also for vaccines, by virtue of its ease of administration and cost. In addition, unlike systemic immunization, an oral vaccine can produce a local immune response, which is desirable with most infectious agents. However, it is difficult to make an effective and safe oral vaccine because of the numerous hurdles presented by the gastrointestinal tract. Antigens undergo proteolytic degradation in the stomach and intestine. Another barrier that needs to be bypassed is the immune tolerance resulting from antigen feeding . Consequently, to reliably immunize with peptide or protein vaccines, antigens must be protected, uptake enhanced, and the immune tolerance properly controlled. Adjuvants are molecules, compounds or macromolecular complexes that increase the specific immune responses to an antigen. Our project is focused on studying whether a bacterial protein can protect antigens delivered in oral vaccines from degradation and act as a trigger to create mucosal immune responses that would better protect the body against mucosal pathogens. We propose to use this protein to stimulate the delivery of antigens in mucosal tissues. We are also working to increase the half life of the antigens, thus increasing the vaccines' effectiveness. We believe that if we finally learn how to effectively deliver oral vaccines, this will transform radically not only the vaccine industry but global health in general.

Distinguished Seaker Seminar Series in Infectious Diseases

Tuesday April 20, 202 1 at 12 Noon

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Distinguished Speaker Seminar Series in Infectious Diseases

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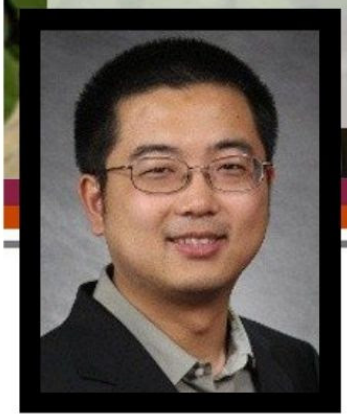
Tuesday, April 27 at 12:00 Noon

https://virginiatech.zoom.us/j/89917075487

Developing culture-free, early plant disease detection methods using hyperspectral sensing, nanopore sequencing and machine learning.



Dr. Song Li

Associate Professor in Plant Genomics and Bioinformatics
School of Plant and Environmental Sciences

Plant diseases pose an increasing threat to the nation's food supply and biosecurity in a changing environment. Early detection of plant diseases is of crucial importance to facilitate disease control and to prevent crop loss due to disease outbreaks. Recent failures to prevent plant disease emergence and spread in the US has resulted in major economic losses (20-40% of total yield) for growers. One central challenge to preventing accidental pathogen dissemination and disease outbreaks is that many plant diseases are difficult to detect at an early stage and asymptomatic plants can spread pathogens undetected when being shipped from one location to another. Until recently (and still common today), detecting infected plants required careful inspection of infected plants, culturing bacteria and fungi from infected materials, and confirming infective agents using molecular biology approaches, such as PCR followed by sequencing. This process is time consuming and thus often too slow to prevent disease spread. To solve these problems, my group has collaborated with plant pathology and genomic groups to develop several culture-free disease detection methods. In the first half of the talk, we will discuss the use of hyperspectral sensing of peanut leaves to detect a stem rot disease caused by Athelia rolfsii. In this case, hyperspectral signatures from infected plants were compared with healthy control samples. Several machine learning (ML) methods were evaluated and the best performing methods were used for feature selection to determine the optimal spectral bands for classification of plant samples. We found that ML-selected features have a 94% accuracy in distinguishing severely infected samples from healthy samples. ML methods consistently outperform the traditional approaches such as chi-square test or principal component analysis. In the second half of the talk, we will discuss meta-whole-genome sequencing based approaches of disease detection. Using a portable sequencing device, the Oxford Nanopore Technologies MinION, we were able to detect pathogen sequences and assemble whole pathogen genomes from tomato leaf samples. Using a ML method called K-mer convolutional neural network, we have successfully classified metagenome reads from infected samples and healthy samples with an accuracy of 97%. The combination of sequencing and imaging methods powered by advanced AI algorithms provides us with the opportunity to achieve early and in field detection of plant diseases. These approaches could lead to novel solutions for precision disease management towards reducing crop losses as well as pesticide usage while increasing agricultural profitability and reducing negative impacts on human health and the environment.

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Dr. Sonia Altizer

University of Georgia

UGA Athletic Association Professor of Ecology
Associate Dean for Research and Operations
Graduate Program Faculty

Distinguished Speaker Seminar Series in Infections Diseases

Tuesday May 4, 2021 at 12 Noon

Food for contagion: Host-parasite responses to resource shifts in human-dominated environments

Human-altered landscapes can dramatically change food sources for wildlife, and for the majority of species, these changes reduce food and other resources. But some species can benefit from the consistently available resources in urban and agricultural areas. Human feeding of wildlife can be intentional, such as backyard bird feeding stations, or unintentional, such as when wildlife feed from landfills or crops. In some cases, human-provided food can alter pathogen interactions within wildlife hosts, and might facilitate pathogen spillover between species, including to humans. The relationship between human provided food and wildlife infection can be challenging to unravel, because provisioning can affect infection in a number of different ways, including through changes in wildlife aggregation and contact rates, by altering demographic rates, and by changing susceptibility to infection through behavioral and immune defenses. In this talk, I examine the mechanisms by which resource subsidy affects host and pathogen processes, and how different mechanisms play out to determine different infection outcomes. Approaches include a combination of synthetic review and meta-analysis, and building mechanistic mathematical models. I describe collaborative work that examines three real-world case studies involving resource subsidies to white ibis in south Florida, vampire bats in Latin America, and monarch butterflies in North America, and consider how their viral, bacterial and protozoan pathogens have responded to feeding by humans.

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