**WHAT IS AN EMERGING PATHOGEN?**

An emerging pathogen is any new or re-emerging infectious disease whose incidence has increased within the past two decades or threatens to increase in the future. The pathogen can be a novel virus, bacteria, parasite or fungus that has the potential to become endemic, epidemic and even pandemic in nature. Emerging pathogens can be transmitted via water, air, food or by direct contact with infected individuals. According to one recent study, since 1940 there have been more than 300 emerging infectious disease “events,” with 60 percent of these coming from animals. Pathogens that “jump” from animals to people are called “zoonosis,” or “zoonotic diseases.”

**EPI’S MISSION IS TO:**

Create opportunities for novel scientific interaction among UF researchers and with their colleagues abroad. The Institute focuses on relevant scientific, clinical and educational issues related to diseases potentially devastating to the health of Floridians and the state economy, as well as the health and economy of the U.S. Investigators at the Institute work to understand the microorganisms causing new and reemerging diseases, and how they are transmitted, so that they can develop ways to slow down or prevent their spread.

**HOW EPI WORKS:**

EPI is primarily a research institute and is not a first-line responder. EPI seeks to position itself to advise first-line responders at the local and state level in Florida, as well as nationally, based on the best available science and the depth of expertise offered by its diverse and highly skilled researchers.

**EPI LEADERSHIP:**

Dr. J. Glenn Morris became EPI’s first director in August 2007. In addition to his position as EPI director, Dr. Morris is a professor of infectious diseases in the UF College of Medicine. Dr. Morris is an internationally-recognized public health expert with more than 30 years of experience working in public health and pathogen-related fields. Prior to his appointment at EPI he was a professor and chairman of the department of epidemiology and preventive medicine at the University of Maryland School of Medicine, as well as an interim dean of the University of Maryland School of Public Health in Baltimore. Dr. Morris received his bachelor's degree from Rice University in Houston and his medical degree and a master's in public health and tropical medicine from Tulane University in New Orleans. He maintains an active research program working in the area of molecular genetics and molecular epidemiology and has authored more than 60 textbook chapters and symposium proceedings and more than 180 articles in peer-reviewed journals. Dr. Morris began his career at the Centers for Disease Control and Prevention, where he focused on cholera and other water- and food-borne diseases. He has served on five National Academy of Sciences expert committees dealing with food safety, and currently serves on the Institute of Medicine’s Food and Nutrition Board. While much of his research has focused on enteric microorganisms, he is actively involved in work with a variety of emerging pathogens including influenza, drug-resistant tuberculosis and methicillin-resistant staphylococci. In addition to the depth of his work and qualifications, Morris is a firm believer in connecting research with the public and local communities. To this end, he makes himself available to qualified media to comment on developing stories or primary research, and he encourages EPI’s researchers to do the same.

**EPI’S FACILITIES:**

On February 27, 2008, UF broke ground on a state-of-the-art 80,000-square-foot facility to house EPI. The four-story building is located near the Cancer and Genetics Research Complex between Archer Road and Mowry Road. The facility includes the following:

- 12 Bio-Safety Level-2 labs, each with 1,500 square feet and lab support
- 4 BSL-3 suites, 16 BSL-3 modules
- Bioinformatics Wings, 6,000 square foot
- 66 offices for faculty investigators, with more than 100 carrels for students and post-doctoral fellows
- 3 conference/team/admin support suites
- 2 staff break areas
- Engineering, operations and support space
- 80-person seminar room
- 1 director’s suite
- 3 BSL-3 Rooftop greenhouses, 1,500 square foot

**EPI’S RESEARCH FIELDS:**

EPI funds many researchers and collaborates with many more across UF’s campus, as well as in other institutions. EPI has more than 150 affiliated investigators, who can be found in the Find an Expert database online. EPI spans eight UF colleges: Medicine, Public Health and Health Professions, Veterinary Medicine, Institute of Food and Agricultural Sciences, Dentistry, Engineering, Pharmacy, and Liberal Arts and Sciences. EPI spans diverse disciplines and scales, from infectious disease and pulmonary specialists to microbiologists; from human, animal and plant pathologists to entomologists; from mathematical modelers to epidemiologists and evolutionary geneticists; from medical veterinary doctors to specialists in GIS and remote sensing; from bioinformatics to bioengineering to nanoscience.

**EPI’S MAJOR PATHOGEN PROJECTS:**

EPI has placed special emphasis on research on the following pathogens and diseases:

- Influenza, including zoonotic forms
- Drug resistant Tuberculosis strains, and non-Tuberculosis Mycobacteria
- MRSA, or Methicillin-resistant Staphylococcus aureus
- Pathogens transmitted by food, including Salmonella, E.coli O157:H7, and Campylobacter
- Diseases transmitted by mosquitoes and other insects, including malaria, dengue, West Nile, and Eastern equine encephalitis
- Cholera and other Vibrio species, including Vibrio vulnificus, V. cholerae, and V. parahaemoliticos
- Citrus greening, sudden oak death, and other plant diseases
- Red tide, ciguatera, and other organisms associated with harmful algal blooms

EPI collaborates closely with the Infectious Disease Pharmacokinetiks Laboratory located in the UF College of Pharmacy, which crafts customized therapeutic drug regimens for people with serious infections, including tuberculosis, HIV and fungal infections.

**EPI’S MAJOR FUNDING:**

EPI is currently funded at $3.6 million per year by the State of Florida which also provided $55 million to build the Institute’s new facility. EPI’s project funding comes from multiple sources, including grants awarded by: U.S. Dept. of Defense; U.S. Dept of Agriculture; private foundations, including the Bill and Melinda Gates Foundation and the Robert Wood Johnson Foundation; the National Institutes of Health; the National Science Foundation; and the National Oceanic and Atmospheric Administration.

**Main contact:** EPI Director Dr. J. Glenn Morris: (352) 273-7526; jgmorris@epi.ufl.edu

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**EPI WAS CREATED BECAUSE:**

Florida’s unique geography and climate require novel disease prevention and control strategies. Florida’s residents and its two major industries, agriculture and tourism, are threatened by new diseases, including West Nile virus, dengue fever, H1N1 swine flu and citrus greening. Other diseases not yet in Florida may pose even greater threats.

**EPI FUNCTIONS TO:**

Bring scientists from key disciplines together to develop research, education and outreach capabilities designed to preserve Florida’s health and economy, and to prevent or contain new and re-emerging diseases.

**FLORIDA’S UNIQUE GEOGRAPHY AND CLIMATE REQUIRE NOVEL DISEASE PREVENTION AND CONTROL STRATEGIES.**

EPI serves on the Institute of Medicine’s Food and Nutrition expert committees dealing with food safety, and currently serves on the Institute of Medicine’s Food and Nutrition Board. While much of his research has focused on enteric diseases. He has served on five National Academy of Sciences expert committees dealing with food safety, and currently serves on the Institute of Medicine’s Food and Nutrition Board. Where much of his research has focused on enteric microorganisms, he is actively involved in work with a variety of emerging pathogens including influenza, drug-resistant tuberculosis and methicillin-resistant staphylococci. In addition to the depth of his work and qualifications, Morris is a firm believer in connecting research with the public and local communities. To this end, he makes himself available to qualified media to comment on developing stories or primary research, and he encourages EPI’s researchers to do the same.
Emerging Pathogens Institute www.epi.ufl.edu

Dr. J. Glenn Morris at the Malcolm Randall V.A. Medical Center, where he performs rounds. Dr. Morris is also a professor of medicine, is board certified, and holds a master’s of public health and tropical medicine.

**Culex nigripalpus larvae,** photographed at the Fla. Medical Entomology Laboratory at Vero Beach. This species is one of the most important disease vectors in Florida, transmitting St. Louis encephalitis, West Nile and eastern equine encephalitis viruses.

Young girl ill with cholera, being cared for at the National Institute of Cholera and Enteric Diseases in Kolkata, India. EPI is forging relationships with institutes and researchers abroad to study a variety of enteric diseases.

**Dr. Judy Johnson** directs the CORE Laboratory with EPI, and researches microbial pathogenesis, antibiotic resistance, and pathways of transmission of bacterial species and genes within and between clinical, community and agricultural settings.

**Alexander Sulakvelidze** is an internationally recognized expert in infectious disease epidemiology and phage technology; at EPI he studies highly pathogenic bacteria with the potential to be used for bioterrorism.

**Citrus greening** is a major threat to Florida’s citrus agriculture, causing mottled and curled leaves and poor fruit. EPI is collaborating with Bill Dawson, an eminent scholar of plant pathology, to better understand how the pathogen (Candidatus Liberibacter asiaticus) is spread by plant-feeding insects (psyllids) and how it can be controlled.

**Dr. Mike Lauzardo** is a doctor and professor in the College of Medicine who is collaborating with EPI on research into patients with drug-resistant strains of tuberculosis and mycobacterial infections. Lauzardo and EPI are also working with doctors at A.G. Holley Hospital in Lantana, the state’s oldest tuberculosis hospital.

**Anita Wright** is a food science professor with EPI and IFAS who investigates Vibrios, a genus of bacteria that naturally infest shellfish such as oyster and shrimp and which can harm certain people if ingested. Here, she displays wild cultured Vibrios, and mutant lab Vibrios used in research to investigate gene and virulence factors.

**Andy Kane** directs the Aquatic Pathobiology Laboratory and is an EPI investigator studying mycobacteria in the environment. Fathead minnows, such as those found in common streams, can be natural reservoirs, such as those found in common streams, can be natural reservoirs, such as those found in common streams, can be natural reservoirs, such as those found in common streams, can be natural reservoirs.

**Charles Peloquin,** relocated the Infectious Diseases Pharmacokinetics Laboratory from Denver, CO. to U.F. in order to partner in research efforts with EPI. The IDPL performs therapeutic drug monitoring for patients with hard-to-treat infections.

**Jonathan Day** is a researcher at the Fla. Medical Entomology Lab in Vero Beach, who maps the presence of insect-vector diseases such as West Nile virus and eastern equine encephalitis. EPI is collaborating with researchers like Day who work at FMEL and with IFAS to better understand insect vector diseases.

**Black-legged ticks** are native to Florida and are vectors for Lyme disease as well as *Anaplasma phagocytophilum*, the causative agent of granulocytic anaplasmosis in humans and horses. U.S. cases of the latter have increased in humans since 1990.

Contact: For high-resolution image files, please contact Delene Beeland, tdb@epi.ufl.edu or 352-870-6856.
FEATURED RESEARCHERS

EPI’s research is diverse and broad. The Institute has more than 150 affiliated researchers, which means that picking a mere handful to highlight is a tough task. We chose these six EPI researchers because their work spans the spectrum of emerging pathogens that affect food safety, humans and wildlife.

ANDREW S. KANE, Ph.D.

College: Public Health and Health Professions; Department: Environmental Health Program
Research interests: Aquatic pathology and toxicology

Dr. Kane researches environmental pathology and toxicology of freshwater and marine organisms, and he directs the Aquatic Pathobiology Laboratory which is supported in part by EPI. While in the past he focused on the Chesapeake Bay region, at EPI he is now expanding his focus to Florida’s numerous waterways. He seeks to understand the effects of chemical or environmental stressors upon aquatic species and to use these species as proxies for interpreting environmental impact and potential effects upon human health and well-being. Dr. Kane’s research focuses on environmental stressors that effect measurable biological or behavioral changes upon fish reproduction. He also examines endocrine disruptors and mechanisms for species-selective toxicity and disease susceptibility. While fish biology differs from human biology, they serve as excellent indicators for exposure effects to chemicals and other stressors in terms of tracking uptake ratios, bioaccumulation and systems effects that can serve as warnings to possible human effects. Dr. Kane is also interested in researching water quality issues associated with aquaculture techniques. He is working to identify the natural reservoir environment of Mycobacterium (a gram-positive, rod-shaped bacteria) colonies in Florida. This genus of bacteria can infect fishes and humans, and includes the species that causes Tuberculosis, as well as other pulmonary diseases. These bacteria are thought to grow in dark waters that are rich in dissolved organic carbon and natural acids, such as tannins.

GREGORY C. GRAY, M.D., M.P.H. & F.I.D.S.A.

College: Public Health and Health Professions; Department: Environmental and Global Health
Research interests: epidemiology of infectious diseases, especially zoonotic diseases

EPI and the College of Public Health and Health Professions attracted Dr. Gray to UF in January 2010 from the University of Iowa where he established and directed a program in infectious disease epidemiology and a Center for Emerging Infectious Diseases. Dr. Gray is an infectious disease epidemiologist and his research interests include emerging infectious diseases, zoonotic infections, evaluation of rapid diagnostics for emerging pathogens, and the epidemiology of respiratory pathogens infections (specifically adenovirus, influenza and human metapneumovirus).

Dr. Gray’s research agenda is centered on zoonotic diseases, including swine flu. His active projects are located in Australia, Cambodia, Mongolia, Nigeria, Romania and Thailand and he has plans to soon expand research into the Republic of Georgia. His international research focuses on the epidemiology of zoonotic disease transmission among rural people, particularly disease caused by swine, avian, and equine influenza viruses. At EPI, he is developing a research program in virology. He also serves as chair of the department of environmental and global health in the college of PHHP, and he is an excellent example of EPI’s cross-college collaboration. “I believe that when you bring people together from different disciplines, and they start to focus their diverse skills in solving a problem, this can lead to some real research breakthroughs,” Dr. Gray said.

“And EPI has a lot to offer in this regard. I’m particularly excited about collaborating with the Veterinary Medicine researchers. It’s hard to predict where the networking and brainstorming may lead.”

JUDY JOHNSON, Ph.D.

College: Medicine; Department: Molecular genetics and microbiology
Research interests: Pathology, microbial pathogenesis and molecular diagnostics

Dr. Johnson researches microbial pathogenesis, antibiotic resistance, and pathways of transmission of bacterial species and genes within and between clinical, community and agricultural settings. She specializes in the bacterial genera Vibrio and Staphylococcus. Dr. Johnson is also the director of CORE laboratories in UF’s Emerging Pathogens Institute, acting as a conduit between researchers in the human health sciences and the Emerging Pathogens Institute. In a broad sense, Dr. Johnson’s work investigates the causes of bacterial pathogenicity, and she specializes in researching the many different expressions and compositions of the polysaccharide surfaces that coat bacteria. She examines how the surface coating is constructed, how different constructions alter a bacterium’s environmental interactions, and how the structures evolve. She is also interested in what toxins are present and how toxins are transferred both between individual bacteria (horizontal gene transfer) and between bacterial species.

Dr. Johnson also uses genomic analysis to map out how genes are transferred between bacteria within certain genera, and the evolution of their pathogenicity, which has broad potential applications because knowing how they are transferred offers clues as to how to block them. Dr. Johnson’s work extends from the lab to the real world, where she investigates microbial ecology, how bacteria travel in surface water, and how this movement interfaces with soil and vegetation. A better understanding of these processes will help in agricultural produce sectors where vegetables or fruits may be consumed raw. She is also interested in molecular epidemiology and examining how merthiolate resistant bacterial strains are transferred within clinical and community settings.

JORGE GIRON, Ph.D.

College: Medicine; Department: Molecular genetics and microbiology
Research interests: Structural microbiology, enterohemorrhagic E. coli, shiga toxins

Dr. Giron’s research focuses on the structural microbiology of pathogenic E. coli O157:H7 and determining the role of specific molecular structures in their pathogenicity and ability to colonize new hosts. His current work has focused upon discovering, describing and understanding new types of pili, which are hair-like protein structures that extend outward from the exterior surface of gram-negative bacteria, and establishing links between genetic expression of pili and virulence. Dr. Giron has contributed to the discovery, description and understanding of at least three new types of “type-IV pili” that aid the bacteria in adhering to different surfaces. A large part of his research deals with enterohemorrhagic E. coli, which is the kind that causes inflammation of the colon and bloody diarrhea. He seeks to understand how these organisms move through the environment, including their non-harmful existence in the intestinal tracts of bovines, and their presence and persistence in agricultural settings including the production and packaging of commercial spinach. He is exploring the mechanisms and processes by which these E. coli colonize leafy vegetables like spinach and how they get into our food system. Taking a comprehensive view of the bacteria’s range of hosts, Dr. Giron is also studying the different structural mechanisms by which these E. coli produce pili that are used to adhere to human intestinal tissue, which helps them to colonize human hosts and then cause disease. By experimentally determining which pili types are important to which host-environment (plant, animal or human), he and his team are seeking to establish which specific genes are responsible for producing host-specific pili. Identifying these pili could be useful for developing a vaccine.
Dr. Wright's research focuses on pathogens that are relevant to the seafood industry. In particular, she is interested in gram-negative bacteria of the genus *Vibrio* which inhabit estuarine environments and are associated with popular seafood species such as oysters, clams, crabs and shrimp. While several species of Vibrio cause illness in people, Dr. Wright predominantly works with *V. vulnificus* which can cause rapid systemic infections due to consumption of raw or undercooked shellfish. Individuals with pre-existing immune deficiency problems, diabetes, or diseases affecting their liver or iron levels (hemochromatosis) are more susceptible to these infections and may succumb to death within one to two days after exposure.

Dr. Wright's laboratory uses molecular diagnostic systems such as real-time polymerase chain reaction (PCR) testing to measure the effectiveness of different post-harvest treatments at eliminating *Vibrio* from oysters. To better assist the oyster industry, Dr. Wright and others at the University of Florida helped to establish the Oyster Industry Laboratory in Apalachicola, Florida. The lab is supported by funds from the U.S. Department of Agriculture and Sea Grant and evaluates post-harvest treatments for commercial oyster production in order to ascertain their effectiveness in reducing or eliminating *Vibrio* in harvested oysters. Unfortunately, most of these treatments will kill the oyster, and her group is currently investigating effective treatments that will still maintain oyster viability. She is also involved with monitoring oysters in their natural estuarine habitat, and is exploring the pathways through which *Vibrio* infect shellfish and cause disease.

Dr. Peloquin’s research focuses on the development of new drugs and new multi-drug regimens for the successful treatment of TB and other unique in the United States. No other lab offers the testing that he does combined with his finely detailed interpretations of the results interpreting these results and advising physicians how to adjust a drug’s dosage to achieve an optimal outcome. Dr. Peloquin's lab is supported by funds from the U.S. Department of Agriculture and Sea Grant and evaluates post-harvest treatments for commercial oyster production in order to ascertain their effectiveness in reducing or eliminating *Vibrio* in harvested oysters. Unfortunately, most of these treatments will kill the oyster, and her group is currently investigating effective treatments that will still maintain oyster viability. She is also involved with monitoring oysters in their natural estuarine habitat, and is exploring the pathways through which *Vibrio* infect shellfish and cause disease.

Dr. Smith is a Visiting Fellow at Resources for the Future where he collaborates with an economist, Ramanan Laxminarayan, to design project, which is the first attempt since 1960 to map the global presence and limits of the organisms that spread and cause malaria. He studies how the increasing mobility of humans and growth in global trade are reducing geographical barriers to the movement of pathogens and exotic species. The recent growth in availability of detailed spatial datasets on climate, population, transport networks and species distributions, combined with sophisticated spatial analysis tools, means that hypotheses on, for instance, exotic species dispersal and vector-borne disease spread can be tested for the first time. Tatem also plans to explore interdisciplinary links through the application molecular epidemiology and spatial demographic tools and datasets.

At EPI, Tatem plans to continue his work with the Malaria Atlas Project by examining approaches to quantifying human movement patterns, as part of a $1.5 million Bill and Melinda Gates Foundation grant with Dr. David Smith aimed at developing spatial tools for local malaria elimination planning. Cell phone records, seasonal satellite imagery and microcensus records are all being used in an effort to explore novel approaches to quantifying human and malaria infection movements in low transmission regions. Tatem is also a research associate at the Centre for Geographic Medicine in Nairobi, Kenya.