EPI

Emerging Pathogens Institute

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Photo Courtesy of Howard Suzuki

University of Florida

Cover photo by Howard Suzuki.

Baby alligator emerging from its shell.

The American alligator, official state reptile of Florida, may also serve as a "reservoir" for emerging diseases such as West Nile and Western equine encephalitis viruses. Since 2002, several outbreaks of West Nile virus have been reported in alligators in a number of states, including Florida. Like birds, alligators can serve as hosts for amplification of the virus and there is evidence for human infections with West Nile virus derived from alligators. Florida also serves as a major import state of exotic reptiles which frequently carry ticks capable of carrying and transmitting a variety of pathogens including heartwater.

EMERGING PATHOGENS INSTITUTE

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Section I – Fact Sheet

Mission: This institute will focus on relevant social, agricultural, 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 rest of the country. This institute will develop and deliver appropriate informatics, diagnostics, treatments and surveillance for the prediction, prevention, detection and management of microbial pathogen-associated diseases of humans, animals and plants.

Background: Florida's vulnerability to newly emerging or imported pathogens place it in an ideal position as a "sentinel state". As such, Florida can develop methods for advance planning for control and eradication prior to spread to the rest of the United States. The sub-tropical climate is a perfect breeding ground for various diseases (including West Nile, Malaria, and Asian Citrus Greening) and vectors for spreading them.

Challenges:

- Lack of communication and techniques between disciplines
- Diagnostic, surveillance, & detection technologies are not adequate.
- Current vaccines/antimicrobial agents are not adequate.
- Current data are unmanageable given current data systems.
- Current pathogen management is not efficient.

Solutions:

- Train scientists with integrated knowledge and insight into the dynamics between human, animal and plant pathogens.
- Integrate bioengineering and nanoscience technologies into detection and diagnostic devices
- Expand research capabilities for development of appropriate vaccines and antimicrobial reagents necessary to interrupt and control emerging infections.
- Research and compile data on worldwide pathogens and provide tools to analyze these data.
- Develop response and prevention plans and coordinate implementation with proper authorities to prevent spread of disease and, if possible, prevent outbreaks outright.

Uniqueness: The Institute will fuse resources and capabilities from diverse fields (Agriculture, Engineering, Medicine) in the sentinel state of Florida to:

- permit novel scientific interaction.
- prevent and contain outbreaks of new diseases that threaten not only Florida but the entire country by development of:
  1) new/improved vaccines and antimicrobial reagents
  2) new detection and improved diagnostics systems
  3) new/improved vaccines and antimicrobial reagents
  4) new detection and improved diagnostics systems
  5) improved outreach mechanisms for community/industry education

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Section II - Executive Summary

PROPOSAL

The Emerging Pathogens Institute brings together researchers from diverse fields to develop control, diagnostic and treatment plans including vaccines and other anti-microbials for new and emerging diseases.

This Institute's focus is on relevant social, agricultural, scientific, clinical and educational issues related to diseases potentially devastating to the health of Floridians and the State economy as well as the rest of the country.

The Institute will develop and deliver appropriate solutions to problems in the management of microbial pathogen-associated diseases of humans, animals and plants. It will do so using informatics, diagnostics, treatments and surveillance for the prediction, prevention, and detection of such diseases.

BACKGROUND

An Emerging Pathogen is any new, re-emerging, or drug-resistant infection whose incidence has increased within the past two decades or whose incidence threatens to increase in the future[1]. 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 blood. According to the World Health Organization[2], given the above criteria, there are 175 infectious species that are considered as emerging pathogens and 75% of these are zoonotic (transmissible from animal to human).

> An emerging pathogen is any new, re-emerging, or drug-resistant infection whose incidence has increased within the past two decades or whose incidence threatens to increase in the future.
>
> – Institute of Medicine, 1992

Florida's residents and its two major industries, agriculture and tourism, are currently threatened by new diseases (i.e. West Nile) that enter Florida. Other diseases, such as avian flu in humans and hoof and mouth disease in cattle, which are currently not present in Florida, are an even greater threat.

Why is Florida particularly vulnerable to Emerging Pathogens?

Florida is a "sentinel state" and a "reservoir state" for diseases of plants, animals, and humans. Its extensive coastline, major ports of entry, and tropical/subtropical climate make it vulnerable to the establishment of new diseases.

Florida's moderate climate contributes to outdoor, active lifestyles and attracts visitors from all over the world increasing its vulnerability to pathogens introduced by visitors and providing suitable conditions for pathogen growth and spread.

As a consequence of our **outdoor lifestyle,** we Floridians are more likely to be bitten by ticks and mosquitoes, insects capable of transmitting pathogens (like West Nile Virus and Ehrlichia) from animals to humans. The mosquito can also transmit pathogens from one human to another. Fortunately, for now, these types of pathogens are rarely found in Florida.

The temperate climate also contributes to a very **active, athletically-oriented** state. According to Dr. Frederick Southwick, Chief of Infectious Disease at the UF College of Medicine, the crowded environments of locker rooms and use of common soap has led to the recent spread of resistant bacteria (methicillin-resistant Staphylococcus aureus, MRSA) among many of our young athletes.

With increased **tourism**, Florida is at potential risk of Malaria and Yellow Fever from the nearby Caribbean Islands. Tourism not only increases human exposure to pathogens but also increases agricultural exposure.

80 million tourists visited Florida in 2005.

Florida is also home to many **cruise ships** and these vessels also provide a unique environment for the spread of specific pathogens. Norwalk virus has become very common in recent years among cruise ship passengers

Our warm weather not only increases our exposure to certain pathogens, but the **moist, humid environment** provides ideal conditions for the growth of fungi including one of particular health concern, black mold.

Florida's humid environment is also ideal for the spread of infections such as Cryptococcus. This fungus is not ordinarily a health threat but poses a significant threat to immuno-compromised individuals such as those with human immunodeficiency virus (HIV). As HIV destroys the immune system, these patients are at increased risk for other infections like tuberculosis (TB).

In Florida **1/100 young people** is infected with HIV.

In many of **Florida's rural communities** tuberculosis, in addition to HIV, is on the rise.

Source: Dr. Frederick Southwick, Chief of Infectious Disease at the UF College of Medicine

Florida has a wide array of temperate, sub-tropical, and tropical ecosystems supporting a diverse agriculture and contributing to its vulnerability to new pathogens.

Florida's production of both food and fiber is under serious threat from emerging pathogens new to this state. Many of Florida's most important agricultural and natural resource industries, including citrus, tomato, strawberry, timber and tourism are facing the potential of enormous economic losses. Florida's natural and managed landscapes are under threat from pathogens such as sudden oak death which have caused massive losses of forest, nursery and landscape plants in peer states such as California. The proposed Emerging Pathogens Institute would facilitate a rapid and focused response and provide novel solutions to emerging pathogens such as such as citrus diseases (canker, blight, greening), sudden oak death, soybean rust, geminiviruses, Pierce's disease of grapes, and human pathogens that are present in vegetables, fruits, and seafood. Florida needs a research capability prepared to prevent and control outbreaks caused by these and other pathogens. We need the teaching capability to train the next generation of scientists who will keep these pathogens at bay in the future. And we need the capability to educate the Florida agricultural producers on steps they can take to avoid economic losses and educate Florida citizens on steps they can take to avoid diseases from food-borne pathogens.

Dead palms due to Lethal Yellowing Disease, an emerging plant pathogen in the US. Photo by Nigel Harrison.

Commercial plant imports from around the world have the potential to unwittingly carry pathogens into our state from other countries.

The majority of **plant imports** into Florida consist of ornamental plants. Florida also **exports** a large number of ornamental and agricultural products to the rest of the US. In 2004 Florida's top four exports were fruits, vegetables and preparations, feeds and fodders, and seeds[3].

According to an online Sacramento newspaper, "Agricultural inspections at ports of entry subsequently fell markedly between 2002 and 2004, federal investigators now note. The 8 percent decrease occurred even as imports kept rising, and coincided with the Homeland Security Department replacing the Agriculture Department at the inspection stations[4]."

ECONOMIC IMPACT

Florida's top four agricultural exports in 2004 were:

- Fruits and preparations -- $597 million
- vegetables and preparations -- $145 million
- feeds and fodders -- $48 million
- seeds -- $35 million

Florida has 25 ports of entry of which 7 are considered major ports of entry. These ports not only open the doors to the state making Florida more vulnerable, they also serve as a portal for spread from Florida to other states. Adequate detection and management systems must be in place to mitigate the effect of new and re-emerging plant pathogens. A halting of agricultural exports would have a significant effect on Florida's economy.

Florida is vulnerable to the introduction of foreign animal diseases and other emerging pathogens. One means of introduction is via migratory birds.

A foreign animal disease, or FAD, is one which is believed to be absent from the United States and its territories, is transmissible to livestock or poultry, and has the potential to cause a significant health or economic impact. One example is the highly pathogenic avian influenza virus, currently being spread across the earth by **migratory birds**, which has demonstrated its capacity to infect and kill both domestic poultry and humans.

Emerging pathogens and foreign animal diseases do much more than temporarily affect livestock production. Just the threat of a FAD can shut down a country's ability to export animals and animal-related products. Disease outbreaks can devastate livestock or poultry populations through high morbidity or mortality and may cause millions, possibly billions, of dollars to be spent to control or eradicate the disease. Current efforts to control the highly pathogenic avian influenza outbreak have resulted in the wholesale destruction of tens of millions of domestic poultry in numerous countries to both prevent the infection of additional domestic fowl and to reduce the potential threat to human health.

Once infection has been introduced, spread can be very rapid from animal to animal and from farm to farm. Although the means and speed of transmission depends on the specific disease, even a single infected animal can quickly cause a widespread outbreak. Foreign animal diseases and emerging pathogens may also spread into susceptible wildlife populations further complicating, or possibly preventing, disease eradication.

Taken together, these consequences could easily cripple the entire Florida agriculture industry. Secondary economic effects such as limiting travel, culling infected animals, and fear of disease could devastate the tourist industry including ecotourism. Obviously, prevention of diseases would be preferable to any sort of response plan.

ECONOMIC IMPACT

Florida's fifth highest agricultural export in 2004 was[4]:

…poultry and poultry products at $28 million.

The practical goal of the University of Florida Emerging Pathogens Institute, relative to animal diseases, is to provide the tools needed to prevent foreign animal diseases and other emerging pathogens from impacting the health of Floridians, their animals and the State's economy.

Florida's coastline and climate present both an attractive destination for a dynamic tourist population and for the ever-growing retirement community. The demographics of these groups contribute to unique issues concerning emerging food-borne diseases.

Vacationers are far more likely to be exposed to contaminated food in restaurants than at home, simply due to the volume of food processed. New and exotic foods may mean exposure to new and exotic infections. Tracking sources of infection among tourists presents difficulties when the affected persons do not become ill until after they return home.

Aging populations in our state are generally declining in their ability to combat infectious disease; consequently, they become much more susceptible to most food-borne illness. The elderly and persons with other immune deficiencies, such as HIV, can harbor emerging diseases that are not evident in healthy populations.

The port cities of Florida often provide the first point of US contact for infected persons or contaminated food sources. Ballast water from ships may carry pathogens around the world, contributing to the spread of pandemic disease. Many of these diseases are not typically found in the US and are a source of emerging infections.

The port cities of Florida often provide the first point of US contact for infected persons or contaminated food sources.

In summary, Florida is particularly vulnerable to Emerging Pathogens because:

- **Florida's moderate climate contributes to outdoor, active lifestyles and attracts visitors from all over the world increasing its vulnerability to pathogens introduced by its visitors and providing suitable conditions for pathogen growth and spread.**
- **Florida has a wide array of temperate, sub-tropical, and tropical ecosystems lending to its diverse agriculture and its vulnerability to new pathogens.**
- **Commercial plant imports from around the world have the potential to unwittingly carry pathogens into our state from other countries.**
- **Florida is vulnerable to the introduction of foreign animal diseases and other emerging pathogens. One means of introduction is via migratory birds.**
- **Florida's coastline and climate present both an attractive destination for a dynamic tourist population and for the ever-growing retirement community. The demographics of these groups contribute to unique issues concerning emerging food-borne diseases.**

All of the above factors make Florida more susceptible to these diseases than perhaps any other state in the Nation and require more intensive research, education, and outreach efforts than can now be provided with current resources.

Increased vulnerability and the potential to act as a portal for emerging pathogen spread to the rest of the United States, make Florida an ideal state to develop advanced planning for control and eradication of emerging pathogens.

In Florida, this species of mosquito (Culex nigripalpus) plays a major role in the transmisssion of disease-causing viruses. (UF/IFAS/File Photo)

CHALLENGES/SOLUTIONS

The **Emerging Pathogens Institute (EPI)** faces many challenges several of which we have already begun to address. With your support, we can continue to address these challenges to accomplish our mission to bring together researchers from various fields to develop prevention, control, diagnostic and treatment plans including vaccines and other anti-microbials for new and emerging diseases.

Sandy Allen, assistant scientist with the University of Florida's Institute of Food and Agricultural Sciences, examines a large African tortoise tick found on an imported reptile. The tick, about a half-inch in diameter, could carry and spread heartwater, an exotic disease that kills livestock and wildlife. To prevent a heartwater epidemic that would devastate the nations cattle, sheep and goat industries, UF/IFAS researchers are working with state and federal veterinary officials to keep the foreign ticks out of the country.
Photo by Thomas Wright.

Challenge: Lack of communication and techniques between disciplines.

It's not surprising that scientific fields such as Engineering, Chemistry, Agricultural, and Medical Sciences each have languages of their own. But what might be surprising is even within related sciences, such as Veterinary Medicine and Human Medicine, vocabularies and even techniques often differ. In an academic setting, disciplines are traditionally packaged into tidy homogenous units each with its own "culture".

A common deviation from research confined to disciplines is "*Multidisciplinary research* (which) approaches an issue from the perspectives of a range of disciplines but each discipline works in a self-contained manner with little cross-fertilization among disciplines, or synergy in the outcomes[5]."

"Multidisciplinary research approaches an issue from the perspectives of a *range of disciplines,* but each discipline works in a *self-contained manner* with little cross-fertilization among disciplines, or synergy in the outcomes."

An example of the sharing of technologies/protocols across disciplines that has positively affected the food safety industry is as follows:

> Hazard Analysis – Critical Control Points (HACCP) was developed as a by-product of another FL industry, the NASA Space Program, to ensure that the astronauts would not become stricken during space travel. NASA recognized that it was virtually impossible to test every item of food for every potential pathogen. Therefore, a strict code of standards at appropriate checkpoints was established to ensure food safety. This process is now in place throughout the entire food industry and recent indications suggest that it may be responsible for substantial declines in food-borne diseases.

To address the complexities of Emerging Pathogens we must go beyond simply sharing ideas and technologies, we must fully integrate them.

Solution. Train scientists with integrated knowledge and insight into the dynamics between human, animal and plant pathogens.

As opposed to multi-disciplinary research, interdisciplinary research can be defined as research approaching a problem from a variety of perspectives in an integrated way to achieve a systemic response[5].

> *"*Interdisciplinary research…approaches an issue from *a range of disciplinary perspectives*…(where) the contributions of the various disciplines are integrated to provide a holistic or *systemic outcome."* -Bruce et al. (2004)

Interdisciplinary research as defined above is the goal of this institute. The traditional roadblocks to this type of collaborative research that we will overcome include communication, academic structure, funding, and education/career development.

To overcome the "interdisciplinary" challenge, EPI will:

- Establish truly **interdisciplinary program areas** that cross traditional academic and scientific barriers. The areas involved should include not only the "standard" fields of bacteriology, virology, mycology and immunology but also encompass practicing infectious-diseases clinicians; experts in veterinary medicine, epidemiology, and mathematical modeling, public health, plant sciences, wildlife biology, entomology, and ecology; computer scientists and bioengineers; informatics specialists; sociologists and psychologists; and outreach specialists. See diagram, Figure 2, on page 21.

- Strategically **recruit faculty** to further integrate research across these program areas.

- Create a rigorous **interdisciplinary training program** supported by well integrated components from each program area.

- **Construct a new facility** to bring faculty from disparate areas together for dedicated research on emerging and re-emerging diseases and their monitoring, prevention, detection, and treatment.

Challenge: Diagnostic and surveillance/detection methods and technologies are not adequate.

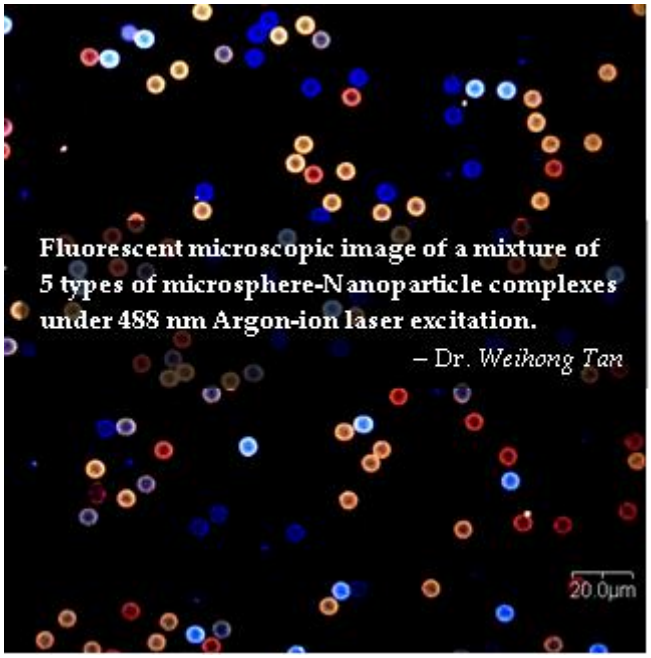
Not only are current detection and diagnosis methods not sensitive enough or quick enough, they lack real-time surveillance capabilities. All are needed for immediate detection and prevention of spread of unwanted pathogens. Prevention of spread not only can save lives but can avoid tremendous economic losses.

Solution. Integrate bioengineering and nanoscience technologies into detection/surveillance and diagnostic devices

Active interdisciplinary research efforts in nanotechnology and nanoscience at the University of Florida and its affiliated organizations such as IFAS have the potential to revolutionize the approaches whereby the State of Florida can effectively deal with the threat of emerging pathogens. The application of these new and powerful disciplines to the study of infectious agents offers unprecedented opportunities to effectively diagnose, prevent, and treat emerging pathogen-related problems that can devastate Florida's population and economy. Specific deliverables include: 1) point-of-care (POC) nanosensors to accurately and rapidly diagnose potentially lethal infections of people, buildings, ships, water, and food in a cost effective manner (nanodiagnostics), and 2) multifunctional nanostructure-based systems to not only identify and report infections within people or other environments, but also to simultaneously treat and eradicate them in a highly selective manner (nanotherapeutics).

Nanotechnology is particularly adept at meeting two benchmarks, which must be met to achieve a favorable outcome following infection with dangerous pathogens: 1) **reliable detection** of low numbers of pathogens, and 2) **rapid diagnosis** of pathogen presence.

In ongoing intercollegiate research programs UF researchers leveraging funds from different federal funding agencies and private companies have begun to pioneer the development of new nanotechnologies that been used to create new nanosensors to detect bioterrorism agents such as dangerous pathogens (i.e., bacillus) or deadly biological toxins (e.g., ricin).



Funding from the Federal and State governments would markedly accelerate this process and optimally integrate the different disciplines into a cohesive unit to effectively create and develop nano-based tools to address emerging pathogens.

What is nanotechnology?

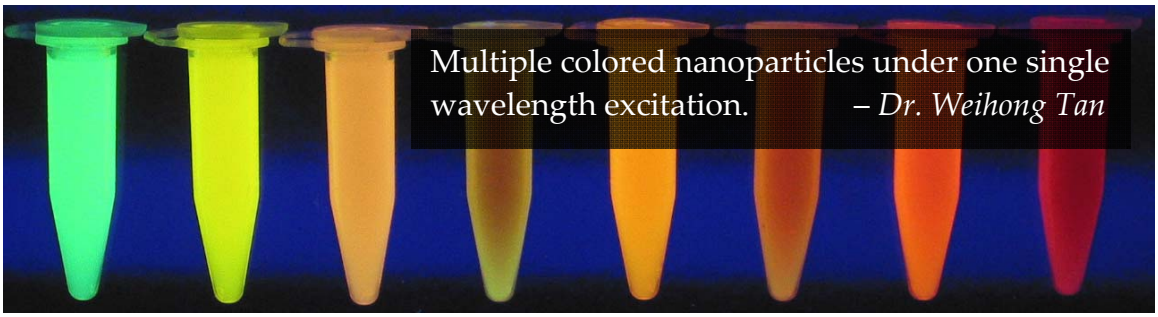
Nanotechnology can be defined as the controlled manipulation of matter at length scales approaching the molecular level (scale = 1-100 nanometers) to create next generation functional materials, devices and systems. Nanotechnology is now creating an **economic revolution** that is driven by emerging insights into the behavior of matter at the nano-scale coupled with an unprecedented ability to control the formation and integration of relevant nanostructures into functional structural devices. This discipline is **rapidly advancing the frontiers of science and technology**, and is predicted to have unprecedented economic impact throughout this century on nearly every commercial sector. Deliverables, including those in food production, energy, medicine, emanating from this nascent but rapidly growing science will fundamentally change the global commercial landscape.

1 nanometer (1nm)

= 1 billionth of a meter = 10^{-9} m
= 3 atoms of solid material
= 1/10,000th hair diameter

Reference: The diameter of a human red blood cell = 6,000 nm

Nanotechnology now offers new opportunities to treat, diagnose and monitor a variety of human, animal and plant diseases that result from emerging pathogens because 1) the nanoscale coincides with the size of many biological molecules and most diseases are caused by interactions at the molecular-nanoscale level, and 2) it offers outstanding potential to measure very low concentrations of pathogens (e.g., bacteria, viruses, prions) and other biomarkers of infection in a remarkably sensitive and specific manner. The goal of the EPI nanomedicine team is to provide an environment that integrates the expertise of biologists, medical researchers, clinicians, businessmen, lawyers and entrepreneurs with the talents of scientists and engineers in a manner that not only protects the citizens of the State of Florida but also enhances economic development. These collaborative efforts promise to yield endless possibilities to develop, test and manufacture novel nanostructure-based sensing and drug delivery platforms for diagnostic and therapeutic applications to emerging pathogens, which require the convergence of engineering practice and biological system materials and applications.



Multiple colored nanoparticles under one single wavelength excitation. – *Dr. Weihong Tan*

To make this goal a reality, an interdisciplinary team assembled from UF, IFAS and other affiliated organizations along with private industry will harness and facilitate select, world-class interdisciplinary resources in the fields of nanoscience, nanotechnology, medicine, and plant sciences to produce high value, life saving, life enhancing, real-time point-of-care (POC) medical diagnostics and therapeutics.

Challenge: Current vaccines and antimicrobial agents are not meeting the needs of the population.

Challenges include the need for timely and well-informed vaccine development. The Influenza vaccine is a perfect example of a vaccine that is not meeting the needs of our population.

Influenza is a serious disease. According to the CDC[6], every year an average of more than 200,000 people are hospitalized from complications of the flu and about **36,000 people die**.

One of the limitations of developing flu vaccines, for example, is the lengthy development process which could take **6-10 months**. Each year experts gather to review data on influenza strains worldwide and from this data make their "best guess" at the three most likely strains to make it to the U.S. and vaccines are manufactured against these strains. Sometimes their guesses are good and sometimes they are not so good. You don't have to imagine, not only the costs, but the threats to human health, when these guesses are wrong.

Another limitation of current technology is the specific method of flu vaccine preparation, a concern expressed by former U.S. Secretary of Health and Human Services, Tommy Thompson, during a news conference to announce his resignation. A major rate-limiting step in the manufacturing process is the availability chicken eggs, the incubator, for vaccine production. Thompson said, "…using the egg-based way of doing it is just too slow and laborious[7]." Of even greater immediate concern, should a pandemic (whether H5N1 or another strain) necessitate production of mass quantities of vaccine, is the ability to produce enough eggs which may be hindered significantly due to the current avian influenza (H5N1) outbreak in birds.

These current outbreaks of the highly pathogenic avian influenza, which began in Southeast Asia in mid-2003, are the largest and most severe on record. Never before in the history of this disease have so many countries been simultaneously affected, resulting in the loss of so many birds. Recent events make it likely that some migratory birds are now directly spreading the H5N1 virus in its highly pathogenic form. Further spread to new areas is expected.

Avian influenza viruses are highly species-specific, but have, on rare occasions including this current outbreak, crossed the species barrier to infect humans. Despite the death or destruction of more than 150 million birds[8], the virus, now considered endemic in many parts of Southeast Asia, Korea, Indonesia and China, has spread most recently to Turkey and Romania. Control of the disease in poultry is expected to take several years.

The risk of pandemic influenza is serious. With the H5N1 virus now firmly entrenched in large parts of Asia, the risk that more human cases will occur will persist. Each additional human case gives the virus an opportunity to improve its transmissibility in humans, and thus develop into a pandemic strain.

Solution. Expand research capabilities for development of appropriate vaccines and antimicrobial reagents necessary to interrupt and control emerging infections.

As described above for influenza, current vaccine development using decades-old technology has limitations. Instead of leaving vaccine development up to probabilities and best guesses and potentially manufacturing a bunch of relatively ineffective vaccine, EPI proposes developing NEW technologies which will permit **making vaccines much more quickly**.

The development of new technologies, perhaps not dependent upon eggs (i.e. cell culture), will be crucial to prepare for Emerging Pathogen outbreaks like an influenza pandemic. Examples of other diseases posing global health and economic threats that could benefit from new vaccine development technologies are human immunodeficiency virus (HIV), tuberculosis (TB), and malaria.

The development of better vaccines will hinge on detection and diagnosis. This will require, not only basic science research into the biology of these pathogens and the immune system's response to them, but also the following:

1. development of novel methods to stimulate specific protective components of the immune system
2. new methods for vaccine delivery (perhaps using technologies such as nanomedicine)
3. identification of therapeutic targets will be critical

Since approximately 80% of emerging infections that affect humans arise from animal reservoirs, EPI's integration of veterinary medicine with human medicine will be vital. Further, our institute's integration of mathematical and computer modeling coupled with epidemiological data and basic science research to predict outcomes of various interventional strategies will facilitate optimal targeting of a rapid response.

Challenge: Current data are unmanageable given existing data systems.

Current problems with data are that our ability to access and subsequently analyze data is not capable of keeping up with our current abilities to collect or capture data. As we are decoding the human genome, as well as the genomes of viruses and bacteria, our ability to process this extent of data and process it in a contextual way is lacking. In addition, data are available from Health Maintenance Organizations (HMO), but we do not yet have the capabilities to optimally manage these rich datasets.

Much of the relevant information is scattered and is found in different formats (i.e. that found in hospitals, pharmacies, USGS, census). As a result, current data are not effectively integrated. Speed of reaction time is key in managing the impact of emerging diseases, requiring automation of most data collection and integration of processes.

Solution. Research and compile data on worldwide pathogens and provide tools for analyzing this data.

Another important component of the Emerging Pathogens Institute is data collection. Data are important for pattern recognition, like identifying unusual patterns of endemic problems, predicting possible outcomes, and analyzing new appearances of pathogens. It is crucial that we have the ability to analyze the data on pathogens but also see this data in the context of other crucial data sets.

Two aspects of emerging pathogen data analysis that are crucial and that EPI researchers are poised to pursue are data mining and simulation. Data mining is used to find critical patterns without having a precise idea of what you are looking for. It uses a combination of artificial intelligence, machine learning, and databases. This technology has the potential to be used to develop automatic detection of emerging pathogen outbreaks by analyzing data. Realistic simulations provide a method for exploring scenarios for how a disease might spread through the population.

Challenge: Current pathogen management is reactive in nature, inhibiting an efficient response.

Solution. Develop response and prevention plans and coordinate implementation with proper authorities to prevent spread of disease and if possible, prevent outbreaks outright .

An example of an existing response program is the Florida citrus canker eradication program (http://www.doacs.state.fl.us/pi/canker/summary-removal-just.html). This program applied epidemiology to management of a disease that might have crippled the Florida citrus industry. Although hurricanes in 2004 and 2005 have spread the disease to the point where eradication is no longer possible, this is an example of the need for collaboration among disciplines (in this case plant pathology and epidemiology). The end of the eradication program, however, demonstrates the need for more integrated, interdisciplinary work. The eradication plan was developed without significant thought to hurricanes; future response plans must take meterological predictions into account, as well as other possible disasters.

The need for crop protection is warranted as there is a long history of natural introductions of invasive species via imported products. The United States imported 38 million metric tons of agricultural products in 2002. Only 2% of all containers in US ports are screened[9]. Natural introductions will continue and are likely to increase.

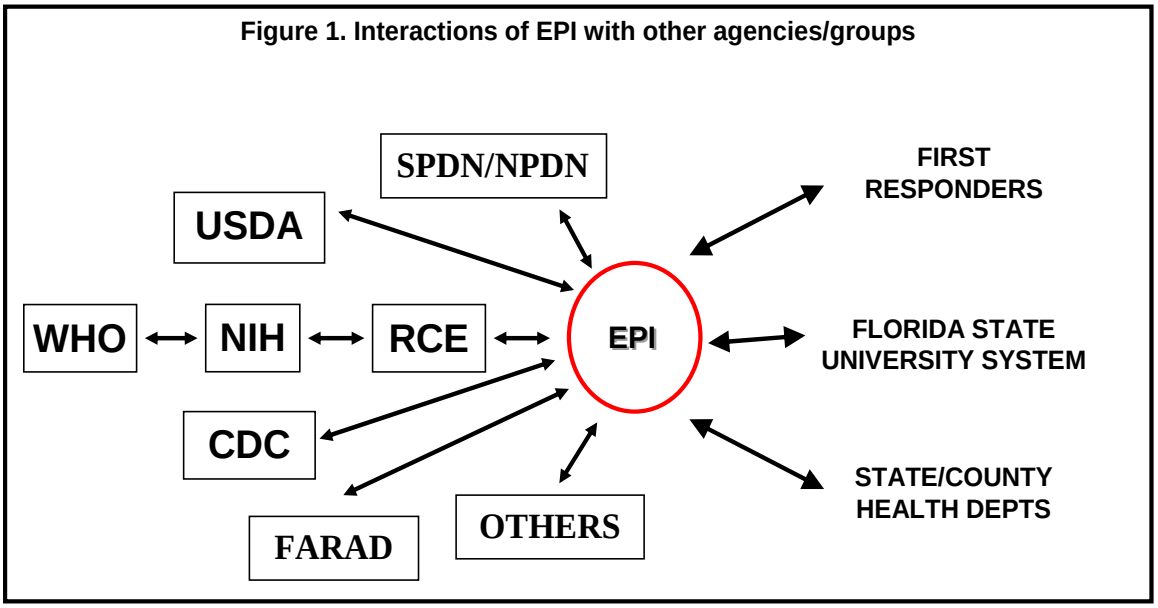


Figure 1. Integration of EPI into the National emerging pathogens network and within the state or local level. World Health Organization (WHO), National Institutes of Health (NIH), Centers for Disease Control (CDC), Unites States Department of Agriculture (USDA), Regional Centers of Excellence (RCE), Southern and National Plant Diagnostic Network (SPDN/NPDN), Food Animal Residue Avoidance Databank (FARAD).

IMPLEMENTATION

To implement the aforementioned solutions, we propose the following:

I. Establishment of program areas and integration of groups with diverse interests

II. Further integration of program areas via recruitment of key executive-level faculty, researchers, administrators

III. Construction of a building to house these recruits and key existing faculty

I. Establishment of program areas and integration of groups with diverse interests

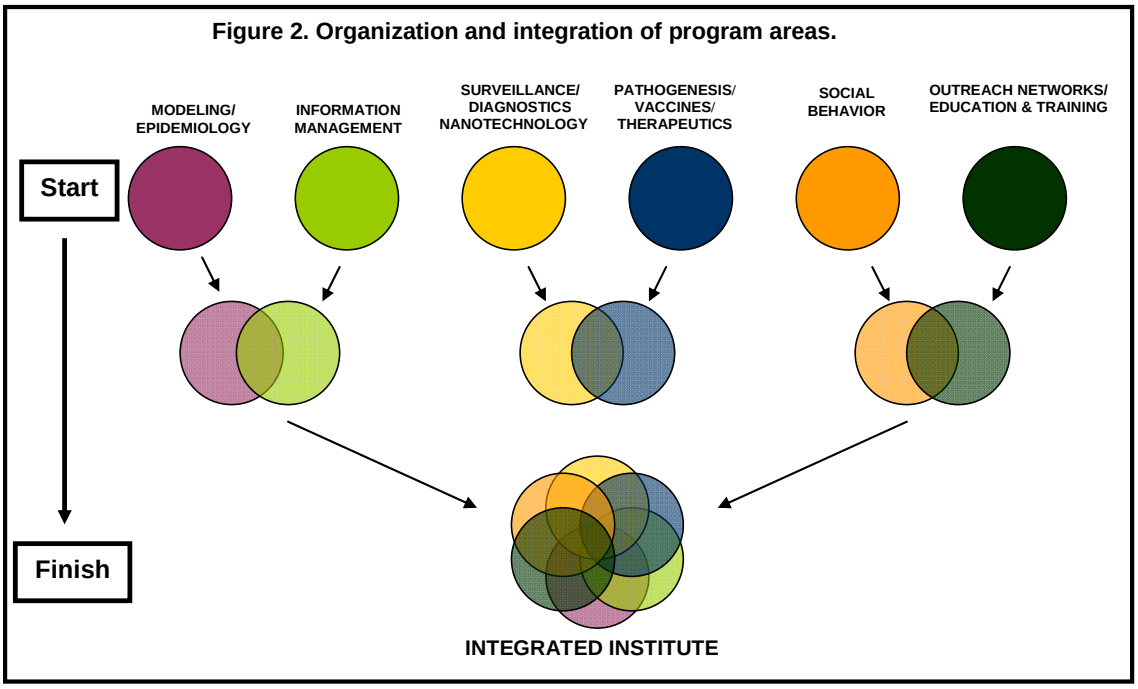


Figure 2. Evolution of EPI beginning with the 6 program areas which develop and evolve to become an integrated institute.

II. Further integration of program areas via recruitment of key executive-level faculty, researchers, administrators

Budgetary expenditures in the first year will focus on the process of recruiting new faculty. Funding for administrative staff will also be required to support this process. Faculty recruitment is expected to continue through the second year.

III. Construction of a building to house these recruits and key existing faculty

The College of Medicine has committed to provide initial "existing" space (20,000 SF) for the Institute in the College's Academic Research Building. We propose construction of a new 300,000 gross square foot emerging pathogens facility on the UF-Gainesville campus to house the new institute and its researchers and administrators under one roof.

Section III – Economic Impact

Economic Impact of Emerging Infectious Diseases

Emerging infectious diseases not only attack the health of our population but also can have a profound impact on the economic health of Florida. Florida thrives on agriculture and tourism for economic stability. These two resources provide our state with the income it needs to support all the institutions that make our great state what it is today. The tremendous economic impact of emerging infectious diseases is seen when considering the impact of Severe Acute Respiratory Syndrome (SARS) on Canada and Bovine Spongiform Encephalopathy (Mad Cow Disease) on England.

Canadian tourism officials report the 2003 outbreak of SARS resulted in significant damage to travel and tourism in Toronto and all of Canada[10]. The national tourism and travel industry in Canada expected to lose $1.1 billion in economic activity in 2003 and a loss in national economic activity of $1.5 billion, which represents 0.15% of Canada's Gross Domestic Product[10].

Also in 2003, the Canadian beef industry was severely impacted when a Canadian steer tested positive for Mad Cow Disease. The outbreak of this infectious disease led to a drop in worth of the export market of Canadian beef from $4.1 billion in 2002 to zero[11]. The closing of borders to most countries, including the United States which received around 90% of all of Canada's beef exports in 2002[11], deepened the economic impact of Mad Cow Disease on the nation. Canada's ranking as third in the world for the highest beef exporter, holding about 15% of the world beef market, fell in light of the outbreak[11].

While SARS and Mad Cow Disease provide examples of the large impact of emerging infectious diseases on the economy, Foot-and-Mouth disease, Influenza, and Citrus Greening are the emerging infectious diseases that currently pose the largest economic threat to Florida.

Foot-and-Mouth disease was responsible for a substantial economic loss in England in 2001. The outbreak of the disease not only affected rural and international tourism expenditures, but also caused huge loss to agricultural producers[12]. These losses are estimated to be £355 million (almost $523 million in 2001), which represents about 20% of the estimated total income from farming in 2001[12].

After the outbreak of Foot-and-Mouth disease in England, models

Potential Economic losses to the state of Florida due to a Foot and Mouth Outbreak

- $1.8 billion indemnity or compensation
- $1 billion cleanup and disinfection
- $658 million humane euthanasia and disposal
- $78 million for business recovery
- $21 million for marketing support

Source: correspondence with Thomas J. Holt, DVM, of the Florida Department of Agriculture and Consumer Services. Reasonable estimates based upon the 2001 FMD costs in England.

were used to estimate the economic impact an outbreak would have on the United States. This model found the most significant impacts on farm income of a Foot-and-Mouth disease outbreak would be from the loss of export markets and decreases in domestic demand from consumer fears resulting in a $14 billion decrease in US farm income[13].

This illustrates an important difference in perspective between public health and animal health which lies in the economic factors associated with lost markets and trade in the event of finding diseases such as FMD or Avian Influenza (H5/H7 strains) in our commercial livestock or poultry. The reporting of a single case of such a disease, required by international treaty, would immediately shut off our ability to send live animals and products to other countries and states until we could prove that we no longer were affected. Such embargos would last a minimum of months and could last for years, assuming eradication was effected. Estimates of the last UK FMD outbreak some years ago were that there was an associated $12 billion cost. Unfortunately there was considerable spread throughout the UK before the disease was recognized which added greatly to its eventual cost. While I have no sources for reference, I am in possession of data presented a few years ago that provided some estimates on cost of a foot and mouth disease outbreak here in Florida.

Pandemic Influenza is another emerging disease that threatens our state. If a pandemic Influenza outbreak hit the United States, economic costs include loss of productivity due to death as well as the potential for a breakdown of infrastructure with consequent devastation to our economy. Industries such as automobiles, travel and tourism, electronics and many others would likely be devastated. One could reasonably expect that an influenza pandemic would also have a devastating impact on the housing market and the stock market. Models predict the total economic impact of an Influenza pandemic could range from $71.3 billion to $166.5 billion[14].

Another recently emerging infectious disease affecting all aspects of the Florida citrus industry is Citrus Greening. This disease ruins the flavor of fruits and ultimately kills citrus trees. Florida is currently trying to eradicate trees infected with Citrus Greening, but there is the likelihood that the disease has become endemic to the state and may result in huge economic losses and may destroy the Florida citrus industry[15].

In order to protect the tourism and agricultural industries of Florida from Emerging Infectious Diseases and mitigate the economic losses these diseases can cause, more research and appropriate and science-based preventative measures must be incorporated into our state disease prevention plans.

Section IV – About The University of Florida

The University of Florida is one of only 34 leading public research universities (one of 60 total) distinguished by membership in the American Association of Universities (AAU). The University of Florida is one of only three university systems in the nation with all of its professional schools on one campus (Gainesville, FL) including Medicine, Nursing, Dentistry, Veterinary Medicine, Pharmacy, Agriculture, Engineering, Business Administration, Education, Law, and Liberal Arts and Sciences.

PROGRAM AREAS & MEMBER RESEARCHERS

Membership in the Emerging Pathogens Institute exceeds 100 scientists and professionals. Representative members within each EPI program area described below and include the individual's research interests and expertise. These researchers and administrators are but a small subset of the extraordinary talent found at the University of Florida.

[★ Internal Advisory Board Members]

Program Area 1: Modeling/Epidemiology

This group includes members from the Departments of Health Policy and Epidemiology, Medicine, Statistics, Wildlife Ecology and Conservation, Infectious Diseases and Pathology (Veterinary Medicine), and Physiological Sciences (Veterinary Medicine). The expertise of this group includes both predictive and prospective epidemiology including the planning, design, execution, and analysis of data from large scale peer reviewed epidemiological studies, studies of the dynamics and regulation of populations, theory and application of matrix population models, statistical methodology and applications in health research, analysis of longitudinal survival data, the dynamics of biological populations, transmission dynamics of diseases in wildlife populations, evolutionary ecology, and wildlife conservation, as well as cutting-edge methods of statistical analysis and modeling. Funding for many of these studies comes from the NIH, HRSA, the ACS, the DOD and the CDC, including several grants funded by the NIOSH.

Lennox Archibald, MBBS, MD, FRCP (Lond), FRCP (Glasg.), DTM&H
Hospital Epidemiologist
Division of Infectious Diseases
College of Medicine

Epidemiology of allograft-associated infections; (fellowship at CDC) epidemiology and microbiology of bloodstream infections in Africa and Southeast Asia and investigation and supervision of numerous nosocomial infection outbreak investigations. Former Medical Director of Regeneration Technologies Inc.; former Acting Medical Director of the Epidemic Information Exchange at CDC and Medical Epidemiologist in the National Center for Infectious Diseases, CDC. Fellow of both the Royal Colleges of Physicians of London and Glasgow in the United Kingdom.

Nabih Asal, PhD
Professor and Director, Division of Epidemiology
Associate Director, Advanced Post Graduate Program in Clinical Investigation (APPCI)
Dept. of Health Policy & Epidemiology

Epidemiology Methodology; planning, design, execution, and analysis of data from large-scale peer reviewed epidemiological studies.

Terrell Carter, MHS
Dept. of Health Policy & Epidemiology
Research Program Coordinator

Ying Chen, PhD
Associate Professor of Biostatistics and Sweesy-Womack Endowed Chair
Dept. of Statistics

Biostatistics with specialty in statistical methodology development and applications in health research; statistical research areas include analysis of longitudinal and survival data; programming and computing.

Paul Gibbs, BVSc, PhD, FRCVS
Professor, Department of Infectious Diseases and Pathology,
College of Veterinary Medicine

Epidemiology, control and prevention of emerging viral diseases with experience at the Institute of Animal Health in the UK working on diseases such as foot-and-mouth disease, bluetongue, sheep pox, and rinderpest, and more recently working on emerging problems and foreign animal diseases that threaten the USA including foot-and-mouth diseases, West Nile virus encephalitis, canine influenza, bovine spongiform encephalopathy, and avian influenza. Works closely with Florida's Department of Agriculture and Consumer Affairs and the Department of Health in developing disease control policies and educational programs; member of the steering committee for the State Agricultural Response Team.

Jorge Hernandez, DVM, MPVM, PhD
Associate Professor of Epidemiology
UF CVM Large Animal Clinical Sciences
Email: Hernandezj@mail.vetmed.ufl.edu

Veterinary epidemiologist with professional experience in Mexico, United States, Ireland, Bolivia, Ecuador, Chile, Cuba, Saudi Arabia, and Switzerland. Interest in formulation, implementation, and evaluation of risk-based surveillance systems of diseases of economic importance to animal agriculture and public health.

Robert D. Holt, PhD
Professor & Arthur R. Marshall Jr. Chair in Ecology
Zoology Department
College of Liberal Arts and Sciences

Theoretical and conceptual issues at the population and community levels of ecological organization, and on the task of linking ecology with evolutionary biology; in addition to basic research, bringing modern ecological theory to bear on significant applied problems, particularly in conservation biology; large-scale experiments on habitat fragmentation. Has historically collaborated with many faculty at a wide range of institutions, both inside and outside the USA.

Madan Oli, PhD
Assistant Professor, Institute of Food and Agricultural Sciences.
Dept. of Wildlife Ecology & Conservation

Dynamics, regulation and conservation of biological populations, evolutionary ecology, and transmission dynamics of diseases in wildlife populations; integrates mathematical models and field data to discern factors and processes influencing dynamics of animal populations.

Stephen Roberts, PhD
Professor
Dept. of Physiological Sciences and Pharmacology and Experimental Therapeutics
Program Director for the Center for Environmental and Human Toxicology
Scientific Advisor, National Toxicology Program (U.S. DHHS and the U.S. EPA)

Toxicology and human health risk assessment; (toxicology) mechanisms of toxicity of drugs and chemicals, particularly involving the liver and immune system; toxicokinetics and cell defense mechanisms against chemical insult; (risk assessment) development of new techniques and approaches for estimating risks from chemical exposure.

Dan Salmon. PhD, MPH
Associate Professor, Department of Epidemiology and Health Policy Research
Adjunct Associate Professor in the Division of Disease Control, Department of International Health, Johns Hopkins School of Public Health and continues to serve as Associate Director for Policy and Behavioral Research for the Institute for Vaccine Safety at the Johns Hopkins School of Public Health Infectious disease

Vaccine epidemiology, health services and policy research; in particular, optimization of the post-licensure use of pediatric vaccines to control infectious diseases; epidemiological studies, including retrospective cohort, case-control, cross-sections, ecological and intervention studies; measurement of vaccine uptake, the epidemiological risks of unvaccinated children, the roles of health care providers in working with parents on vaccination decisions, and the impact of federal, state and local laws and policies on vaccine uptake. Widely considered the national expert on mandatory immunizations and the impact of non-medical exemptions and has contributed to the development and evaluation of federal policies and programs to ensure the safety of vaccines, post-licensure.

★**Betsy Shenkman, PhD, MSN**
Professor and Chairperson
Dept. of Epidemiology and Health Policy Research and Dept. of Pediatrics
Director, Institute for Child Health Policy
College of Public Health and Health Professions, UF-HSC

Health services research; specializations includes examining the quality and outcomes of care for children and adolescents in the context of the health care delivery system, their families, and their communities; expert in program evaluation, particularly for public insurance programs such as Medicaid and the State Children's Health Insurance Program and special waiver projects. Principal Investigator on four large scale state projects including the evaluation of the Texas Medicaid and Children's Health Insurance Program, the Florida KidCare Program, the Florida Title V Program, and a special waiver project designed to provide hospice services for children with life threatening conditions.

Program Area 2: Social Behavior

The Social Behavior program area includes individuals from IFAS and the Colleges of Liberal Arts and Sciences and Public Health and Health Professions. Expertise within this team includes but is not limited to, rural health, child and pediatric psychology, occupational psychology, behavioral medicine, mental health and public policy, training issues for psychology, methods of educating and preparing communities to deal with the psychological aspects of natural or manmade disasters as well as methods of educating primary care physicians on these events to prepare them to deal with patients, the demography of health and aging with particular attention to minority populations, Latino Sociology, family and household demography, and the sociology of sex and gender. One example of a presently funded grant is entitled "The Impact of Bioterrorism on Rural Mental Health Needs". The aim of this project is to assess and improve the **preparedness of rural primary care professionals** to provide care for mental health conditions resulting from bioterrorism and **infectious disease outbreaks**.

James Shepperd, PhD
Director of Graduate Training and Associate Professor, Social Psychology
Dept. of Psychology, CLAS

Experimental social psychologist; self-esteem and identity regulation in the face of inconsistent and threatening information. Recipient of the 2004 ICARE Development Grant.

Brenda Wiens, PhD
Research Assistant Professor
National Rural Behavioral Health Center (NRBHC)
Dept. of Clinical & Health Psychology
College of Public Health and Health Professions

Methods of educating and preparing communities to deal with the psychological aspects of disasters (as well as terrorism) and methods of educating primary care physicians to deal with affected patients/victims.

Barbara Zsembik, PhD,LPN
Associate Chair and Associate Professor
Sociology Department, CLAS

Demography of health and aging with particular attention to minority populations, Latino Sociology, family and household demography, and sociology of sex and gender.

Program Area 3: Surveillance/Diagnostics/Nanotechnology

The members of this program area include faculty from the Colleges of Medicine, Veterinary Medicine, Pharmacy, Engineering and departments of IFAS. Examples of research expertise on this team include: solid-state device physics and its applications to micro- and nano-scale sensors, actuators and very large scale integrated circuits, the scaling of solid-state devices to smaller dimensions, device reliability, novel sensor transduction mechanisms, noise-limited minimum detectable signals and biomedical current probes, drug detoxification using nanostructured materials, interactions of nanoparticles with human tissues, nanotechnology-based detection of molecules in exhaled breath, medical applications of nanotechnology including diagnostics and therapeutics, degradable polymers for drug delivery and scaffolds for tissue regeneration, as well as surface modified polymers for sensors, the design and synthesis of micro and nano-spheres with defined properties, ways of generating self-assembly scaffolds of polyelectrolyte complexes with oriented typography, and the development of monolithic and gelling delivery methods. One member of the team is the Principal Investigator for the Antimicrobial Resistance Management (ARM) Program which tracks microbial resistance through a web-based analysis tool. As of January 2004, the database currently housed over 22 million isolates of data. Another member is a member of the oversight committee of the UF Nanofabrication Facility unit, and coordinator of the Smart Integrated Nanosensors for Space Biotechnology Applications project of the Space Biotechnology and Commercial Applications program at UF funded by NASA.

★Chris Batich, PhD
Founding Director of the UF Biomedical Engineering Program
Professor, Materials Science and Engineering
Biomedical Engineering Dept.
College of Engineering

Use of plastics and polymeric materials for diagnoses development, infection control, and other biomedical applications such as controlled drug delivery. Collaborations with faculty in Ob/Gyn, Nephrology, Surgery, Veterinary Medicine, Dental School, and other Health Center groups have led to joint publications and patents. Some of the UF technologies have been licensed to a local start-up company which has established a laboratory in Gainesville, and they are developing various means of preventing infection transmission. Also works with micro and nano particles with specific surface and bulk modifications to accomplish these goals.

Cynda Crawford, DVM, PhD
Assistant Scientist, Small Animal Clinical Sciences
College of Veterinary Medicine

Diagnosis, epidemiology, control and prevention of emerging viral diseases in dogs and cats. Specific projects focus on the newly emerging canine influenza H3N8 virus and the use of dogs and cats as sentinels for West Nile virus and avian influenza H5N1 virus.

★Donn Dennis, MD
Professor, Dept. of Anesthesiology
College of Medicine

Medical applications of nanotechnology (drug detoxification, ultraselective drug delivery); Cardiac electrophysiological effects of adenosine, anesthetics, and antiarrhythmic agents; design and development of novel antiarrhythmics, anesthetic agents and adenosine receptor ligands; pharmacology of adenosine receptor coupling mechanisms. Member, NSF Engineering Research Center at the University of Florida, Nanoparticulate Systems for Drug Detoxification section. Vice President, ARYx Therapeutics.

★Lou Guillette, PhD
Distinguished Professor, Zoology Dept.
Associate Dean for Research, CLAS

Mechanisms by which environmental factors influence the evolution, development and functioning of the reproduction system in vertebrates, specifically the influence of contaminants on the developmental and reproductive biology of wildlife and humans, endangered species reproduction, and the evolution of maternal-fetal chemical communication.

John Gums, PharmD
Professor of Pharmacy and Medicine; Director of Clinical Pharmacology Education
Director, Clinical Research in Family Medicine, Dept. Pharmacy Practice & Dept. Community Health & Family Medicine

Surveillance and therapeutics; clinical research, clinical trials; Principal Investigator for the Antimicrobial Resistance Management (ARM) Program which tracks microbial resistance through a web-based analysis tool; database currently houses over 22 million isolates of data..

Elliott Jacobson, DVM, PhD
Diplomate, American College of Zoological Medicine
Professor, Department of Small Animal Clinical Sciences

Identifying infectious diseases of wildlife and zoo animals, with an emphasis on reptiles, using histology, electron microscopy, immunodiagnostics and molecular diagnostic techniques. Developing new assays for the identification of reptile pathogens.

Huabei Jiang, PhD
Professor, J. Crayton Pruitt Family Department of Biomedical Engineering
College of Engineering

Optical imaging of breast cancer, diffuse optical tomography of osteoarthritis, optical spectroscopy of skin cancer, microwave imaging, fluorescence/bioluminescence tomography, photo-acoustic tomography, inverse scattering based ultrasound tomography.

Paul A. Klein, PhD
Professor Emeritus, Department of Pathology, Immunology, and Laboratory Medicine, College of Medicine
Affiliate Professor, Department of Infectious Diseases and Pathology,
College of Veterinary Medicine

Immunology, virology, microbial pathogenesis and host defense mechanisms in lower vertebrates. Serodiagnosis and seroepidemiology of infectious diseases of wildlife.

Julie K. Levy, DVM, PhD, DACVIM
Associate Professor, Small Animal Clinical Sciences
College of Veterinary Medicine

Diagnosis, epidemiology, control and prevention of emerging viral diseases in cats. Specific projects focus on the use of cats as sentinels for West Nile virus and avian influenza H5N1 virus.

Maureen T. Long, DVM, MS, PhD, DACVIM
Assistant Professor, Department of Large Animal Clinical Sciences
College of Veterinary Medicine

Emerging pathogens of large animals including the immunoprophylaxis, diagnosis, and prevention of new and old pathogens of the horse. Investigation of the immune response to West Nile virus (WNV) in the outbred host using a model which produces neurological disease. Genetic regulation of anti-viral interferons and specific T-cell mediated effector molecules. Safety and efficacy testing of a new modified live recombinant vaccine for prevention of clinical signs of West Nile virus (WNV) induced disease in horses, a vaccine also under investigation as a human vaccine. Surveillance, both retrospectively and prospectively, for arboviral pathogens that may cause disease in the horse; determination of what mosquitoes feed on horses and examination of commonly used therapies to ameliorate clinical signs of encephalitis. Emerging Diseases and Arboviruses Research and Test Program (EDART).

Charles R. Martin, PhD
Colonel Allan R. and Margaret G. Crow Professor of Chemistry, CLAS
Director, Center for Research at the Bio/Nano Interface
Professor, Department of Anesthesiology, COM

Interface between analytical chemistry and materials science; new approaches to do chemical analyses and separations and developing new materials that will make these separations and analyses possible; particularly the application of nanomaterials to bioanalytical chemistry; has pioneered a powerful new method to prepare nanomaterials.

Jim Maruniak, PhD
Associate Professor, Entomology; Graduate Faculty, Microbiology and Cell Science.
Dept. of Entomology & Nematology

Insect viruses and field application as biological pesticides; molecular techniques to determine and elucidate function of genes involved in pathogenesis, virulence and host specificity. Insect baculoviruses and insect cell cultures used as molecular expression systems for the production of important proteins for medical, veterinary and agricultural purposes.

Tim Morey, MD
Board certified Anestesiologist; Associate Professor, Dept. of Anesthesiology

Medical applications of nanotechnology including diagnostics and therapeutics; specific focus areas include drug detoxification using nanostructured materials, interactions of nanoparticles with human tissues, and nanotechnology-based detection of molecules in exhaled breath. Two patents for systems to solubilize drugs.

★Toshi Nishida, PhD
Associate Professor, Dept. of Electrical & Computer Engineering, COE

Solid-state device physics and applications to micro- and nano-scale sensors, actuators, and very large scale integrated circuits; scaling of solid-state devices to smaller dimensions,
device reliability, novel sensor transduction mechanisms, and noise-limited minimum detectable signals. Several patents for MEMS technology.

Hendrik Nollens, DVM, MSc, PhD
Department of Small Animal Clinical Sciences
College of Veterinary Medicine

Detection and characterization of emerging and newly recognized viruses of marine mammals. Surveying captive and free-ranging marine mammals populations for novel viral pathogens and evaluating the clinical significance of these viruses.

★David E. Richardson, PhD
Professor and Chair
Chemistry Department
Coll. of Liberal Arts & Sci.

Study of kinetics of chemical processes to deduce mechanistic schemes of how chemical transformations occur and allow for understanding the factors that influence the progression of reactions. Current research interests fall into a couple of broad categories including chemical warfare agent decontamination and transition metal catalysis.

Carlos Romero, DVM, PhD
Scientist, Department of Infectious Diseases and Pathology,
College of Veterinary Medicine

Exotic viral infections of livestock, poultry and wildlife with emphasis on diagnostics and control. Use of non-infectious molecular approaches for the detection and identification of animal viruses in tissues/secretions/lesions. Detection and identification of novel viruses from aquatic mammals. Development of recombinant vaccines for livestock based on poxviruses, herpesviruses and nucleic acids.

Marilyn G. Spalding, DVM
Associate Scientist
Department of Infectious Diseases and Pathology
College of Veterinary Medicine

Diseases of wild birds, avian die-off events, influence of disease on the re-introduction of the endangered whooping crane in Florida.

Sean Sullivan, PhD
Associate Professor, Pharmaceutics Dept.
College of Pharmacy

Drug delivery with emphasis on increasing the effectiveness of drugs and decreasing side effects. Areas of therapeutic applications include infectious disease (HIV, HSV and Hepatitis), arthritis and cancer. Application of this technology toward the development of non-viral gene delivery systems, specifically for the treatment of cancer with emphasis on brain cancer.

Weihong Tan, PhD
Professor, Chemistry Department
Associate Director, UF Center of Research at Bio/nano Interface Faculty, McKnight Brain Institute, Shands Cancer Center and Genetics Institute

Bioanalytical chemistry; molecular engineering; biomedical engineering; bionano-technology.

Glen Walter, PhD
Assistant Professor, Dept. of Physiology and Functional Genomics
College of Medicine

Bioengineering of Muscle Structure and Metabolism**.**

Program Area 4: Pathogenesis/Vaccines/Therapeutics

This group represents the most traditional component of our Institute. Members of this team include faculty from the Department of Plant Pathology of IFAS, and faculty from the Colleges of Veterinary Medicine, Medicine, and Dentistry.

The University of Florida is also a full member of the region IV National Center of Excellence for Biodefense and Emerging Infectious Diseases (SERCEB) which provides a major strength not only to this group but to the whole effort. All of the faculty are principal investigators of laboratories that are extremely productive and are well funded in the areas of viral and bacterial diseases of plants, animals (both domesticated and wildlife) and various human diseases.

Funded projects of this team include: defining the pathogenic mechanisms by which mycoplasmas cause both respiratory and urogenital infections, the elucidation of the etiologic agent, characterization of clinical disease, and diagnosis of respiratory mycoplasmosis in two environmentally threatened species of tortoise and in American alligators, the development of serological diagnostic tests (ELISA) as well as a PCR based diagnostic tests to allow epidemiological surveys of large natural populations with ongoing investigations into mechanisms of transmission and pathogenesis of these infections, determination of the role of*Ureoplasma urealyticum* both as an etiologic agent of urinary tract infections (UTIs) in women and as a potential risk factor for establishment of susceptibility to recurrent and chronic urinary tract infection, investigations of intracellular pathogen actin-based motility , the effects of Anthrax toxins on actin-based motility, the immune function of CapG null mice, the application of IVIAT (In vivo Induced Antigen Technology) to a number of human pathogens to identify genes turned on during human infections, identification of *Porphyromonas gingivalis* genes involved in the invasion of cardiovascular endothelial cells, the study of the mechanism of paracellular invasion of human tissues by *P. gingivalis*. There are also substantial efforts directed towards identification of new poxvirus antivirals and identification of the poxvirus receptor(s) funded by the Region IV RCE as well as independently funded longstanding studies on of the mechanism by which poxvirus genes deflect host responses to infection. We also have well recognized groups working on the study and dynamics of plant virus diseases. One member of the team is the Director of the Southern Plant Diagnostic Network, another is co-Director of the SERCEB and another is Chair of the task force on Bioterrorism Research.

David R. Allred, PhD
Associate Professor, Department of Infectious Diseases and Pathology
College of Veterinary Medicine
Affiliate, Department of Pathology, Immunology, and Laboratory Medicine
College of Medicine

Molecular, biochemical, and immunological bases for host-parasite interactions that lead to the establishment of persistent hemoparasitic infections in immune mammalian hosts; structural aspects of membrane organization and modification in parasite-infected cells; particular expertise with parasites responsible for bovine babesiosis and human malaria; combinatorial genetics as a strategy for identification of interacting components. Our

projects are aimed toward the development of strategies to induce variation-transcending immunity.

Anthony F. Barbet, PhD
Professor, Department of Infectious Diseases and Pathology
College of Veterinary Medicine
Affiliate, Department of Pathology, Immunology, and Laboratory Medicine
College of Medicine

Molecular biochemical and immunological basis for persistent infections, with current emphasis on diseases caused by Anaplasma and Ehrlichia in humans and animals. The development of improved vaccines and diagnostic tests for tropical diseases using molecular methods.

David Bloom, PhD
Associate Professor, Dept. of Molecular Genetics & Microbiology
College of Medicine

Developmental Neuro-Biology, Neuro-Virology. Molecular basis of pathogenesis of the herpesviruses, and application of these pathogenic concepts to the development of herpes simplex virus (HSV) as a gene therapy vector.

Daniel R. Brown, PhD
Assistant Professor, Department of Infectious Diseases and Pathology
College of Veterinary Medicine
UF Genetics Institute Graduate Faculty Member
UF Shands Cancer Center Signaling, Apoptosis, and Cancer Program Member

Discovery and characterization of bacterial pathogens; genome sequencing and annotation; molecular analysis of virulence mechanisms; comparative immunology and host cell signaling in response to infection; genome-based predictive modeling of pathogen evolution.

⋆Mary B. Brown, PhD
Professor, Department of Infectious Diseases and Pathology
College of Veterinary Medicine
Affiliate, Department of Pediatrics, College of Medicine

Defining the pathogenic mechanisms by which mycoplasmas cause both respiratory and urogenital infections in a variety of hosts including humans, rodents, food and fiber animals, and wildlife; development of models to study virulence factors of *Mycoplasma mycoides* SC type (class B agent of special concern by USDA and APHIS) with special emphasis on the pathogen and host factors that exacerbate pulmonary disease and facilitate spread to extrapulmonary sites, particularly the central nervous system.

William Castleman, DVM, PhD
Professor, Department of Infectious Diseases and Pathology
College of Veterinary Medicine

Research is focused on pathology and pathogenesis of viral respiratory disease including studies on the newly emerged canine influenza virus infection.

Neil Clancy, MD
Associate Professor
Div. of Infectious Diseases
Department of Medicine
College of Medicine

Medical mycology; particularly, opportunistic fungal pathogens.

★John B. Dame, PhD
Professor and Chair, Department of Infectious Diseases and Pathology
College of Veterinary Medicine

Molecular biology of parasites with research goals targeted toward prevention, diagnosis, and chemotherapy of infection. Current emphasis is on identifying targets for the rational design of novel antimalarial drugs to control or prevent infection with the human malaria parasite, *Plasmodium falciparum*. These studies include developing genetic tools for conditional knockout mutagenesis in this species. Specific projects focus on the family of aspartic proteinases expressed by the parasite and the DNA gyrase of the apicoplast, a unique organelle derived from an ancestral algal chloroplast.

Jack M. Gaskin, DVM, PhD
Diplomate, American College of Veterinary Microbiology
Associate Professor, Department of Infectious Diseases and Pathology
College of Veterinary Medicine
Chief, Clinical Microbiology, Parasitology, and Serology Service
Veterinary Medical Center

Diagnostic microbiology and serology. Investigation of microbial disease problems of domestic and exotic animals with emphasis on culture and differentiation of pathogenic species of bacteria, fungi, and viruses. Infectious diseases of small ruminants, dogs, cats, birds, horses, reptiles, and fish are of particular interest.

Steeve Giguère, DVM, PhD
Associate Professor, Department of Large Animal Clinical Sciences
College of Veterinary Medicine

Neonatal immune responses to facultative intracellular bacterial pathogens with emphasis on *Rhodococcus equi*; Pathogenesis of *Rhodococcus equi* infections in foals; Role of cytokines in the pathogenesis of bacterial diseases of horses; Pharmacokinetics and pharmacodynamics of antibacterial agents in horses.

Maureen T. Long, DVM, MS, PhD, DACVIM
Assistant Professor, Department of Large Animal Clinical Sciences
College of Veterinary Medicine

Emerging pathogens of large animals including the immunoprophylaxis, diagnosis, and prevention of new and old pathogens of the horse. Investigation of the immune response to West Nile virus (WNV) in the outbred host using a model which produces neurological disease. Genetic regulation of anti-viral interferons and specific T-cell mediated effector molecules. Safety and efficacy testing of a new modified live recombinant vaccine for prevention of clinical signs of West Nile virus (WNV) induced disease in horses, a vaccine also under investigation as a human vaccine. Surveillance, both retrospectively and prospectively, for arboviral pathogens that may cause disease in the horse; determination of what mosquitoes feed on horses and examination of commonly used therapies to ameliorate clinical signs of encephalitis. Emerging Diseases and Arboviruses Research and Test Program (EDART).

Suman Mahan, BVM, MSc, PhD
Associate Scientist, Department of Infectious Diseases and Pathology
College of Veterinary Medicine

Development of improved vaccines and diagnostic/detection capabilities (serology and DNA based assays) for *Ehrlichia ruminantium* (a select / agro-terrorism agent, causes Heartwater in domestic and wild ruminants). Field tested an inactivated vaccine for heartwater in southern Africa (from 1991-2005) where heartwater is endemic. This vaccine is now being commercialized by a South African vaccine production company. Have started a project on *Coxiella burnetii*, a potential bioweapon agent that naturally causes a zoonotic infection called Q fever; in which characterization of immune responses and identification of candidate vaccine antigens for development of recombinant vaccines for animals as well as humans will be the primary focus.

★Richard Moyer, PhD
Professor, Dept. of Molecular Genetics & Microbiology
Senior Associate Dean for Research Development
College of Medicine

Virologist, identification and characterization of genes which contribute to poxvirus pathogenesis and disease in their respective hosts.

Minh-Hong Nguyen, MD
Associate Professor, Div. of Infectious Diseases
Department of Medicine
College of Medicine

Fungal infections and treatment.

★Jane E. Polston, Ph.D.
Professor
Department of Plant Pathology
IFAS/College of Agricultural and Life Sciences

Plant virology; biological and molecular chacterization of new or emerging whitefly-transmitted geminiviruses, study of transmission of geminiviruses by whiteflies, development of pathogen-derived resistance in plants to geminiviruses, development of pollen-mediated transformation methods for crop plants.

★Ann Progulske-Fox, PhD
Professor, Dept. of Oral Biology, Director, UF Center for Molecular Microbiology
College of Dentistry

Development of technology for identification of in vivo induced genes of human pathogens; pathogenic mechanisms of oral gram negative bacteria; biological basis of the relationship between periodontal disease and cardiovascular disease. Chair, UF Bioterrorism Task Force; Member, Public and Scientific Affairs Board, American Society for Microbiology.

Jeffrey Rollins, Ph.D.
Assistant Professor
Department of Plant Pathology, Plant Molecular and Cellular Biology Program
IFAS/College of Agricultural and Life Sciences

Research focused on the mechanisms of broad host range pathogenesis in fungi that infect plants. Use forward and reverse genetic approaches using single genes and whole genomes to identifying and characterizing physiological and molecular components of pathogenesis and the signal transduction pathways that regulate them.

★Fred Southwick, MD
Professor and Chief, Div. of Infectious Diseases
Department of Medicine
College of Medicine

Infectious Diseases expert; clinical interests in central nervous system infections and air sinus infections. Research interests in cell motility in macrophages and neutrophils and pathogenesis of Listeria and Shigella; effects of anthrax toxins on neutrophil and macrophage motility. Chief, Infectious Diseases; Member, Bioterrorist Agent Task Force (UF).

Sankar Swaminathan, MD
Associate Professor
Dept. of Molecular Genetics & Microbiology
College of Medicine

Epstein Barr virus (EBV) and its role in carcinogenesis.

★Eric Triplett, PhD
Professor and Chair
Department of Microbiology and Cell Science
IFAS/College of Agricultural and Life Sciences

Study of endophytic bacteria colonization of plants as related to plant growth and nutrition as well as the study of some human pathogenic bacteria that can colonize the interior of plants and the basis of strain specificity and ability to enter plant hosts. Development of new tools for microbial diversity research including Automated Ribosomal Intergenic Spacer Analysis (ARISA) and a web-based tool for T-RFLP analysis.

Janet K. Yamamoto, PhD
Professor, Department of Infectious Diseases and Pathology,
College of Veterinary Medicine.

Retroviral immunology; cellular and transplantation immunology with major emphasis on feline immunodeficiency virus (FIV) vaccine development and immunotherapy for veterinary practice as well as to provide new insights to approach the development of an effective human immunodeficiency virus (HIV) vaccine.

Program Area 5: Information Management

This group is composed of faculty from the Colleges of Engineering, Veterinary Medicine, Medicine and the Institute of Food and Agricultural Sciences. The collective expertise of this team includes, but is not limited to, development and applications of large-scale software systems, high performance networking, interactive marketing, data mining and optimization, biomedical computing, database management, artificial intelligence, decision support systems, applications of eLearning, medical systems design and development, medical decision support technology for diagnostic evaluations, medical database design and development, and the development of real-time optimization software. A member of this group is director of information technologies for the Southern Plant Diagnostic Network and is currently developing learning content management systems for training first detectors of pathogens in the National Plant Diagnostic Network.

Howard Beck, PhD
Professor, Agricultural & Biological Engineering
College of Engineering
Director of Information Technologies for Regional Homeland Security Project, the SPDN

Information technologies, with emphasis on database management, artificial intelligence, and decision support systems. Has constructed several operational information systems including the Extension Digital Information System (EDIS) containing over 6000 publications for the Florida Cooperative Extension Service, the Decision Information System for Citrus (DISC) project, and the Distance Diagnostics and Identification System (DDIS).

Ralph Grams, MD
Professor
Dept. of Pathology
College of Medicine

Medical systems design and development, medical decision support technology for diagnostic evaluations, medical education using distance learning and internet-based technologies, medical database design and development, and electronic medical records and medical internet communications. Web-based training development.

Chris Jermaine, PhD
Assistant Professor, Computer & Information Sciences & Engineering
College of Engineering

Design and theoretical/empirical evaluation of algorithms/software to support large databases; development of techniques for indexing/layout of massive databases across multiple hard disks, in order to support high throughput of new data insertion, as well as heavy, concurrent query workloads. Developing new statistical models for massive databases for subsequent processing of statistical queries; development of algorithms for knowledge discovery from data and data mining, particularly data that is part of very large or very complex databases.

***Sanjay Ranka, PhD**
Professor, Computer and Information Sciences & Engineering
College of Engineering

World-renowned technologist in the areas of large-scale software systems, high performance networking, interactive marketing, CRM, data mining and optimization, and biomedical computing.

Program Area 6: Outreach Networks/Education & Training

This area includes individuals from the Colleges of Nursing, Medicine, and Veterinary Medicine and multiple departments (Food Science, Entomology, and Plant Pathology) in the Institute of Food and Agricultural Sciences. The charge to this team is to 1) develop collaborations and cooperative agreements with institutions and groups outside the University of Florida and 2) to develop and organize the educational component of the Institute. Some individuals within this group are presently working for the Southern Plant Diagnostic Network (SPDN) to develop a region-wide education program for the SPDN and to initiate programs for rapid detection of exotic pests entering the region, especially those that pose a threat to agriculture, as well as assisting with the identification of client groups and their needs in detecting exotic arthropods. Additional expertise within this team includes medical informatics, laboratory automation, and electronic medical record management. Members are currently developing training materials in all media for other purposes. One member serves on the Food and Drug Administration's Food Advisory Committee. An important link from this group is the county extension agents of IFAS that are located in every county in Florida.

Doug Archer, PhD
Professor and former Chairperson
Food Science & Human Nutrition Department
IFAS

Government regulations related to food safety and food microbiology; genetic consequences of stress on bacteria, particularly gastrointestinal immunity and chronic sequelae to acute illness. Project Director (UF), "Improving the Safety of Fruits and Vegetables: A Tri-state Consortium" funded by USDA - IFAFS. Member, FDA Food Advisory Committee Representative (US), WHO Expert Panel on Food Safety.

Paul Gibbs, BVSc, PhD, FRCVS
Professor, Department of Infectious Diseases and Pathology,
College of Veterinary Medicine

Epidemiology, control and prevention of emerging viral diseases with experience at the Institute of Animal Health in the UK working on diseases such as foot-and-mouth disease, bluetongue, sheep pox, and rinderpest, and more recently working on emerging problems and foreign animal diseases that threaten the USA including foot-and-mouth diseases, West Nile virus encephalitis, canine influenza, bovine spongiform encephalopathy, and avian influenza. Works closely with Florida's Department of Agriculture and Consumer Affairs and the Department of Health in developing disease control policies and educational programs; member of the steering committee for the State Agricultural Response Team.

Carrie L. Harmon, MS
Assistant Director, Southern Plant Diagnostic Network

Plant pathologist with specialized training in mycology and plant pathogen diagnostics; coordinates the university plant diagnostic laboratories for the southern region of the US - 12 states, plus Puerto Rico; activities include coordinating funding for each member state, training diagnosticians and first detectors, developing educational materials on pathogens of high natural or economic impact, and maintaining communication with the network members, growers, regulatory officials, and the public through a monthly newsletter and website (http://spdn.ifas.ufl.edu).

Amanda Hodges, PhD
Dept. of Entomology & Nematology, IFAS

Development of region-wide education program for the Southern Plant Diagnostic Network (SPDN); initiation of programs for rapid detection of exotic pests entering the region, especially those that pose a threat to agriculture; identification of client groups and their needs in detecting exotic arthropods.

Nancy Menzel, PhD, RN
Dept. of Health Care Environments & Systems

Effects of pain and stress management classes on back pain, disability, stress, job satisfaction, burnout, depression, and unscheduled absences in hospital nursing staff. Assistant Professor, College of Nursing; Vice President, Florida State Association of Occupational Health Nurses. Assistant Professor, Nursing.

Robert J. McGovern, Ph.D.
Professor and Director
UF-IFAS/CALS Plant Medicine Program
Florida Extension Plant Disease Clinic

Directs the multidisciplinary Plant Medicine Program that encompasses over 20 faculty members in six participating departments. The objective of this professional doctoral

program is to train practitioners in all aspects of the prevention, diagnosis and integrated management of plant health problems. Coordinates the Certificate in Plant Pest Risk Assessment and Management which assists graduate students at the University of Florida in developing the personal and professional skills required to effectively lead and conduct plant pest risk assessment and management on the local, national and international level. Is a co-primary investigator on the USDA-CSREES-funded grant, "Regional Plant Diagnostic Center Laboratory", that established and maintains the Southern Plant Diagnostic Network (SPDN).

Anita Wright, PhD
Food Science & Human Nutrition Dept.

Pathogenesis of foodborne infections, particularly seafood-associated diseases; genetics of virulence factors with emphasis on bacterial polysaccharides; molecular probes for applications in food product safety and microbial ecology of infectious diseas. Funded by USDA and Sea Grants. Assistant Professor, Food Science.

Other: Ex officio, internal advisory board

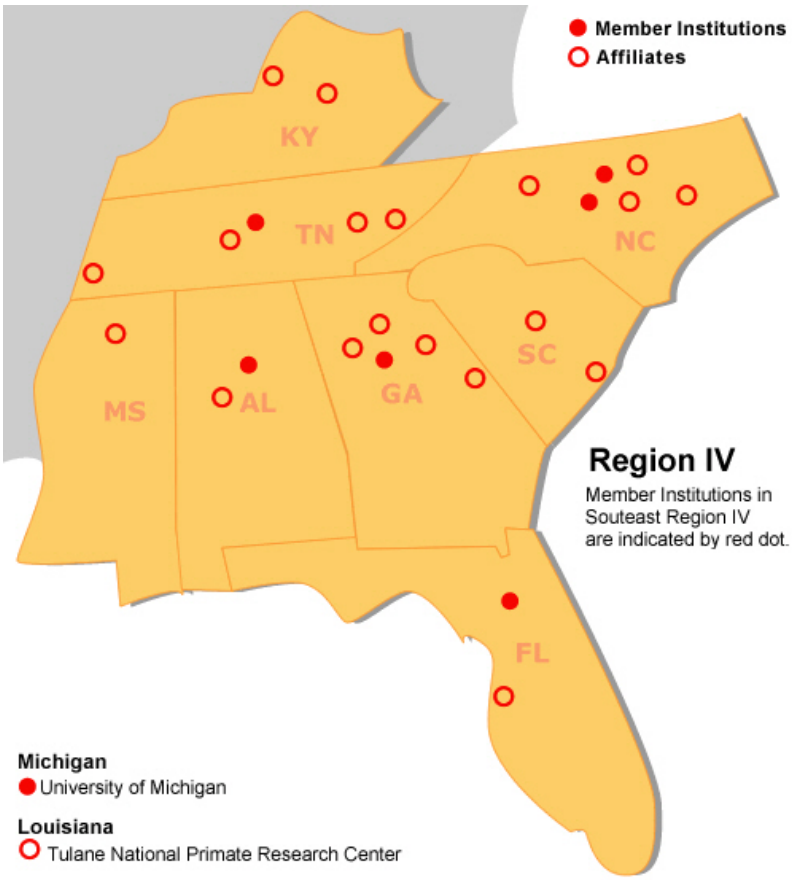
Elaine Young, PhD
Assistant Program Director, Research Development
College of Medicine

Assist faculty with grant applications, especially large complicated projects requiring interdisciplinary expertise. Represent the university to external sponsors, and advise the Senior Associate Dean for Research Development on issues relating to external funding. Teach grantsmanship to faculty and postdoctoral fellows. Extensive experience with the NIH. Past research in transplantation immunology, pathogenic bacteriology, marine biology.

OTHER RELEVANT PROGRAMS

Southeast Regional Center of Excellence in Biodefense and Emerging Infections (SERCEB)

SERCEB is a consortium of academic institutions in the southeast comprised of member schools and affiliate members (see map), as well as government partners. UF is a full member of SERCEB and co-directs the consortium.



The mission of SERCEB is to perform basic and translational research that will lead to the development of the drugs, vaccines and diagnostics that are needed to protect society from emerging infections and biologic threats. https://www.serceb.org.

University of Florida Institute of Food and Agricultural Sciences (UF/IFAS)

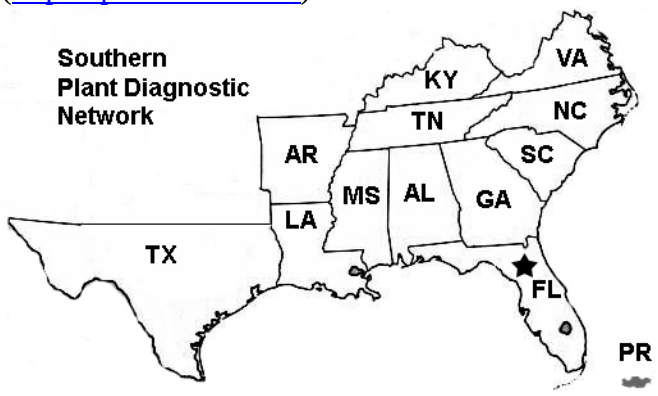
IFAS is a federal-state-county partnership dedicated to developing knowledge in agriculture, human and natural resources, and the life sciences, and enhancing and sustaining the quality of human life by making that information accessible. While extending into every community of the state, UF/IFAS has developed an international reputation for its accomplishments in teaching, research and extension. Because of this mission and the diversity of Florida's climate and agricultural commodities, IFAS has facilities located throughout Florida. Each of Florida's 67 counties has its own Cooperative Extension Service office.
For a map visit: http://www.ifas.ufl.edu/extension/cesmap.htm.

Center for Research at the Bio/Nano Interface

This center serves as an interface between nanoscience and the biomedical sciences. Researchers are exploring new high-tech methods for drug and other biomolecule delivery to the human body, new ways to remediate environmental pollution, and new highly sensitive and selective biodetection devices. (http://www.uf-bio-nano-center.org/)

Southern Plant Diagnostic Network (SPDN)

One of five partners in the National Plant Diagnostic Network (NPDN) the SPDN seeks to 1) establish a secure, regional network for the detection and diagnosis of plant health problems, 2) extend and support sound public policies, implement rapid and accurate diagnoses, and response strategies, and 2) provide leadership and training. (http://spdn.ifas.ufl.edu)



University of Florida Center for Telehealth

This center "facilitates collaborative multidisciplinary research on distance approaches to healthcare research, service, and education. The Center for Telehealth supports scientific investigation and clinical training in telehealth by providing specialized technology research, educational, and clinical support services." http://www.phhp.ufl.edu/telehealth/

National Rural Behavioral Health Center (NRBHC)

The National Rural Behavioral Health Center is sponsored by the College of Public Health and Health Professions and the Institute for Food and Agricultural Sciences (IFAS). The NRBHC houses a team of behavioral health scientists, educators, scholars, and practitioners dedicated to improving the health care status of rural Americans. The Center focuses on four components of rural behavioral health: 1) rural disaster and trauma, 2) violence prevention, 3) occupational health, and 4) innovative models of health service delivery. http://www.nrbhc.org/

Florida Medical Entomology Laboratory (FMEL)

One of the world's largest research institutions devoted to the understanding and control of medically important and biting insects. Mandated by the Florida State Legislature to 1) study the biology and control of mosquitoes and the 2) effects of insect-carried diseases on the citizens of Florida and on its tourism industry. FMEL conducts research, trains students and personnel, and extends research and training to international programs. http://fmel.ifas.ufl.edu/

Bureau of Economic and Business Research (BEBR)

An applied research center in the Warrington College of Business at the University of Florida. Its primary mission is to: 1) Collect economic and demographic data for Florida and its local areas; 2) Conduct economic, demographic, and public policy research on topics of particular importance to the state of Florida; and 3) Distribute data and research findings throughout the state and the nation. http://www.bebr.ufl.edu/

A Few Current Research Initiatives

Bionanotechnology Research

Chemistry Department
College o f Liberal Arts and Sciences

Brucellosis Research

Department of Microbiology and Cell Science
College of Agricultural and Life Sciences

Poxvirus Research

Department of Molecular Genetics and Microbiology
College of Medicine

Bionanotechnology

Rapid and sensitive monitoring of infectious disease agents

Dr. Weihong Tan and colleagues are using novel applications of bionanotechnology to develop biomarkers for the rapid and specific detection of single bacterial cells and in a variety of biological, food and environmental samples. The need for more sensitive, yet simple, fluorescence-based bioanalytical techniques can be addressed by coupling nanotechnology with traditional bioassay methods for the detection not only of bacteria, but viruses, DNA and proteins. Fluorescent nanoparticles have been developed for these sensitive bioassays. When compared to traditional fluorescent dye molecules, the fluorescent nanoparticles enhance detection sensitivity by 1,000-100,000 fold. Recently, Dr. Tan's group's was able to detect a single *E. coli* bacterium in a sample of ground beef in 20 minutes. Further development will be aimed at instant detection of each of a number of multiple pathogenic microorganisms within a single sample.

Molecular signatures of infectious diseases

Emerging infections and bioterrorist events are generally manageable as long as medical intervention occurs *before* the disease becomes prevalent and disseminated. By default, this places an emphasis on sensitive and effective early warning and diagnostic tools that not only detect the presence of certain pathogen biomarkers but also offer reliable predictions regarding evolution of the pathogen during passage in humans. Specimens, from blood or urine, could then be readily analyzed and the results would suggest which pathogen(s) are present in a particular patient. Clearly, sensitive molecular probes are required to detect these pathogens prior to onset of disease. Current bioassays lack sufficient probes for the effective study of infectious diseases. Out of the many potential molecular probes, a new class of designer nucleic acids (called **aptamers**) holds great potential for providing a biosignature and thereby elucidating the underlying basis of an infectious disease. Recently, Dr. Tan's lab has developed a novel cell-based aptamer selection strategy called Cell-SELEX. The selection process is simple, fast and reproducible. Development, selection and utilization of the selective aptamers will create an additional strategy for novel diagnostics and therapeutics as well as allow design of prevention and intervention strategies in many infectious diseases. Dr. Tan has not only shown that cell-based aptamer selection is widely applicable to various cell types for molecular medicine, but has also demonstrated a quantum leap in the ability to deal with different diseases by using cell-based aptamers for medical difficulties that current methodologies fail to adequately address.

Professor Weihong Tan

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Shands Cancer Ctr & UF Genetics Instit.
University of Florida
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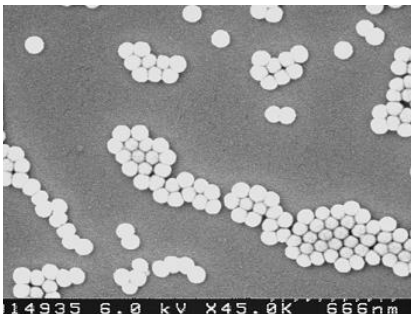
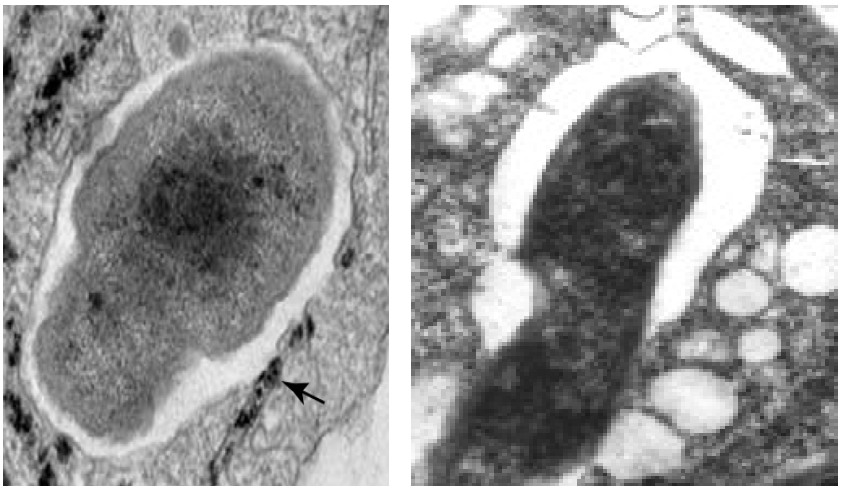


Scanning electron microscope images of nanoparticles.

Brucellosis

In collaboration with Marty Roop at East Carolina University and Michael Kahn of Washington State University, Triplett and coworkers are taking advantage of the close phylogenetic relationship of two bacteria, a beneficial bacterium that associates with plants and a human pathogen, to develop vaccines and a therapy for the chronic disease, Brucellosis. Brucellosis is caused by brucellae bacteria that are close relatives of the rhizobia, which are plant symbionts. Both bacteria invade and survive within cells (see photo below). By comparing the genomes of both bacteria and other relatives that do not invade cells, we will identify genes that are likely necessary for cell invasion and survival. Brucellae with mutations in those genes will likely be avirulent and could serve as candidate vaccine strains. In addition, a strong antibiotic made by rhizobia inhibits the brucellae. Experiments will be done to determine whether this antibiotic can eliminate a brucellae infection in an animal model system.

This project is important since there are no vaccines available for human use for Brucellosis. The pathogens that cause Brucellosis are category B agents as defined by NIH and have been in the bioweapons arsenals of a number of countries. Brucellosis is rarely fatal but is very incapacitating leading to fatigue, recurring fevers, sore joints, and other ailments. The Department of Defense is interested in this issue as Brucellosis is very common in the Middle East.



Similarity between *Brucella* invasion of animal cells (left) and *Sinorhizobium* invasion of plants cells (right).

Professor Eric Triplett

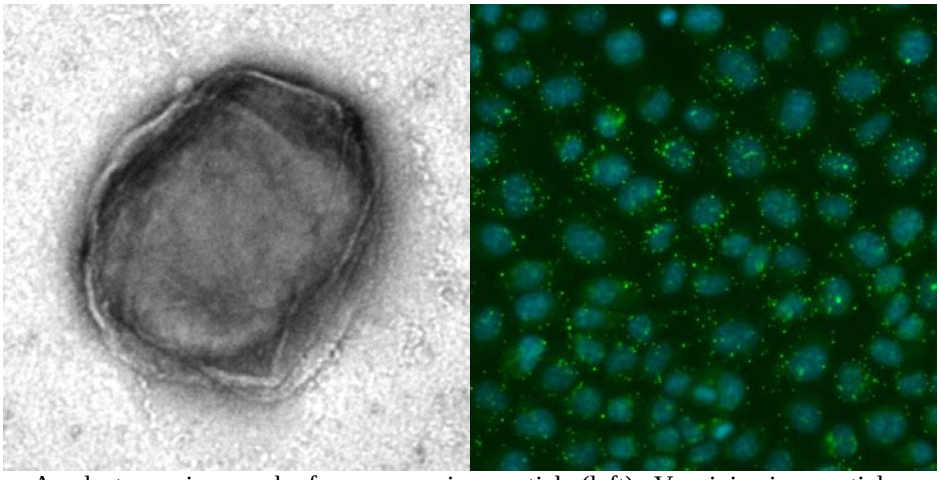
Professor and Chair
Department of Microbiology and Cell Science
IFAS/College of Agricultural and Life Sciences
Phone: 352-392-5430
Email: ewt@ufl.edu

Poxviruses

Dr. Moyer is internationally known for his work on the identification and characterization of poxvirus genes that contribute to pathogenesis and disease and the development of appropriate animal models of disease. Specific viral genes currently under investigation in his laboratory are poxvirus-encoded serpins, which control aspects of the host response which include inflammation, chemotaxis and apoptosis. This work has led to the detection of cellular proteinase targets and identification of viral proteins which interact with the serpins to further modulate the structure and *in vivo* activity of the serpin. As part of those studies, he has developed a novel genetic screening/mapping system for poxviruses that facilitates recombinant poxvirus construction, mapping of mutations and which can be adapted for use as a rapid poxvirus diagnostic procedure.

Recently, he has developed poxvirus infected rabbits as a surrogate model for human smallpox infections. The advantages of his model include a small dose initiated, disseminated, lethal infection accompanied by natural aerosol transmission of virus from infected to non-infected animals. A final project in his laboratory involving vertebrate poxviruses is to determine the cellular receptor and virus encoded ligands which mediate entry of poxviruses into infected cells.

In separate studies, he has developed a unique, poxvirus system of insects which offers important opportunities to study viral genes that interfere with innate immune responses and apoptosis in the absence of an adaptive immune response.



An electron micrograph of a cowpox virus particle (left). Vaccinia virus particles (fluorescent green specs) bound to susceptible cells and visualized with a green fluorescent dye; the nuclei of the cells are stained blue (right).

Professor Richard W. Moyer

Molecular Genetics and Microbiology
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Acronymns and Abbreviations

CLAS – College of Liberal Arts and Sciences
COE – College of Engineering
COM – College of Medicine
CVM – College of Veterinary Medicine
EPI – Emerging Pathogens Institute
IASEP – Institute for the Advanced Study of Emerging, former "working" name for EPI
IFAS – Institute of Food and Agricultural Sciences
UF-HSC – University of Florida Health Sciences Center (consists of Dentistry, Medicine, Nursing, Pharmacy, Public Health, & Veterinary Medicine)

FINANCIAL REQUESTS

Proposed Federal Participation

Funds are being requested to organize and build a center on the main campus of the University of Florida to house the research and training needs of the Emerging Pathogens Institute. An important part of building our institute, aside from creating physical space, is the recruitment of faculty and the necessity to offer competitive start-up packages and once recruited, the promise of dedicated space and funds to support development of infrastructure.

- **FY 2006. Start-up costs …….……$5,000,000**

To cover start-up costs, excluding salaries, for newly recruited faculty. The funds will be applied to funding both lines and startup packages and is expected to be partnered with the relevant units within the University.

- **FY 2007. Building costs.……$5,000,000**

To help defray building costs which are expected to be the initial planning, design and construction costs of this 300,000 gross square foot building.

BUILDING SUMMARY

Research space……...162,500 gross sq. ft.
Office space……..31,250 gross sq. ft.
Conference room space...……..…6,250 gross sq. ft.
Other (non-assignable)…..……...100,000 gross sq. ft.
TOTAL……...……..300,000 gross sq. ft.

- **FY 2008. Core Equipment……...……$5,000,000**

To cover costs associated with development of infrastructure, including primarily core equipment purchases, required by various members of the proposed Institute.

Total Federal Participation…….…….....……..$15,000,000

Proposed State/University of Florida Participation

It is expected that $24 million ($8 million from each of the 3 participating colleges) will be required in the first year to initiate planning and construction of this 300,000 gross square foot facility.

- **FY 2006. Building cost (1st year)……$8,000,000**

Money requested of the State in UF Educational and General Budget.

- **FY 2006. Building cost (1st year)..……..…$8,000,000**

Money requested of the State money in Health Science Center Budget.

- **FY 2006. Building cost (1st year)..…….$8,000,000**

Recurring money requested of the State in IFAS Budget.

- **FY 2006. Faculty salary lines...……$2,300,000**

Money requested of the State in UF Educational and General Budget.

- **FY 2006. Faculty salary lines…….$2,300,000**

Money requested of the State money in Health Science Center Budget.

- **FY 2006. Faculty salary lines…….……$2,088,000**

Recurring money requested of the State in IFAS Budget.

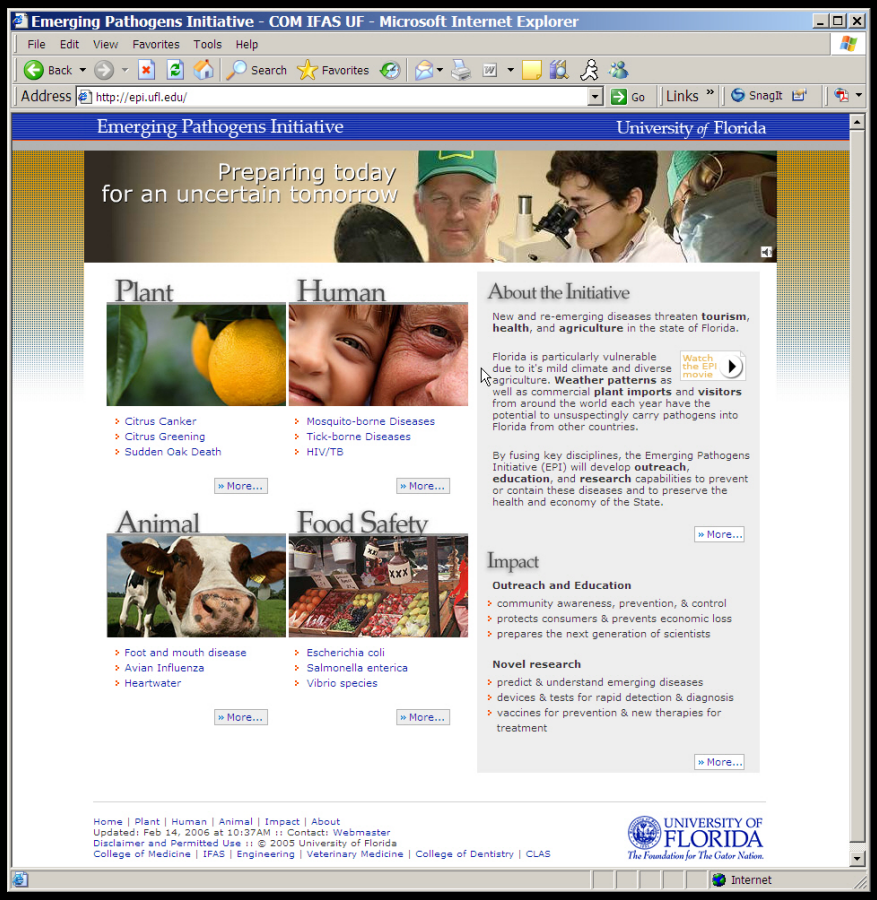
- **FY 2006. Budget for salary lines.....$2,500,000**

Money committed by the College of Medicine.

Total State/University Participation……..……...…….$33,188,000

UNIVERSITY OF FLORIDA
EMERGING PATHOGENS INSTITUTE

"Preparing Today…
for an Uncertain Tomorrow"



To watch our video and find additional information on pathogens of concern, please visit our website at:

http://epi.ufl.edu

PRODUCED BY: UF-COM OFFICE OF RESEARCH DEVELOPMENT
DESIGN BY: Kristal W. Boyett
CONTENT PROVIDED BY: members of the Emerging Pathogens Institute
with specials thanks to Ms. Carrie Harmon.