2015-2020

National Institute for Microbial Forensics in Food and Agricultural Biosecurity

Oklahoma State University
Stillwater, OK
GLOBAL PURPOSE

A microbial forensics community provides leadership, coordination and science to support the discrimination and attribution of pathogenic microbe introductions to the U.S. food and agriculture critical infrastructure through tool development, pathway analysis, and communication.

NIMFFAB MISSION

To identify, prioritize, facilitate and conduct research, education and outreach related to national needs in microbial forensic science with respect to pathogens of crops, forests, rangelands, animal production and wildlife, and on food; and to act as a convener for the microbial forensics for biosecurity community.

STRATEGIES AND APPROACHES

OUTPUT 1: MULTI-DISCIPLINARY TEAMS AND COLLABORATIONS

NIMFFAB’s educational and research activities and accomplishments will be justified and relevant only after they are transferred to those who will use them in the field, on the ground or in the courtroom. Our work targets diverse communities and stakeholders including law enforcement, regulatory officials, security agencies, crop producers, plant disease diagnosticians, Cooperative Extension agents, and researchers. It is important that these groups become familiar with one another and that they understand their respective roles in the event of a crop event investigation.

• Liaise with end users: Law enforcement and security communities, policy makers, funding agencies, including:
  o FBI – Federal Bureau of Investigation, Department of Justice
  o DHS/BNBI – National Bioforensic Analysis Center (NBFAC)
  o DOD – Department of Defense
  o DTRA – Defense Threat Reduction Agency
  o ODNI – Office of the Director of National Intelligence
  o USDA – APHIS, ARS, NIFA
  o National Academy of Sciences – IOM Forum on Microbial Threats
  o FDA – Food and Drug Administration
  o Center for Produce Safety – UC Davis
  o Oklahoma Department of Agriculture

PARTNERS
OUTPUT 2: COMMUNICATIONS PLAN: Foster a forensic microbiology community

- APS Microbial Forensics Interest Group – American Phytopathology Society Meetings
- OSU Center for Microbiome Sciences
- OSU Center for Health Sciences Department of Forensic Sciences
- OSU Departments of Entomology and Plant Pathology and Veterinary Medicine
- Food and Agriculture Product Center, OSU

NIMFFAB’s outreach efforts focus on:

- Maintaining strong lines of communication with Federal law enforcement, security and regulatory agencies
- Bringing the law enforcement, security and agricultural communities together to discuss and practice roles and responsibilities
- Education outside of normal academic settings (ag community, youth)

Anticipated Outreach Activities

- 2016 – EDNA for microbiologists
- 2016 - PCR Primers for Plant Disease Diagnostics
- 2017 – APS Microbial Forensics Working Group; Workshop on Assay Validation
- 2017 - EDNA for microbiologists
- 2017 - Exercise with Food and Ag Product Center, FBI, FSIS
- 2017 - Science Café: Microbial CSI
- 2018 - EDNA for microbiologists
- 2018 – APS Microbial Forensics Working Group; International Workshop on Assay Validation

Scenes from the field exercise training hosted by NIMFFAB and the OK Office of Homeland Security.

OUTPUT 3: TOOLS DEVELOPED (OR ADAPTED) AND ADOPTED

OSU’s NIMFFAB provides expertise and research support to federal agencies in agricultural biosecurity, forensic microbiology, food defense and produce safety. NIMFFAB’s current research goals include developing and optimizing sampling, detection and characterization methods for plant and animal pathogens, as well as for human enteric pathogens, including *Salmonella* and toxigenic *E. coli*, that contaminate foods. These technologies will enhance our nation’s capabilities to detect and respond to outbreaks of high consequence; determine origin of microbial invaders, and support law enforcement, federal and state regulatory agencies in safeguarding food and agricultural resources.

Research:
• Rapid, sensitive and discriminatory ID of causative microbes in unexpected disease outbreaks
• Screening for multiple pathogens in a complex sample
• Detection of unexpected, unknown, and uncultivable pathogens
• Identification of signatures of genetic modification
• Developing prediction tools through pathway analysis and risk mapping
• Developing in silico microarray probes for high consequence microbe detection in plants, animals, soils, food, food processing facilities and water.
• Creating user-friendly bioinformatics tools
• Developing qPCR probes for quantifying microbe presence in a substrate
• Testing “decision tools” for use by regulatory and law enforcement personnel at a potential crime scene in food and/or agriculture:
  o Geographical anomalies
  o Vector/food matrix dispersal
  o Pattern of disease outbreak
  o Weather factors
  o Anomalous timing
  o Field/processing plant history
  o Sampling and testing protocols
  o Laboratory biosecurity and biosafety
  o Human access and activity
  o Physical evidence
  o Potential motive
  o Pathogen features

**Patents:**
• Cold Plasma for Food Safety. Patent pending

**Current new:** National Science Foundation (NSF) GoLife – Integrative Genealogy and Ecology of Deltcephaline Leafhoppers and their Microbial Associates

**Pending:** NIFA-AMR – Ecology of Antibiotic-Resistant Gene Reservoirs in Livestock Associated House flies (Musca domestica) and Fly Control as a Mitigation Strategy

**Pending:** Oklahoma Soybean Board – Sequence and annotation of Coniothyrium glycines (in preparation)

**Pending:** NIFA – Determining risk of dissemination of viral pathogens through indirect water re-use in agriculture (submitted)

**Pending:** NSF – Ecology and Evolution of Aflatoxicosis.

**On-going and Concluding:**

**US Department of Homeland Security/Battelle/NBACC/NBFAC**

Federal Bureau of Investigation – cBIO, Inc.
• Population of the Microbial Rosetta Stone Pathogen Database with plant pathogen information
• Selection of 100 highest-threat plant pathogens
• Collection and curation of pathogen information for inclusion in database

**US Department of Homeland Security/Battelle/NBACC/NBFAC**

Establishment of a NBFAC Spoke Laboratory for Plant Pathogen Forensics Capability
• Assay development - Real time PCR
• Assay validation
US Department of Homeland Security Science and Technology Division

- Whole genome sequencing for enhancement of microbial forensics
- Collaboration with MRIGlobal, University of Texas Medical Branch, and cBIO, Inc.
- NIMFFAB is responsible for all aspects of plant pathogen sequence gap assessment, whole genome sequencing and sequence analysis

DOD & University Multispectral Laboratory, Ponca City

Technical Applications for Security Enhancement (TASE)

- Federal agency supported
- Development and validation of field portable PCR assays for plant pathogens

US Department of Agriculture – AFRI

Massively Parallel Sequencing as a Diagnostic & Forensic Analysis Tool for Plant Pathogens

USDA Food Safety Programs

- Characterize the factors that facilitate interactions of human pathogens, such as *Escherichia coli* O157:H7 and *Salmonella*, with plants
- Develop more efficient, rapid and reliable approaches to trace sources of contamination
- Identify more effective contamination prevention strategies
- Current projects focus on the interactions of *E. coli* O157:H7 on fresh spinach and pecans, and the interactions of *Salmonella* with cantaloupe

Transcripts from the microbiome in blowflies excreta indicate a high proportion of anti-microbial resistance genes. Flies attracted to fresh vegetables are capable of transmitting AMR on the produce, possibly resulting in food-related illness.
Center for Produce Safety Programs
A fresh produce industry supported funding agency directed to address food safety concerns in unprocessed fruits, vegetables, and nuts.

- Screen insects (filth flies) collected in greens-growing areas of the Salinas Valley for E. coli O157:H7
- Assess the ability of insects to deliver E. coli O157:H7 to spinach leaf surfaces
- Examine structural differences between warm and cool season spinach to determine why spinach grown under warm-season conditions have a higher incidence of human disease outbreak association
- Possible role of filth flies from livestock facilities as vectors of human pathogens to pre-harvest plants
- Forensic methods for traceback of flies to their point of origin

Oklahoma Water Resources Center Thomas E. Berry Fellows Program in Integrated Water Research and Management.

Developing and integrating a field deployable water filtration system with bioinformatics and pyrosequencing for effective monitoring and survey of water-borne viruses

**OUTPUT 4: COORDINATED DATABASE OF FORENSIC AND DIAGNOSTIC TOOLS AND RESOURCES**

Modern microbial forensics tools for Biosecurity require a secure data center and robust cyber-infrastructure. Sequencing costs are declining enough that in silico probes and primer diagnostics are becoming mainstream. With this technology comes the need for terabytes of data storage and bioinformatic tools that streamline bioinformatic access and query. Under an NSF Major Research Instrumentation grant, Oklahoma maintains an extensible petascale storage instrument, the Oklahoma Petastore. For NIMFFAB a secure sector of Oklahoma Petastore will be dedicated to housing sequences of high consequence microbes, bioinformatics tools, and user interface codeware. Expected activities include:

- Pathogen and microbe genome resources (mini-GenBank)
- In depth taxa genomic resources for strain typing and forensics
- E-probe collections for diagnostics and forensics
- Primers and probe collections for diagnostics/forensics
- Protocols for pathogen detection
- Code and application collection
- Uninhibited access for partners and collaborators

**OUTPUT 5: EDUCATED AND PREPARED CADRE OF MICROBIAL FORENSICS AND BIOSECURITY SCIENTISTS**
NIMFFAB faculty members are committed to all phases of graduate student education, training, and professional development. In addition to providing educational programs that prepare young scientists to meet national staffing needs in emerging areas of homeland security, we also create opportunities for “pipelining” them into these fields through interactive experiences such as internships, visits, community events and seminars.

In 2011, OSU was named the highest-ranked plant pathology graduate program in the U.S. by PhD.org.

- Undergraduate teaching and experience
- Graduate student fellowships
- Summer internships: USDA ARS, Ft. Detrick
- Summer 4-H mini-camp
- Summer workshop for high school teachers
- Training events
  - Adult continuing education
  - Primer and diagnostic probe development for diagnosticians
  - Biosecurity and law enforcement seminars

New, targeted Oklahoma State University coursework
- Quantitative Microbiology for Forensics - Graduate
- Microbial Forensics – Graduate
- Phytobiome - Graduate
- Global Issues in Agricultural Biosecurity – Undergraduate
- Produce Safety – Undergraduate

New, NIMFFAB workshops
- 2016 – Electronic Diagnostic Nucleic Acid Assay (EDNA) for microbiologists
- 2016 - Developing PCR Primers for Disease Diagnostics
- 2016 - Bioinformatics Certificate
- 2017 – APS Microbial Forensics Working Group; Workshop on Assay Validation
- 2017 - EDNA for microbiologists
- 2017 - Exercise with Food and Ag Product Center, FBI, FDA
- 2017 - Bioinformatics Certificate
- 2018 - EDNA for microbiologists
- 2018 – APS Microbial Forensics Working Group; International Workshop on Assay Validation

New, interdisciplinary graduate specialization
- Microbial Forensics Core Discipline
- Microbiome Core Discipline

USDA National Needs Graduate Fellowship Program: “Forensic Plant Pathology: Extending National Capability in Microbial Forensics”
- Coursework, internships and research blending plant pathology and forensic science
- Graduates as of 2016: 15. Currently in program: 10.
NIMFFAB - USDA National Needs Graduate Student Fellows learning in the lab and on summer FBI Laboratory internships.

**Output 6: Physical infrastructure**

On the OSU campus in Stillwater, there are 5 BSL3 level laboratories in Veterinary Medicine, Molecular Biology, and NIMFFAB, including a large animal forensic BSL3 containment facility. Additionally, NIMFFAB supports a state of the art BSL2 (plus) laboratory for research and teaching.

In the next five years, NIMFFAB intends to

- Obtain funding to upgrade a greenhouse to BSL3 to promote research on exotic plant pathogens
- Upgrade an existing BSL2 lab to BSL3, with a plant growth incubator inside; and
- Expand storage capability by acquisition of 2 additional -80 freezers to house the microbial reference collection

**NIMFFAB Faculty**

Kitty Cardwell  
Director and Professor  
*Plant pathology, microbiology, biosecurity*  
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B.A. University of Texas, Austin, Botany, Cum Laude,  
Ph.D. Texas A&M University Plant Pathology & Microbiology  
Key Executive Leadership Program, SES CDP, American University, Washington, DC

- **Oklahoma State University**, Director and Professor, as of March 15, 2016  
- **United States Department of Agriculture**, National Program Leader, GS15, Washington, DC, 2001-2016  
- **United States Department of Agriculture**, Senior Executive Service Development Program, Professional Detail, Senior Advisor, World Bank, 2012-2013  
- **International Institute of Tropical Agriculture (IITA)** Research Scientist & Team Leader, Ibadan, Nigeria, 1989-2001
Dr. Kitty Cardwell joined Oklahoma State University March 15th, 2016. She brings experience in biosecurity program management and expertise in microbial epidemiology. As result of the events of 9/11/01, she developed the National Plant Diagnostic Network (NPDN) a functional network of 74 public and private agricultural institutional plant diagnostic clinics. Under her leadership, the NPDN became a coordinated and cohesive, distributed system that has quickly detected and responded to the introduction of high-consequence pests. For more information see: www.NPDN.org. At OSU, Dr. Cardwell conducts research in novel detection technologies and teaches a Spring Special Topic in Quantitative Microbial Forensics.

Jacqueline Fletcher
Regents Professor Emeritus
Plant pathology, microbiology, forensics
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B.S. Emory University Biology
M.S. University of Montana Botany
Ph.D. Texas A&M University Plant Pathology
Postdoc University of Illinois Plant Pathology

Dr. Jacqueline Fletcher joined Oklahoma State University in 1984, and was appointed Sarkeys Distinguished Professor in 2001 and Regents Professor in 2008. She was named a Fellow of APS in 2005 and a Fellow of AAAS in 2007. Dr. Fletcher was the founding Director of the National Institute for Microbial Forensics and Food and Agricultural Biosecurity (NIMFFAB), a multidisciplinary OSU initiative that addresses high priority national issues in research, teaching/education and outreach with emphases in microbial forensics applications in plant pathology and produce safety.

Dr. Fletcher served on the American Phytopathological Society (APS) Governing Council for ten years, including the four-year APS Presidential sequence. Following September 11, 2001, Dr. Fletcher led APS responses and input to new National biosecurity initiatives. She served 9 years on the APS Public Policy Board (4 years as Chair), and currently chairs the APS Microbial Forensics Interest Group and the APS Food Safety Interest Group. She is a member of the APS Threatening Pathogens Advisory Committee. She serves on several Federal biosecurity advisory panels and is a member of the National Academy of Sciences’ Forum on Microbial Threats.

Dr. Fletcher’s research focuses on the emerging disciplines of microbial forensics and agricultural biosecurity and the relationships between human pathogens, such as Salmonella and Escherichia coli, and plants.

Astri Wayadande
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Associate Professor
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B.S. University of California at Davis Entomology
M.S. University of Missouri Entomology
Ph.D. Ohio State University Entomology
Postdoc Oklahoma State University Plant Pathology

After Dr. Wayadande received her Ph.D. under the direction of Dr. Lowell R. Nault, she joined Jacqueline Fletcher at Oklahoma State University for a post-doc and later as a non-tenure track faculty, a position which she held for 17 years before beginning her current position as Assistant Professor of Plant Pathology and Assistant Director of NIMFFAB in 2007. She is active in the Entomological Society of America and the American Phytopathological Society where she has served/serves as an officer in Insect Vectors of Plant Pathogens and Hemipteran Feeding Network (ESA) and the Vector Complexes (APS) committees.

Dr. Wayadande’s research interests focus on Hemipteran transmission of plant pathogens and insect (filth fly) transfer of human pathogens to plants. For over 25 years, she has studied the feeding physiology of leafhopper and true bug vectors of plant pathogens. Using transmission electron microscopy, she described the salivary glands of various vector species and the functional barriers to bacterial movement through vectors. She is one of only a few scientists experienced in electrical penetration graph (EPG) technology, which produces electrical waveforms representing specific stylet activities of the feeding insect. Using EPG, she and her students identified specific probing activities responsible for acquisition and/or inoculation of phloem-inhabiting bacteria. She is also working to develop better molecular tools for field detection of high-impact vectors of exotic plant pathogens.

Francisco Ochoa Corona, Associate Professor
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Ag. Eng. University of Zulia State, Venezuela
M.S. University of Central Venezuela Plant Protection
Ph.D. University of Florida Plant Pathology
Postdoc University of Florida Plant Virology

Dr. Ochoa Corona received his Ph.D. from the University of Florida and is a forensic plant pathologist, specializing in developing and delivering reference diagnostics for exotic, naturalized, and indigenous plant viruses and other phytopathogens of relevance to agricultural biosecurity and microbial forensics. He then served as Principle Advisor, Virology, of the Investigation and Diagnostic Centre (IDC) at Biosecurity New Zealand (BNZ), Ministry of Agriculture and Forestry (MAF), in Auckland, NZ. His work is applicable to plant pathogens that can be intercepted at borders or detected by general surveillance of field settings or within transitional facilities.

Dr. Ochoa Corona moved to NIMFFAB, at OSU, in 2008. His current research includes adaptation and development of novel tools for sampling, pathogen detection and discrimination and diagnostics. Also targeted are the identification of molecular landmarks and signatures, and the implications of such genetic data for elucidating taxonomic relationships, host-pathogen associations and pathogen detection (including select agents and other high consequence microorganisms). Of particular interest are the prediction of biosecurity threats, monitoring of the disease dynamics of relevant plant pathogens, tracking of their global dispersal routes and delimiting their bio-geographic distribution.
Li Maria Ma, Associate Professor  
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<th>B.S.</th>
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After receiving her Ph.D. degree from Purdue University, Dr. Ma moved to the University of Georgia’s Center for Food Safety, where she worked with Center Director Dr. Michael Doyle. Her research focus was to better understand issues related to the contamination of food products (meats, dairy, seafood, and produce) by foodborne human pathogens, particularly pathogenic *E. coli, Salmonella* spp., *Listeria monocytogenes, Campylobacter jejuni*, and *Clostridium botulinum*. During this time she also performed contract work with the Centers for Disease Control and Prevention (CDC) in foodborne outbreak investigations. In 2009 she joined the faculty at Oklahoma State University, with an appointment in the NIMFFAB, to focus on the contamination of fresh produce by foodborne pathogens.

Dr. Ma’s current research areas include detection and strain discrimination of foodborne pathogens, ecological studies of foodborne pathogens in plant/animal environments through conventional and metagenomic & meta-transcriptomic approaches, control of foodborne pathogen contamination in foods by cold plasma technology and probiotics.

Trenna Blagden, Assistant Research Scientist  

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While completing her Ph.D. degree under Dr. Stanley Gilliland, Dr. Blagden worked as Oklahoma State University’s Biological Safety Officer overseeing compliance of the select agent program and all BSL2 laboratories. In 2009, Dr. Blagden served as an Adjunct Faculty teaching the Food Microbiology course in the Animal Science Department at OSU before accepting a Post-Doctoral Fellow position with NIMFFAB in 2010. Upon completion of her post-doc work in 2013, Dr. Blagden accepted a non-tenured faculty position within NIMFFAB as an Assistant Research Scientist.

Dr. Blagden’s current research interests include 1) development and validation of microbial forensic assays for detection and trace back of foodborne pathogens and high consequence plant pathogens, 2) genomic studies in both insect vectors and plant pathogens, and 3) genomic and microbiological studies related to probiotics and their use.

Andres Espindola Camacho, Post Doctoral Fellow  

*Plant Pathology, bioinformatics, diagnostics.*  
Development of tools to effectively detect plant pathogens using
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B.S. Universidad de las Fuerzas Armadas, Ecuador. Biotechnology Engineering
M.Sc. Oklahoma State University, Stillwater, Entomology and Plant Pathology
Ph.D. Oklahoma State University, Stillwater Plant Pathology
Graduate certificate Oklahoma State University, Stillwater, OK. Bioinformatics

After receiving his BS, Dr. Espindola moved to Oklahoma State University where he received a MS. and Ph.D. degrees. During his graduate studies (2011-2013), he worked on next generation sequencing (NGS) metagenome data analysis of plant-pathogen interaction systems to rapidly detect eukaryotic plant pathogens. Dr. Espindola and other students designed a bioinformatic tool termed EDNA (E-probe Diagnostic Nucleic acid Analysis) that effectively detects plant pathogens in sequenced metagenomes. Dr. Espindola’s Ph.D. research (2013-2016) focused on the refinement of EDNA (termed EDNAtran) to detect actively infecting plant pathogens using transcriptomics and metatranscriptomic databases. Additional EDNAtran refinements included the detection of active metabolic pathways in plant-pathogen interaction systems, specifically the detection of metabolic transcripts involved in the production of aflatoxin in toxigenic Aspergillus flavus strains in corn. Currently, Dr. Espindola has joined NIMFFAB as a postdoctoral researcher to work on further refinements of EDNA which will ultimately add new statistical and bioinformatic approaches to make EDNA effectively available to the research, regulatory and law enforcement communities.

NIMFFAB AFFILIATED OSU FACULTY

Ulrich Melcher, Regents Professor & RJ Sirny Professor of Agricultural Biochemistry
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B.S. University of Chicago Biochemistry
Ph.D. Michigan State University Biochemistry
Postdoc University of Aarhus, Denmark Molecular Biology
Postdoc N.Y.U. & U. of Texas SW Medical School Immunology

Before joining OSU in 1975, Dr. Melcher was a NATO postdoctoral fellow in molecular microbiology at the University of Aarhus, Denmark and in immunology at New York University and University of Texas Southwestern Medical Schools. As a Fulbright sabbatical scholar, he studied molecular virology at the Institute of Molecular Biology of Plants in Strasbourg, France. He was appointed Robert J. Sirny Professor in Agricultural Biochemistry in 1999 and Regents Professor in 2008. He was named a Fellow of the American Phytopathological Society in 2006.

From 1992-2000, Dr. Melcher served as Director of OSU’s Recombinant DNA/Protein Resource Facility. He has coordinated two statewide scientific themes (Functional Genomics and Plant Virus Biodiversity and Ecology) for Oklahoma EPSCoR and currently coordinates the NSF-supported Plant Virus Ecology Network. He has been associated with NIMFFAB since its inception, consulting and advising in matters related to molecular biology.
Dr. Melcher’s research, which focuses on the biodiversity and evolution of plant associated microbes, particularly viruses and bacteria, include activities supportive of multiple NIMFFAB goals including the use of sequence and phylogenetic analyses in the attribution of agricultural bioterrorism or biocriminal events, the documentation of background levels and patterns of biodiversity against which outbreaks must be compared and methods of detection of agricultural pathogens. Methods used include nucleotide sequencing, phylogenetics, single nucleotide polymorphism analysis, microarray hybridization, t-RFLP characterization of bacterial communities, reverse transcription-polymerase chain reaction, multilocus sequence typing, multilocus variable number of tandem repeat analysis, AFLP, RFLP and other methods.

**Carla Garzon, Associate Professor**  
*Population genetics, mycology and oomycology, molecular biology*

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**B.S.** Pontificia Universidad Catolica, Ecuador  
**Ph.D.** Pennsylvania State University  
**Biological Sciences**  
**Plant Pathology**

Dr. Garzon specializes in the population genetics of plant pathogens and their effect on disease development and epidemiology. Recent projects have focused on the population genetics of *Puccinia emaculata*, a serious fungal pathogen of the biofuels crop switchgrass, *Sclerotinia minor*, the causal agent of Sclerotinia blight of peanut in Oklahoma, *Phymatotrichopsis omnivora*, a pathogen of cotton in the southwest, *Fusarium oxysporum* in ornamental palm trees, *Pythium* spp., mainly *P. irregulare* and other members of the F group of *Pythium*, and *Rhizoctonia solani* from natural and agricultural soils.

Dr. Garzon also works to develop new tools and protocols for diagnostic and forensic applications using soil- and waterborne Oomycetes and fungi as model systems. For example, she is identifying sources of *Pythium* spp inoculum in ornamental nurseries and greenhouse operations, and is examining the effect of low doses of fungicides on soilborne oomycetes and fungi.

**Robert Allen, Professor and Head, OSU Forensic Sciences Department**  
*Human forensic science, DNA technology, graduate education*

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**B.S.** University of Tulsa  
**Ph.D.** Purdue University  
**Postdoc** Scripps Clinic & Research Foundation

**Zoology**  
**Cell Biology**  
**Scripps Clinic & Research Foundation**

Dr. Allen, Professor of Forensic Sciences at Oklahoma State University’s Center for Health Sciences in Tulsa, OK, also serves as Director of the OSU Human Identity Testing Laboratory. Dr. Allen, who is Board Certified by the American Board of Histocompatibility and Immunogenetics, has served as the Director of the H.A. Chapman Institute of Medical Genetics and as a Scientific Director of the American Red Cross.

Dr. Allen is widely published and active in numerous professional scientific organizations including the American Academy of Forensic Sciences and the International Society of Forensic Genetics.
External service includes membership on the Editorial Board of Transfusion and chairmanship of the Parentage Testing Subcommittee, both of which are units of the American Association of Blood Banks. Dr. Allen also serves on the Histocompatibility/Human Identity Testing Committee for the College of American Pathologists. He is a recent recipient of the Director’s Award from the Oklahoma State Bureau of Investigation.

The focus of his research is variability in human DNA and technologies for pathogen strain discrimination.

Akhilesh Ramachandran, Assistant Professor
Section Head – Microbiology and Molecular Diagnostics
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BVSc&AH Kerala Agricultural University, India Veterinary Medicine
Ph.D. Oklahoma State University Veterinary Biomedical Sciences

Dr. Ramachandran’s research focuses on Diagnostic microbiology. He is studying the antibiotic resistance pattern of common veterinary and zoonotic bacterial pathogens. In addition, Dr. Ramachandran is also evaluating the genomic profile of common pathogens for source attribution studies.

William Schneider, USDA ARS Research Scientist
OSU Adjunct Professor
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B.S. University of Minnesota-Duluth Biology
Ph.D. Michigan State University Genetics

Dr. Schneider is a research plant pathologist for the USDA-ARS Foreign Disease/Weed Science Research unit at Fort Detrick, MD. His work on plant pathogen diagnostics focuses on broad range approaches, looking for assays and protocols that allow for the simultaneous detection of all microbes in a given sample. Dr. Schneider’s lab has utilized several techniques as platforms for broad range plant pathogen diagnostics, including microarrays, macroarrays, PCR/ESI-MS and next-generation sequencing.

Dr. Schneider has actively developed collaborators within the field of diagnostics and forensics, including projects with scientists from NIMMFAB, the US Army Research Institute for Infectious Disease, and the Department of Homeland Security National Bioforensic Analysis and Countermeasures Center.

NIMFFAB Collaborators – Oklahoma State University

Dr. Jerry Malayer Veterinary Medicine
Dean of Veterinary Medicine

Dr. Keith Bailey Department of Veterinary Medicine
Director, Oklahoma Animal Disease Diagnostic Laboratory

**Dr John Gustafson**  
Department of Biochemistry & Molecular Biology  
Chair

**Dr. Roy Escoubas**  
Director, Food and Agriculture Product Center

**Dr. Steve Hartson**  
Department of Biochemistry & Molecular Biology  
Director, OSU Nucleic Acids Core Facility

**Dr. Peter Hoyt**  
Department of Biochemistry & Molecular Biology  
Director, Microarray Core Facility, pyrosequencing, metagenomics, bioinformatics

**Ms. Jen Olson**  
Department of Entomology and Plant Pathology  
OSU Plant Disease Diagnostician

**Dr. George Opit**  
Stored Products Entomologist, Entomology & Plant Pathology  
Molecular detection of insects in large enclosed areas

**Dr. Justin Talley**  
Extension Livestock Entomologist  
Food safety, fly dispersal of foodborne pathogens

**Dr. Udaya DeSilva**  
Department of Animal Sciences  
Animal geneticist, food safety, microbiota associated with animals

**Dr. Mark Payton**  
Department of Statistics  
Experimental design, data analysis

**NIMFFAB Collaborators – Non-OSU**

**Dr. Stephen Goldsmith**  
DVM, FBI, Weapons of Mass Destruction, Biological Countermeasures Unit

**Dr. Stephanie Normand**  
Ph.D., FBI, FBI Scientific Response & Analysis Unit, Quantico, VA

**Dr. Neil Barnaby**  
Ph.D. Forensic examiner, FBI Science Response and Analysis Unit, Quantico

**Sa. Franklin Alexander**  
FBI, Oklahoma Field Office, WMD coordinator

**Sa. Dana Harper**  
FBI, Oklahoma Field Office, Intel analyst

**Dr. Jim Burans**  
Director, National Bioforensic Analysis Center  
NIMFFAB is a Spoke Laboratory for NBFAC

**Dr. Jim Stack**  
Department of Plant Pathology, Kansas State University  
Plant disease diagnostics, Director, Great Plains Diagnostic Network

**Dr. Douglas Luster**  
USDA ARS Plant Diseases & Weeds Lab, Ft. Detrick  
Emerging plant diseases, plant pathogen select agents

**Dr. Mary Palm**  
USDA APHIS, Director Plant Protection and Quarantine, Pest Management

**Dr. Phillip Berger**  
USDA APHIS, Director Center for Plant Health Science and Technology
Dr. Steve Harbeson  University Multispectral Laboratory, OSU, Ponca City, OK  
Technical applications for security enhancement

Dr. Cris Lewis  University Multispectral Laboratory, OSU, Ponca City, OK  
Technical applications for security enhancement

Dr. Laura Vanderberg  University Multispectral Laboratory, OSU, Ponca City, OK

Dr. Bruce Budowle  Director, Institute for Human Identification, University of North Texas  
Former-FBI scientist, pioneer of the emerging field of microbial forensics