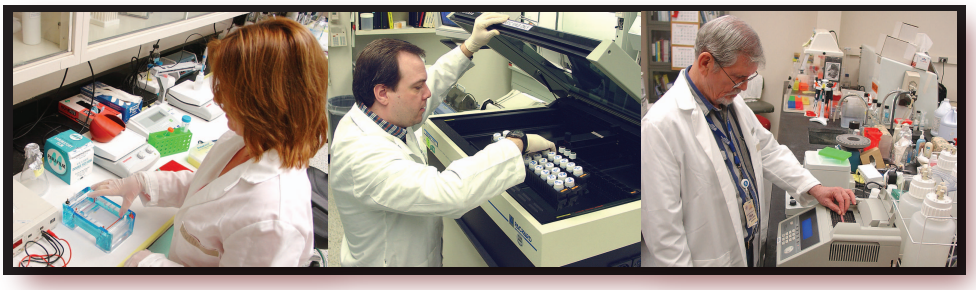
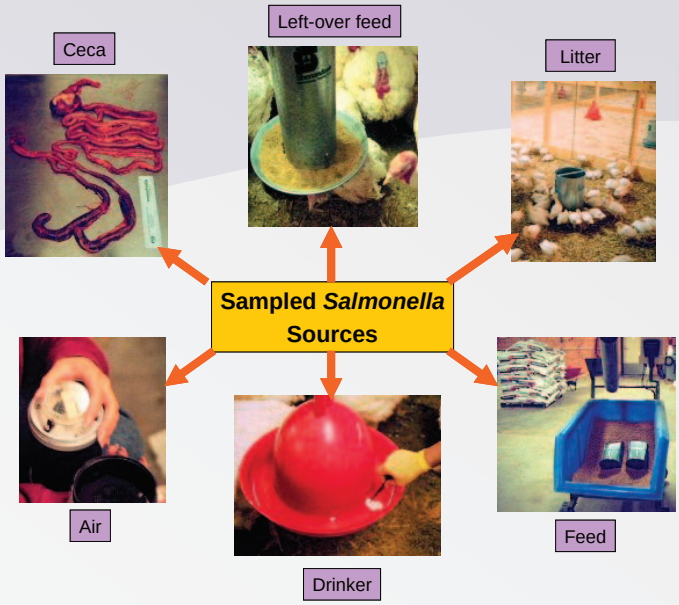
Microbiology



Using Scientific Expertise, New Technologies, and State-of-the-Art Equipment to Protect Public Health

- **Detect foodborne pathogens**
- **Evaluate antimicrobial resistance**
- **Understand relationship between gastrointestinal microbiology and host interactions**
- **Use microbes for bioremediation**
- **Predict metabolic pathways for mammals using microorganisms**
- **Insure healthy animals via microbiological surveillance**



Food Safety and Biosecurity

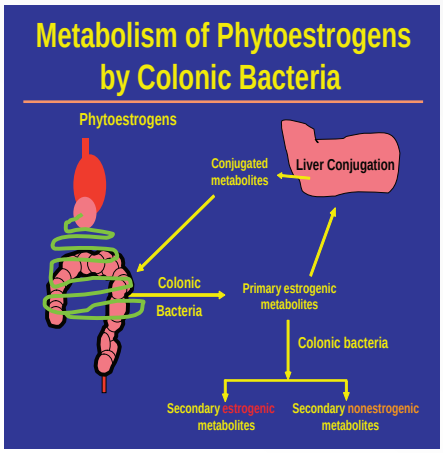
NCTR microbiologists provide state-of-the art research to assure that the U.S. food supply is safe from microbiological contamination. Rapid identification of pathogenic bacteria and characterization of foodborne hazards protects public health from naturally occurring contamination and from bioterrorist attacks. NCTR scientists actively collaborate with the other FDA Centers, other government agencies, academic institutions, and public health laboratories on a variety of projects to rapidly and accurately identify and genetically characterize bacteria involved in disease outbreaks and adulterated foods.

Antimicrobial Resistance

Reports of antimicrobial resistant bacteria from farms, animal carcasses, and aquaculture facilities raise concerns that antibiotic use in food-producing animals could result in the transfer of the resistant bacteria from food animals to humans. NCTR researchers evaluate this problem and provide information that is changing agricultural polices and practices and decreasing the possibility that antibiotic resistant bacteria is entering the food chain.

Disk Diffusion Asssay

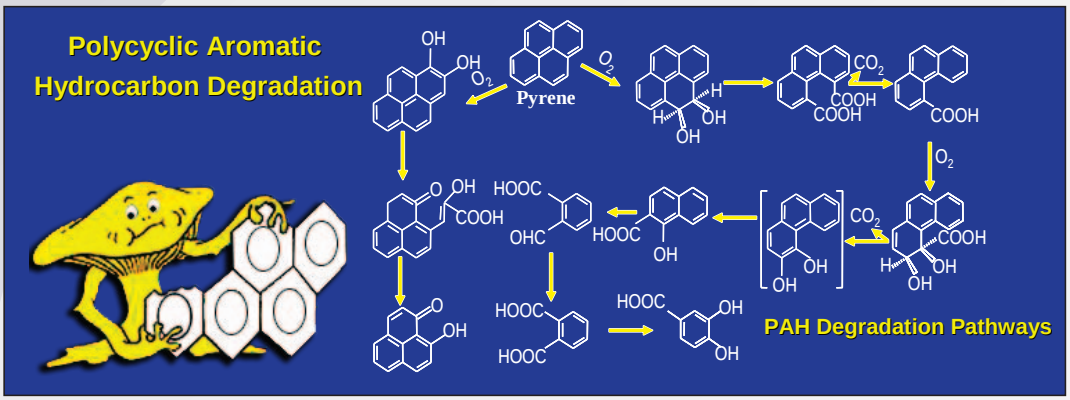
Gastrointestinal Microbiology and Host Interactions



The human gastrointestinal tract is populated with a complex and diverse population of anaerobic bacteria. These bacteria play an important role in human health, acting as a barrier to colonization of the intestinal tract by pathogenic bacteria, as well as contributing to the digestion of dietary components and metabolism of drugs, xenobiotics, and nutrients. Shifts in the composition of the population of the intestinal microbiota may contribute to increased susceptibility to infection or altered metabolic potential. Scientists in the Division of Microbiology develop and utilize methods to monitor changes in the bacterial population within the human gut after the individual is exposed to residual levels of antimicrobial compounds. This research provides critical information concerning the interactions between mammalian hosts, commensal bacteria or probiotics, and enteric pathogens.

Environmental Biotechnology

The Division of Microbiology has extensive expertise and pioneering research experience in studying the decomposition of material by microorganisms (biodegradation) of a wide range of environmental pollutants, especially polycyclic aromatic hydrocarbons (PAHs), a common carcinogen. This research includes both fundamental and applied studies to determine the biodegradation pathways and the enzyme and genetic basis for the biodegradation of priority pollutants. A team of scientists with expertise in analytical chemistry and molecular biology are determining the feasibility of using microorganisms to return the environment altered by contaminants to its original condition (bioremediate) and to determine the enzymatic mechanisms involved in the biodegradation of priority pollutants.



Models to Predict Metabolic Pathways for Mammals

Microorganisms catalyze the synthesis of useful compounds, such as pharmaceuticals, by biotransformation. Knowing that microorganisms can be used as models of mammalian drug metabolism, NCTR scientists have used microorganisms for the biotransformation of a wide range of drugs to provide sufficient metabolites for structure elucidation and toxicity evaluation. Studies in the Division of Microbiology have shown that the filamentous fungi can simulate mammalian metabolism by phase I and phase II enzymes for numerous structurally diverse pharmaceutical compounds. The utilization of a microbial system for biotransformation studies provides the capability to increase metabolite production to give milligram, or sometimes gram, quantities for structure elucidation and biological evaluation. Furthermore, the metabolites produced in a microbial system can be used as reference standards to give insight on the characterization of mammalian metabolites.

Microbiological Surveillance and Diagnostic Support

The Surveillance/Diagnostic research team provides assurance that NCTR research data is not compromised by the use of infected or unhealthy experimental animals. The highly trained microbiologists operate sophisticated instrumentation in a state-of-the-art, full-service laboratory to screen animals for infectious diseases using techniques of bacteriology, parasitology, virology, and mycology. Results of all surveillance testing are computerized and available to NCTR scientists in a variety of formats.

The staff, the know-how and the facilities to address microbial challenges to public health.

Experienced Research Staff

Experienced, multidisciplinary staff including 13 Ph.D. research scientists, 3 M.S. and 13 B.S. research support staff, ORISE (Oak Ridge Institute for Science and Education) and FDA post-doctoral fellows, undergraduate/graduate students, visiting scientists and administrative assistants.

Laboratory Research Facilities

Twenty-three high-tech laboratories, equipped with biosafety cabinets and chemical fume hoods, are available to conduct microbiology research and perform diagnostic surveillance support. These laboratories house 6,879 square feet of general laboratory space, composed of 330 square feet of ozone-controlled bench space for printing microarrays and 253 square feet of limited-access space for microarray experimentation.

Technologies and Expertise

Anaerobic Bacterial Cultures–Methods and Detection Techniques
Bacterial and Fungal Isolation and Identification
Biodegradation Methods
Cellular Fatty Acids Analysis
Diagnostic Surveillance of Environmental Samples
DNA Sequencing
Endo- and Ectoparasite Identification
Enzyme-Linked Immunosorbent Assay (ELISA)
Fast Protein Liquid Chromatography (FPLC)
Fermentation Facility
Gas Liquid Chromatography
Gene Cloning and Sequencing
Gene Isolation and Manipulation
Germ Free and Gnotobiotic Animal Research Facility
High Performance Liquid Chromatography (HPLC)
Identification of Bacteria by 16S rRNA Sequencing
Isolation and Identification of Metabolic Intermediates
Media Preparation
Microarray Technology
Microbial Bioassays
Monoclonal and Polyclonal Antibody Production
Polymerase Chain Reaction (PCR)
Protein Purification Techniques
Proteomics in Functional Genomics
Rapid Molecular Methods for the Detection of Microorganisms
Semicontinuous and Continuous Anaerobe Culture System
Site-Directed Mutagenesis
Viral Detection

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