Research in Microbial Safety of Food and Environment

Dr. Pratik Banerjee is leading an interdisciplinary research program in **microbial food safety** in collaboration with US FDA, USDA, Tennessee Department of Health, Shelby County Health Department (SCHD), industry, major US and International Universities, and departments within the University of Memphis. Several MPH and doctoral students are involved in Dr. Banerjee's research projects.

Research Highlights *(summary of some recent projects):*

- **Food Safety and Rapid Microbial Diagnostic Method Development.** Biosensor based rapid detection of pathogens, toxins, and contaminants in food and environmental (water, soil, air) samples. (check out our relevant publication at: *Toxins* **2013**, *5*(12), 2366-2383), novel nanotechnology-based method to mitigate the "matrix effect" of foods to enable successful detection and identification of pathogens (find our work here: *International Journal of Food Microbiology* **2014**;189:89–97).

- **Application of Microbiome Research in Public Health**

o ***Dissemination of pathogens/infections and human health risks and molecular epidemiology of multi-drug resistant pathogens***. With the advent of the advanced Next Generation Sequencing (NGS) technologies, it is possible to visualize the unseen diversity of microbial pathogens inhabiting in the environment surrounding us. In one of such projects, we collaborated with a Memphis-based investigative journalist and accessed the "microbial cleanliness" of the large fitness centers around Memphis metropolitan area. Check the news coverage here: http://www.wmcactionnews5.com/story/24036649/the-investigators-gyms-undercover. The first round of our findings including the bacterial diversity from gym surfaces is reported in *International Journal of Environmental Research and Public Health* **2014**, *11*(12), 12544-12561. In an extension of this project, Dr. Banerjee's group has recently reported the prevalence of multi-drug resistant (MDR) methicillin-resistant *Staphylococcus aureus* (MRSA) in indoor surfaces, and the molecular characterization of a MRSA type (CC59) found for the first time in the US. This is reported in the *American Journal of Infection Control* **2016**, 44(12):1681-1683.

o ***Microbial ecology and prevalence of multi-drug resistant organisms in in human and food environment***. In collaboration with SCHD, this project aims to assess microbiological quality and safety of retail foods commodities available in low- and high-socioeconomic neighborhoods of Memphis metropolitan. We are using conventional microbiological as well as Next Generation Sequencing-based metagenomics techniques to evaluate microbial populations of food commodities, and presence of antibiotic resistance genes in these products. The study was featured in the University of Memphis YouTube portal and can be found here: https://www.youtube.com/watch?v=gx4rboE0fLI.

o ***Haiti Drinking Water Project***: In a recent project, we examined the overall bacterial diversity of selected source and point-of-use water from rural areas in Central Plateau, Haiti using NGS based metagenomics methods (pyrosequencing of 16s rRNA genes). We also evaluated the impact of interventions (filtration) in removing or reducing the overall microbial loads of drinking water in the study area. You can read the full report published in *PLOS ONE* **2016**, 11(12): e0167353.

- **Genome-wide study of pathogens - *understanding factors affecting virulence and antibiotic resistance properties in pathogens*:** Environment poses stress to pathogens. Recently, we have finished an extensive study where we used whole genome sequencing to understand the differential expression of virulence genes of pathogenic *E. coli* O157:H7 during environmental shock (such as cold temperature). The initial findings were reported in *Journal of Food Protection* **2016**, 79(7):1259-65. Our group is also working on to understand the relationship of virulence gene expression in multi-drug resistant and drug-sensitive bacteria.

Microbial Safety of Food and Environment Research in Action @ UofM SPH

Public Health
foodborne illness
antibiotic resistance
metagenomics
Bacillus
Klebsiella
detection
qPCR
drug-resistance
disinfection
food deserts
MRSA
microbiome
NGS
mold
ecology
food access
environment
Salmonella
water
food safety
E coli
infection
hygiene
Clostrodium
molecular epidemiology
Listeria
pathogens
gene-expression
16s
bacteria
biosensors
environmental health
food microbiology