



**David Ussery, PhD**

# Pioneering Pathogen Surveillance

*Arkansas Researcher Changes the Game of Infectious Disease Prevention*

Dr. David Ussery is a distinguished expert in the field of genomic epidemiology, which uses low-cost, high-output genome sequencing technology to protect people from infectious diseases. He is leading an innovative pilot program that is set to revolutionize infectious disease prevention and monitoring in Arkansas.

Genome sequencing allows scientists to read the genetic code of pathogens, such as bacteria and viruses, providing a comprehensive understanding of their genetic makeup. This information is crucial in stopping the spread of infectious diseases because it helps detect pathogens earlier, track transmission, develop new drugs and vaccines, and monitor the emergence of new strains of pathogens.

Dr. Ussery's work presents exciting potential applications across a spectrum of emerging infectious diseases. Collaborating closely with the Arkansas Department of Health, his team has already sequenced outbreaks of mumps, the Zika virus, and Influenza. Dr. Ussery and his team also collaborate with clinicians to analyze genome and microbiome data from patients at UAMS, including COVID-19 viruses.

## The Challenge

The global fight against infectious diseases has faced significant challenges in recent years, including limited funding and a lack of proactive measures. Recently, there has been a resurgence of malaria and polio, two diseases that we have made significant progress eradicating over the decades. Emerging pathogens continue to threaten national security, public health, and economic stability, necessitating a coordinated, interdisciplinary response. The National Science Foundation (NSF) has initiated programs like Predictive Intelligence for Pandemic Prevention (PIPP) to address these issues.



## The Solution

Dr. Ussery's pilot program aims to monitor Arkansas waters, including rivers and wastewater treatment plant systems, over a span of six months. His primary objective is to detect three distinct types of pathogenic organisms:

1. A protozoan, *Cryptosporidium parvum*, which can live in water and can cause cryptosporidiosis, a gastrointestinal illness, in humans.
2. The bacterium *Salmonella*, one of the most common food-borne pathogens in water.
3. Several viruses, including SARS-CoV-2, Influenza A virus, and Hepatitis E virus. These viruses can all be found in water and can cause viral infections in humans.

This initiative extends beyond mere sequencing; it involves the continuous tracking of the presence and variations of these pathogens in Arkansas water. Regular monitoring, potentially on a weekly basis, will enable Dr. Ussery and his team to identify specific strains and their changes over time. This data holds the key to early detection and prevention of viral infections and optimizing treatment strategies, for example, predicting which antibiotics to use for a particular *Salmonella* outbreak. This approach can prevent the spread of diseases, tailor treatment to individual cases, and ultimately save lives by reducing the severity and impact of outbreaks.

## Next Steps

To effectively execute this groundbreaking pilot program, Dr. Ussery seeks \$90,000 in funding. Collaboration agreements with wastewater treatment plants, encompassing a significant portion of the state's population, are already in place. The funding primarily will be used to purchase sequencing kits and essential laboratory reagents for the detection and quantification of pathogen genomic DNA. Importantly, this initiative aligns with the NSF's mission to enhance society's ability to predict pandemic-scale events, detect outbreaks early, and respond quickly and effectively.

This pilot program serves as a crucial steppingstone, providing preliminary results instrumental in grant applications, including the NSF PIPP grant. These preliminary findings will not only bolster the case for Phase II funding (from \$15-18M) but also contribute to a broader understanding of the program's potential impact on infectious disease prevention and management.

Dr. Ussery's innovative program has the potential to significantly advance our capabilities in infectious disease monitoring, early detection, and treatment. This initiative will help safeguard public health and prevent the spread of pathogens through cutting-edge genomic monitoring and analysis, paving the way for advancements in pandemic prevention.

## Contact

 [dwussery@uams.edu](mailto:dwussery@uams.edu)

