

## USGS NSF GRIP Opportunity

 <b>USGS Center:</b>	Wyoming-Montana Water Science Center
 <b>Project Title:</b>	Assessment of Thermophilic Pathogens in Geothermally Influenced Hot Springs within Grand Teton and Yellowstone National Parks
 <b>Project Hypothesis or Objectives:</b>	<p>Increasing temperatures due to climate change expedites the need to understand the factors that influence pathogens in warm waters. The thermophile <i>Naegleria fowleri</i>, the causative agent of primary amebic meningoencephalitis (PAM), a rare but almost always fatal disease, has recently infected several children in Minnesota, 500 miles further north than any previously reported case. A warming climate could be making it easier for <i>N. fowleri</i> to thrive in northern waters. <i>N. fowleri</i> has previously been detected in the in the Boiling River swimming area in Yellowstone National Park. The thermal and geochemical gradients that exist in many of the hot springs in Yellowstone National Park and Grand Teton National Park offer a unique opportunity to investigate the environmental factors that contribute to the survival of <i>N. fowleri</i> in northern states.</p> <p>A multidisciplinary team of nationally and internationally recognized researchers from the U.S. Geological Survey (USGS), National Park Service (NPS), Thermal Biology Institute (TBI), and Centers for Disease Control (CDC) have teamed up to investigate this issue and plan to integrate the existence of <i>N. fowleri</i> (qPCR analysis and isolation methods) with the physical (streamflow, temperature, pH and specific conductance) and chemical (nutrients and organic carbon) characteristics of the different hot springs at various spatial and temporal scales.</p>
 <b>Duration:</b>	14 weeks to 6 months
 <b>Internship Location:</b>	Helena, Montana
 <b>Area of Discipline:</b>	Microbiology, Biogeochemistry, Molecular Biology or related discipline
 <b>Expected Outcome:</b>	This study could provide scientific and monitoring information essential to better understand aquatic ecosystem changes and risks to human health resulting from increases in water temperature due to climate change. The study will generate accessible,

human-health related data for the CDC and will provide the NPS insight into the occurrence of *N. fowleri* in their hot springs in Yellowstone and Grand Teton National Parks which will help understand the safety and health risks to humans. Opportunities will exist for authoring and/or co-authoring a variety of peer-reviewed information products.

- **Special skills/training Required:** Knowledge of aseptic sampling/laboratory pipetting techniques
- **Duties/Responsibilities:** This intern position will provide the research fellow with the opportunity to sample several different hot springs in Grand Teton National Park with USGS researchers. The intern will also extract DNA from the samples and perform qPCR analysis to determine the presence and quantity of *N. fowleri* in the hot springs and coordinate sample analysis with the CDC. The intern may also have the opportunity to present results at local meetings hosted by the Thermal Biology Institute (<http://tbi.montana.edu/index.html>). Depending on the skill level, the intern could also have the opportunity to expand our project by investigating other microbial communities associated with *N. fowleri* with in-house Illumina DNA sequencing at the Center for Biofilm Engineering.
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