GEOPIG in Yellowstone 2010
Research Goals

• Sample fluctuating (‘on/off’) hydrothermal systems for geochemical and gene expression changes (team 1)
• Sample geochemical gradients for evidence of biologically driven changes in dissolved gases (H₂, CO, CH₄) (team A)
• Sample the photosynthetic fringe in acidic hydrothermal ecosystems (both teams)
• Expand our database of dynamic thermal measurements (both teams)
Flat Cone in Sentinel Meadows (Lower Geyser Basin) undergoes periodic eruptions

At these times the supply of hot water is shut off to the thermophilic chemotrophic and phototrophic microbial communities in the outflow channel
Flat Cone in steady flow conditions…

When eruptions occur, there is a burst of water from the spring, followed by a drop in the water level -- sometimes of more than a meter.

After eruptions there is no flow in the outflow channel, and the microbial communities are exposed to the atmosphere and much lower temperatures -- sometimes for several hours. How do these communities cope?
Thermophilic, chemotrophic microbial community at Flat Cone exposed to 60°C temperature changes (≈90°C to ≈30°C) usually every day, and sometimes more than once a day.

Team 1 studied several systems of this type in the Lower Geyser Basin, Sylvan Springs, and Crater Hills
Last year, dissolved gas samples showed an increase in dissolved hydrogen downstream at Bison Pool (samples collected by Peter, Danny and Volcano Boy, and analyzed by Peter at Tori Hoehler’s lab)

Is this common? Is it biology? Is it abiotic geochemistry?
Team A sampled gradient systems at Bison Pool, Mound Spring, Sylvan springs, and elsewhere.

This example is from the Rabbit Creek area where two systems were studied that cross the photosynthetic fringe.

Here at ‘Peek-a-boo’ hot water flows from the lower left into the hot spring on the right…
Crossing the photosynthetic fringe took us to new territories. Team A found acidic and alkaline waters mixing at Geyser Creek. The acidic water creates the pale yellow-green areas in the right side of stream below, while alkaline water supports the darker green and brown colors…
Acidic soil conditions at the bottom of this view and alkaline soil conditions at the top yield distinct photosynthetic pigment assemblages... different communities?
Two photosynthetic fringes in the same stream! Acid soils lower left, alkaline upper right, and too hot in the middle…