Honors Seminar 292 — cheat sheet for 9/18/2019 — Andrew Baker

Vetriani et al. (2005)

You should read all of this paper except the "Materials and Methods" section. Key questions to think about:

1. Mercury (among other heavy metals) is toxic to living organisms that have not developed mechanisms to cope with it. As one moves farther from a deep-sea vent, what happens to the mercury content of the water, and what happens to the mercury resistance of living organisms?

2. Tests in the lab indicate that certain microbes are "happiest" (i.e., they multiply most rapidly) at particular temperatures. How do these preferred temperatures relate to the locations in which the particular microbes described in this paper were found?

3. On what basis was the "family tree" in Figure 2 constructed?

4. What is the distinction between the temperatures at which an *organism* is happiest and at which a particular enzyme acts most efficiently? If there is a distinction between these temperatures, what does it tell us about the circumstances under which manufacture of the enzyme evolved?

5. What were the authors' "control" samples in their investigation?

6. If we wanted to use microbes to "clean up" material from a site that had been contaminated with mercury, what considerations would enter into our choice of organism and treatment facility?

Key terms:

- **ASW** = artificial seawater medium
- **bioavailability** = degree to which a given substance can be ingested/absorbed and used by living organisms; this can be quantified in terms of the amount of the substance that enters the circulatory system
- **ectosymbiosis** = symbiotic relationship in which one organism lives "on" the body of another (this can include living "on" the lining of an interior organ; it excludes endosymbiotic arrangements like that of mitochondria within a eukaryotic cell)
- **flavoenzyme** = any enzyme containing one of a set of "flavin" compounds in its structure (the biochemical source for the latter is riboflavin, a.k.a. vitamin B_2)
- **mercuric reductase** = MR = enzyme responsible for reducing the oxidation state (i.e., degree of ionization) of mercury, as desired by living organisms
- **mercury (0)** = neutral mercury, Hg
- **mercury (I)** = mercurous mercury, singly ionized (Hg^+)

- **mercury (II)** = mercuric mercury, doubly ionized (Hg^{2+})
- **mesophile** = an organism that thrives at an intermediate environmental temperature ($15° \leq T \leq 40°$ C)
- **metal speciation** = the details of which form(s) a particular element takes in a given environment
- **operon** = a sequence of nucleotides that together are responsible for the synthesis of "messenger RNA", which is subsequently translated into a protein
- **polychaete annelid** = a particular, mostly marine class of segmented worms ("annelids" broadly are the phylum that includes earthworms)
- **psychophile** = an organism that thrives at a low environmental temperature ($T < 15°$ C)
- **taxon** = any category in a phylogenetic classification system
- **thermophile** = an organism that thrives at a high environmental temperature ($T \geq 45°$ C)
- **U/nmol** = [dimensionless] "units" per nanomole
- **vestimeniferan** = adjective describing a family of polychaete annelids (i.e., marine worms) that live in tubes attached to the seafloor
- **volatilization** = process by which a substance is coverted to vapor