In-Class Activity: **The Iron that Keeps and Kills Us**

Prior to coming to class, please read the accompanying article *The Iron in Our Blood That Keeps and Kills Us*, by Bradley Wertheim in [*The Atlantic*](http://www.theatlantic.com/health/print/2013/01/the-iron-in-our-blood-that-keeps-and-kills-us/266936/)*.* If you have not already done so, also finish reading the chapter on “Biological Inorganic Chemistry” of your book. You can complete this assignment on your own, or work with a partner or group. Feel free to consult any source you want. **Bring answers to the following questions with you when you come to class.** We will spend only the first 10 min of class comparing notes.

Name(s) (printed)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_­­­­­­­­­­\_\_\_\_\_­­­­­­­­­

The article claims “*As elements go, iron is a fickle and mischievous companion. Essential to life, yet impulsive, promiscuous, and destructive when allowed to roam unescorted, it poses a tremendous engineering challenge to human tissues*.” Let’s dig into this statement and others a little more.

1. *Iron readily exchanges electrons with other elements*. What are the accessible oxidation states of Fe in a biological setting?
2. *Indispensable to oxygen transport and metabolism*. Name an iron-containing protein involved in oxygen transport. What about metabolism?
3. *Iron participates in unsanctioned electron exchanges that produce free radicals*. The author is likely referring to the Haber-Weiss cycle and the Fenton reaction here. Write balanced equations for these reactions below.
4. *primitive bacteria to mammals go to great lengths to safely transport and store this potentially poisonous payload.*
	1. What is the major iron transport protein in mammals? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	2. What is the major iron storage protein in mammals? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. What molecules do bacteria use to acquire iron? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. *the plague's own taste for iron. In fact, this pathogen actually hijacks iron from its victim's stores to enhance its own ability to infect host cells. Interestingly, in 1956, Jackson and Burrows showed that a mutant strain of Yersinia pestis lacking a particular iron-harvesting mechanism was far less lethal to mice.*
	1. The iron-harvesting mechanism referred to here is yersiniabactin. Do a quick internet search to learn more about yersiniabactin (Wikipedia is fine). What is the overall formation constant for the yersiniabactin-Fe(III) complex?
	2. Given that siderophores have some of the highest formation constants for iron binding known (it’s why they are so affective at scavenging iron after all!), how does the microorganism release the iron contents for utilization? Suggest at least 3 properties/processes that might help release the contents (think about the principles of coordination chemistry here!)
	3. The weakened strain of *Yersinia* that Dr. Casdaban studied is weakened because it lacks the biosynthetic machinery to produce yersiniabactin. Propose a hypothesis as to why he succumbed to this otherwise “weakened” strain of the plague?