Biology and Sustainability by the Numbers- **Exercise 1**

Submit your answers in DOC, DOCX, PDF, or any other readable format to **the course Moodle.**

Here and in the future, any added insights or suggestions might earn you a bonus ☺

1. Read the following chapter from the course book: *Cell Biology by the Numbers, Introduction to Chapter 1: Why should we care about the numbers?*

http://book.bionumbers.org/the-facts-of-life-why-we-should-care-about-the-numbers/

2. Compose a back-of-the-envelope Fermi style estimate on any question you wish (doesn't have to be biological).
Write the question and your calculation. Do not look up numbers from the web, rely on your intuition. You don't have to get the "correct" number!

3. Know thyself (Adapted from the book "Physical Biology of the Cell", Phillips et al, 2nd ed. pp 83)

a.
   i. Justify that assuming a surface area of 6 μm^2 and a volume of 1 μm^3 for a characteristic bacterial cell (e.g. *E. coli*) is reasonable. Use the accompanying figures.
   ii. Express this volume in femtoliters.
   iii. Make an estimate of the mass of such a bacterium.

b. Try to make an estimate of the total number of bacteria inhabiting your intestine (where most of the bacteria in the body are thought to reside).

c. Estimate the total number of human cells in your body.

d. Using the above, calculate the ratio of bacteria to human cells in the body.

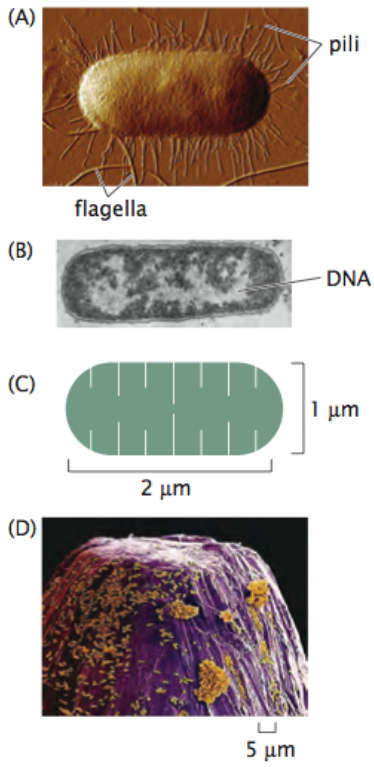

Figure 2.1: *E. coli* as a standard ruler for characterizing spatial scales. (A) Atomic-force microscopy (AFM) image of an *E. coli* cell, (B) electron micrograph of a sectioned *E. coli* bacterium, and (C) the *E. coli* ruler.

4. As the name of our course suggests, we really care a lot about numbers 😊 One part of this passion involves the correct way for reporting significant digits when writing numbers. Please read the following chapter in the book "RIGOROUS RULES FOR SLOPPY CALCULATIONS**"** and revisit your answers to questions 2 and 3 based on these guidelines**.**