

# Order of Magnitudes: Making Estimates in Cellular Biology

Chaitanya A. Athale

August 13, 2013

Submit this assignment as a hand-written sheet to the Teaching Assistant.

## 1 Estimating

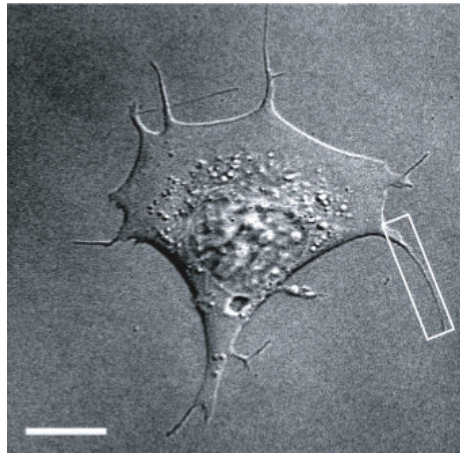


Figure 1: A DIC image of a fibroblast taken from Johnston et al. (2008). Scale bar  $10 \mu\text{m}$ .

1. How many lipid molecules are present in a *Saccharomyces cerevisiae* cell membrane? Assume half the membrane consists of lipids and the other half of proteins. Show using calculations how you reach your number. Use the order of magnitude estimates approach and compare to published values citing the reference.
2. What is the fraction of cellular volume occupied by a yeast nucleus in *Saccharomyces cerevisiae*, i.e. cell:nucleus volume? Use an order of magnitude calculation to justify your answer.

3. Given a mammalian fibroblast cell which has dimensions as seen in Figure 1<sup>1</sup>, what are the approximate number of water molecules present? Make a reasonable assumption of the height of the fibroblast from the discussion in class and the reference.
4. After 100 divisions of a *Drosophila melanogaster* embryo, how many cells should the embryo have?

---

<sup>1</sup>Johnston et al. (2008) BMC Cell Biology, 9:65