BMB/Bi/Ch 173 – Winter 2018 Revision 1, 2/1/2018, office hours changed

Homework Set 4.1 – Assigned 1/30/2018, Due 2/6/18 by 10:30am

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Office hours – Friday 2-5pm in BI EM Lab and Monday Feb 5 11am-12pm BI EM Lab, or by appointment

Problem 1 - (60 points) Resolution in Electron Microscopy

1.a. (10 points) What factors limit resolution in a single particle cryoEM experiment? What is the fundamental resolution limitation in a cryo-EM experiment?

1.b. (30 points) Describe in a few sentences how, if at all, resolution can be assessed in electron crystallography, single particle analysis, and electron tomography.

1.c. (10 points) What regions of reciprocal space are missing in:

- Single--axis electron tomography (one tilt series)
- Dual--axis electron tomography (two tilt series)
- Single particle analysis
- 2D electron crystallography

1.d. (10 points) What is the Fourier Shell Correlation (FSC) curve? Conceptually explain how it is solved and what is it used for in single particle cryoEM.

1.e. (5 points) What does a low value on the FSC curve mean? What does this tell you about your reconstruction at that spatial frequency?

1.f. (5 points) Why was the ResMap software developed?

Problem 2 – (30 points) Electron crystallography

2.a. (10 points) How is the convolution theory related to electron crystallography?

2.b. (10 points) What does the Fourier transform of a 2-D crystal look like? What about a 3D crystal?

2.c. (10 points) In an ideal 2D crystal, every unit cell would be identical. Real 2D crystals have subtle differences between unit cells. How do you find that information?