

January 2016
Biochemistry Cumulative Exam
S.M. Cologna

Topic: Biological Mass Spectrometry

Instructions: Answer each question as concise as possible. There are a total of 5 questions.

1. There were two Chemistry Nobel prizes awarded in 2002 directly related to biological mass spectrometry. Who are the Nobel Laureates and what was their major contribution that led to the award?
2. Design a "shot-gun proteomics" experiment in which you want to identify proteins that are differentially expressed in cancer cells versus non-cancerous cells. Make sure to denote the entire experimental set-up that will achieve these goals and explain each step. Also denote what technique you will use for the quantification and how the mass spectrometry data is interpreted to obtain protein identification and quantification.
3. Protein structure can be achieved using mass spectrometry resulting in a low resolution protein landscape. Describe two techniques that can be used for structural analysis of proteins and explain how each methodology works.
4. Describe how tandem mass spectrometry via collision induced dissociation (CID) could be used to sequence oligonucleotides or peptides. What are two major challenges when attempting to sequence DNA via mass spectrometry?
5. Brain lipid binding protein is a member of the fatty acid binding protein family. As the name suggests members of this family of proteins are responsible for lipid binding and transport. Examples of binding include oleic acid and arachidonic acid. Considering this information, design two experiments (i) calculate the K_d of the protein-ligand using mass spectrometry and (ii) determine the binding site using mass spectrometry. Be sure to describe full experimental details, including the types of mass spectrometry that will be used as well as draw what the data may look like and how you would interpret it.