**BCH/PLS/PPA 609 1st section exam February 26, 2014 (100 points)**

Each question is worth a total of 20 points.

1. Give all 15 steps of the Calvin-Benson Cycle starting with the fixation of ribulose-bis-phosphate (RuBP) with 6 CO2 molecules to the generation of glucose and regeneration of RuBP. Include all substrates and products including source(s) of energy and reduction (electrons). You will get full credit if you have all the structures correct or mostly correct. You can get partial credit for most of the cycle and some compound names instead of structures. (15 points)

To help you with this the structures and names of RUBP, a five, a four and a seven carbon intermediate are given (Pi represents phosphate, PO43-):



Provide the structure of a major molecule providing carbon export (photosynthate) from chloroplasts of photosynthetically active leaves. (5 points)

1. Describe the nitrogen (N) cycle in biology including nitrification and denitrification. How are the major forms of N used in biochemistry usually formed and what are the forms usually utilized by plants? Mention the major forms of N used in natural ecosystems versus commercial agricultural production of crops such as corn (*Zea mays*).
2. Compare and contrast starch and fructan biosynthesis in storage tissue starting with sucrose arriving from photosynthetically active leaves. (20 points)
3. Many oilseeds have been engineered to accumulate mainly oleate (18:1) in the oil body (seed oil) triacylglycerol. For example soybeans normally have 20 – 30% 18:1 in the oil but new soybeans have been genetically altered to have oil with 80 – 90% 18:1. Describe what biochemical steps you think may have been changed to achieve this.
4. Give the reactions that lysophosphatidylcholine acyltransferase (LPCAT), cytidine-5′-diphosphocholine:diacylglycerol cholinephosphotransferase (CPT) and phosphatidylcholine:diacylglycerol cholinephosphotransferase (PDCT) catalyze. (Include all substrates & products!). How do they fit into triacylglycerol (TAG) biosynthesis pathways and how do they affect TAG fatty acid composition? What was the new discovery of how LPCAT can affect oil composition described by Lager et al. (2013; Journal of Biological Chemistry *288*, 36902-36914) you read for assignment 1.