open.michigan

Author(s): Aken Desai, Michael Mathis, 2008

Phospholipids

Wednesday, January 16, 2008
10:00 AM

23. How is choline incorporated into phosphatidylcholine?
    a. Choline kinase: Choline + ATP --> Phosphocholine + ADP
    b. CTP-Choline Cytidylyl Transferase: Phosphocholine + CTP --> CDP-Choline + Ppi
        i. Rate limiting
        ii. Point of regulation
    c. CDP-Choline + 1,2 DAG --> Phosphatidylcholine
24. What is the immediate precursor for diacylglycerol?
    a. Phosphatidic acid
    b. See 18 for synthesis of phosphtidate
25. How is phosphatidic acid synthesized from dihydroxyacetone-P and fatty acids?
    a. G3P + 2 FA-CoA --> phosphatidic acid
    b. See 18c for G3P sources
26. What is the methylation pathway? What phospholipids is synthesized by this pathway?
    a. Phosphatidylethanolamine + 3 adoMet --> Phosphatidylcholine + 3 adoHomocysteine
    b. adoMet is from S-adenosyl methionine
27. How is phosphatedylethanolamine synthesized from diacylglycerol and from phosphatidylserine?
    a. From DAG
        i. CDP-Ethanolamine Pathway
        ii. Similar to CDP-Choline pathway
    b. Phosphatidyserine
        i. PS Decarboxylase
        ii. Phosphatidylserine --> CO2 + Phoshatidylserine
28. How is phosphatidylserine synthesized?
    a. From phosphatidylethanolamine
    b. Phosphatidylethanolamine:serine transferase: Phosphatidylethanolamine + Ser --> Phosphatidylserine + Ethanolamine
    c. W/ PS decarboxylase, forms cycle that can change charge distribution on plasma membranes (ethanolamine is positive, serine is negative)
29. How are phosphatidylinositol and phosphatidyl glycerol synthesized?
    a. From Phosphatidic Acid + CTP --> CDP-DAG + Ppi
    b. CDP-DAG + G3P --> CMP + Phosphatidylglycerol-P --> Phosphatidylglycerol + Pi
    c. CDP-DAG + Inositol --> CMP + Phosphatidylinositol
        i. Phosphatidylinositol is a major molecule in signal transduction
        ii. Phosphatidylcholine and phosphatidylethanolamine are the major constituents of plasma membranes
30. What are the actions of phospholipases A_1, A_2, C and D?
    a. PL-A1: splits FA1 off of phospholipid
    b. PL-A2: splits FA2 off of phospholipid
    c. PL-C
        i. G-protein coupled (learned it before)
        ii. Prodcues diglyceride and phosphoX
    d. PL-D: splits off phosphatidic acid and X
31. What are the functional significance of these phospholipases?
    a. PL-A2
        i. Adjusts FA composition
        ii. Can be used to switch groups from unsaturated to saturated (surfactant)
    b. PL-C: signal transduction
        i. G-protein coupled receptor activation
        ii. Takes phosphatidylinositol and makes IP3 and DAG

c. PL-D: signal transduction

32. What is the overall composition of pulmonary surfactant? What is the major surface active component? How is it synthesized?
    a. Role of Surfactant
        i. Produced by type II pneumocytes
        ii. Alveolar spaces have enormous air/liquid interface
        iii. Surfactant forms layer at surface and reduces surface tension to prevent alveolar collapse
        iv. Also allows for larger alveolar spaces
        v. Contributes to defense mechanism
            1) Supports non-specific host defense mechanisms by forming barrier to microorganisms
            2) Suppresses activation and proliferation of lymphocytes
            3) Augments alveolar macrophage activities
    b. Surfactant deficiency
        i. Neonatal RDS: premature birth, babies haven't began to secrete surfactant
        ii. ARDS: lung injury
        iii. Can lead to respiratory failure
    c. Composition
        i. Isolated from bronchoalveolar lavage fluid
        ii. Nearly half saturated (dipalmitoyl phosphatidylcholine) fatty acids
        iii. Number of proteins and other phosphatidylcholine make up rest
    d. Synthesis of dipalmitoyl phosphatidylcholine
        i. CDP-choline pathway: dipalmitoyl diglyceride + CDP-choline
        ii. Using PL-A2 to replace unsaturated FA on C2 w/ palmitate