

Chemistry 4055 (Spring 2013)
Exam 4 Study Guide

Chapter 10

Lipids

- Amphiphatic
- Solubility
- Presence in the body
 - Blood
 - Cells
- Physical properties
- Roles in storage, structure, bioactivity
- Cleavage by lipases
- General localization in biological membranes
- Study the specific lipids discussed in lectures

Fatty acids

- Identification by carbon skeleton numbering system
 - Saturation
 - Unsaturation
 - Common carbon chain length
 - Common sites of unsaturation
 - cis vs trans configuration, which is physiologically relevant and which is not good for the body
- Factors that affect solubility
- Factors that affect melting point
- Polarity
- Structure
- Stabilizing forces between fatty acids

Storage Lipids:

Triacylglycerol

- Composition
- Factors that affect solubility
- Factors that affect melting point
- Naturally occurring form
- Function

Waxes

- Composition
- Function

Structural Lipids

Glycerophospholipids

- Glycerol backbone
- General composition
- Head groups and charge
- Acyl linkages
- Ether linkages

Galactolipids

- Glycerol backbone
- Use by plants
- No phosphate

Sphingolipids

- Sphingosine backbone
- Head groups and charge

Sterols

- Four fused carbon rings
- Localization particularly of cholesterol (See Chapter 11)

Bioactive Lipids

- Intracellular signals often coupled with changes in $[Ca^{2+}]$
- Extracellular hormones
- Understand the idea of hormone precursors and activation by UV or enzyme transformation
- Redox Cofactors
- Pigments
- Therapeutic Agents
- Eicosanoids
 - Paracrine hormones
 - Derivatives of arachidonate
- Steroids
 - Not localized hormones

- Vitamin D₃
- Vitamin E

Lipid Extraction, Purification, and Identification

- Nonaqueous solvents
- Normal phase chromatography
 - TLC
- Reverse phase chromatography
- HPLC
- Gas Chromatography
- Mass spectrometry

Chapter 11

Biological Membranes

- Function
- Micelles
- Bilayers
- Vesicles
- Composition and structure
 - Fluid Mosaic Model
 - Asymmetry of lipid distribution
 - Know the localization of lipids that I mentioned in lecture and the ones that are moved for a functional purpose
 - Reorganization of lipids due to fusion
 - Asymmetry of protein distribution
 - Know the examples that I mentioned in lecture
 - Asymmetry of sugar distribution
 - Know the examples that I mentioned in lecture
 - Electrochemical gradient
- Proteins
 - Peripheral proteins
 - Function
 - Integral proteins
 - Function
 - Know the six types
 - Be able to recognize if a specific protein is one of the six types of integral proteins
 - Membrane topology
 - Alpha helices
 - Beta barrels
 - Hydrophathy plots as it is applicable to specific transmembranes
- Membrane dynamics
 - Liquid-ordered state
 - Liquid-disordered state
 - State defined by lipid composition and defined by temperature
 - Lateral movement and rates
 - Tracking by fluorescent labeling
 - Molecular fences
 - Transbilayer movement and rates
 - transport facilitated by enzymes like flippases
- Membrane rafts
 - Typical components of microdomains in terms of lipids and proteins
 - Caveolins
 - Membrane structural alterations
 - Timescale of existence
- Membrane fusion
 - Vesicle budding

- Vesicle fusion
- Exocytosis
- Endocytosis (Review Fe^{3+} transport in serum)
- Cell Division
- Nerve cell communication
- Membrane transport
 - Dependent on size, charge, concentration, and hydrophobicity
 - Simple diffusion
 - Passive vs Active transport
 - How are these processes facilitated thermodynamically?
 - Chemical gradient
 - Electrochemical gradient
 - Membrane potential
 - Transporters (or permeases)
 - Energy changes accompanying passage of hydrophilic solutes
 - Active and passive transporters
 - Uniports
 - Symports
 - Antiports
 - Carriers vs channels
 - Kinetics of transport by carriers
 - Glucose transporters
 - Be able to calculate ΔG_T for solutes that are **uncharged** and **charged**.

Introduction to Metabolism

Catabolism vs Anabolism

- Classification of organisms in terms of energy sources
- Digestion of biopolymers into monomers during eating
- Digestion of biopolymers into monomers during mobilization
- Understand why glycogen branching is a good thing for glucose storage and also know where glycogen storage occurs.
- Explain why nucleotides are not metabolic fuels.
- Explain why proteins are not a good source for storage of amino acids.
- Be aware of the common metabolite intermediates (glyceraldehyde-3-phosphate; pyruvate; acetyl-CoA) and the common electron carrier cofactors (NAD(P)⁺).
- Know the complete ΔG equation and understand why something that is not favorable under standard biochemical conditions can still move forward.
- Understand why ATP is a source of energy and is a way for us to conserve energy. How is ATP coupled to reactions to enable thermodynamically unfavorable reactions to occur?

Glucose transport and regulation

- Normal blood glucose levels
- Glucose transport by GLUT1
- Glucose control by GLP1, glucagon, insulin, dipeptidylpeptidase IV (DPP4)