

CEE 370

Environmental Engineering Principles



Lecture #12

Environmental Biology I:
Biochemical Fundamentals

Reading: Mihelcic & Zimmerman, Chapter 5

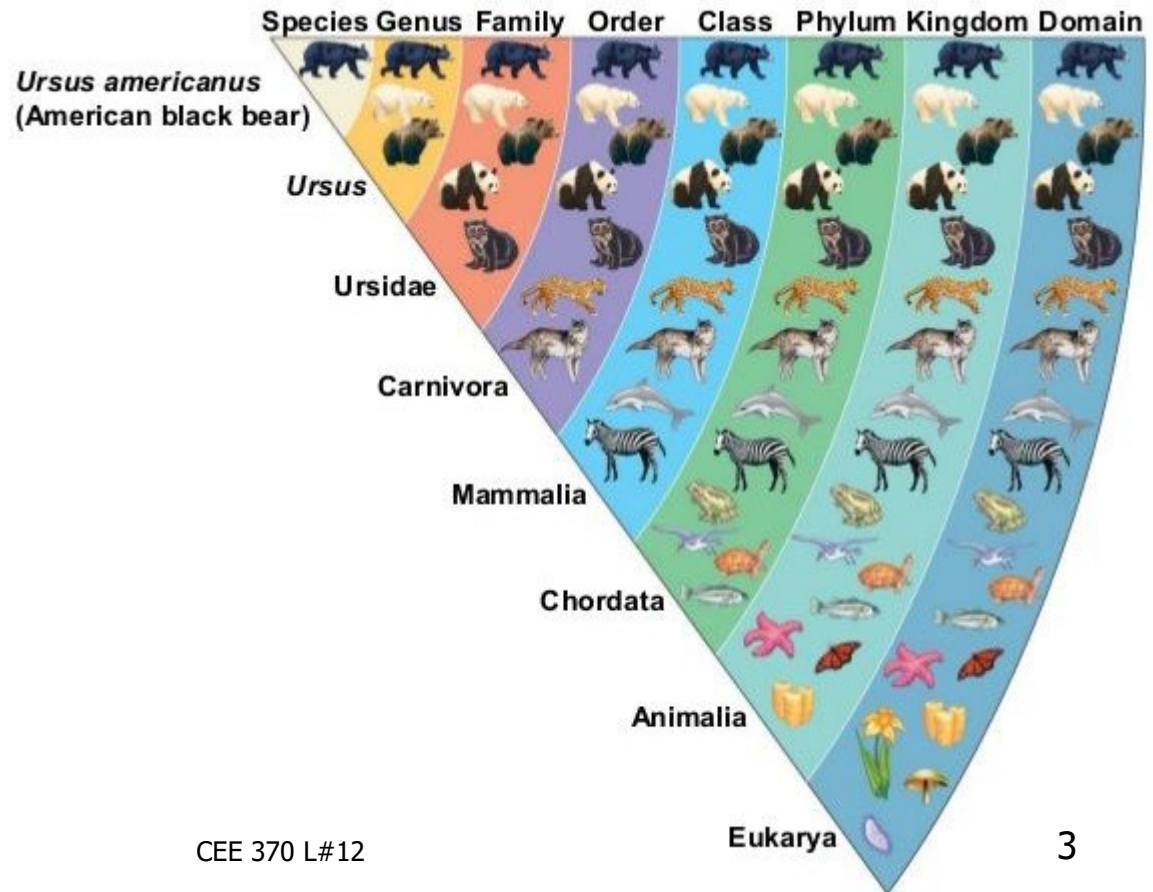


Why study microorganisms

- Biodegradation!
 - They are the engines of our wastewater treatment system
 - They are often used to purify drinking water
 - They account for natural attenuation of pollutants
- They may interfere in treatment systems
- Indicators of environmental degradation
- Some are disease causing agents
- Future biotechnology
 - Can we harness and engineer their biochemical engines?
 - Molecular biology
 - Genomics
 - Proteomics

What is the next lowest category below "Phylum"

- A. Kingdom
- B. Discipline
- C. Domain
- D. Class
- E. Order



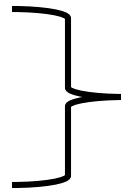


phylogeny

- Domains

- Archaea

- Bacteria



Procaryotes

- Eucaryotes – nucleus, organelles

- Kingdoms of Eucaryotes

- Protists, Fungi, Plants, Animals

- Other: KPCOFGS



Environmental Microbiology

- Types of Microorganisms
 - Bacteria
 - Viruses
 - Protozoa
 - Rotifers
 - Fungi
- Metabolism
- Microbial Disease
- Microbial Growth

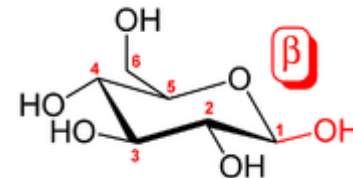
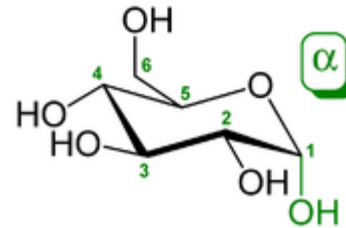
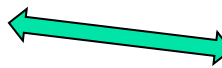
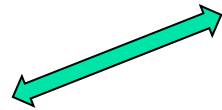
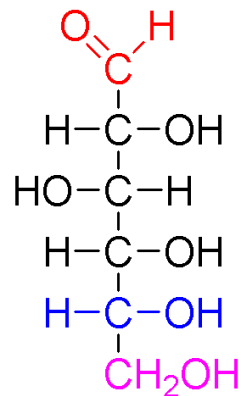


Biochemical Molecules

- Carbohydrates: polysaccharides & sugars
 - Sources of energy, structural components, markers for identification & communication
- Nucleic Acids
 - Transmit information across generations – the blueprint, code for protein synthesis
- Proteins & amino acids
 - Site of reactions, transport, storage, structure, defense
- Lipids
 - Storage of energy, membrane functions

Carbohydrates

- Polyhydroxy aldehydes and ketones
 - Empirical formula: CH_2O
- Monomer: sugars
 - Linear chain and ring forms
 - example: glucose





Types of sugars

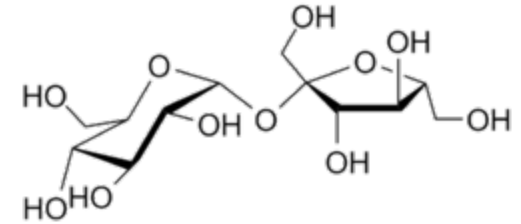
- Position of carbonyl
 - Terminal: aldehyde – an aldose
 - Mid-chain: ketone – a ketose
- Number of carbons
 - Three – triose
 - Five – pentose
 - Six - hexose

Polymeric carbohydrates

■ Disaccharides

■ Example: sucrose

■ D-glucose + D-fructose

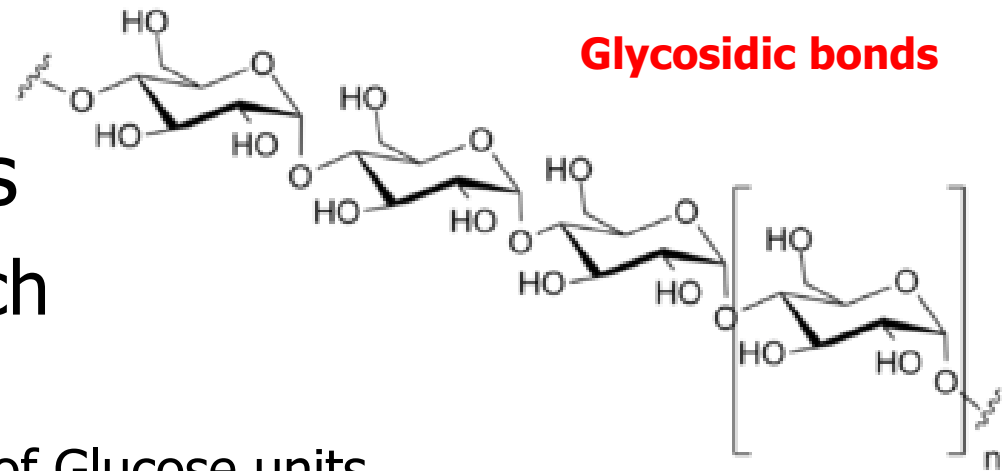


■ Polysaccharides

■ Example: Starch

■ Amylose unit

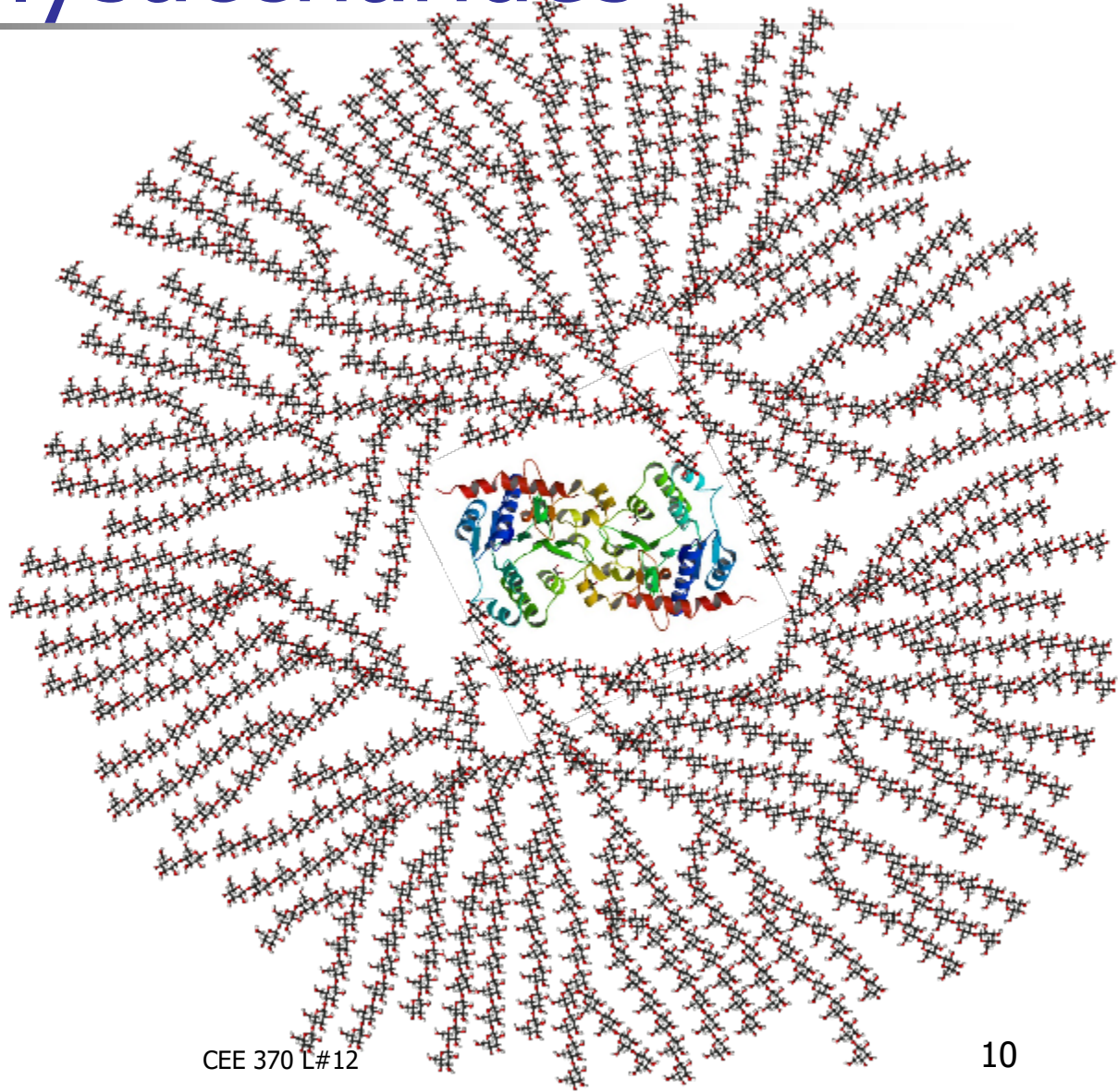
■ Linear array of Glucose units



Large polysaccharides

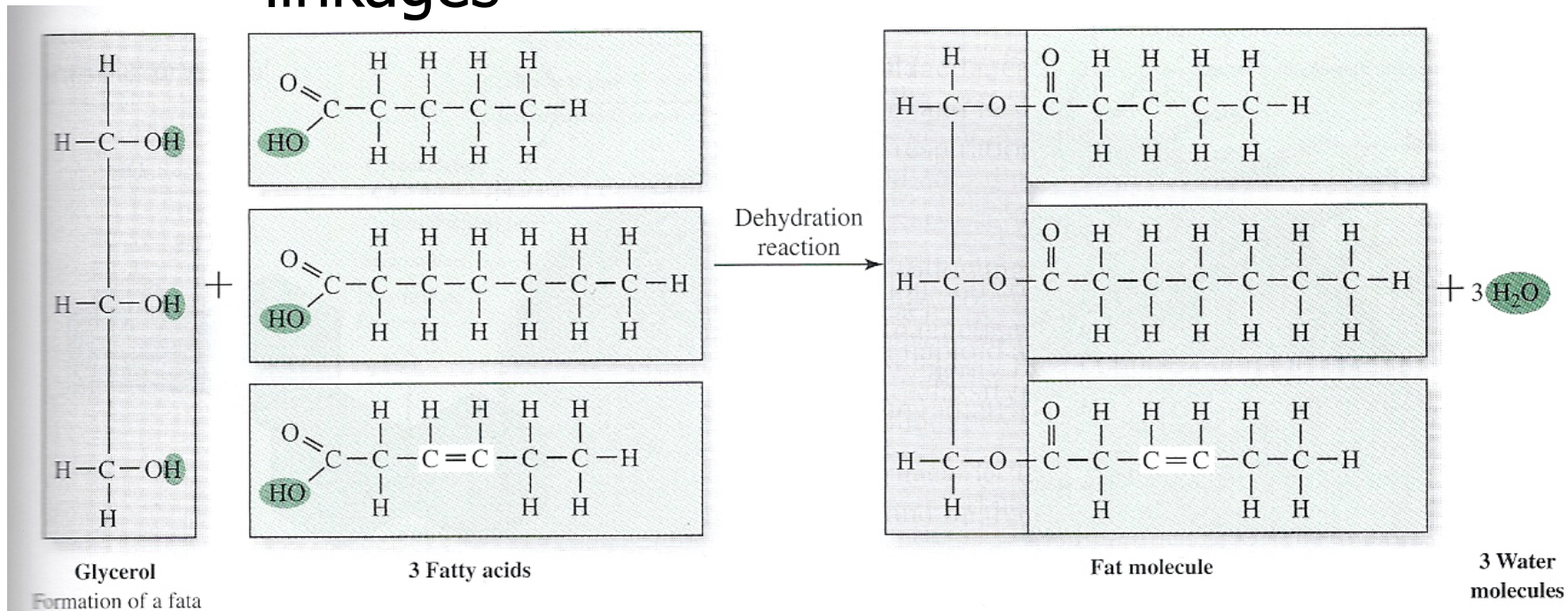
■ Glycogen

- Long-term storage in animals & fungi
- Core protein surrounded by glucose chains

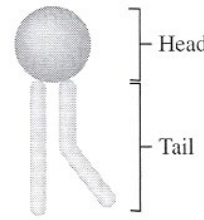
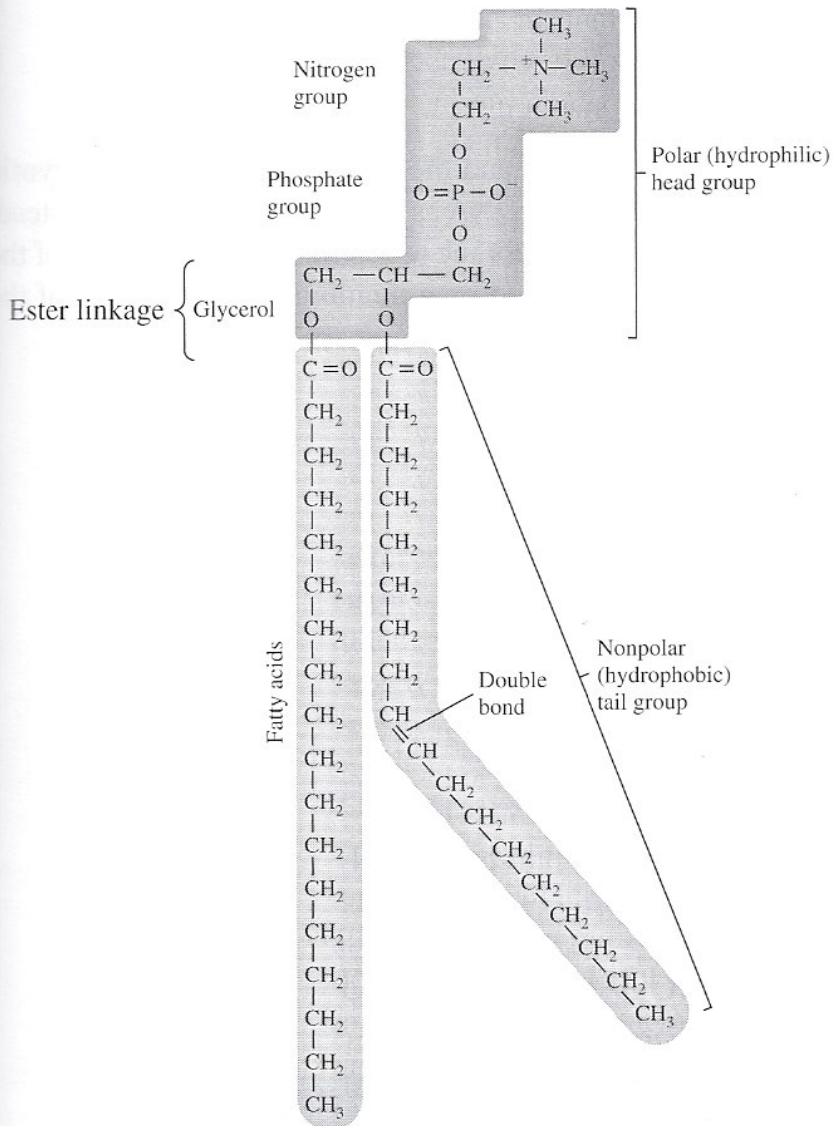


Lipids I

- Hydrophobic – not very soluble in water
- Fats
 - Glycerol + fatty acids bound by ester linkages

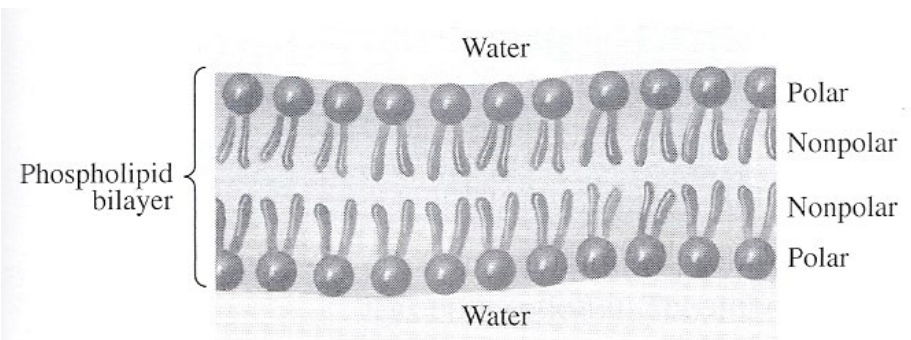


Lipids II

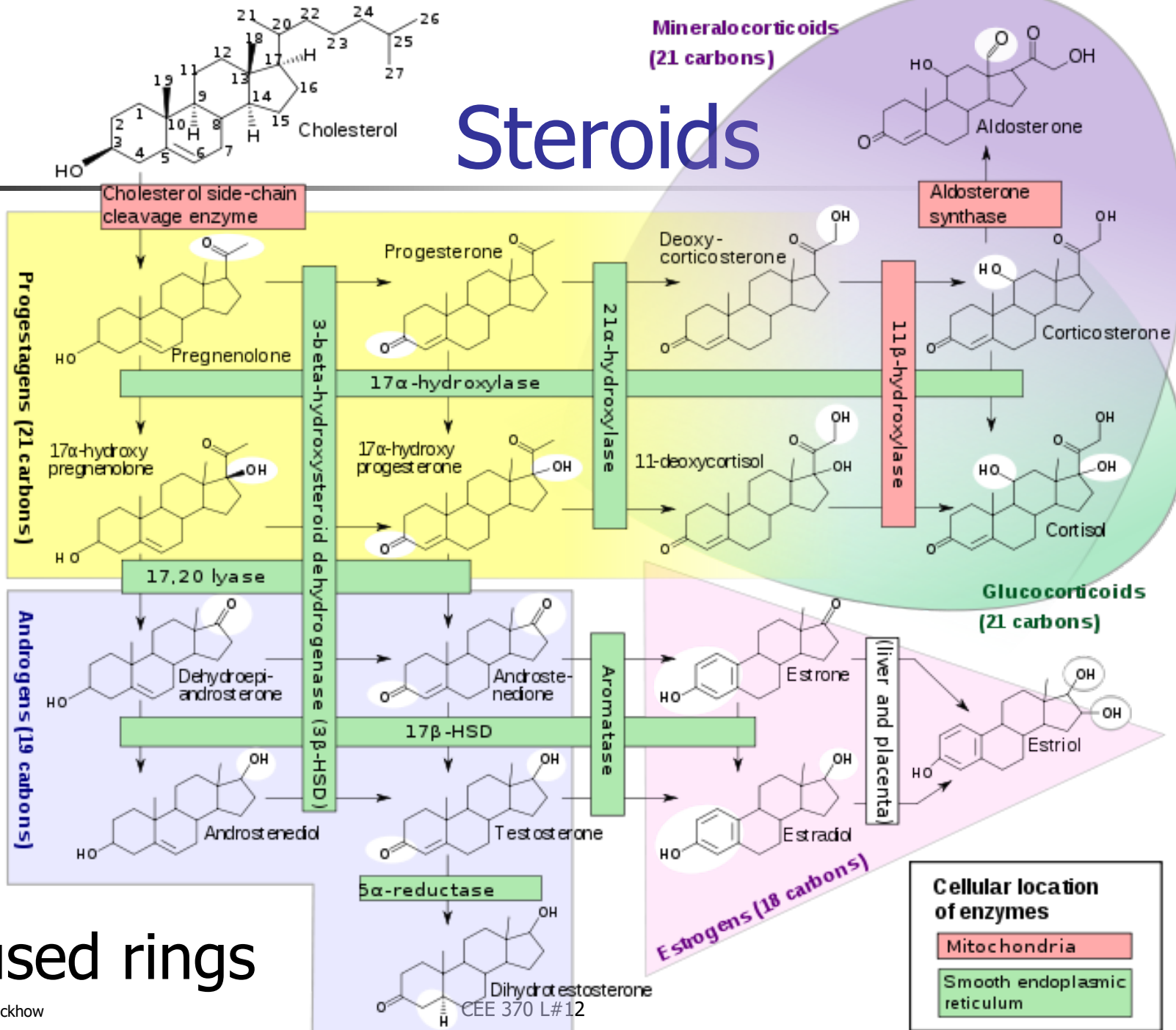


Phospholipids

- Major components of cell membranes
- Composed of a glycerol, 2 fatty acids and a phosphate group



Steroids





Others

- Very important and will be discussed in lecture on genetics (#10)
 - Proteins, amino acids
 - Bases, Nucleic acids, DNA, RNA



■ To next lecture