

## KEY:

Answers left-to-right, row-by-row:

## 1. Building Blocks

- (a) Proteins: amino acids
- (b) Carbs: monosaccharides
- (c) Lipids: Fatty acids, various polar head groups, framework to hold it all together (glycerol, sphingosine)
- (d) Nucleic Acids: Nucleotides

## 2. Functional Groups

- (a) Proteins: amides
- (b) Carbs: acetals or ketals
- (c) Lipids: esters mostly, sometimes amides
- (d) Nucleic Acids: phosphodiester

## 3. No. of Building Blocks

- (a) Proteins: 20
- (b) Carbs: many
- (c) Lipids: many
- (d) Nucleic Acids: 4 or 5

## 4. Source of Structural Variety

- (a) Proteins: amino acid side chains
- (b) Carbs: stereochemistry, types of linkages, modifications like oxidized sugars, amino sugars
- (c) Lipids: Fatty acid length and number and position of alkenes, type of framework, type of polar head group
- (d) Nucleic Acids: Choice of base

## 5. Chiral Building Blocks?

- (a) Proteins: Yes, amino acids are chiral except for glycine.
- (b) Carbs: Yes, this is the main difference between sugars.
- (c) Lipids: Yes, glycerol is chiral once you start putting different groups on it. Sphingosine is chiral.
- (d) Nucleic Acids: Yes, the sugar is chiral.

## 6. Directional Chains?

- (a) Proteins: Yes, N → C.
- (b) Carbs: Yes, non-reducing end to reducing end.
- (c) Lipids: No.
- (d) Nucleic Acids: Yes, 5' → 3'

## 7. Encode Information?

- (a) Proteins: Yes.
- (b) Carbs: Generally not.
- (c) Lipids: No.
- (d) Nucleic Acids: Yes.

8. Net Charge *pH* 7?

- (a) Proteins: Varies according to side chains.

- (b) Carbs: Typical carbs are zero-charged, but modified forms may have charges.
- (c) Lipids: Typically neutral because plus is canceling minus charges.
- (d) Nucleic Acids: Phosphodiester backbone has one negative charge per phosphate.

9. Cross Linking Possible?

- (a) Proteins: Disulfide bonds
- (b) Carbs: Yes, e.g. starch with 1 → 6 linkages amount to cross linking.
- (c) Lipids: No.
- (d) Nucleic Acids: No.