LIPIDS STUDY SHEET (ANSWER KEY)

EXAM: Wednesday or Thursday

Functions of Lipids

1. Fats hold more energy than **carbohydrates**. How much 2.25x more
2. Gives structure to **cell membranes**.
3. Important for fat-soluble vitamins = **A, D, E, K**. a double decker burger has alot of fat
4. Provides **insulation** (keeps animals warm).
5. Provides **protection** (internal fat protects organs).

Structures

- Unsaturated fatty acid = has a **double** bond.
- Glycerol backbone + 3 fatty acids = **ester** bond = fat (**triglyceride**)
- Ester bond is a source of creating **metabolic** water.
- Common fatty acids: **oleic** and **palmitic**. Weird way to remember: Fat people get greasy palms

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Nomenclature

- First value after C = number of **carbons**

- Second value = number of **double bonds**
- Unsaturated fats have at least **one** double bond.
- Saturated fats have **zero** double bonds.
- Essential fatty acids = **linoleic acid**, **linolenic acid**, and **arachidonic acid**
    - (Arachidonic acid is **semi-essential** if linoleic acid is limiting)

Symptoms of Deficiency

- **Scaled** skin
- Loss of **hair, feathering**
- **Poor growth and performance**
- **Reproductive failure**
- **hemorrhage**

Classifications of Lipids

- Simple lipid = Esters of fatty acids with various alcohols
    - Triglycerides:

      Esters with glycerol = fats and oils

      Esters with other alcohols = waxes
- Compound lipids = phospholipids - cell membrane components, lipoproteins
- Sterols = Cholesterol and fat soluble vitamins

Properties of Fats and Lipids

- Melting point - change from solid to liquid
    - Short chain lower than long chain
    - Unsaturated chain lower than saturated

- Iodine value: allows comparison of how **saturated/unsaturated** a fat is.

    - High iodine value → **unsaturated** fat
    - Low iodine value - saturated fat
- What are the 4 Fat depots + Prioritization ?

1) Internal -Kidney fat

2) Intermuscular-seam fat

3) Subcutaneous-backfat

4) Intramuscular-marbling

- Cattle deposit mainly **saturated** fat

- Swine and poultry deposit **what they consume**

- Marbling occurs in **intramuscular** fat

Non-Ruminant Digestion

- Triglycerides consumed and leave **stomach**

- Broken down by: **gastric lipase, pancreatic lipase, and bile salts**

- Products: **free fatty acids (FFA)**, **glycerol**, and **monoglycerides**

- Fat must form **micelles** to enter mucosal membrane for absorption
- Absorbed fats are reformed into **triglycerides (TGs)**
- Chylomicrons coat fats with **protein**
    - Increases absorption and availability
    - Leaves enterocyte → enters **lymphatic** system

Ruminant Digestion

- Rumen microbes produce **VFAs** and **glycerol** from triglycerides
- VFAs: **acetate, butyrate, propionate** (from carbons of glycerol backbone)
- FFA hydrogenated by microbes → deposited as **saturated** fatty acids
- Ruminants absorb fat from **diet**

Lipid Transport & Uptake

- Chylomicrons carried through body by **lipoproteins**
- Enzyme **lipoprotein lipase** breaks down chylomicrons → fat enters cells
- Process is stimulated by **insulin**
- Lipo = **fat**

Breakdown of Fats for Energy

1. Hormone-sensitive lipase mobilizes triglycerides and fatty acids from **adipose** tissue

2. Fatty acids enter **mitochondria** (requires carnitine, a conditional vitamin)
3. Stepwise removal of 2 carbons at a time forms **Acetyl CoA**
4. Acetyl CoA enters **Krebs** cycle → produces **ATP**
5. This process is called **beta-oxidation**
