

SNS COLLEGE OF ALLIED HEALTH SCIENCE
Affiliated to The Tamil Nadu Dr M.G.R Medical University, Chennai



DEPARTMENT OF OPERATION THEATRE AND ANAESTHESIA

TECHNOLOGY

COURSE NAME: BIOCHEMISTRY

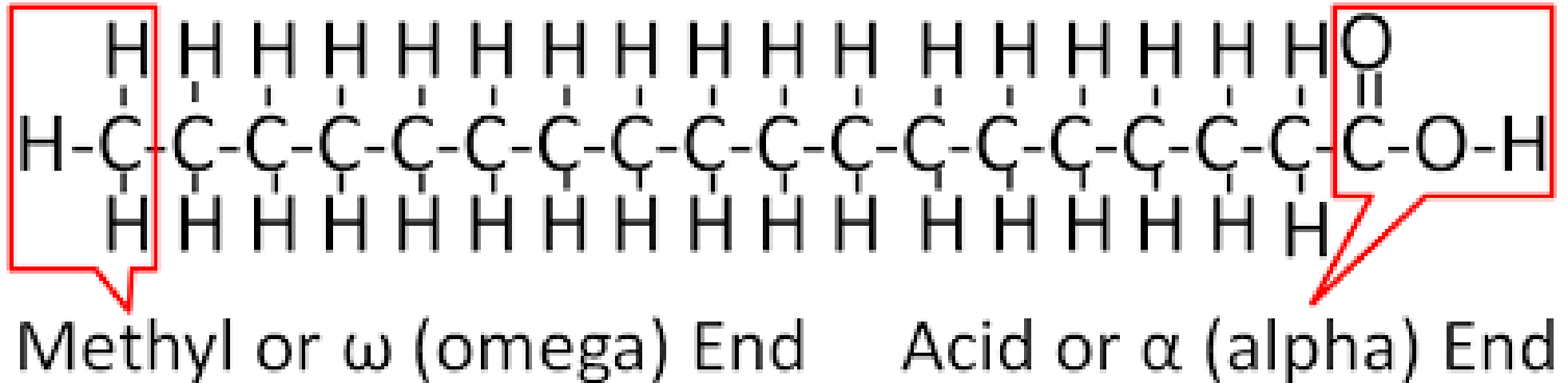
UNIT : 3

TOPIC : LIPIDS – FATTY ACIDS CLASSIFICATION

FACULTY NAME: MITHRA V

FATTY ACIDS (DEFINE)

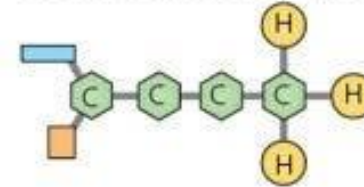
- Long **hydrocarbon** chain at one end + terminal **carboxyl group** (-COOH)
- Usually **even number** of carbon atoms
- Building blocks of most lipids, used as **energy** when **glucose is unavailable**



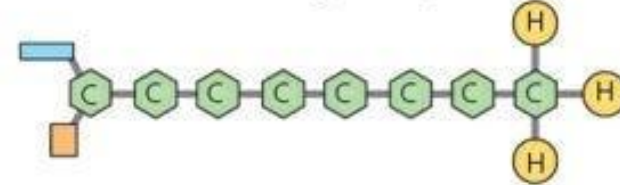
CLASSIFICATION – BASED ON CHAIN LENGTH

- **Short-chain fatty acids (SCFA) – ≤ 6 carbons**
 - Butyric acid (4:0) – found in butter, cheese
- **Medium-chain fatty acids (MCFA) – 6–12 carbons**
 - Caprylic acid (8:0) – found in coconut oil, breast milk
- **Long-chain fatty acids (LCFA) – 13–21 carbons**
 - Palmitic acid (16:0) – common in palm oil, meat, dairy
- **Very long-chain fatty acids (VLCFA) – ≥ 22 carbons**
 - Behenic acid (22:0) – found in peanut oil, canola oil

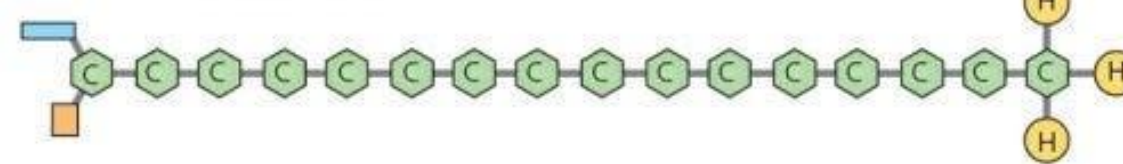
Short-chain fatty acid (fewer than 6 carbons)



Medium-chain fatty acid (6–10 carbons)



Long-chain fatty acid (12 or more carbons)



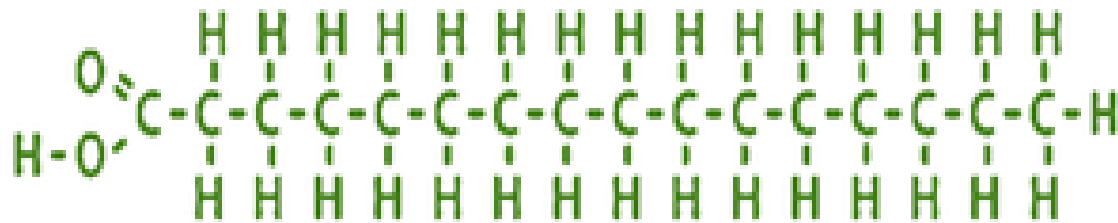
CLASSIFICATION – BASED ON TOTAL NUMBER OF CARBON ATOMS



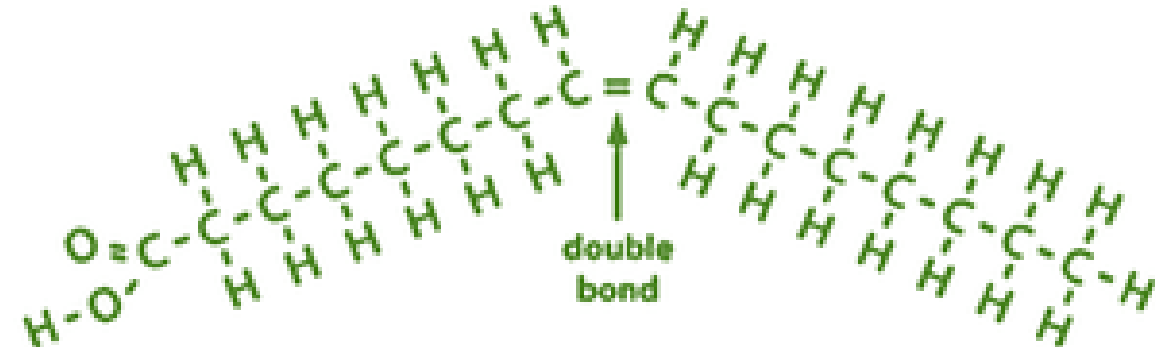
- **Even-chain:** Most common, have an even number of carbons
- Example: Palmitic, Stearic, Oleic acid
- **Odd-chain:** Less common, have odd number of carbons found in some dairy products
- Examples: Pentadecanoic acid, Heptadecanoic acid

CLASSIFICATION – BASED ON DEGREE OF SATURATION/UNSATURATION

- **Saturated** Fatty acids : No double bonds (only **C–C** single bonds)
- **Unsaturated** Fatty acids : One or more **C=C** double bonds
- **Monounsaturated** Fatty acids (MUFA) : **1** double bond
- **Polyunsaturated** Fatty acids (PUFA) : **≥2** double bonds



SATURATED



UNSATURATED

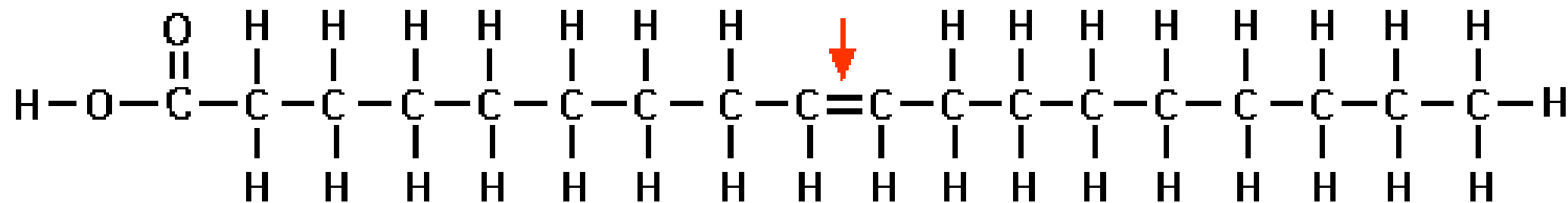
- **SATURATED FATTY ACIDS**
- Only **single C–C** bonds
- Pack tightly → high melting point → solid at room temperature
- **Examples:** **Palmitic acid** (16:0), **Stearic acid** (18:0)
- **UNSATURATED FATTY ACIDS**
- Contain one or **more C=C** double bonds
- Monounsaturated (MUFA): e.g., **Oleic acid** (18:1)
- Polyunsaturated (PUFA): e.g., **Linoleic acid** (18:2)

- **MONOUNSATURATED FATTY ACIDS (MUFA)**

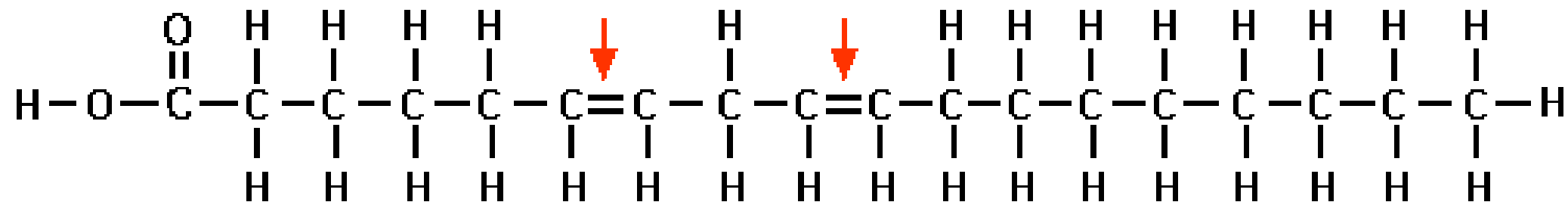
- Healthy fat molecule, **One C=C double bond**, Liquid at room temp, solidify when chilled
- **Rich sources:** Olive oil (75%), canola oil, avocados, nuts, seeds, sesame, peanut.

- **POLYUNSATURATED FATTY ACIDS (PUFA)**

- **Two or more C=C double bonds**, Remain liquid even when cold
 - Omega-3 - Fish, flaxseeds, chia seeds, walnuts - (e.g., α -linolenic, Eicosapentaenoic Acid (EPA), Docosahexaenoic Acid (DHA))
 - Omega-6 - Soybean, sunflower, corn oil, nuts, seeds - (e.g., linoleic acid, arachidonic acid)



Oleic Acid- Monounsaturated Fatty Acid

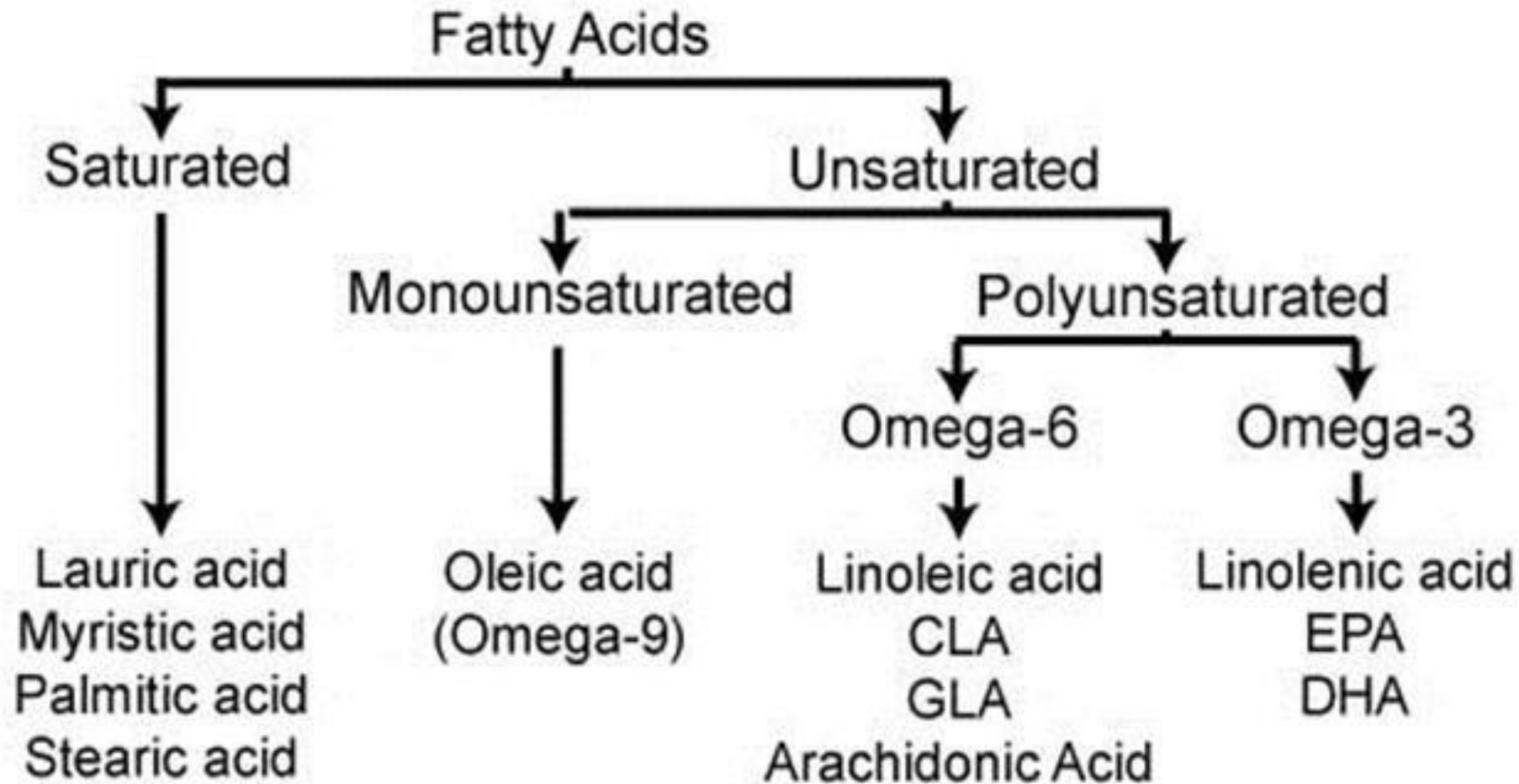


Linoleic Acid- Polyunsaturated Fatty Acid

CLINICAL SIGNIFICANCE OF MUFA & PUFA

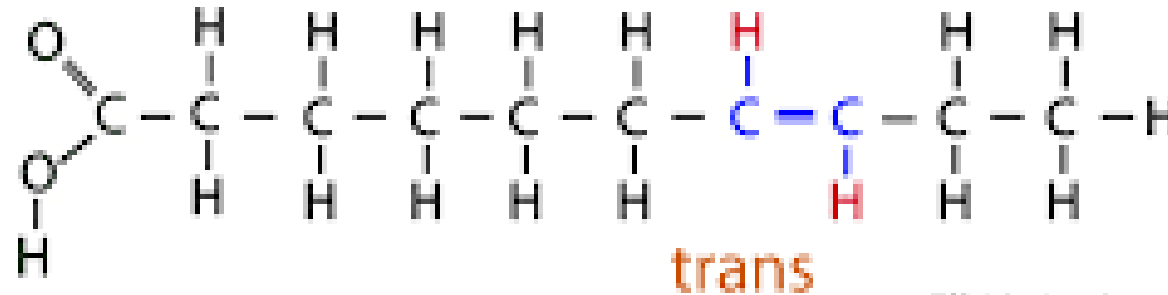
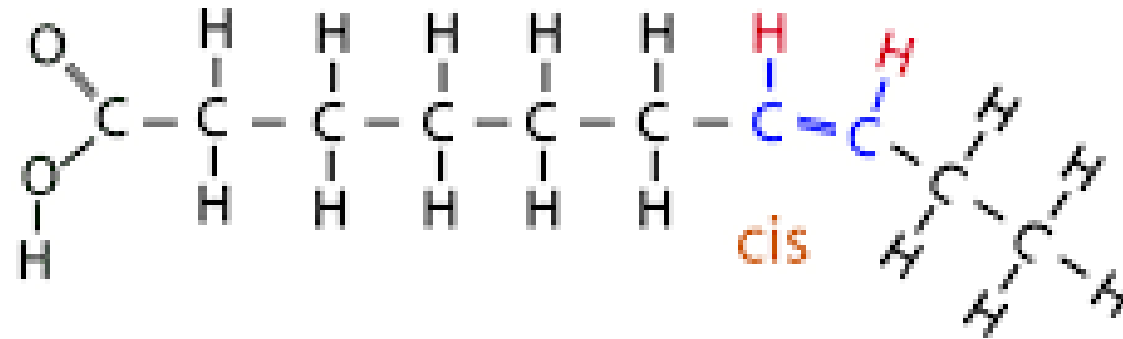


- **Omega-3 fatty acids:** Strong **anti-inflammatory** → reduce heart disease & Alzheimer's risk
- **Omega-3:** **Improve vision**, brain health, mood; reduce depression & anxiety
- **Omega-3:** Support **normal fetal development**
- **MUFA:** **Improve insulin** sensitivity → control blood sugar
- **MUFA & Omega-3 (PUFA):** Prevent hyperglycemia, hypoglycemia, prediabetes
- **MUFA:** **↓ LDL (bad)** cholesterol, **↑ HDL (good)** cholesterol
- Help in cell membrane & nerve maintenance and aid digestion



CIS AND TRANS FATTY ACIDS

- **CIS:** Both **H atoms** on **same side** of double bond (natural, kinked shape)
- **TRANS:** **H atoms** on **opposite sides** (straight shape, mostly artificial)



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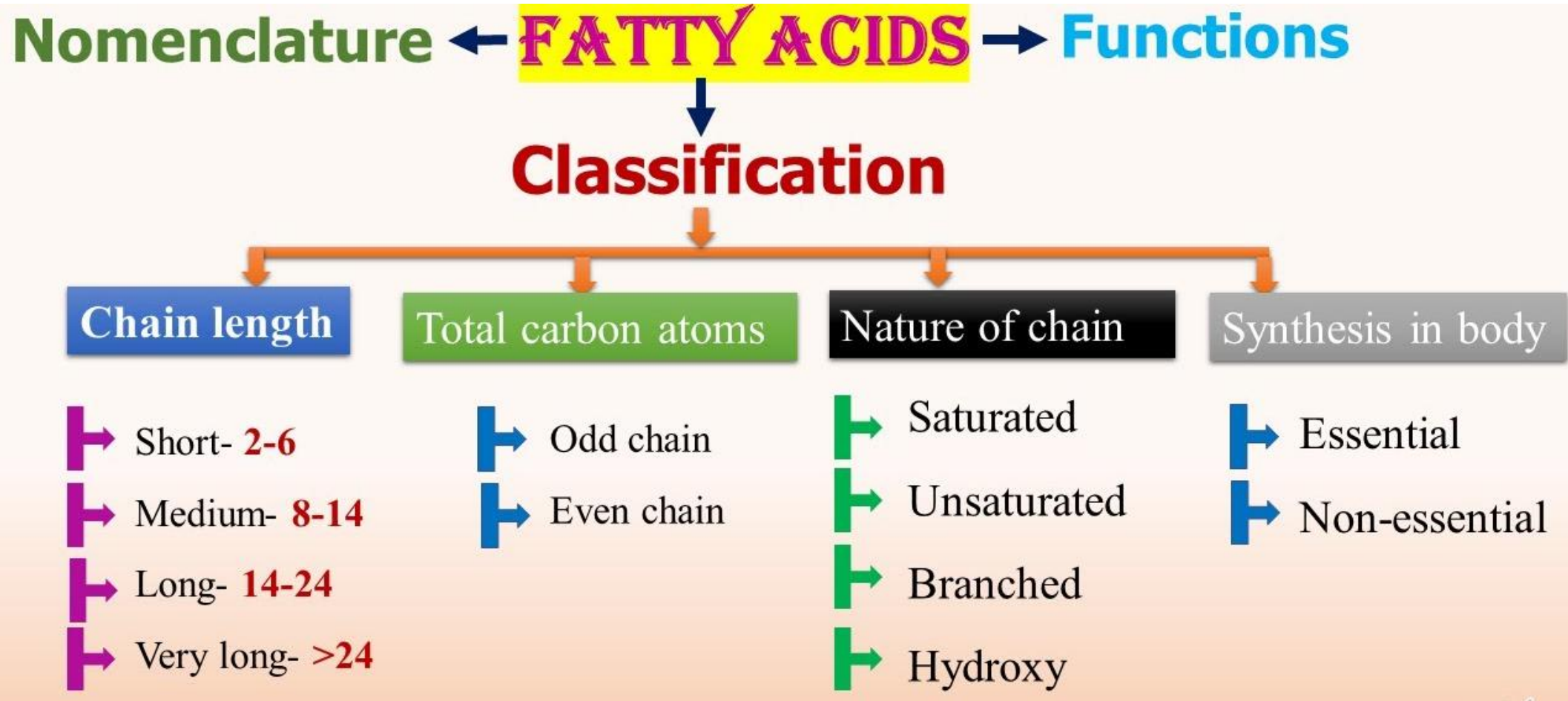
CLASSIFICATION – BASED ON SYNTHESIS IN THE BODY

- **ESSENTIAL VS NON-ESSENTIAL FATTY ACIDS**
- **Essential** (cannot be synthesized by our body, need to be taken through a diet)
- Eg: Linoleic (ω -6), α -Linolenic (ω -3), Arachidonic
- **Non-essential** (body can be synthesized)
- Eg: Palmitic, Oleic, Butyric acid

USES OF FATTY ACIDS

- Food industry (**emulsifiers, stabilizers**)
- Soaps, detergents, cosmetics (Na/K salts)
- **Skin care** products
- Energy source for body
- **Health Risks of Excess Fatty Acids**
- **High saturated** fat intake → obesity, **heart disease**, some cancers
- Excess trans fats → strongly linked to cardiovascular disease

SUMMARY



REFERENCES

- **Lipids: Biochemistry, Biotechnology & Health** (6th Edition), Michael I. Gurr, John L. Harwood.
- **Biochemistry of Lipids, Lipoproteins and Membranes** (6th Edition) by Neale Ridgway and Roger McPherson
- **Lipid Biochemistry** (5th Edition) by John L. Harwood and Keith N. Frayn
- <https://www.sciencedirect.com/book/9780444634382/biochemistry-of-lipids-lipoproteins-and-membranes>
- <https://onlinelibrary.wiley.com/doi/book/10.1002/9780470774366>

THANK YOU