Carboxylic acids

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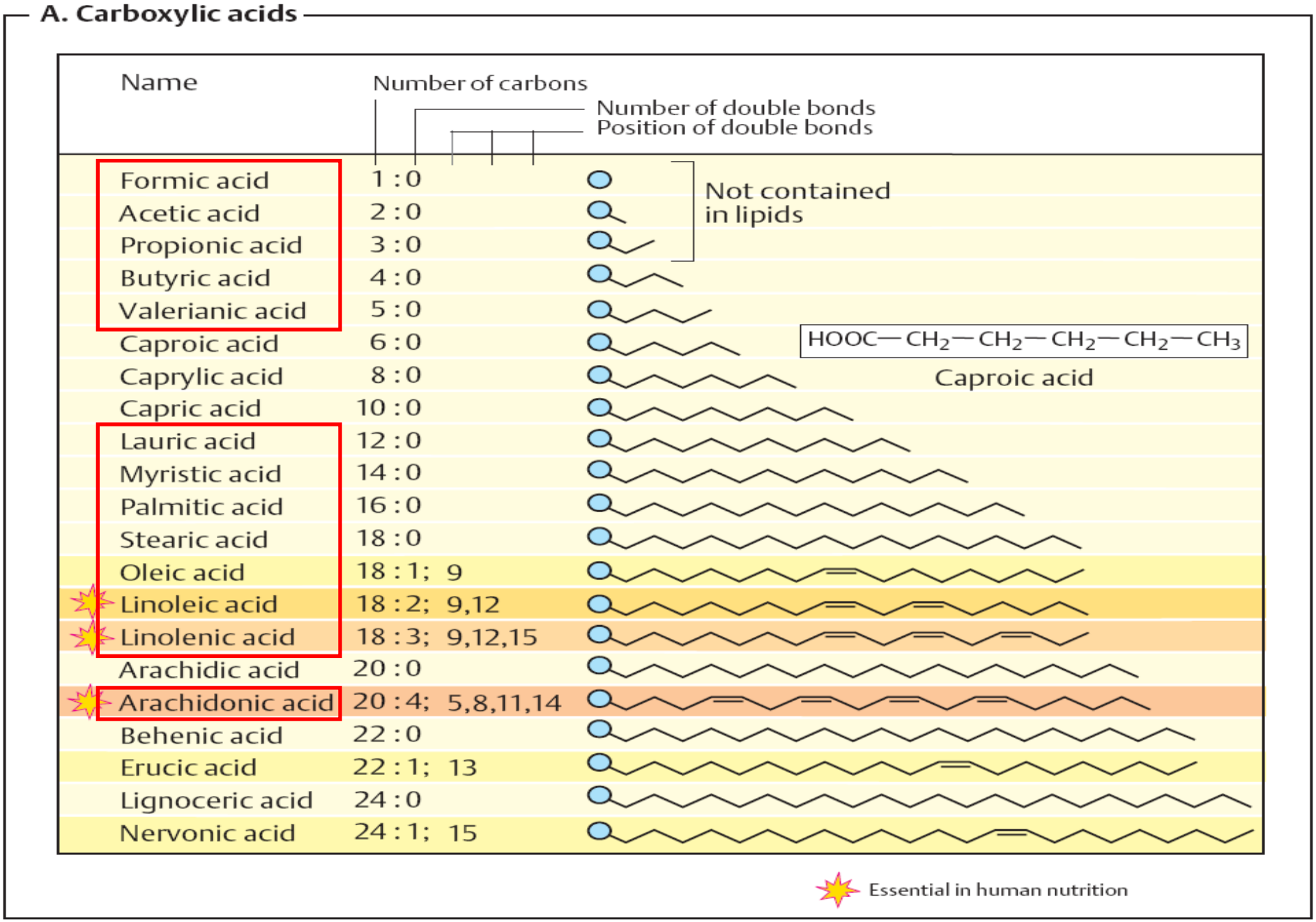
Properties

- widely distributed in the nature (AA, FA)
- **tart taste** (vinegar, sour milk, fruits)
- low MW: liquids (sharp, unpleasant odor)
- high MW: waxlike solids
- hydrogen bonds
  - high boiling points
  - solubility in water (low MW)
- **weak acids** (carboxylate is stabilized by free e^-)
- α-halogen derivatives are stronger acids

carboxyl group: R-COOH / R-CO_2H

- suffix: -oic / -dioic acid

  parent hydrocarbon carboxylic acid
- trivial names!
- saturated / unsaturated
- mono-, di-, tri-carboxylic acids
- alpha (α) / omega (ω) carbon
- ω- or *n*- fatty acids
- acyl / anion



The figure was adopted from: J.Koolman, K.H.Röhm / Color Atlas of Biochemistry, 2nd edition, Thieme 2005

Important dicarboxylic acids

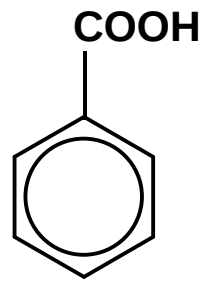
C2	HOOC-COOH	**oxalic acid**
C3	$HOOC-CH_2-COOH$	**malonic acid**
C4	$HOOC-(CH_2)_2-COOH$	**succinic acid**
C5	$HOOC-(CH_2)_3-COOH$	**glutaric acid**
C6	$HOOC-(CH_2)_4-COOH$	**adipic acid**

HOOC-CH=CH-COOH

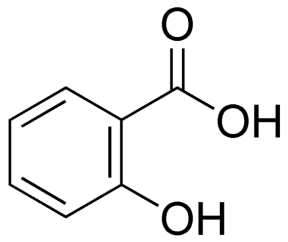
cis	**maleic acid**
trans	**fumaric acid**

Important aromatic carboxylic acids

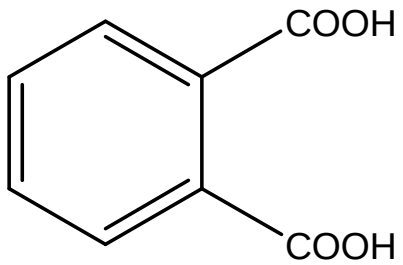
- **benzoic acid**
  (= benzene carboxylic acid)



- **salicylic acid**
  (= 2-hydroxybenzoic acid)



- **phtalic acid**
  (= benzene-1,2-dicarboxylic acid)



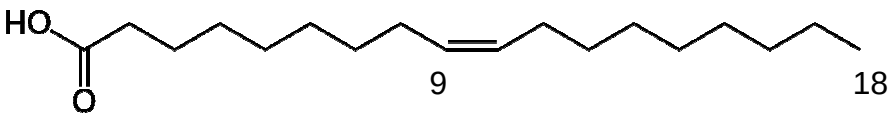
EXERCISE

- CH_3-COOH — acetic acid
- CH_3-COO^- — acetate
- CH_3-CO- — acetyl
- CH_3-CH_2-CH_2-COOH — butyric acid
- CH_3-CH_2-CH_2-COO^- — butyrate
- CH_3-CH_2-CH_2-CO- — butyryl

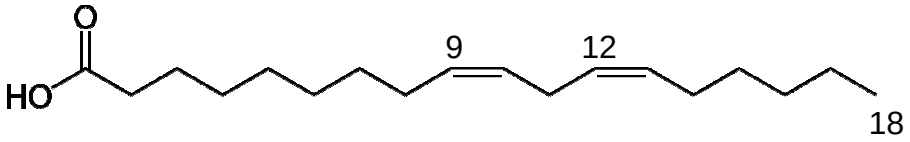
R-COOH	carboxylic acid
$R\text{-}COO^-$	carboxylate
R-CO-	acyl

EXERCISE

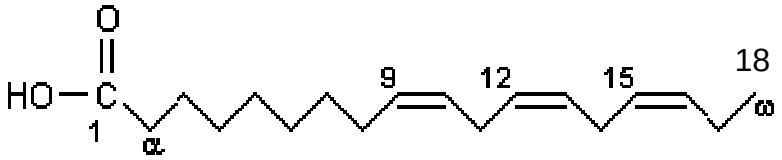
- CH_3-CHCl-COOH
- CH_3-CHBr-CH_2COOH
- CCl_3-COOH
- HO-CH_2-CH_2-COOH
- CH_3-CH(NH_2)-CH_2-CH_2-COOH
- CH_3-CH_2-CH(CH_3)-CH_2-CHCl-COOH
- HOOC-CH_2-CH_2-COOH
- $(COOH)_2$



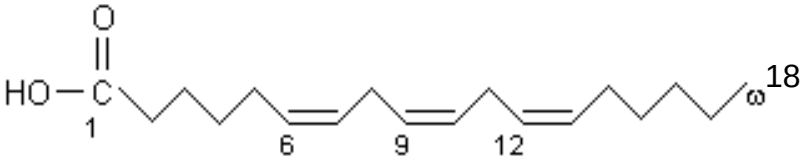
oleic acid



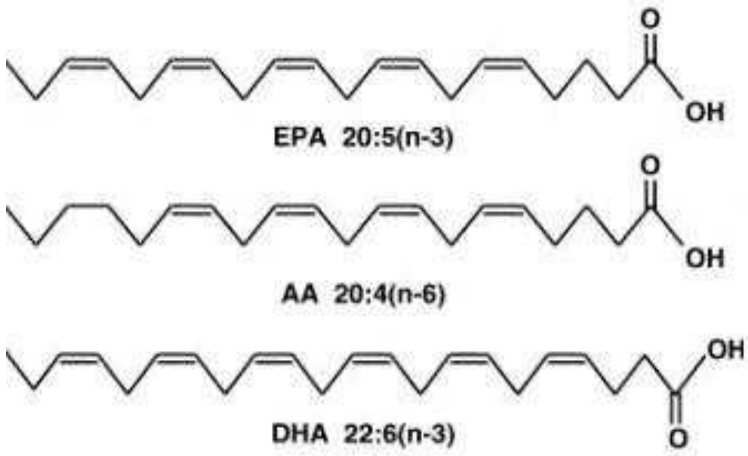
linoleic acid



alpha linolenic acid



gamma linolenic acid



eicosapentenoic acid

arachidonic acid

docosahexenoic acid