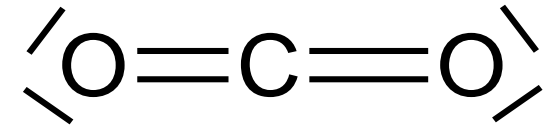


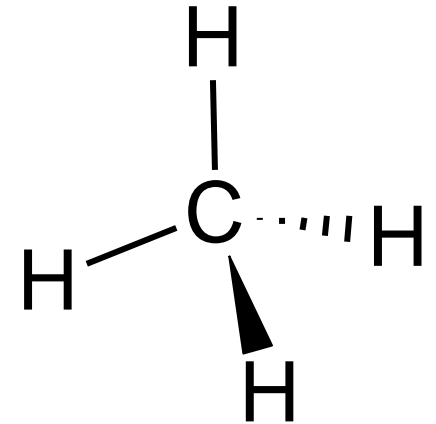
BIOCHEMISTRY OF BIOGAS **PRODUCTION**

What is biogas?

- Biogas is a mixture of **CO₂** and **CH₄**



- **CH₄ + 2 O₂ → CO₂ + 2 H₂O + Energy**



- Only CH₄, is suitable, biogas should contain at least 50%
- Biogas is produced of organic products using anaerobic conditions and several microorganisms

From what is biogas produced?

- **In nature:**
 - Wetlands
 - Rice fields
 - Intestines of animals
 - Manures
- **Biogas can also be produced of organic products like:**
 - Waste from agro-industrial units
 - Energy crops (corn, sorghum)
 - Effluent from wastewater treatment
 - Decomposition of organic waste fraction

The production contains 4 steps:

- | | | |
|-----------|-----------------------|----------------------|
| 1. | Hydrolysis | Hydrolases |
| 2. | Acidogenesis | Acidogenic bacteria |
| 3. | Acetogenesis | Acetogenic bacteria |
| 4. | Methanogenesis | Methanogenic Archaea |

Archaea

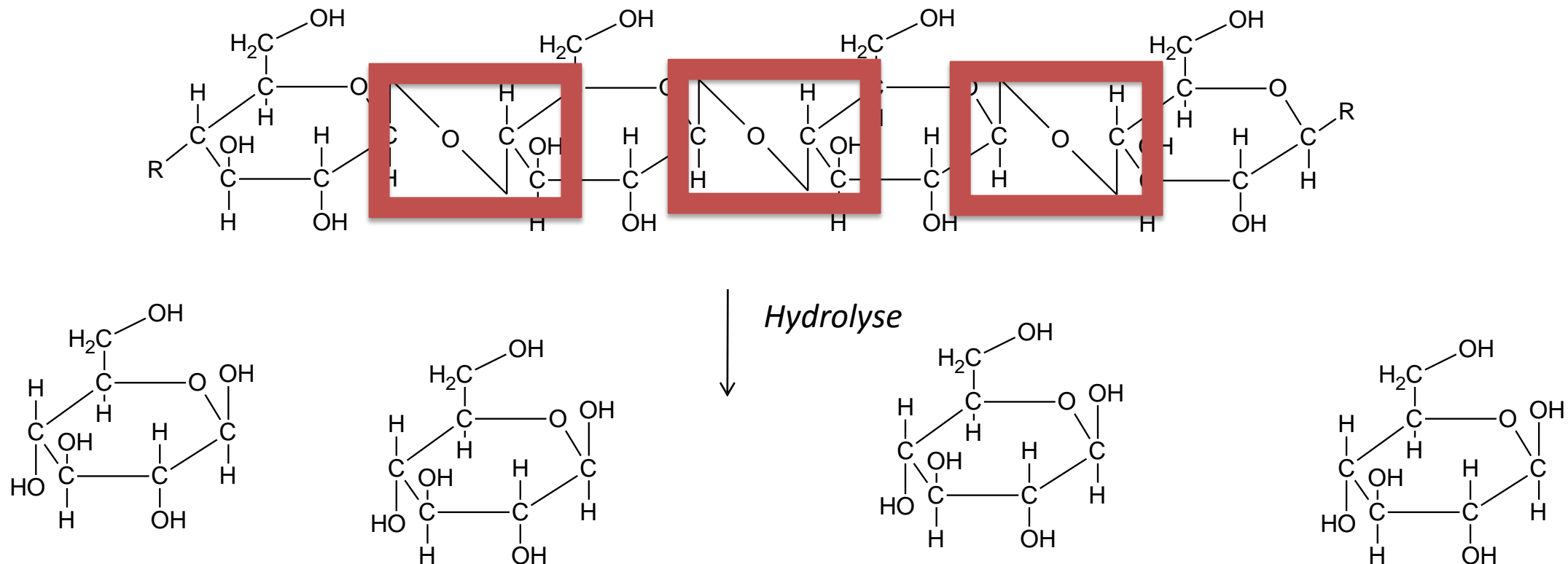
- Constructed like procaryotes, but aren't bacteria!!!
- Anerobic
- Occur in extreme conditions e.g. geyser

Methanic archaea

- Swamps
- Sludge facilities
- Animal digestive organs

Step 1: Hydrolysis

- Macromolecules (carbohydrates, fat, proteins) are decomposed by enzymes, which are hydrolases.



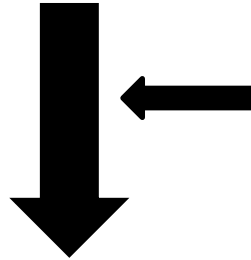
Step 2: Acidogenesis

Small organic
molecules to
carbonic acids

**Oligomers
(Soluble organic
molecules)
sugars, amino-acids, fatty
acids**

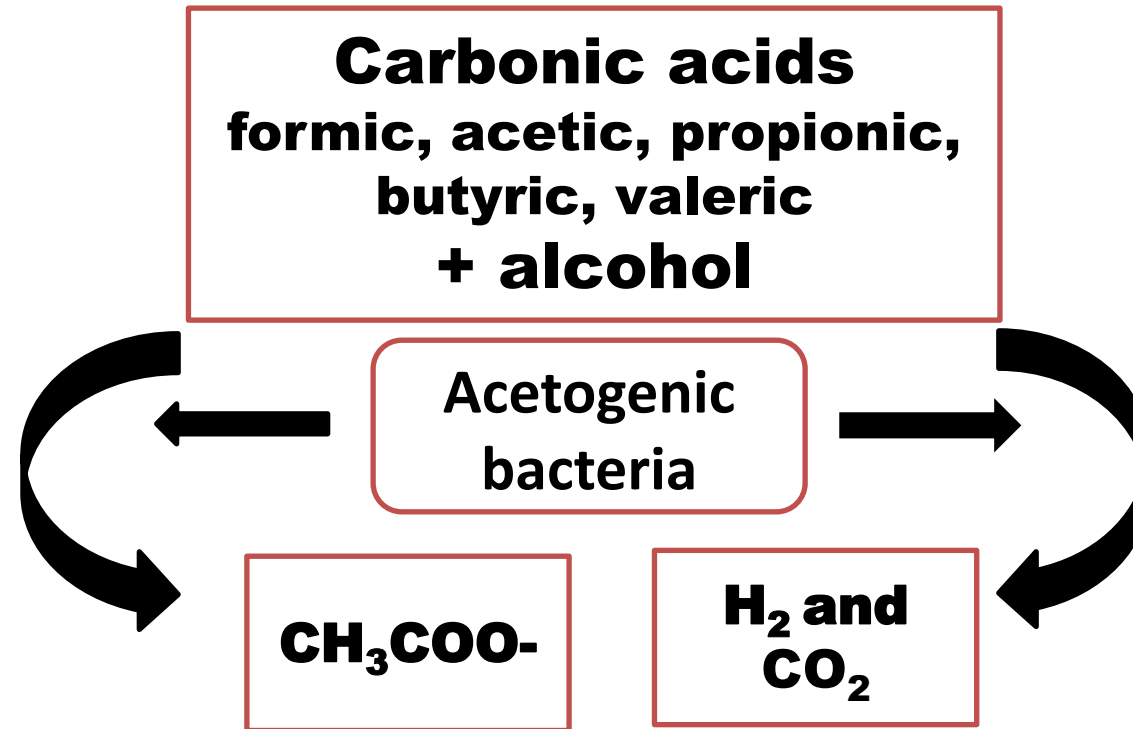
**Acidogenic
bacteria**

**Volatile fatty acids
(Carbonic acids:
formic, acetic, propionic
butyric, valeric)
+ alcohol**



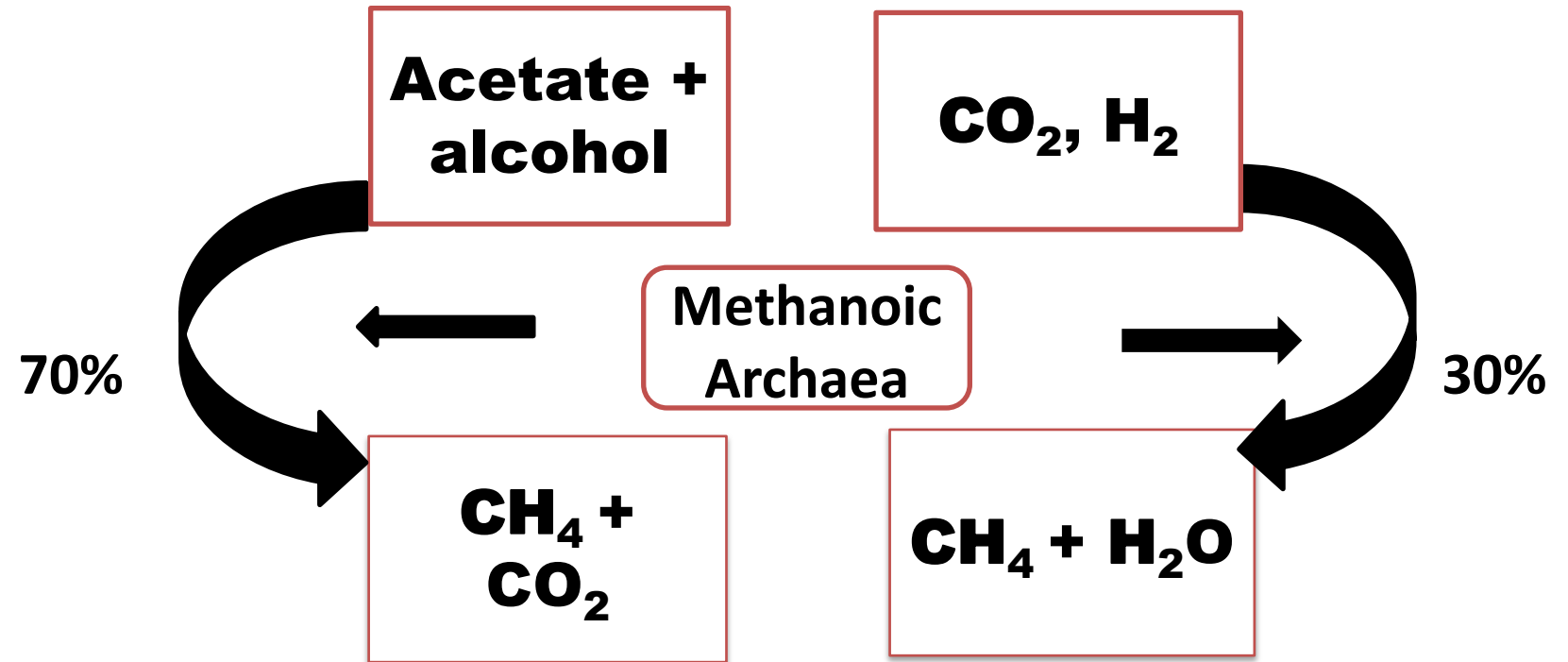
Step 3: Acetogenesis

conversion to
acetate and CO₂



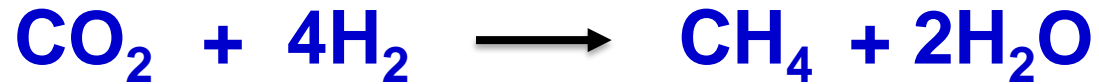
Step 4: Methanogenesis

final conversion
to CH_4



Methanogenesis:

1) methane is made of formate (HCOO-) or CO₂:



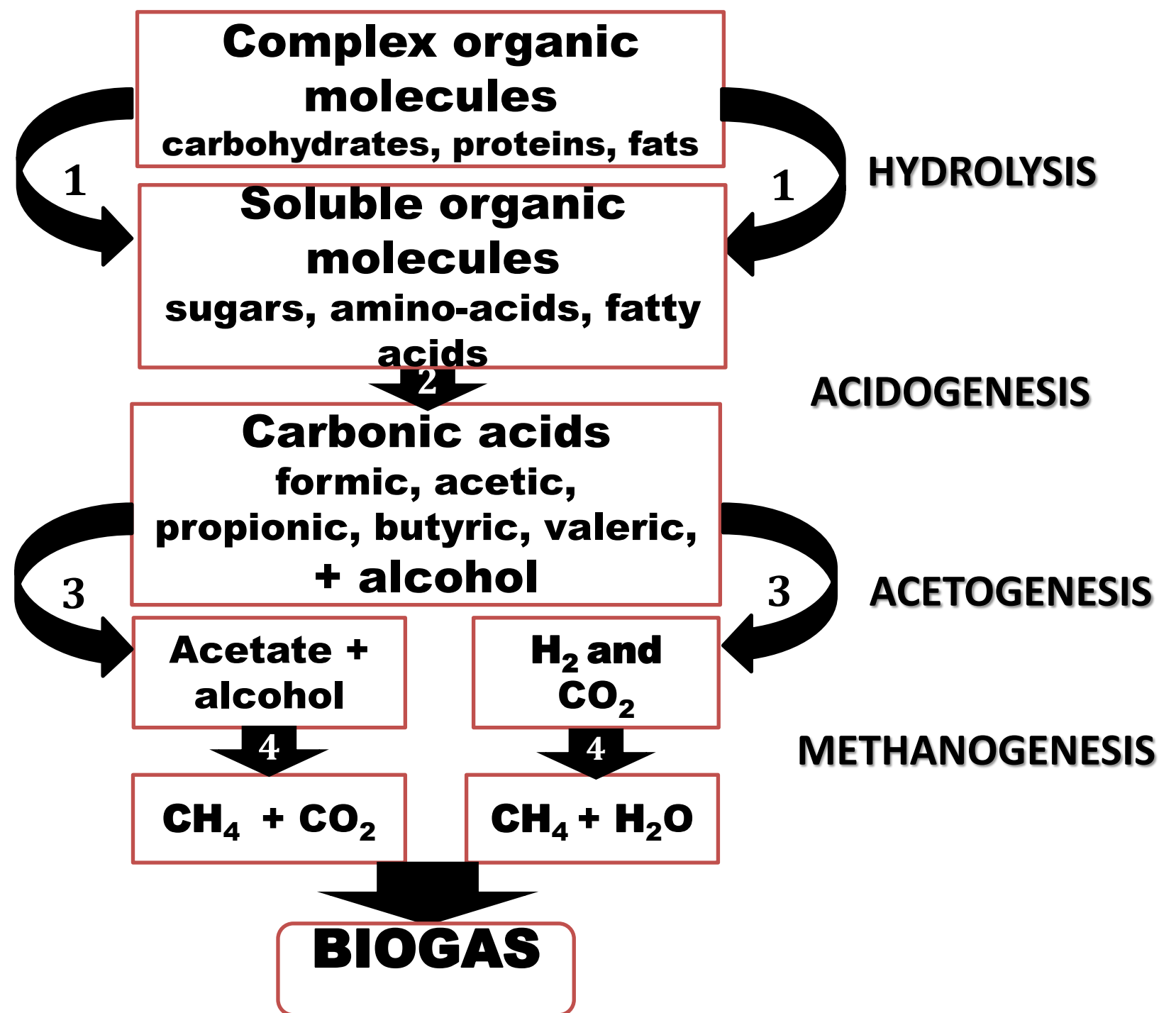
2) methane is made of acetate(CH₃COO-) witch is the salt of acetic acid:



3) methane is made of alcohols like methanol:



Summary of the steps



THANK YOU FOR YOUR ATTENTION!!!