



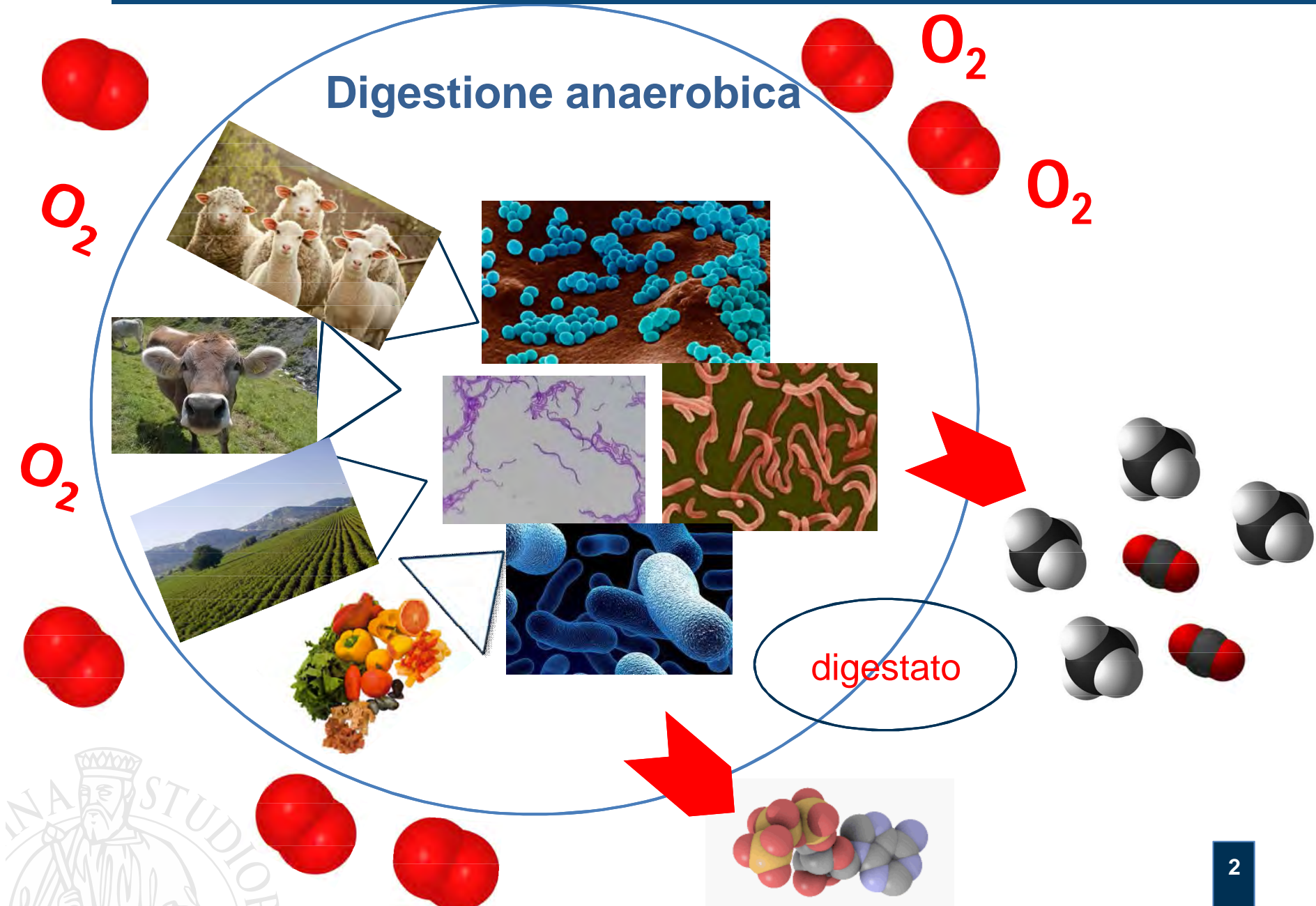
UNIVERSITÀ  
DEGLI STUDI  
FIRENZE

# **Aspetti chimici del processo di digestione anaerobica**

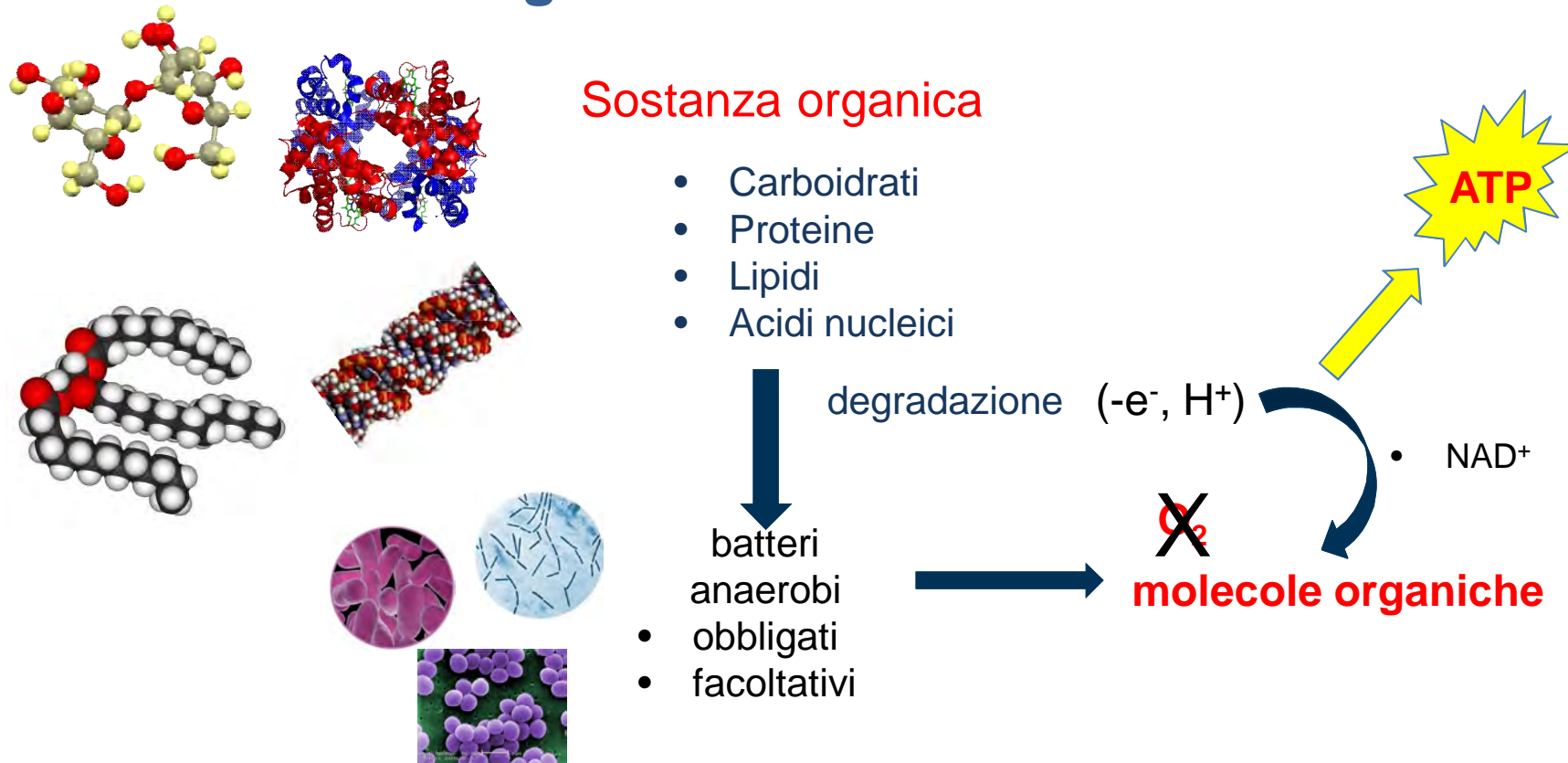
**Paola Paoli**

**Digestione Anaerobica da BIOrifiuti: fra ricerca,  
sviluppo industriale e impatti ambientali**

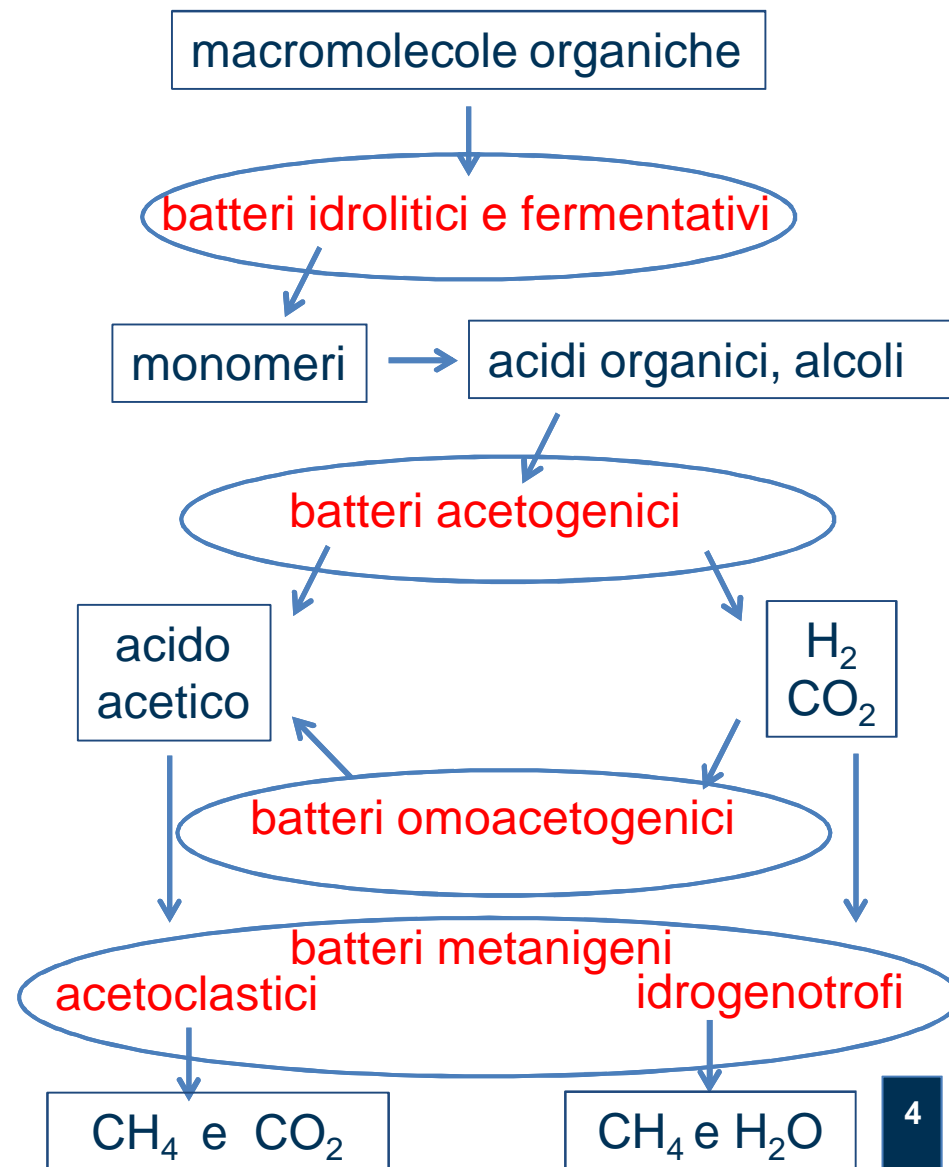
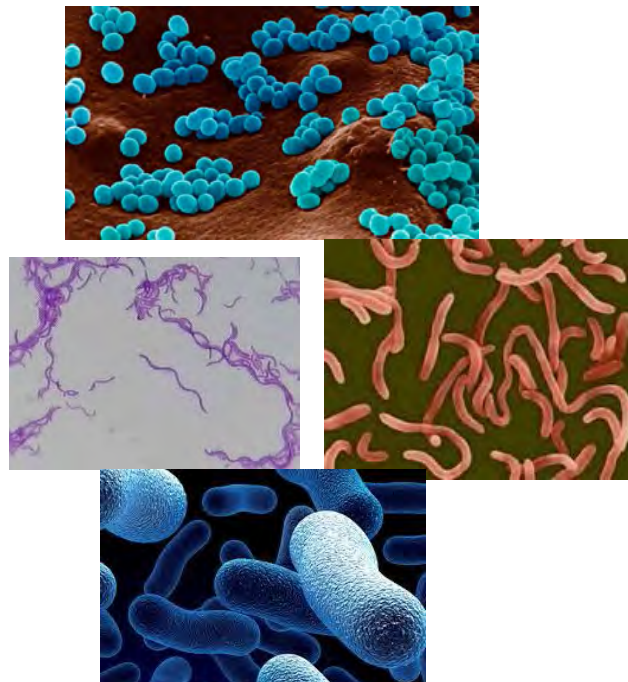
**Firenze, 20 marzo 2015**



## Digestione anaerobica

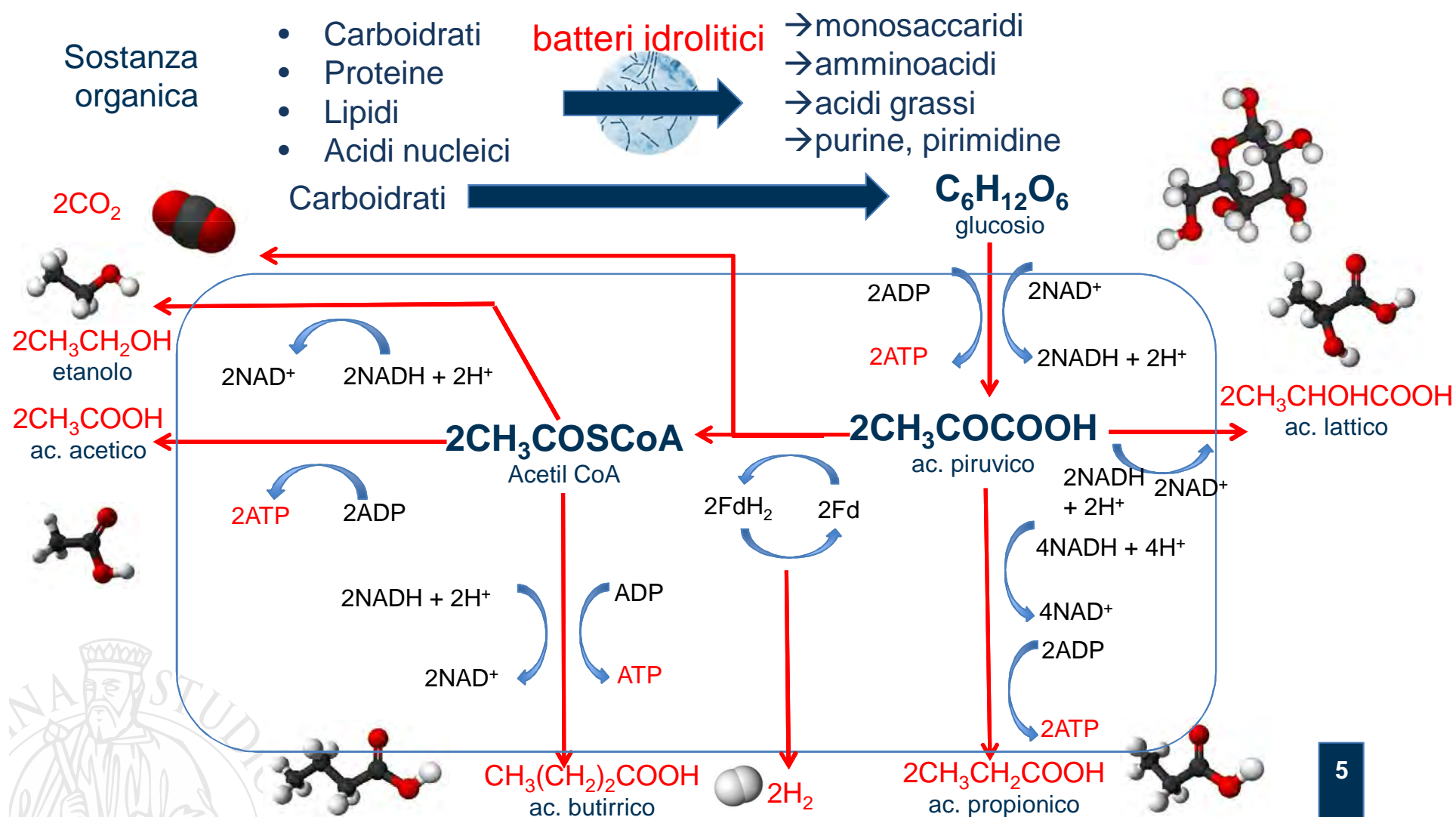


## Digestione anaerobica

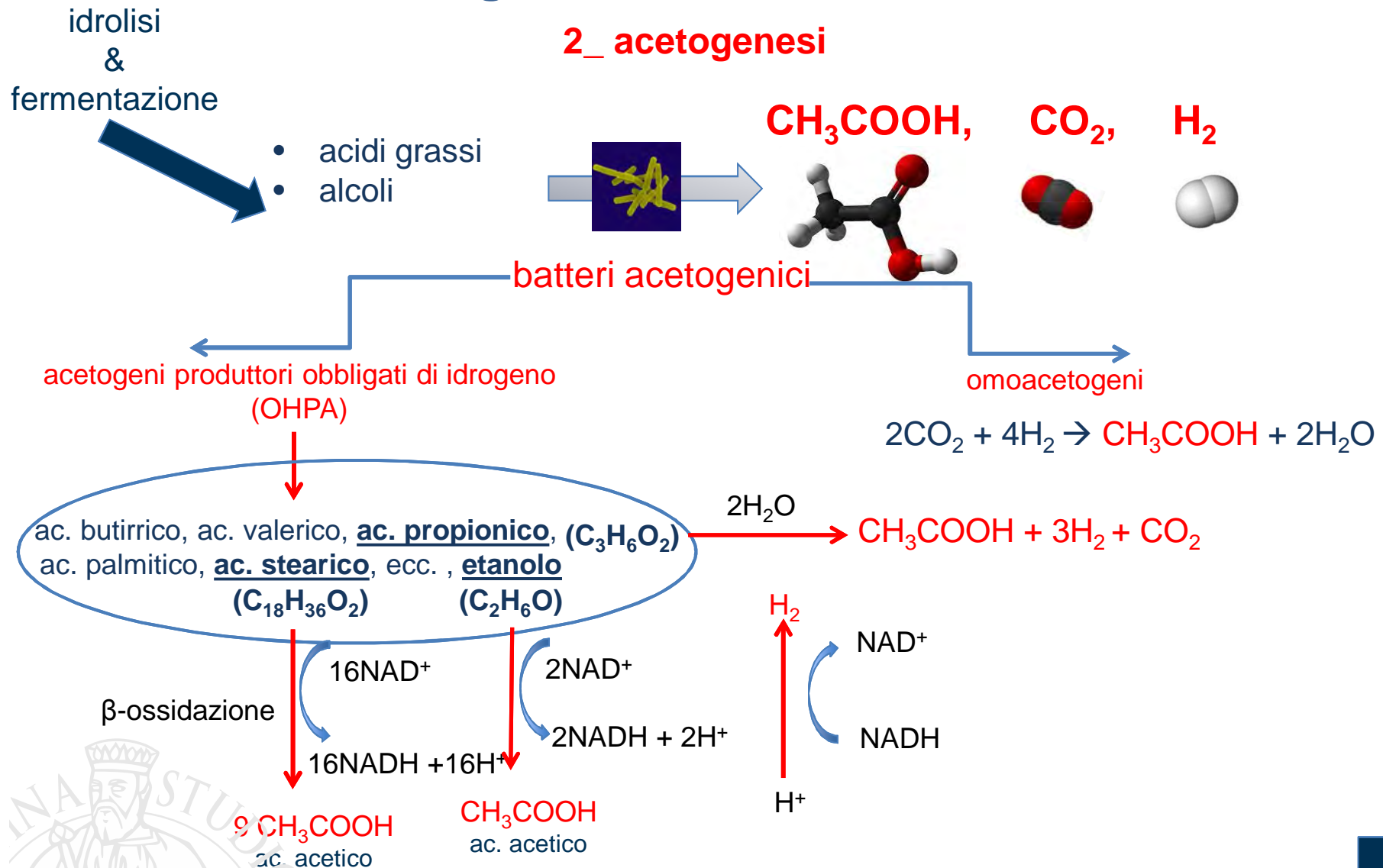


## Digestione anaerobica

## 1\_ idrolisi & fermentazione



## Digestione anaerobica

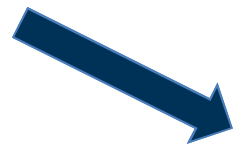




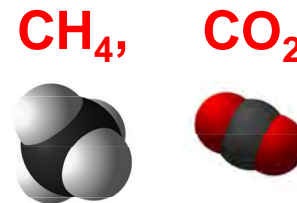
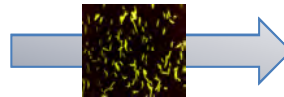
# Digestione anaerobica

## 3\_ metanogenesi

acetogenesi



- acido acetico
- $\text{CO}_2$
- $\text{H}_2$



batteri metanigeni

acetoclastici

idrogenotrofi



cobalammina  
(vitamina B12)

(acido tetraidrofolico)

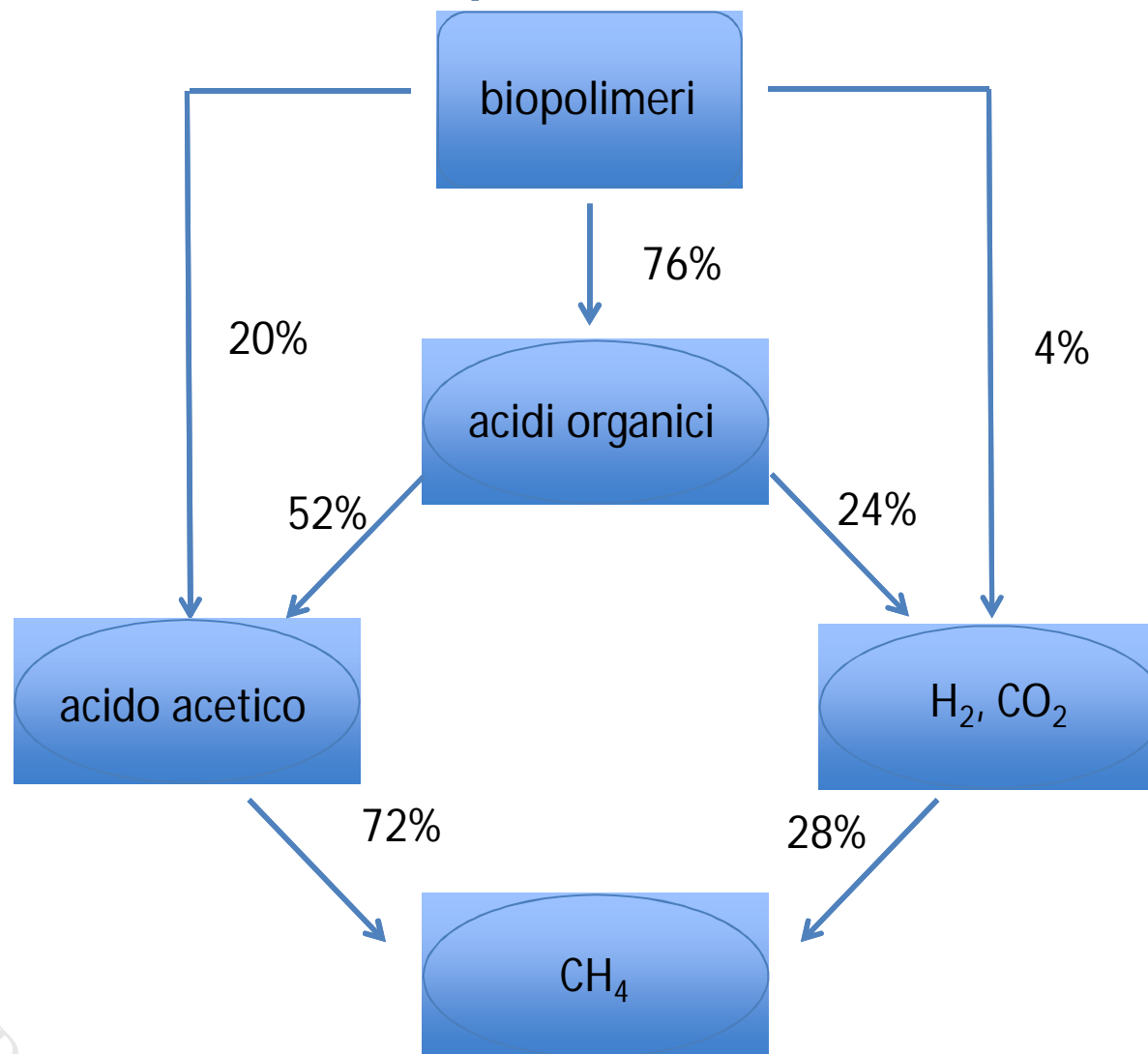
metilcobalammina  
( $\text{CH}_3$ -B12)



$\text{CH}_4$

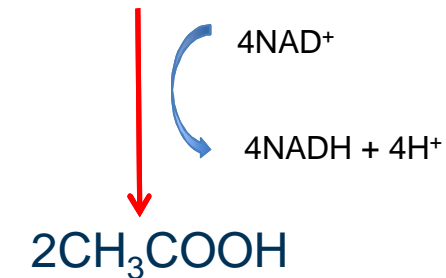
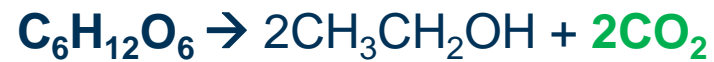
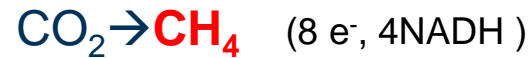


## Schema quantitativo conversione

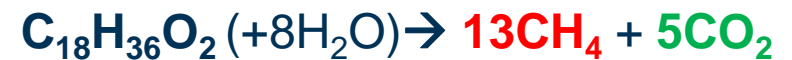
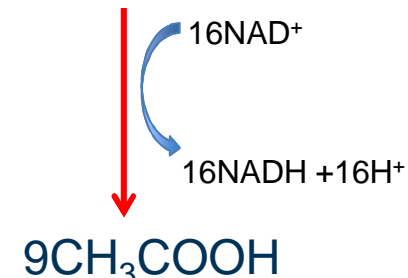
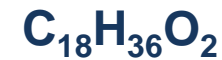




## Composizione del bio\_gas



50%  $\text{CH}_4$ ; 50%  $\text{CO}_2$



72%  $\text{CH}_4$ ; 28%  $\text{CO}_2$



## Produzione di CH<sub>4</sub>

### respirazione



180kg glucosio ↔ 192kg di ossigeno

### digestione anaerobica



180kg glucosio → 48kg di metano

0,25kg di metano/kg di COD



a 0°C, P=1atm → 0,35m<sup>3</sup> di CH<sub>4</sub>/kg di COD

MM glucosio: 180 g/mol  
MM ossigeno: 32 g/mol  
MM metano: 16 g/mol  
1mol → 22,414 dm<sup>3</sup> in c.s.



## Principali parametri ambientali

- **temperatura**      psicrofili ( $T < 20^{\circ}\text{C}$ )  
                         mesofili ( $20^{\circ} < T < 40^{\circ}$ , ideale  $35-37^{\circ}\text{C}$ )  
                         termofili ( $T > 40^{\circ}$ , ideale  $50-55^{\circ}\text{C}$ )
- **pH**                       $6 < \text{pH} < 8$
- **acidi grassi volatili (VFA)**
- **substrato**
- **agenti inibenti**
- **pezzatura ed umidità del materiale**





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