

DECOMPOSITION AND METHANE PRODUCTION IN ANAEROBIC ENVIRONMENTS:

**A case study in a
methanogenic bioreactor**



MBL



EMILY GEOGHEGAN

MENTORS:

ZOE CARDON

JOE VALLINO

Can we make microbes make more methane?

MBL



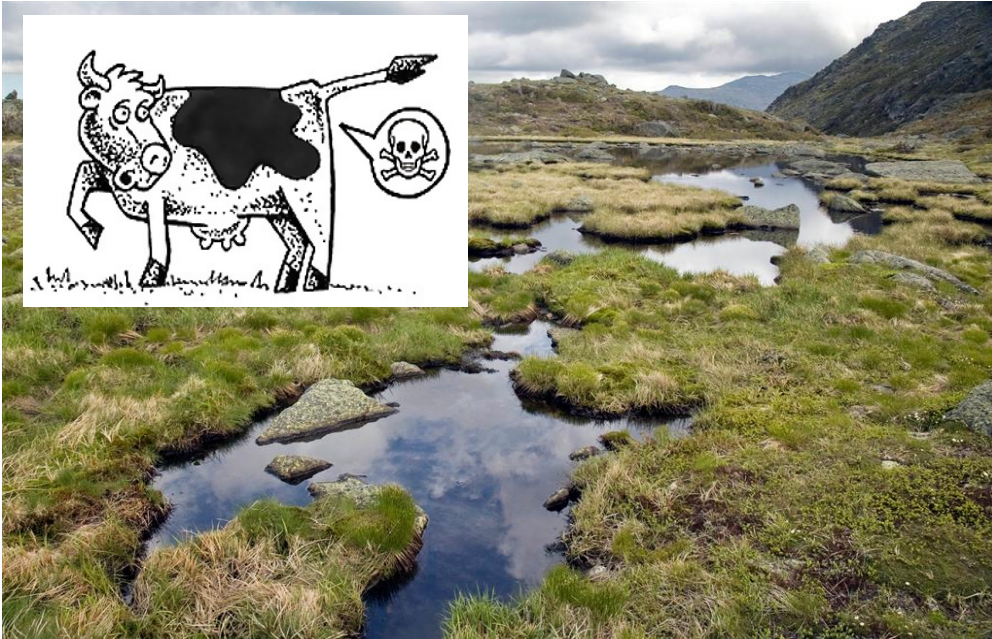
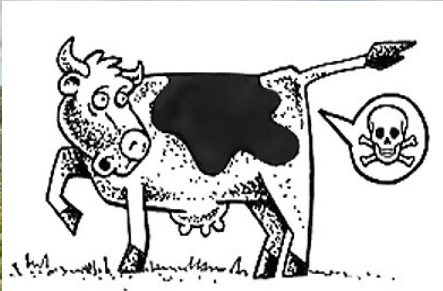
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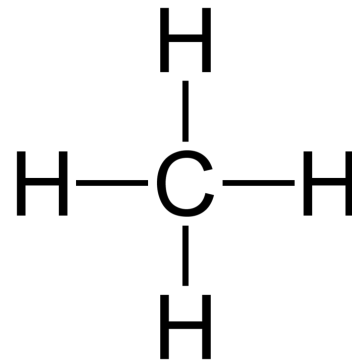
JOE VALLINO

METHANE

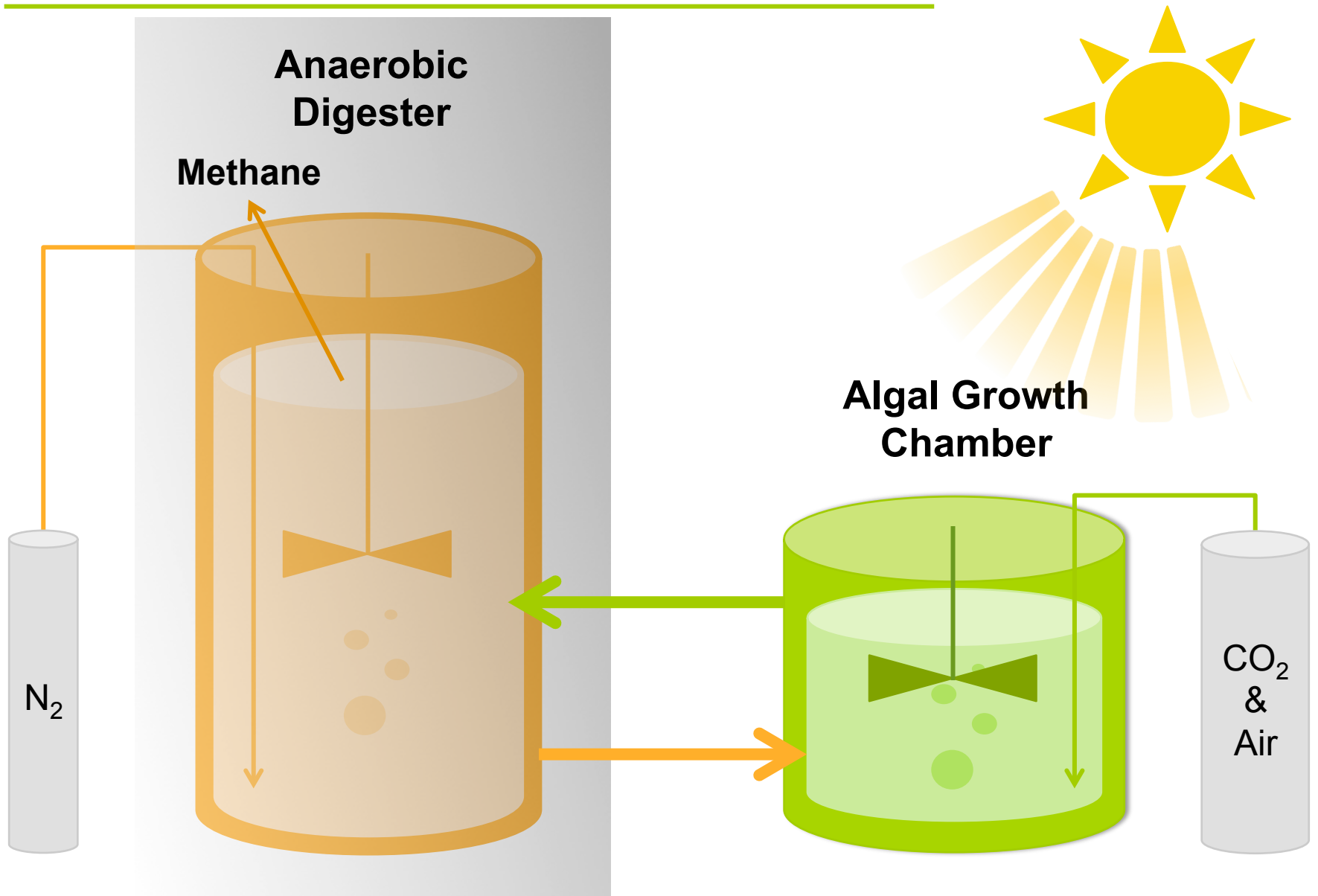


**GREENHOUSE
GAS**

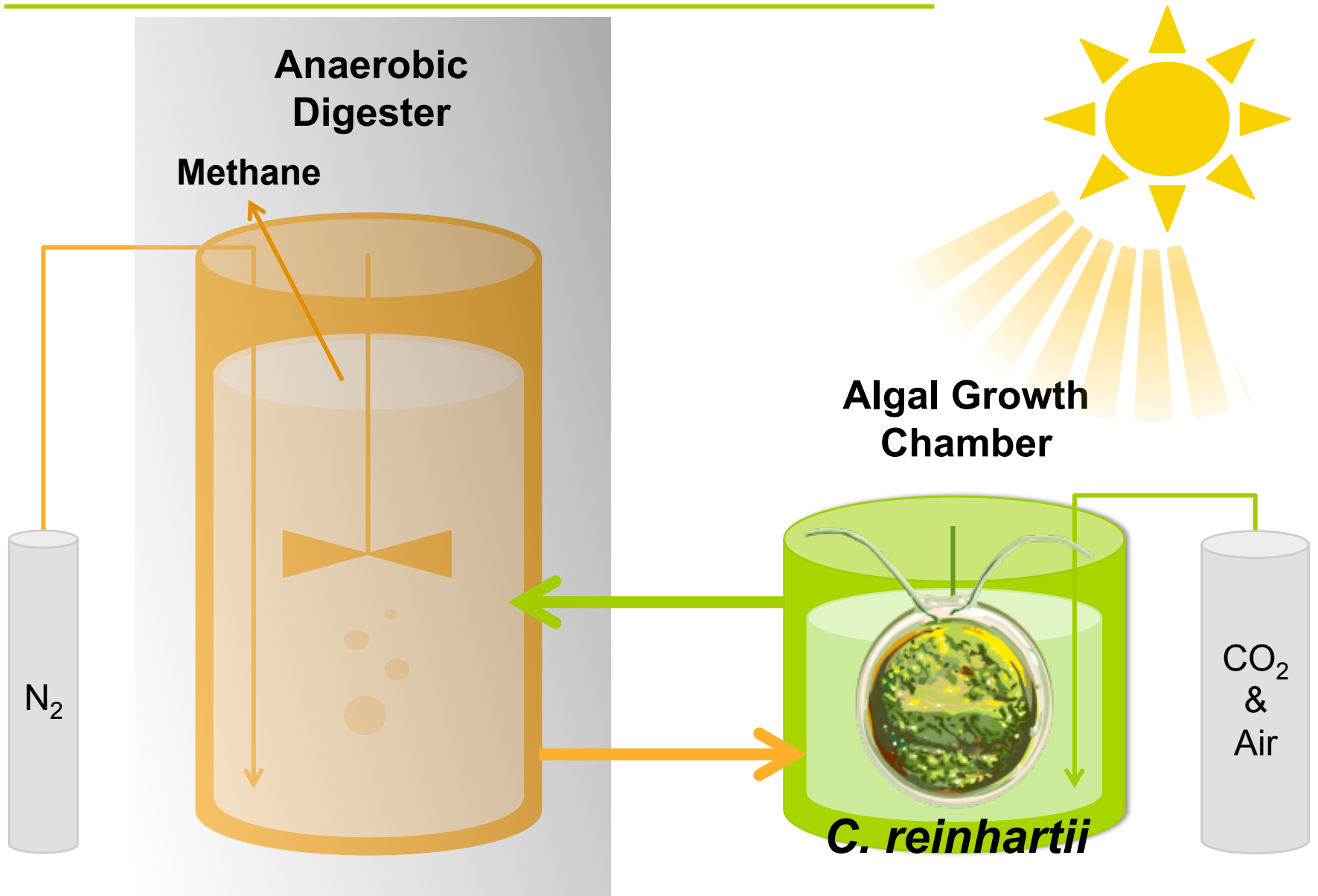
BIOFUELS



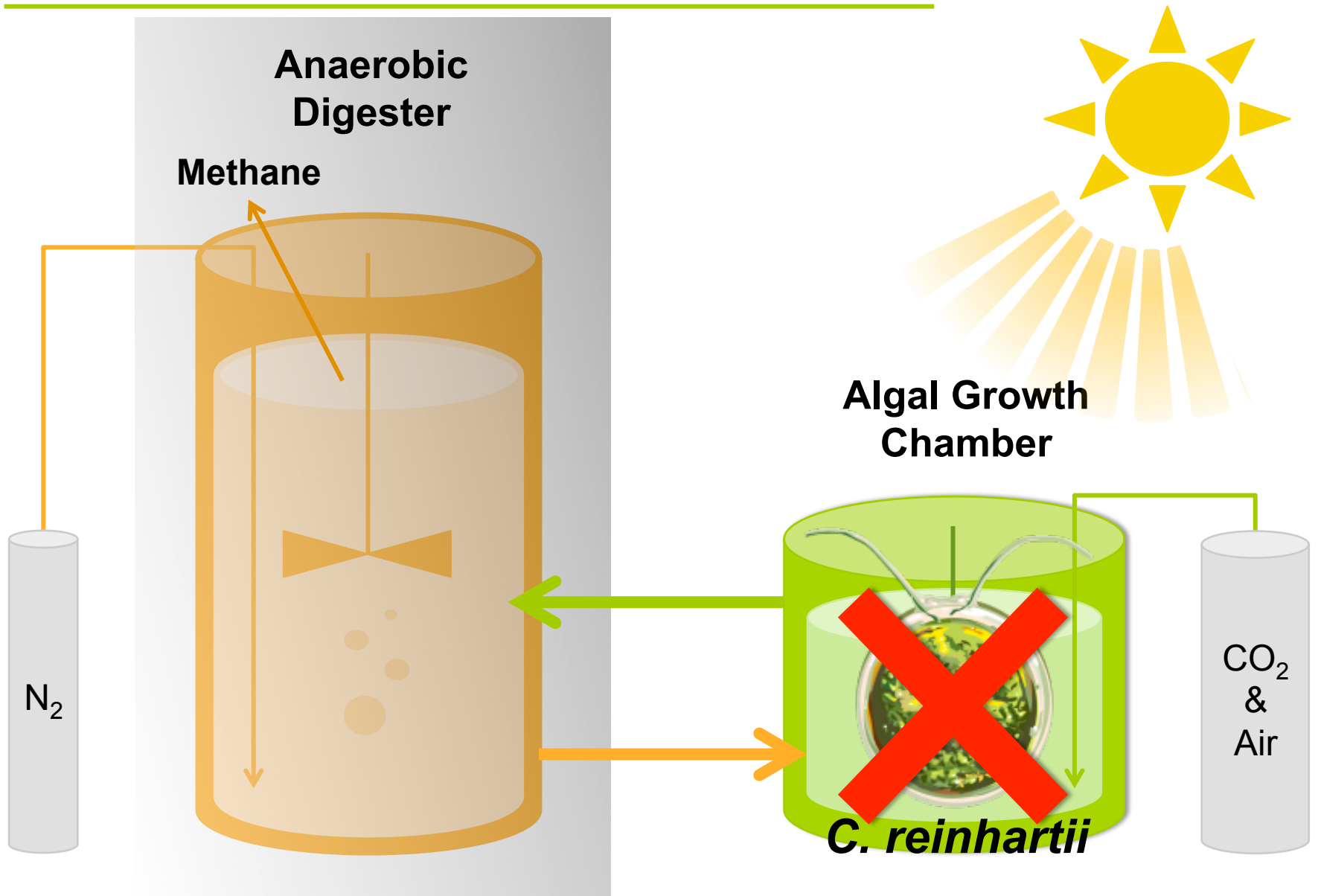
A2M BIOREACTOR



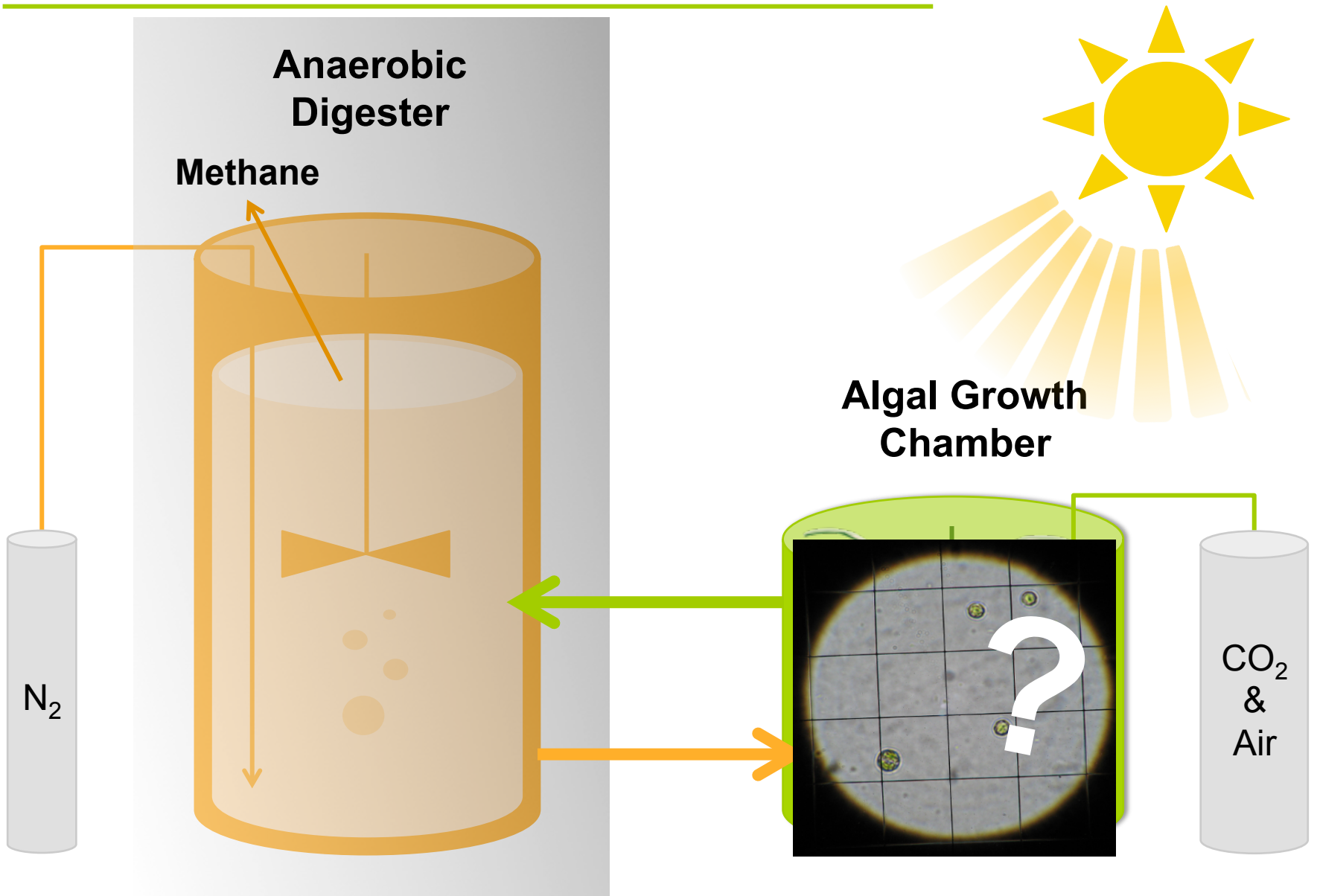
A2M BIOREACTOR



A2M BIOREACTOR

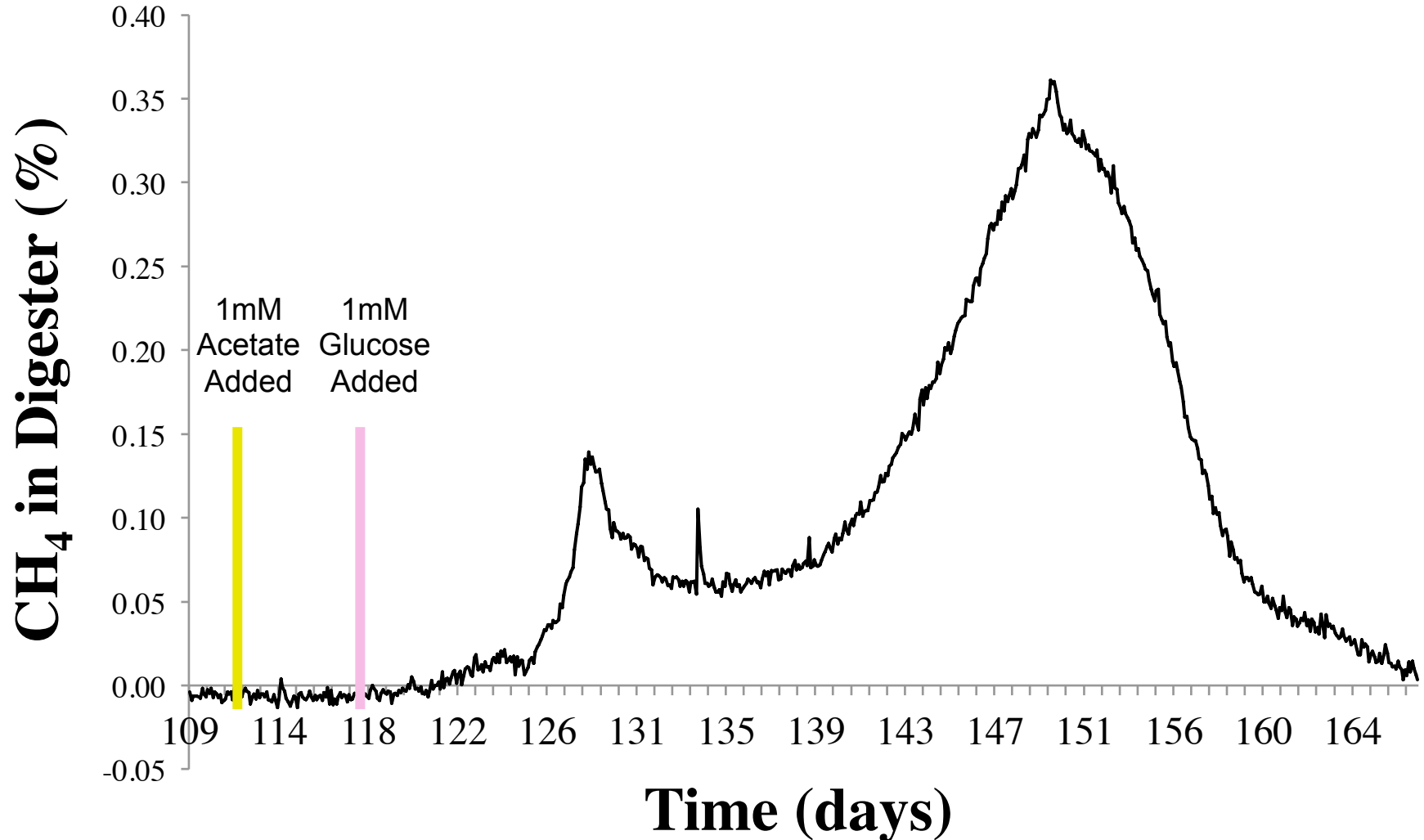


A2M BIOREACTOR



ACETATE + GLUCOSE = METHANE INCREASE

Digester CH₄ over time



GOALS

What affects methane production?



- **H1:** glucose stimulates decomposition and methane production (priming)
- **H2:** acetate stimulates methane production (direct)
- **H3:** autoclaving stimulates decomposition and methane production

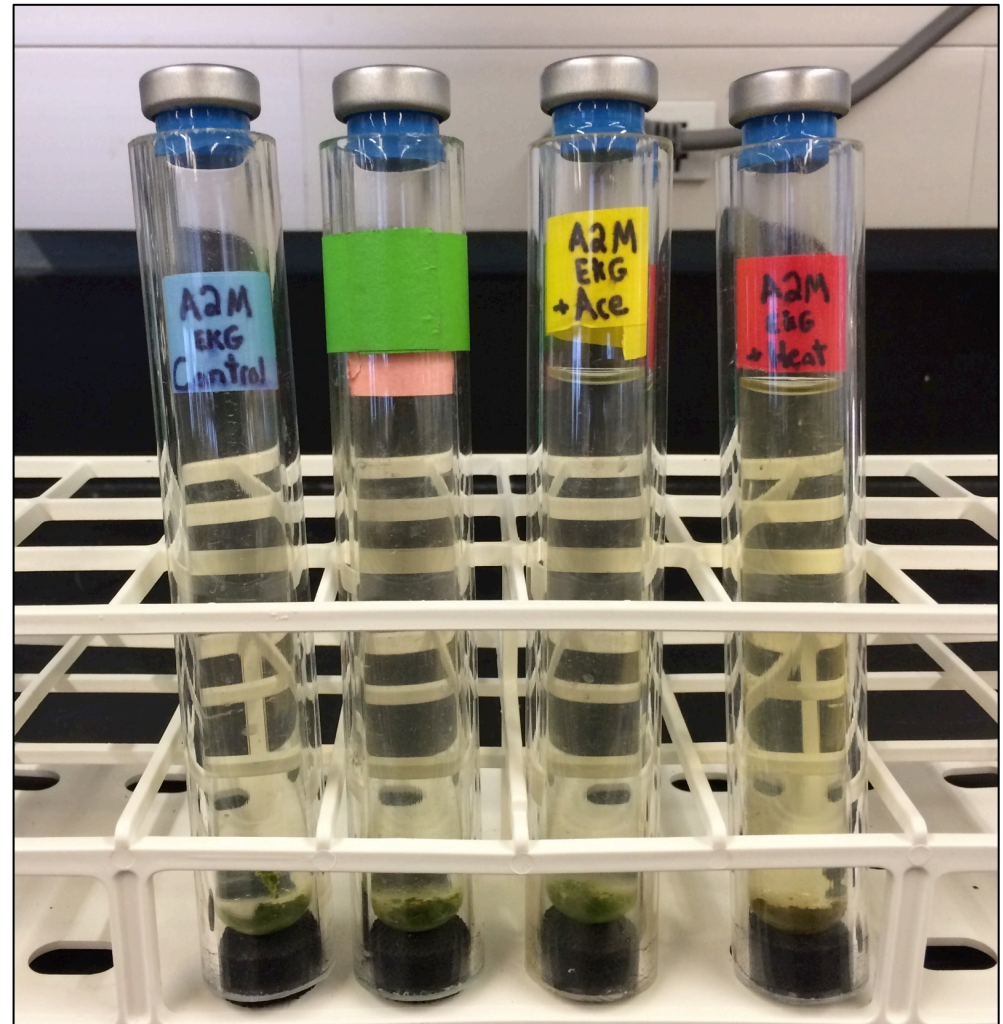
TREATMENTS

1 CONTROL

2 GLUCOSE
(100 μ M in 20mL)

3 ACETATE
(100 μ M in 20mL)

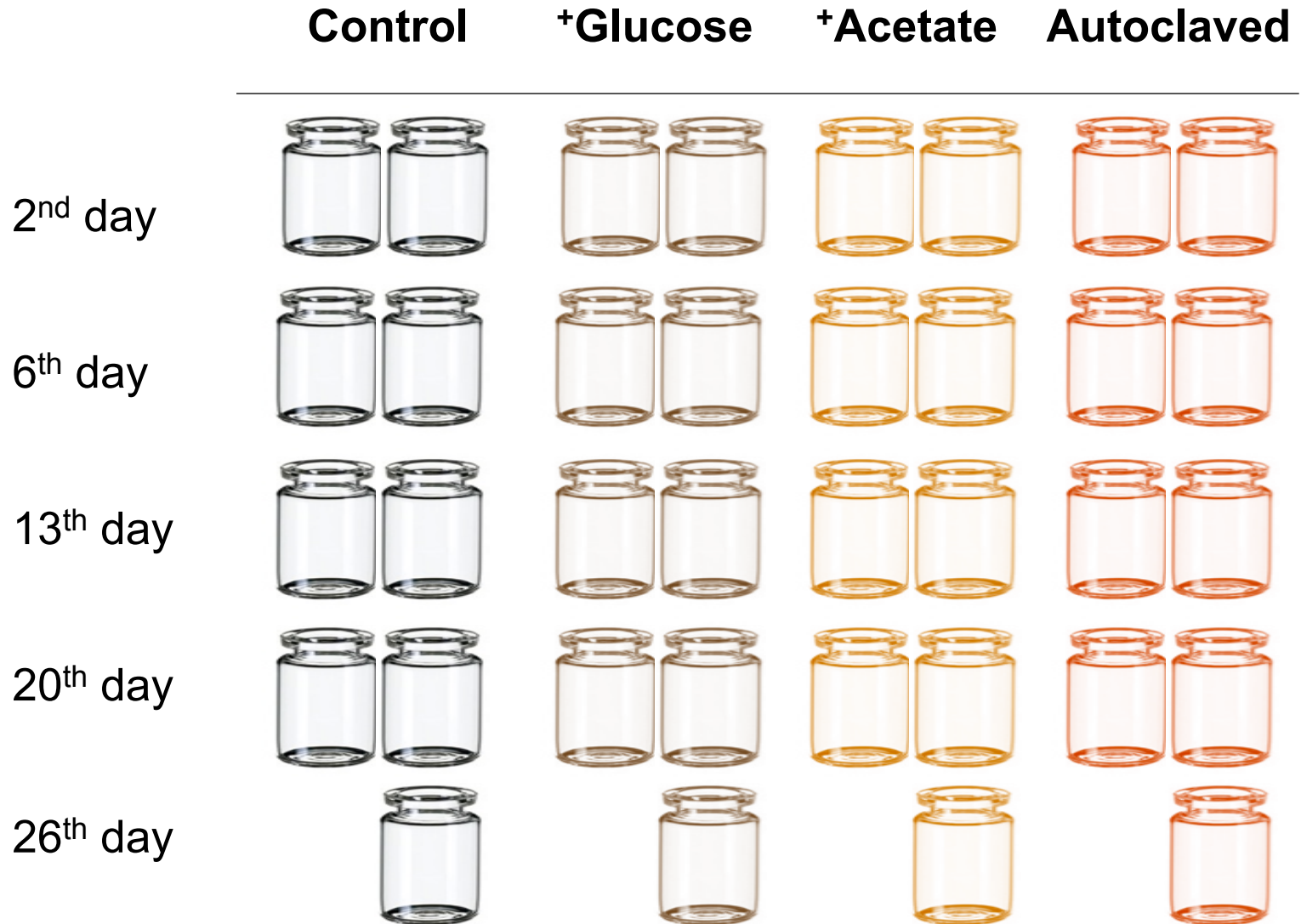
**4 AUTOCLAVE
PRETREATMENT**
(heat + pressure)





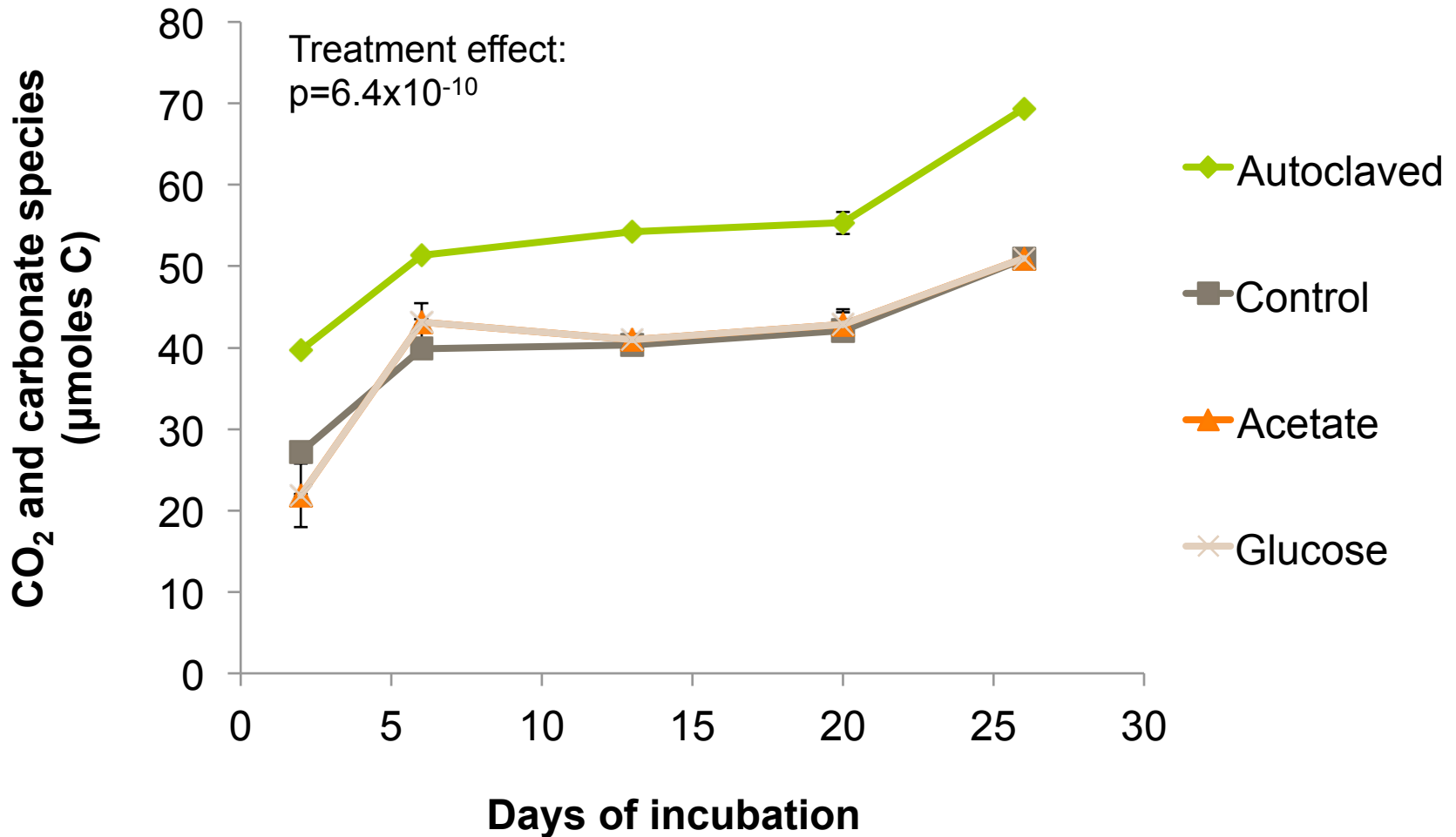
INCUBATIONS

Destructive Harvest



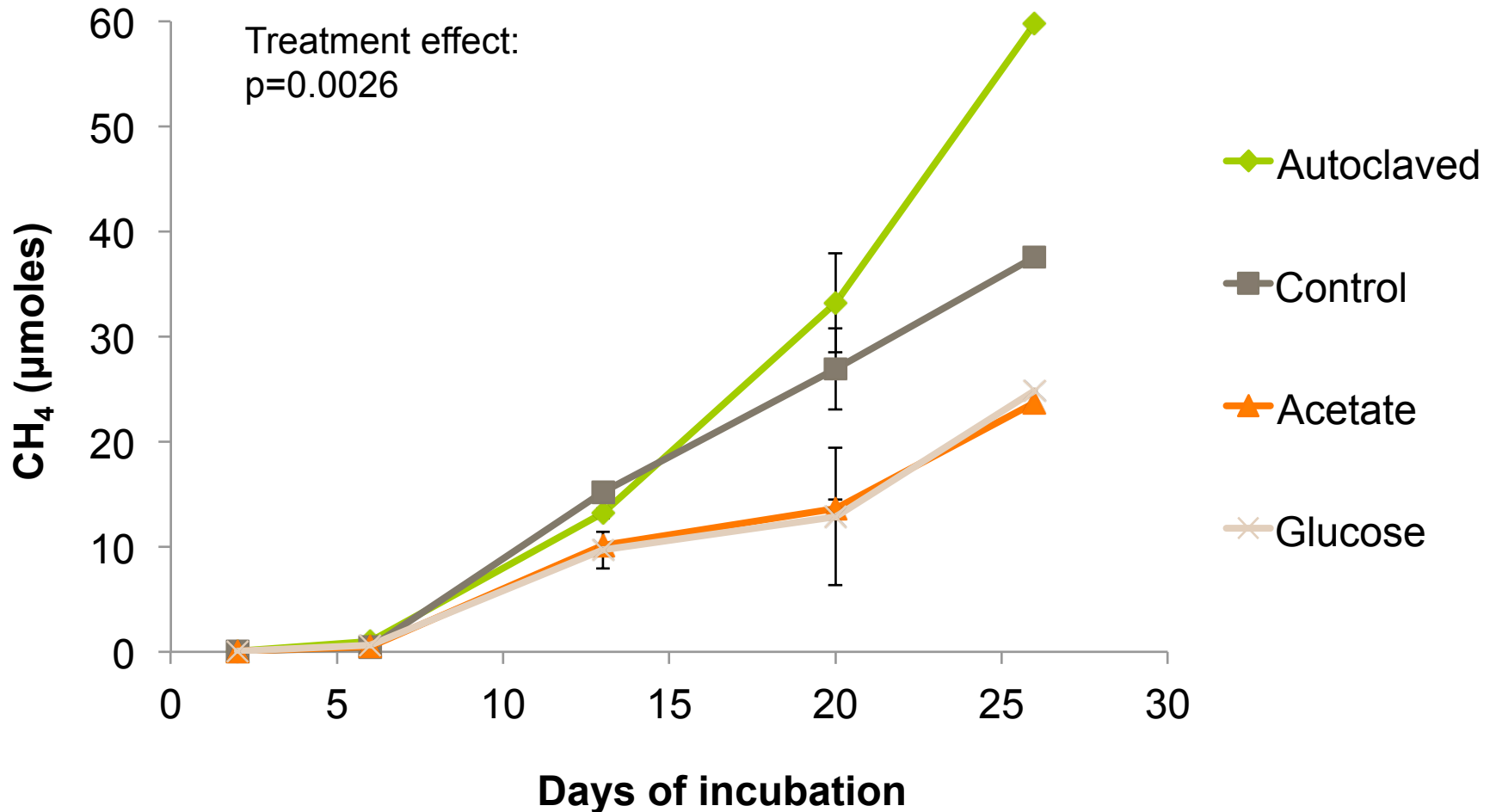
RESULTS

CO₂ production over time

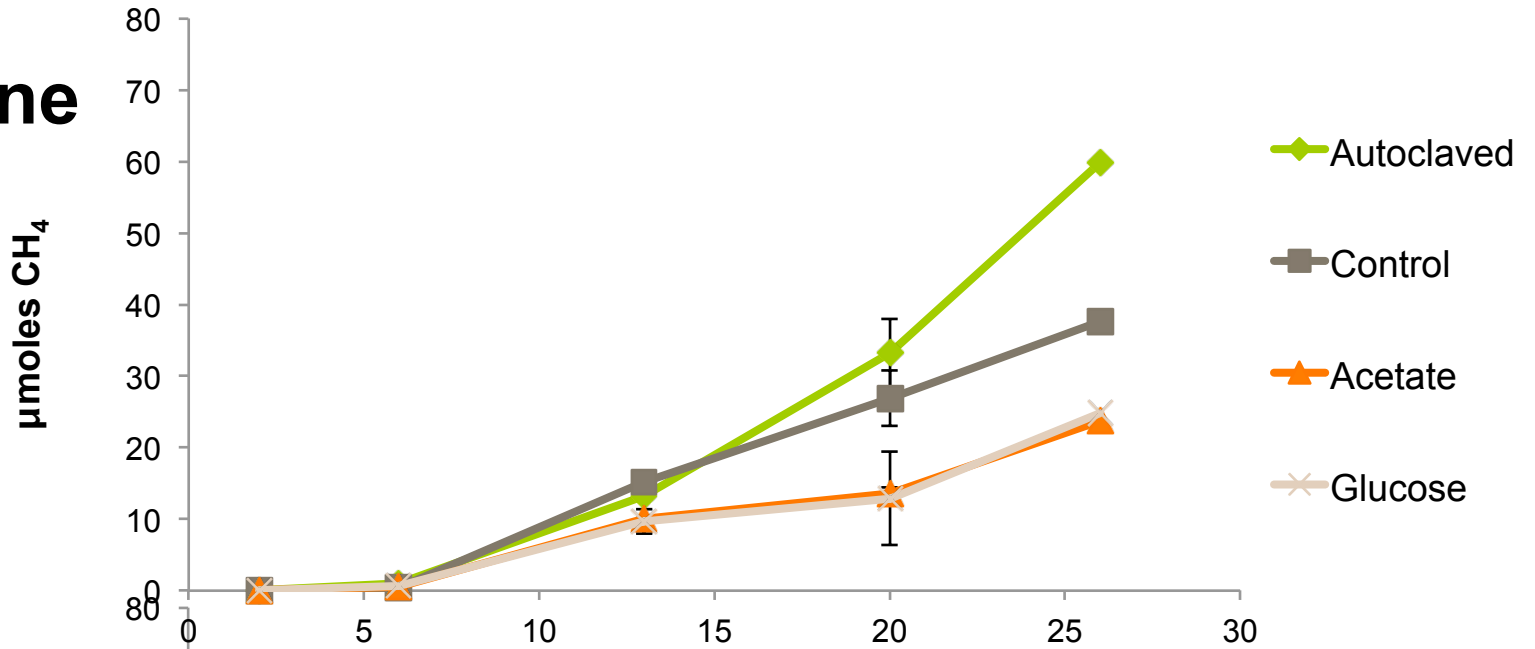


RESULTS

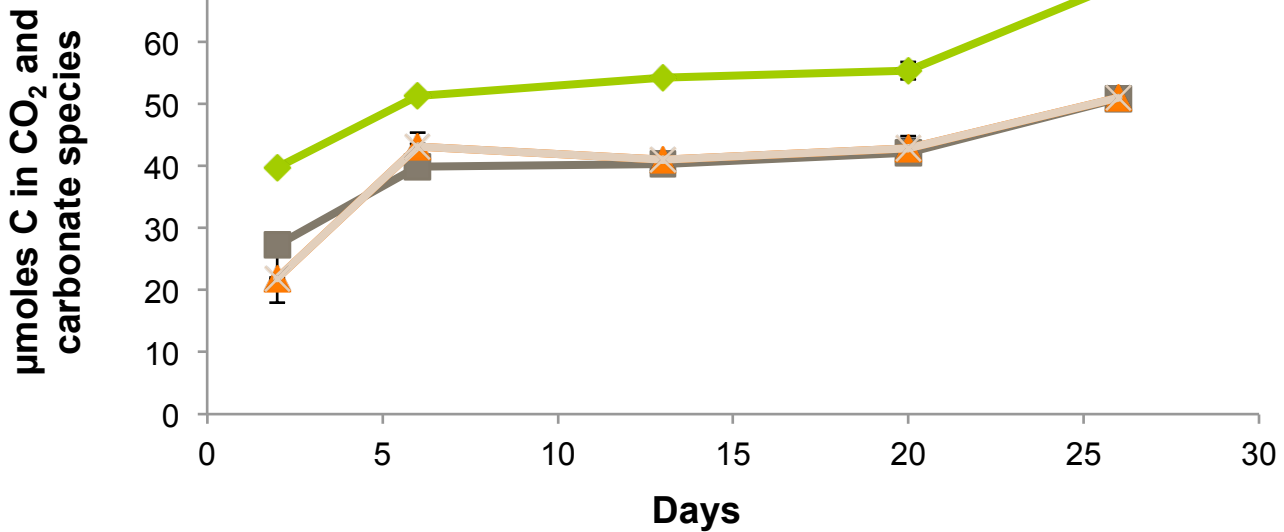
Methane (CH₄) production over time



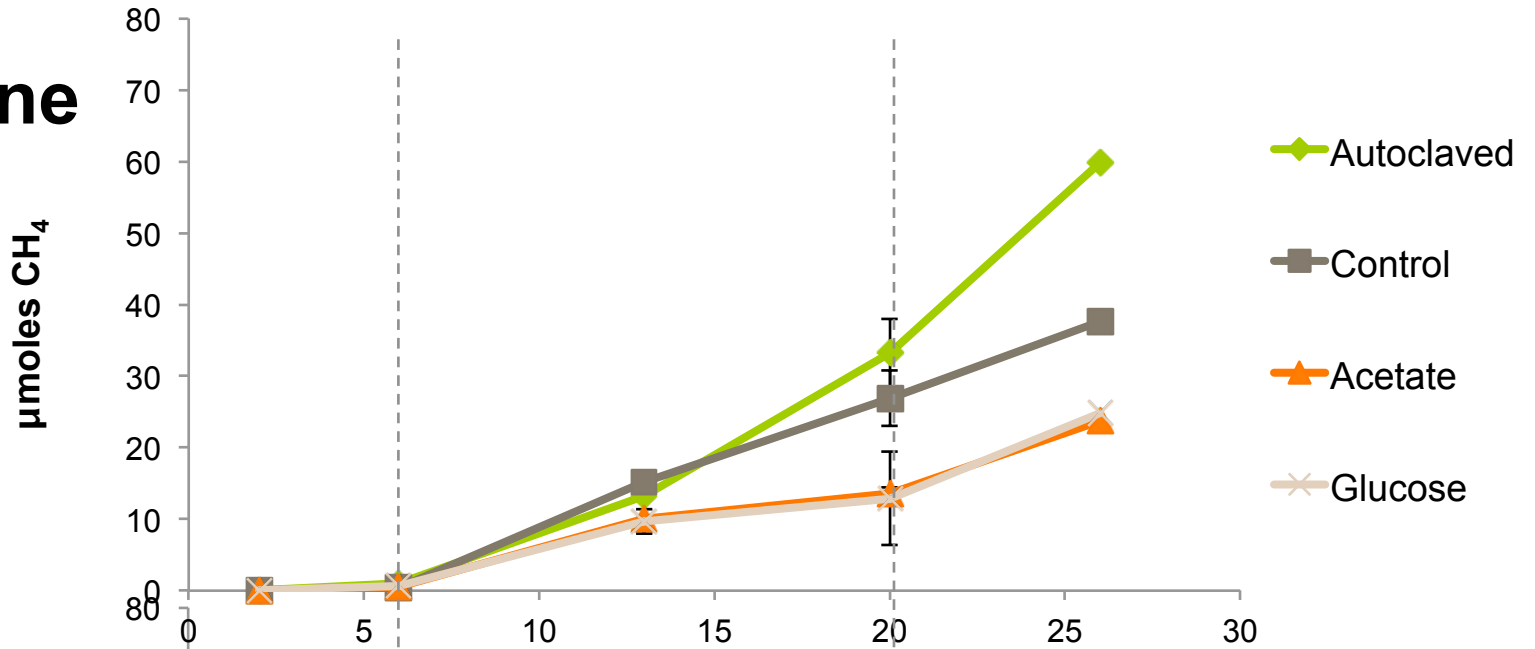
Methane



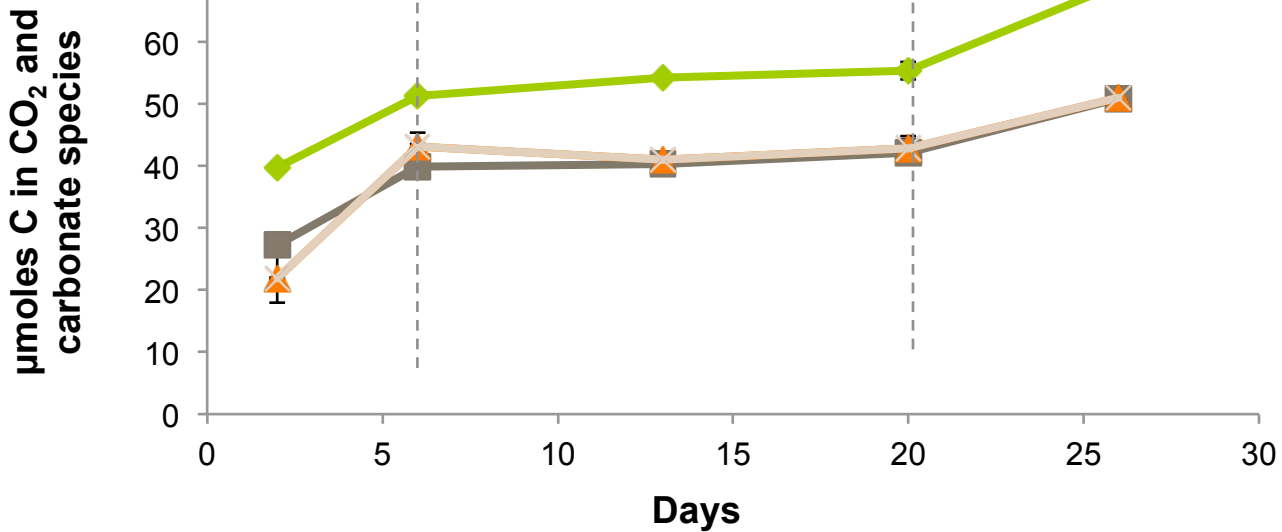
CO₂



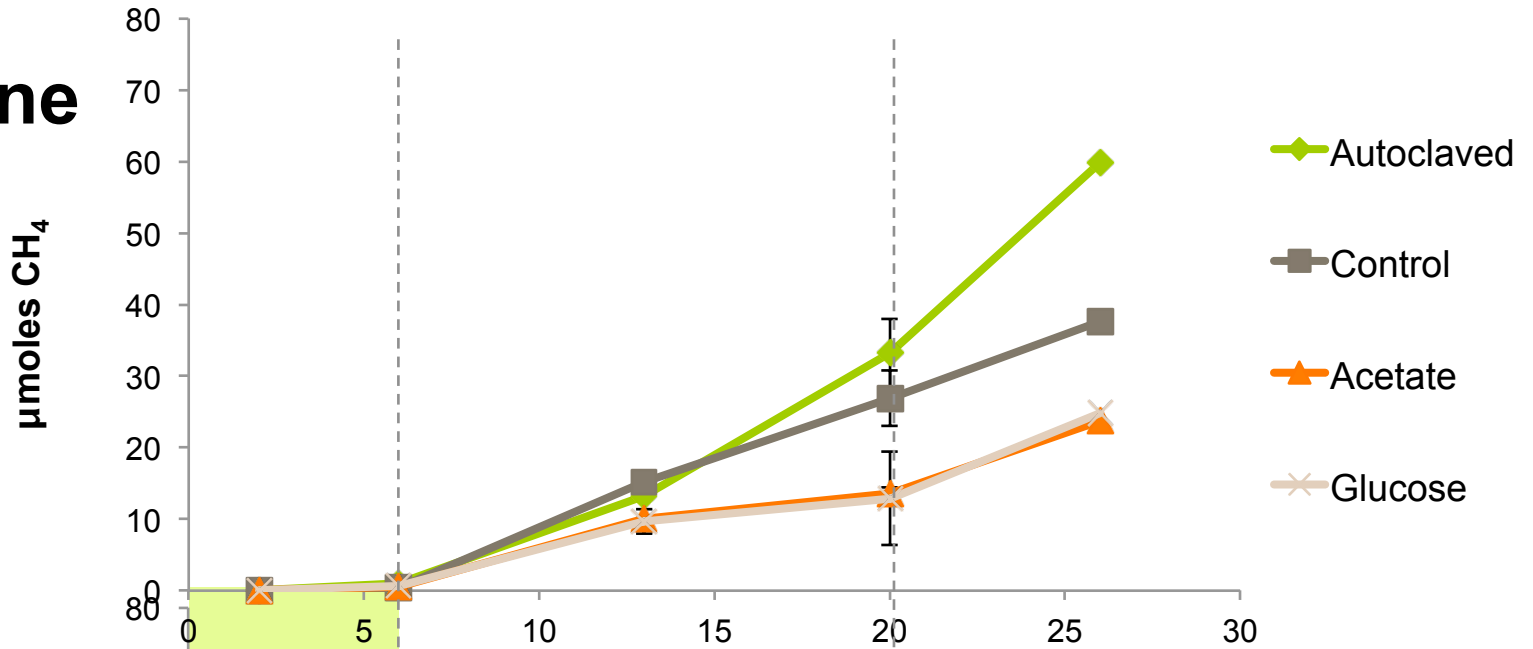
Methane



CO₂

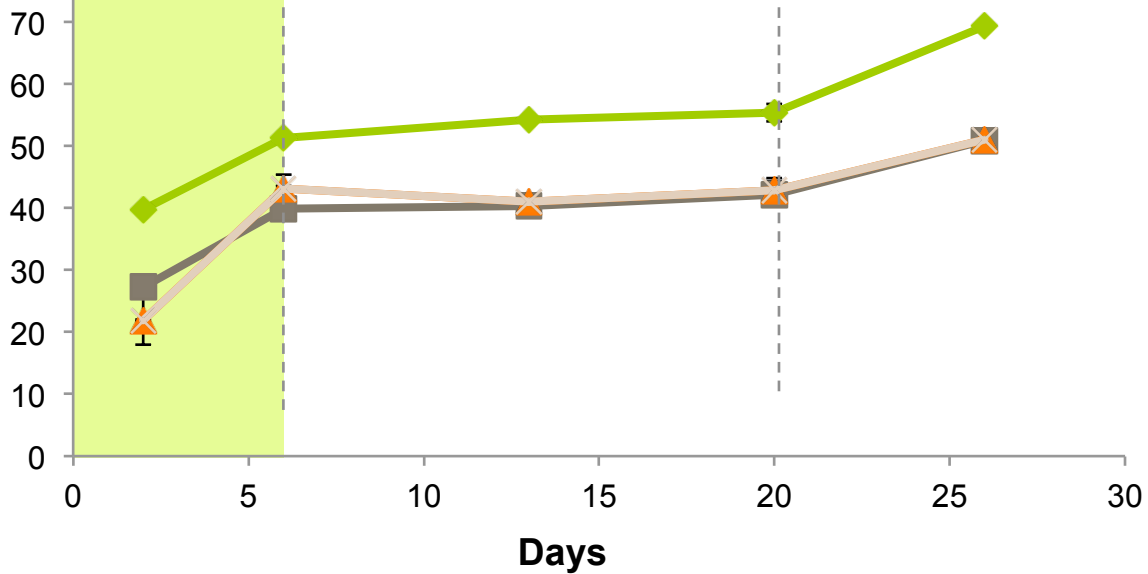


Methane

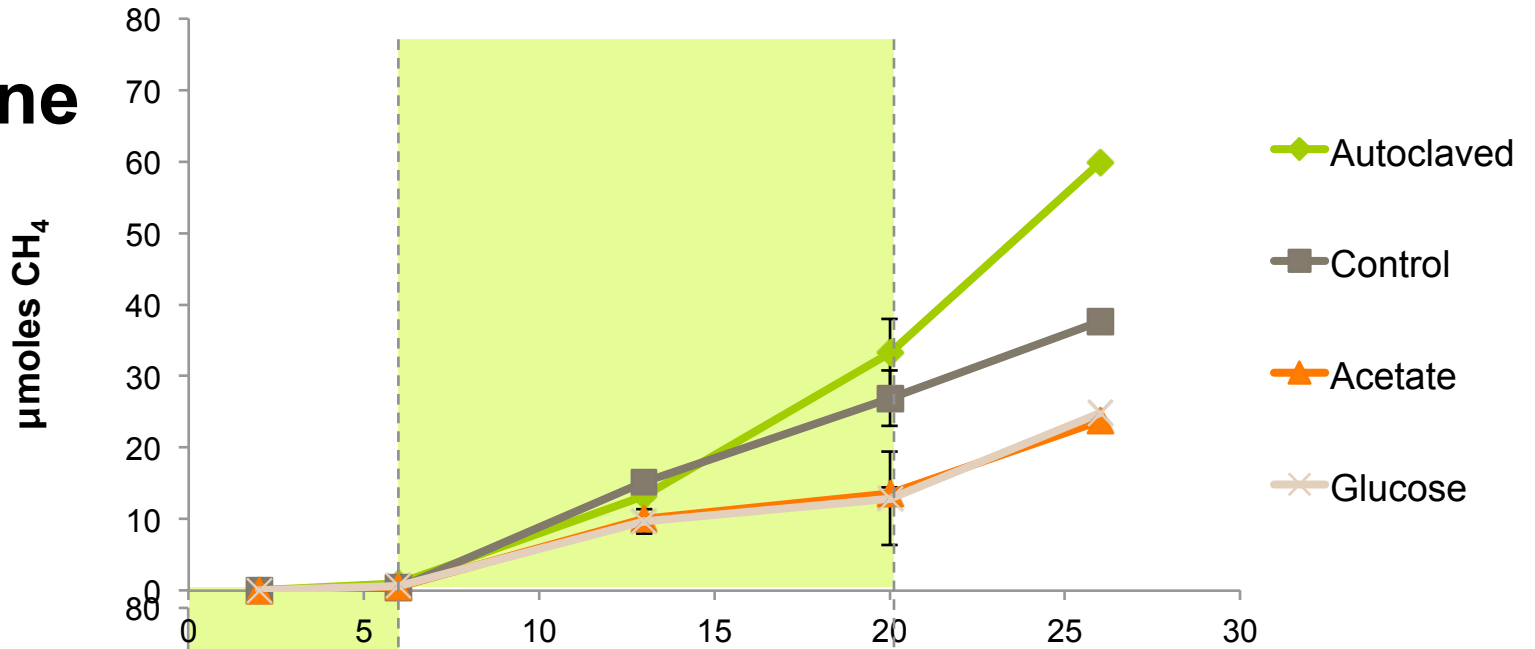


CO₂

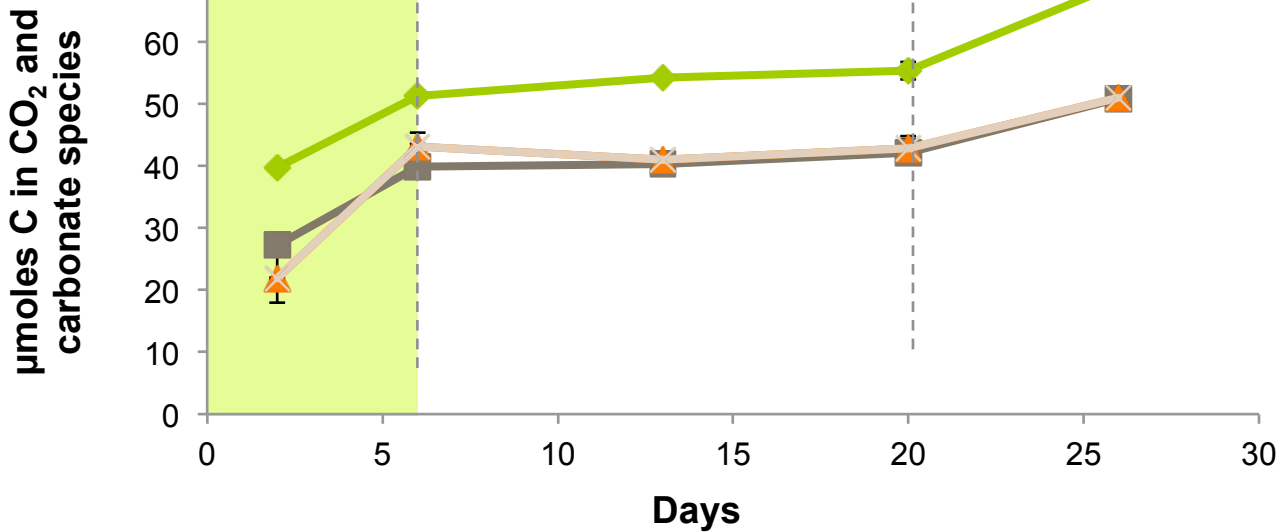
µmoles C in CO₂ and carbonate species

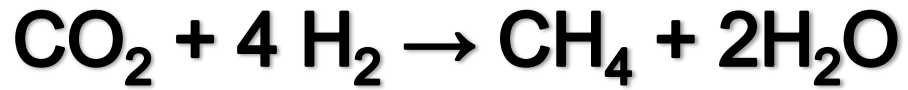


Methane

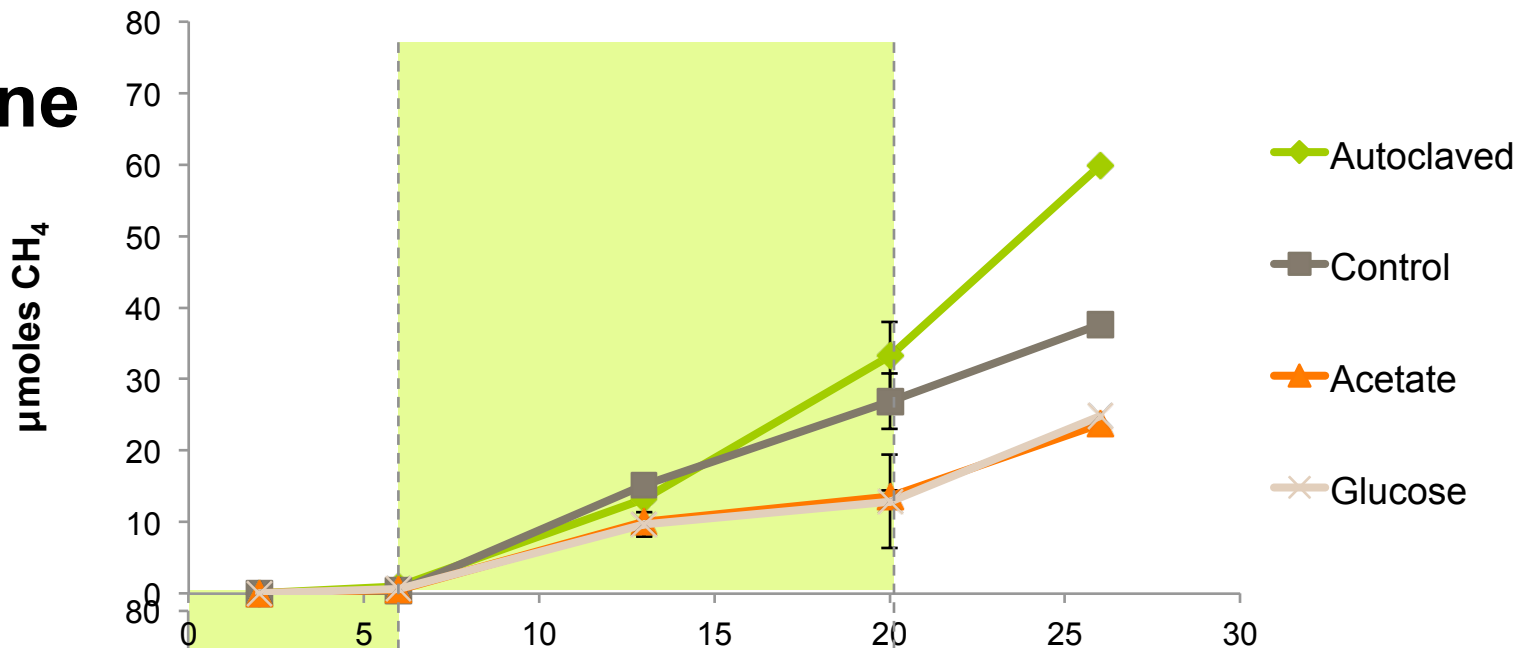


CO₂



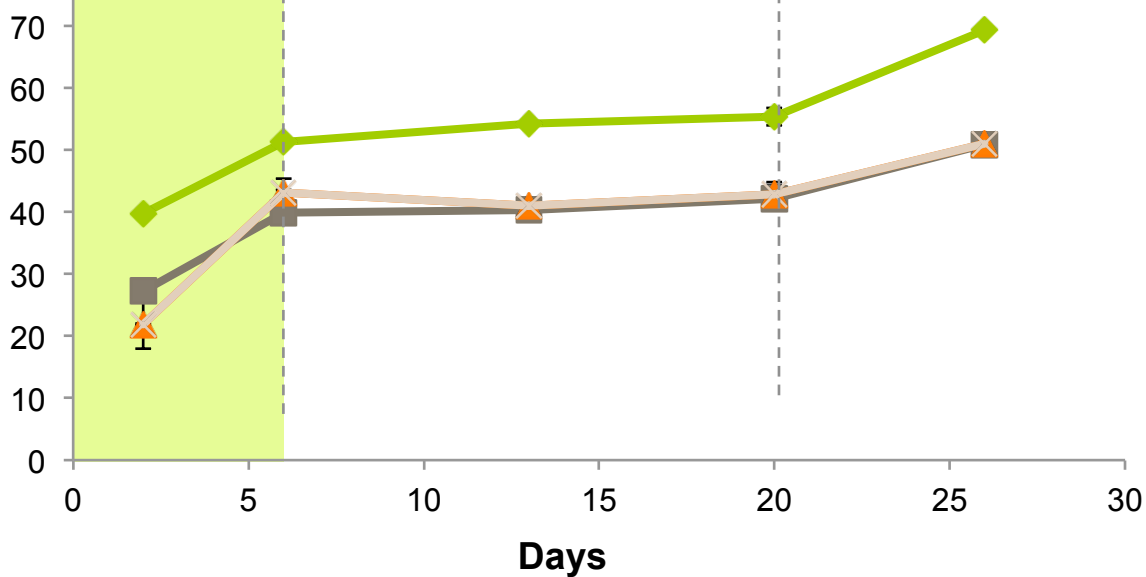


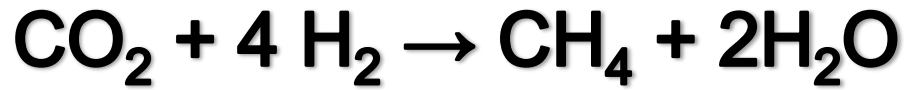
Methane



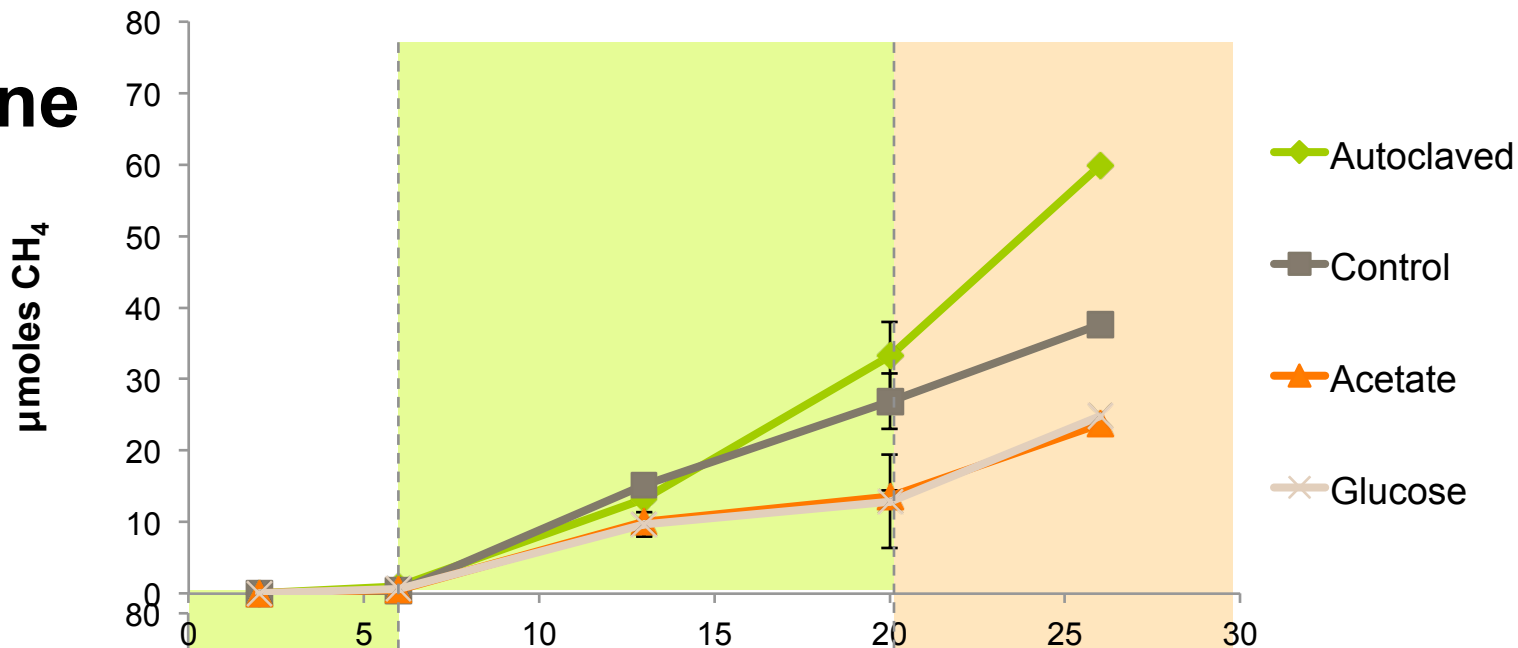
CO₂

µmoles C in CO₂ and carbonate species



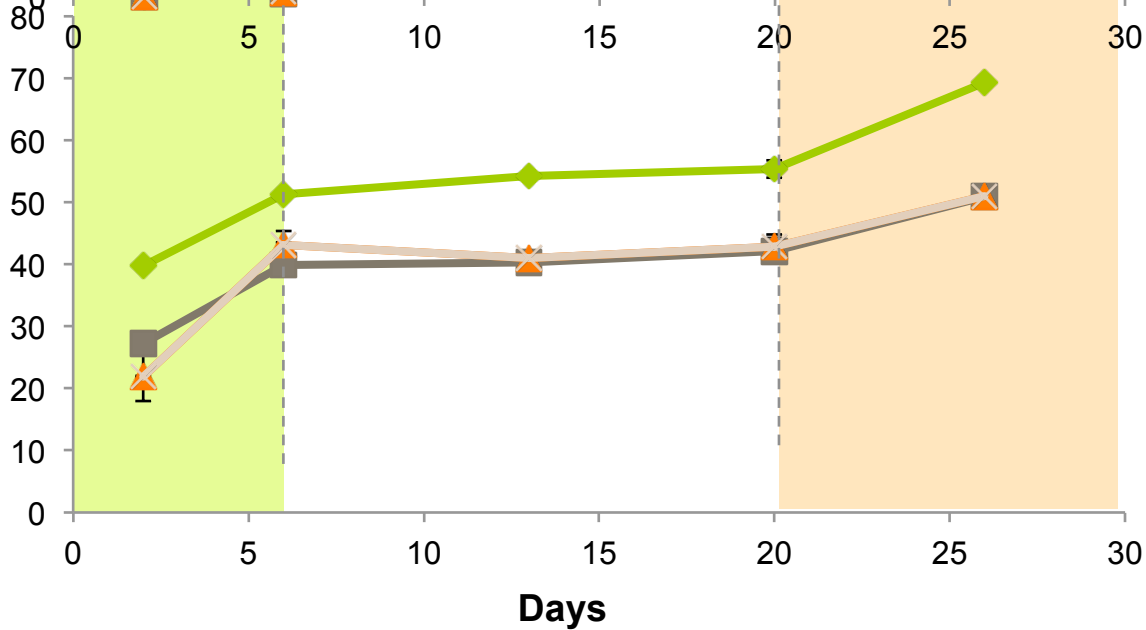


Methane



CO₂

$\mu\text{moles C in CO}_2$ and
carbonate species



CONCLUSIONS

Trends show autoclaved could make **more** methane

But not conclusive w/ 1 replicate

Autoclaved had more CO₂ – more decomposition

Acetate and glucose don't make more methane

Glucose & acetate **inhibited** methane production – VFA?

Opposite of results from previous experiment

Large effect for small amount added

CO₂ **plateaus** and until last time point

Methanogens using CO₂

FUTURE STEPS

Pretreat algae before entering digester

Heat or UV light

Make algae easier to use

Possible source of energy production if perfected

Self-sustaining

ACKNOWLEDGEMENTS



Zoe Cardon

Rich McHorney

Joe Vallino

Aliza Ray

Suzanne Thomas

Ken Foreman

Jane Tucker

SES Students

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