

# Biofilters for mitigation of landfill methane emissions

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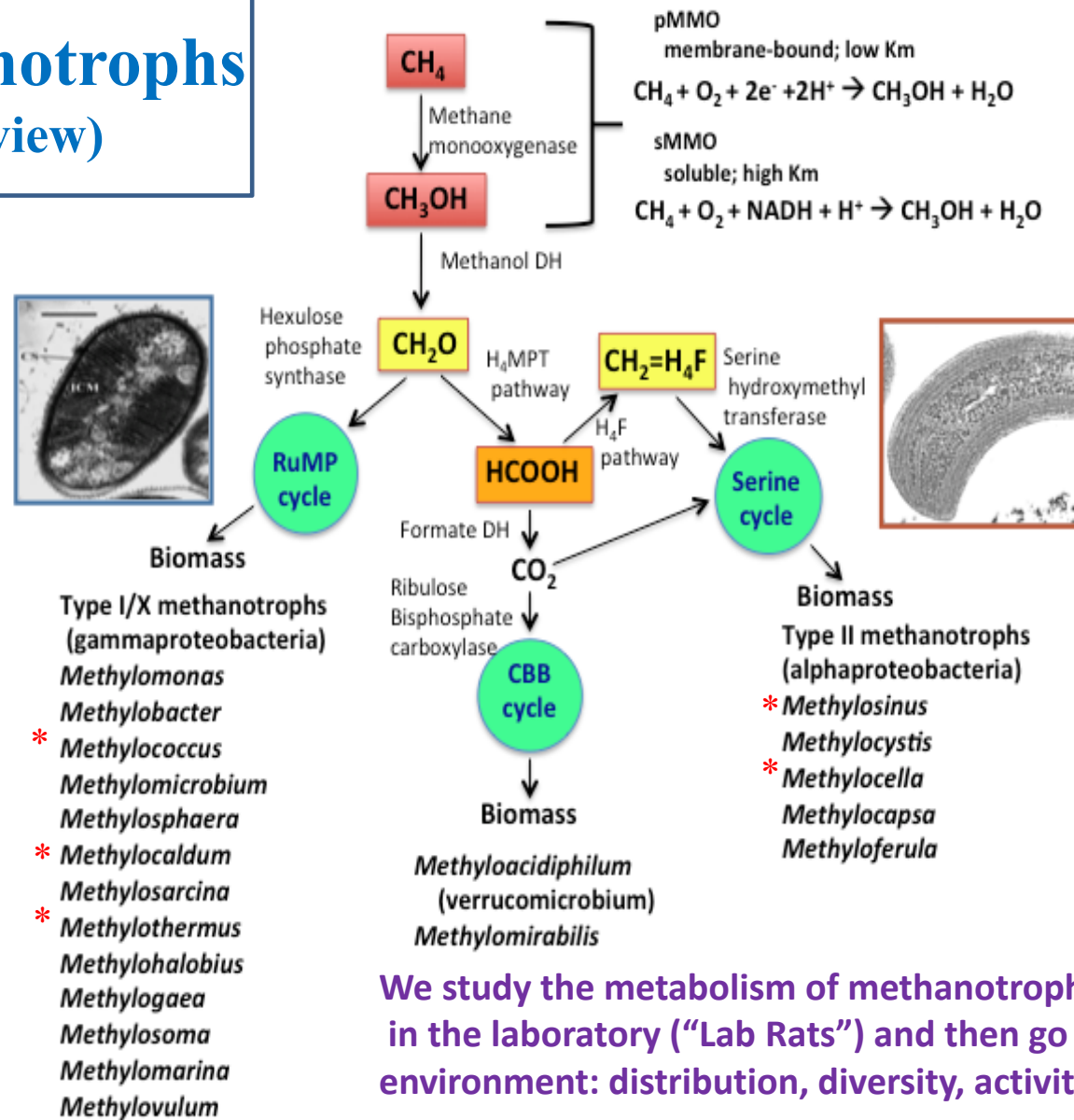
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# Methane, Landfills and Methanotrophs

- CH<sub>4</sub> is a potent greenhouse gas.
- Landfills are a significant anthropogenic source of CH<sub>4</sub>.
- Methanotrophs are bacteria that metabolise and use CH<sub>4</sub> as their carbon source and therefore act as a CH<sub>4</sub> sink.
- Biofilters: methanotroph bioreactors for waste CH<sub>4</sub> removal.

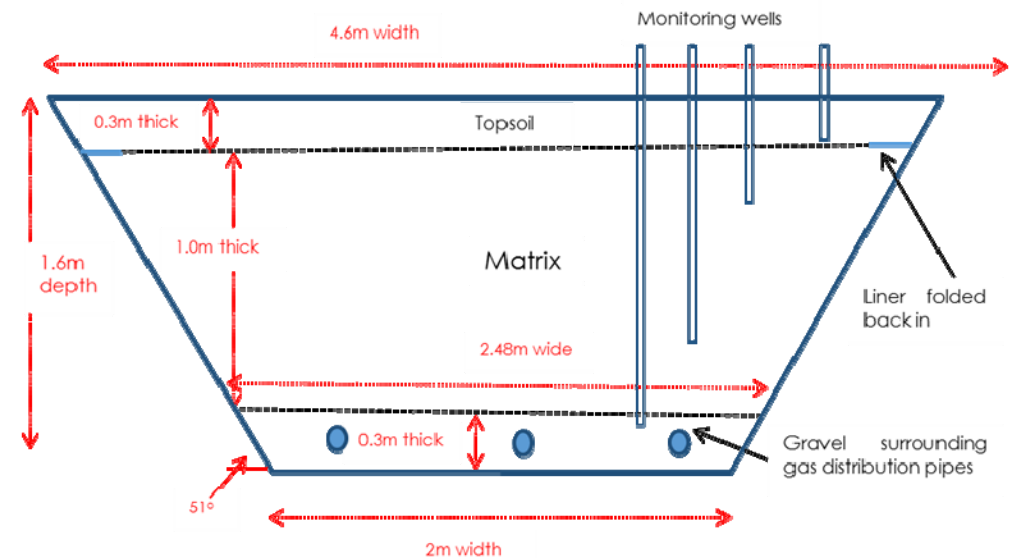
# The Methanotrophs (an overview)



We study the metabolism of methanotrophs in the laboratory (“Lab Rats”) and then go back into the environment: distribution, diversity, activity and regulation

# Strumpshaw CH<sub>4</sub> Biofilter

- Strumpshaw is an older closed landfill producing landfill gas with low levels of CH<sub>4</sub>.
- Norfolk County Council are trialling a biofilter on site.
- Biofilter: a matrix designed to maximize potential of methanotrophs.



Biofilter size: 20 x 4 x 1.6m

Currently supplied with 75m<sup>3</sup> LFG h<sup>-1</sup> containing 8% CH<sub>4</sub>, 16% O<sub>2</sub>

# My PhD project

- Identify the most active methanotrophs in the biofilter.
- Isolate and characterise the most active methanotrophs.
- What parameters are limiting the activity of methanotrophs?
  - N, P, water, gas regimens, metals?
- How to improve the oxidative capacity of the biofilter?

# Which regions of the biofilter are most active?

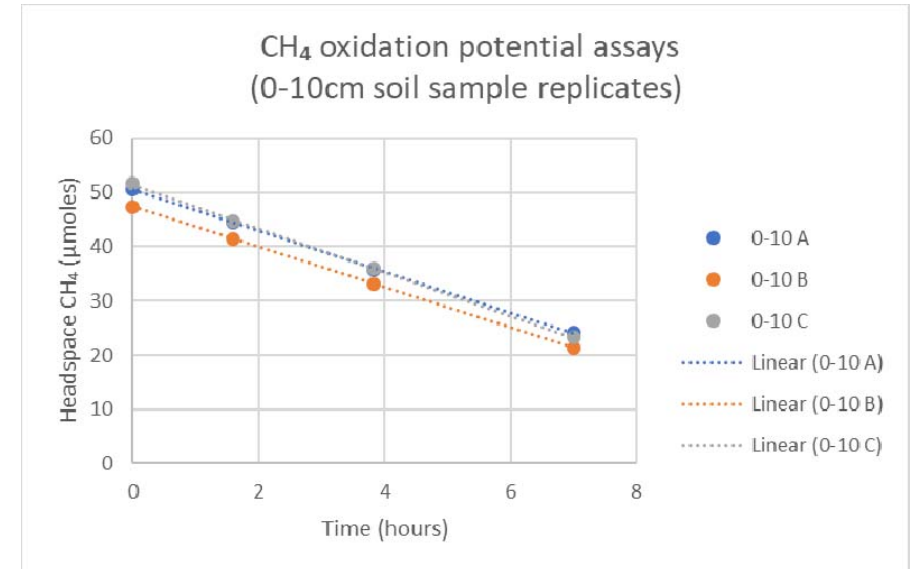
Soil CH<sub>4</sub> oxidation assays (gas chromatography)



Biofilter sampling



Soil CH<sub>4</sub> oxidation assay



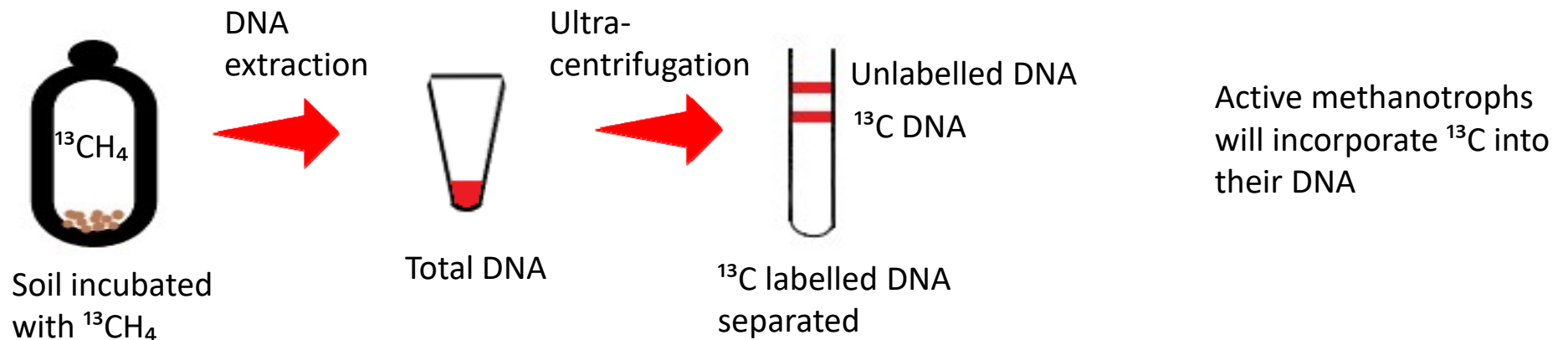
CH<sub>4</sub> depletion vs time, gradient used to calculate rate

**Rates observed vary with depth; consistent with rates seen in literature.**

# Culture independent methods

“What methanotrophs are in the biofilter?”

- “Functional gene probing”. Genes required for CH<sub>4</sub> oxidation amplified from biofilter sample DNA and sequenced to build a profile of the methanotroph community.
- “DNA-Stable isotope probing” (DNA-SIP) used to identify the active CH<sub>4</sub> oxidising methanotrophs in biofilter soil samples.



# Cultivation of key methanotrophs

Isolation and characterisation



Soil enrichment



Plating



Growth in liquid culture

**Information gained about properties of key methanotrophs in the biofilter will aid better design and operation.**