



**HAL**  
open science

## Rumen methanogens display species-specific methane production kinetics

Milka Popova, Maxence Tillier, Dominique Graviou, Diego Morgavi, Gérard Fonty, Jean Pierre Morel, Nicole Morel Desrosier

### ► To cite this version:

Milka Popova, Maxence Tillier, Dominique Graviou, Diego Morgavi, Gérard Fonty, et al.. Rumen methanogens display species-specific methane production kinetics. 10. Joint Symposium Inra Rowett, Jun 2016, Clermont-Ferrand, France. 2016. hal-02742850

**HAL Id: hal-02742850**

**<https://hal.inrae.fr/hal-02742850>**

Submitted on 3 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Rumen methanogens display species-specific methane production kinetics

M. Popova<sup>1</sup>, M. Tillier<sup>1</sup>, D. Graviou<sup>1</sup>, D. P. Morgavi<sup>1</sup>, G. Fonty<sup>2</sup>, J P Morel<sup>2</sup>, N. Morel-Desrosiers<sup>2</sup>

## INTRODUCTION

The objective of this work was to improve our knowledge of methanogens' metabolism at the intra-cellular level in order to design effective strategies for mitigating methane emission in ruminants

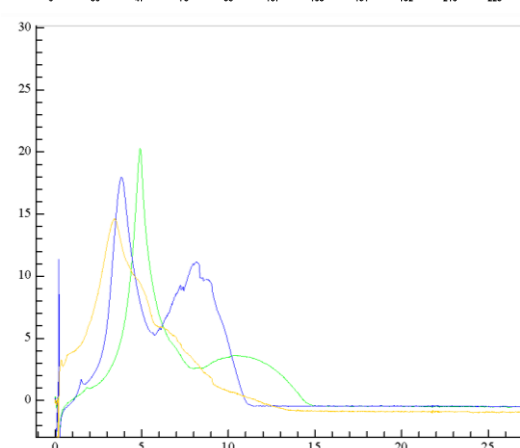
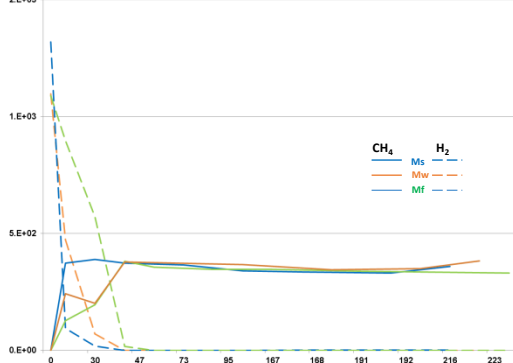
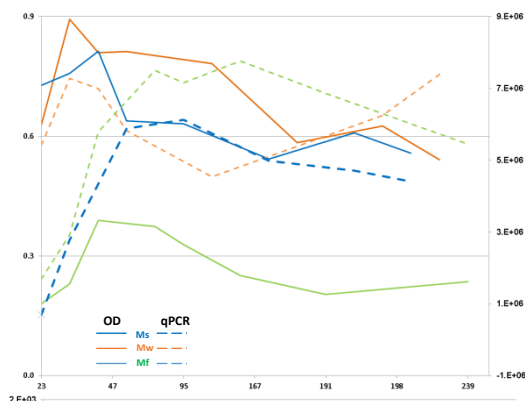
## MATERIALS & METHODS

- 3 species of methanogenic Archaea

*Methanobrevibacter smithii* (Ms), *Methanobacterium formicum* (Mf), *Methanobrevibacter wolinii* (Mw)

- modified Balch medium containing 30% clarified rumen fluid with H<sub>2</sub>/CO<sub>2</sub> over-pressure : 6 ml of media inoculated with 1ml actively growing culture, incubated at 39°C
- daily measures : optical density (OD), H<sub>2</sub> and CH<sub>4</sub> concentrations, qPCR targeting 16S rRNA gene
- **isothermal microcalorimetry** at 39°C; 1.8 ml of media and 0.2 ml of just thawed microbial cultures.

## RESULTS



- According to OD measures, all three species reached the exponential phase in less than 24h and maximum OD values within 2 days after the inoculation. However the maximum OD value for Mf was twice as small as those for Ms and Mw.
- According to 16S rRNA gene copy numbers quantification, the maximum population density was reached within one day for Mw, 2 days for Ms and 3 days for Mf. Differences between species were less pronounced.
- There was no correlation between OD values and 16S rRNA for none of the species.
- All the hydrogen was consumed over a period of two days
- There was no difference in the total amount of methane produced between species
- Isothermal microcalorimetry revealed that methanogenesis is not a simple process. This pathway rather cumulates quite a few simultaneous catabolic and anabolic reactions represented by the two main peaks and the numerous shoulders on the thermal power signal .
- The first peak's form and kinetics are rather comparable but the second one marks the differences between species.
- Though 16S rRNA gene counts and the amount of methane produced were similar between species, total heat was similar for Ms and Mw (6.7 and 6.6 J) but lower for Mf (5.6 J).

## IMPORTANCE & PERSPECTIVES

Species-specific metabolism kinetics revealed by this study suggest differentiation within methanogenesis niche- specialists that may be important to understand. Methanogens physiology will be further studied using transcriptomic and metabolomics approaches to identify the underlying metabolic processes.

<sup>1</sup> INRA, UMR1213 Herbivores, F-63122 Saint-Genès-Champagnelle, France

<sup>2</sup> Université Clermont Auvergne - Université Blaise Pascal, Laboratoire Microorganismes: Génome et Environnement, UMR CNRS 6023, BP 10448, 63000 Clermont-Ferrand, France