**Background**

- Enteric methane (CH<sub>4</sub>) emissions of cows
- Losses of dietary energy
- Contribution to climate change
- Growing interest in reducing CH<sub>4</sub> emissions
- Milk fatty acid (FA) profile is influenced by rumen fermentations

**Objective:** Estimation of phenotypic and genetic variability of CH<sub>4</sub> emissions & FA contents of milk

**Conclusions**

- SFA & SCFA are higher genetically & phenotypically correlated with MIR CH<sub>4</sub> emissions than UFA & LCFA
- These correlations reflected indirect link between milk FA & CH<sub>4</sub> emissions through rumen metabolism

**Results**

- Heritabilities of FA and MIR CH<sub>4</sub> emissions

<table>
<thead>
<tr>
<th>Trait</th>
<th>h&lt;sup&gt;2&lt;/sup&gt;</th>
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<tbody>
<tr>
<td>MIR CH&lt;sub&gt;4&lt;/sub&gt; (g/d)</td>
<td>0.11</td>
<td>C18:0 (g/dl of milk)</td>
<td>0.19</td>
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<tr>
<td>C4:0 (g/dl of milk)</td>
<td>0.24</td>
<td>C18:1 cis-9 (g/dl of milk)</td>
<td>0.15</td>
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<tr>
<td>C6:0 (g/dl of milk)</td>
<td>0.41</td>
<td>SFA (g/dl of milk)</td>
<td>0.42</td>
</tr>
<tr>
<td>C8:0 (g/dl of milk)</td>
<td>0.41</td>
<td>MUFA (g/dl of milk)</td>
<td>0.19</td>
</tr>
<tr>
<td>C10:0 (g/dl of milk)</td>
<td>0.40</td>
<td>PUFA (g/dl of milk)</td>
<td>0.30</td>
</tr>
<tr>
<td>C12:0 (g/dl of milk)</td>
<td>0.41</td>
<td>UFA (g/dl of milk)</td>
<td>0.20</td>
</tr>
<tr>
<td>C14:0 (g/dl of milk)</td>
<td>0.43</td>
<td>SCFA (g/dl of milk)</td>
<td>0.42</td>
</tr>
<tr>
<td>C16:0 (g/dl of milk)</td>
<td>0.40</td>
<td>MCF (g/dl of milk)</td>
<td>0.42</td>
</tr>
<tr>
<td>C17:0 (g/dl of milk)</td>
<td>0.36</td>
<td>LCFA (g/dl of milk)</td>
<td>0.17</td>
</tr>
</tbody>
</table>

**Abbreviations:** SFA = Saturated FA; MUFA = Monounsaturated FA; PUFA = Polyunsaturated FA; UFA = Unsaturated FA; SCFA = Short chain FA; MCF = Medium chain FA; LCFA = Long chain FA

**Model**

- Bivariate random regression test-day models
  - Resolved using REMLF90 (Nieuw, 2012)
  - MIR CH<sub>4</sub> (g/d) & 1 FA trait

- y = Xb + Q (Wh + Zp + Za) + e
  - where y = Vector of observations
  - b = Vector of fixed effects
  - H = Herd x test-day
  - Z = Classes of days in milk
  - W = Gestation stage x lactation stage
  - a = Lactation stage x age at calving x season of calving
  - h = Vector of herd x year of calving random effects
  - p = Vector of permanent environmental random effects
  - a = Vector of additive genetic random effects
  - Q = Covariance matrix for 2<sup>nd</sup> order Legendre polynomials
  - X, W & Z = Incidence matrices
  - e = Error

**Data**

- Prediction of CH<sub>4</sub> emissions & milk FA contents from milk mid-infrared (MIR) spectra
  - 161,681 MIR spectra collected between January 2007 and June 2013
  - From 5 to 305 days in milk (DIM)
  - 22,642 first-parity Walloon Holstein cows from 489 herds
  - Pedigree file
  - 79,736 animals