Lab-based meat production: Science Fiction or Reality?

Mark Post, Maastricht University
@MarkPost6

Cornell Nutrition Conference, Syracuse 2017
Greenhouse Gases

**Methane** 39%
**CO₂** 5%

World Average Virtual Water Content

<table>
<thead>
<tr>
<th>Product</th>
<th>Water Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>15,500</td>
</tr>
<tr>
<td>Pork</td>
<td>4,850</td>
</tr>
<tr>
<td>Chicken</td>
<td>3,900</td>
</tr>
<tr>
<td>Rice</td>
<td>2,300</td>
</tr>
<tr>
<td>Soya</td>
<td>1,800</td>
</tr>
<tr>
<td>Wheat</td>
<td>1,300</td>
</tr>
</tbody>
</table>

**Feed conversion ratio**

<table>
<thead>
<tr>
<th>Animal</th>
<th>Conversion Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmon</td>
<td>1.2</td>
</tr>
<tr>
<td>Pork</td>
<td>2.8</td>
</tr>
<tr>
<td>Chicken</td>
<td>1.9</td>
</tr>
<tr>
<td>Beef</td>
<td>6-9</td>
</tr>
</tbody>
</table>

(Adapted from Global Salmon Initiative, 2016)

Supermarket shelf during Harvey
Human trophic level

Bonhommeau et al, PNAS, Dec 2013

Median human trophic level

GDP per capita (USD)

2000        2010

2.05        2.15        2.25        2.35
2.0          2.2          2.4          2.6

World
World without China and India
China and India

Churchill, 1932
Alexis Carrell & Charles Lindbergh, 1932

BIOPSY
**Muscle stem cell (=satellite cell)**

- > 35 doublings
- differentiation → muscle

3 weeks
No serum, no antibiotics

Cattle Cultured

Life cycle analysis

Percent of earth resources dedicated to meat production

3A stretching!
Alginate Contraction with C2C12 cells

Volume Change

-80%  -60%  -40%  -20%  0%  20%  40%  60%  80%

high RGD  low RGD  low CYCLO  None

11 days

14 days

The laboratory “gym”


Color, Fe?

Myoglobin expression in bovine satellite cells

Creating fat tissue (preferably containing ω-3 fatty acids)

no insulin
193 subjects

**Sensory analysis**
- N=65
- N=64
- N=64

**Social benefits**
- Sensory analysis

**Personal benefits**
- Sensory analysis

**Meat quality and taste**
- Sensory analysis

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**Before information**

**After information**

- **2.1 Are you in favor or against the production of cultured meat?**
  - Definitively against
  - Probably against
  - Unsure
  - Probably in favor
  - Definitively in favor

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**Sensory evaluation: tenderness**

- “Personal benefits” group scored lower
- “Social benefits” group scored higher

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Information ➤ higher acceptance

“Personal benefits” info led to an even higher acceptance
"Meat quality and taste" - open ended question

- **Worries**
  - Weird, artificial, unnatural, scary
  - Worries about manipulation, production
  - Don't see the added value
  - Worries about health risks
  - Want an affordable price
  - Worries about farmer's future

- **Information**
  - Process
  - Ingredients/food material
  - Health/nutritional aspect
  - Possibility to creating other types of meat
  - Effects on the environment

**Main concern**: expected too high price
**Most requested information**: health/nutritional aspects
330,000 $  
2013 2020  

startups
- Finless food
- Future Meats
- Memphis Meats
- SuperMeat
- FutureMeat
- Perfect Day
- Modern Meadow
- Qorium

Funding
- a.o.:
- Tyson
- Cargill

Food Startups

Finless food

Future of Meat

Perfect Day

Funding a.o.