From Plants to products – The Quorn story
The 1960s was a time of huge achievements...
Quorn in context

....And growing concerns
Quorn is born

A man with a big idea
The scale of livestock production is driven by our desire for cheaper and more plentiful meat, but there are damaging consequences, which at the moment are forecast only to intensify.

<table>
<thead>
<tr>
<th>Animal</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chickens</td>
<td>110,000</td>
</tr>
<tr>
<td>Pigs</td>
<td>2,630</td>
</tr>
<tr>
<td>Sheep</td>
<td>922</td>
</tr>
<tr>
<td>Goats</td>
<td>781</td>
</tr>
<tr>
<td>Cows</td>
<td>557</td>
</tr>
</tbody>
</table>

+ a large number of ducks, rabbits, horses, turkeys...

...3 camels and one unfortunate mule
Dramatic changes are shaping the future of food policy
### Challenges for a scalable meat based sustainable food future

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>To feed 9bn in 2050 FAO say we need</td>
<td>a 60% increase in food production</td>
</tr>
</tbody>
</table>

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**SILENT BUT DEADLY**

It's not just a lot of hot air.

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Some of the true costs of cheap and plentiful animal protein

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http://www.tristramstuart.co.uk/FoodWasteFacts.html
“The need for new business models that help address the 9bn challenge - including a healthy new protein with a lower environmental impact....”

Prof. Alan Knight Single Planet Living
Quorn offers important benefits in everyday foods

And because of mycoprotein delivers against the four mega-trends

**Meat reduction and vegetarianism**
Quorn provides the protein lost from not eating meat.
Superior in taste and texture to alternatives.
Superior in taste and texture to alternatives.
Safe and non allergenic¹

**Environmental impact³**
Quorn mince is lower in embedded greenhouse gas than beef, chicken or lamb.
Lower pressure on scarce land resources.
Converting starch into protein (mycoprotein) is environmentally more benign than livestock.

**Heart Disease and diet**
Quorn (mycoprotein) is Cholesterol free and lower is sat fat than the meat equivalent.
Initial studies show evidence of Cholesterol reduction²

**Obesity and health**
Lower in fat so lower in calories v meat.
High in protein and fibre so satiating/satisfying.
Initial studies show potential for weight reduction claim.

References:
2. EFSA ruling mycoprotein and beta-glucan April 2011
Vegetarians vs. Non Vegetarians - The Marketplace Dynamics

Both groups are important to the Quorn brand.
### Quorn UK consumer profile

<table>
<thead>
<tr>
<th></th>
<th>Vegetarian</th>
<th>Health &amp; weight managers</th>
</tr>
</thead>
<tbody>
<tr>
<td>% UK households</td>
<td>9%</td>
<td>58%</td>
</tr>
<tr>
<td>% of Quorn sales</td>
<td>63%</td>
<td>37%</td>
</tr>
<tr>
<td>Meat free category penetration</td>
<td>83%</td>
<td>30%</td>
</tr>
<tr>
<td>Quorn brand penetration</td>
<td>65%</td>
<td>26%</td>
</tr>
<tr>
<td>Purchase frequency</td>
<td>Every 2.5 weeks</td>
<td>Every 11 weeks</td>
</tr>
<tr>
<td>Annual spend on Quorn</td>
<td>£60.35</td>
<td>£12.20</td>
</tr>
</tbody>
</table>

- Proven history of expanding vegetarian frequency
- Proven ability to grow non vegetarian penetration with considerable head room

Source: Kantar 52 w/e 20/1/13
Levels of vegetarianism vary by market

Australia is low: levels are in line with Northern Europe

UK Penetration @ 24% shows we transcend vegetarianism

Vegetarian eating is much more mainstream when it includes those who usually maintain a vegetarian diet

Australia has highest percentage of Meat Reducers and obesity, which correlates to relevance to Health Managers.

Cumulative 61.3% are Meat Reducers in Aus

<table>
<thead>
<tr>
<th></th>
<th>UK</th>
<th>US</th>
<th>France</th>
<th>Holland</th>
<th>Sweden</th>
<th>Aus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat Reduction</td>
<td>40.6</td>
<td>15</td>
<td>27</td>
<td>43.2</td>
<td>36.3</td>
<td>58.4</td>
</tr>
<tr>
<td>Vegetarian</td>
<td>8.9</td>
<td>3.5</td>
<td>2</td>
<td>4.2</td>
<td>3.3</td>
<td>2.9</td>
</tr>
</tbody>
</table>

The Dual Target ensures we serve more than just Vegetarians

Source: Datamonitor

*Source: Brainjuicer U&A Australia June 2009
At the heart of all Quorn foods is **mycoprotein**...

..Our 50 year ‘overnight success’

**So, what is it?**
Quorn manufacturing process

**Fermentation and harvesting**
Belasis

**Inputs**
- Fungi organism
- Oxygen
- Glucose
- Micro nutrients

**Output**
Mycoprotein paste

**Forming and freezing**
Stokesley

**Input**
Mycoprotein paste

**Processes**
- Add binder/flavour
- Shape
- Steam
- Freeze

**Output**
Finished goods frozen e.g. Mince/pieces ‘Intermediate’ chilled

**Pasteurisation, frying/coating**
Methwold

**Input**
Intermediate*

**Processes**
- Retorting
- Frying
- Coating
- Packing

**Output**
Finished chilled and frozen

*Intermediate can be formed product for frying/coating or finished product (e.g. Sausage) for pasteurisation (retorting) and packing*
Mycoprotein—key ingredient in Quorn products

**BENEFITS**

**Physical Properties (shape)**
- 400-700µ
- 3-5µ

**Composition**
- **General Nutrition**
  - High quality protein
  - Low fat content (membrane phospho-lipids)
  - High fibre (cell wall)
  - Low energy density

- **Clinical Research Programmes**
  - Lowering serum cholesterol
  - Satiety
  - Insulinemia and glycemia in diabetics

- **Additional Interest**
  - SCFA production
  - Fibre (chitin and β-glucans)

**Texture creation**
- Authentic meat-like texture
- Creation of fibrosity through fibre assembly

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Mycoprotein is grown through controlled fermentation

Converts starch to protein efficiently
Main raw materials are glucose, electricity and egg albumen
Quorn products are manufactured similar to other foods using mycoprotein.

Main raw materials are egg albumen, whey protein & flavour.
Quorn is superior to soya/wheat based competitors

**Why Quorn is superior**

- Quorn superior on replicating texture – delivers fibrosity
- Quorn superior on taste
  - no aftertaste
  - absorbs flavour
- Quorn is a non allergen
  - soya and wheat are both allergens
Quorn meets key consumer health needs …

- Low In fat
  - Less than 3% fat
  - Less than 1% saturated fat
- No artificial colours or preservatives
- High in fibre
  - Mycoprotein uniquely contains high fibre and high quality protein
- Weight management
  - Contains less kilojoules than meat equivalents
- Acts as a pre-biotic
- No cholesterol
  - Mycoprotein is cholesterol free

With peer reviewed nutrition studies
- Improves serum lipid profiles - 6 peer reviewed publications
- Increases satiety - 3 peer reviewed publications
- Reduces glycaemia and insulinemia - 1 peer review

…and is available in a wide range of easy to use products
Consumers recognise product superiority to leading competitors

<table>
<thead>
<tr>
<th>Country &amp; Product</th>
<th>Brand</th>
<th>Purchase Intent</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK Mince</td>
<td>Quorn</td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td>Linda McCartney</td>
<td>42%</td>
</tr>
<tr>
<td>US Chicken Nuggets</td>
<td>Quorn</td>
<td>86%</td>
</tr>
<tr>
<td></td>
<td>Morningstar</td>
<td>58%</td>
</tr>
<tr>
<td>Australia Sausages</td>
<td>Quorn</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>Fry’s</td>
<td>30%</td>
</tr>
</tbody>
</table>
Meals are healthier with Quorn

Switching from using beef mince to Quorn mince in a Spaghetti Bolognese once a week is equivalent to running 4 marathons a year*

<table>
<thead>
<tr>
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<th>Spaghetti Bolognese</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Meat</td>
</tr>
<tr>
<td>Calories</td>
<td>516</td>
</tr>
<tr>
<td>Fat %</td>
<td>26.6</td>
</tr>
<tr>
<td>Saturated Fat %</td>
<td>10.1</td>
</tr>
</tbody>
</table>

Source: Lucy Jones C4 nutritionist using METS data
Livestock represent 18%+ of greenhouse gases issue*
- Quorn environmental footprint – 90% lower than beef

Land and Water are becoming in short supply
- Quorn uses 90% less land and water than beef

Livestock is inefficient at producing protein
- Beef converts grains – protein at 10 – 1 ratio
- Quorn converts at 2 – 1 ratio (wheat– protein)

Quorn Foods is the first global meat-alternative brand to achieve third-party certification of its carbon footprint figures

* UN report ‘Livestock’s Long Shadow’ 2006
## Ingredients in Quorn

### Dried egg white
- **214 million eggs in 2014**

<table>
<thead>
<tr>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cost</td>
</tr>
<tr>
<td>• Availability (e.g. avian flu)</td>
</tr>
<tr>
<td>• Reduce protein from animal source</td>
</tr>
</tbody>
</table>

### Dried whey protein
- **214 million litres of milk in 2014**

<table>
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<tbody>
<tr>
<td>• Cost</td>
</tr>
<tr>
<td>• Availability (e.g. foot &amp; mouth)</td>
</tr>
<tr>
<td>• Reduce protein from animal source</td>
</tr>
</tbody>
</table>
Ingredients in Quorn

Glucose syrup from wheat
- 60 million kg of wheat in 2014

Challenges
- Cost
- Availability (e.g. competition)
- Evaluate other sources of fermentable CHO's

Range of flavours and seasonings
- 665,000 kg in 2014

Challenges
- Relatively high dosage
- Severe process (losses)
- Retain healthiness – low salt, natural, etc.
Quorn International

Quorn is market leader in 9 of the 14 international markets where the business is present and is the most international of all the competitors.

<table>
<thead>
<tr>
<th>Brand</th>
<th>Ingredient</th>
<th>Countries Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quorn</td>
<td>Mycoprotein</td>
<td>UK(#1), USA (#3), Australia(#1) Belgium(#1), Luxembourg(#1), Holland(#3), Switzerland(#1), Ireland(#1), Sweden(#2), Denmark(#1), Norway(#1), Australia(#1), Finland(#2) Germany(new), New Zealand(new), South Africa (new)</td>
</tr>
<tr>
<td>Fry’s (Family)</td>
<td>Soya and Wheat</td>
<td>South Africa, Australia, India</td>
</tr>
<tr>
<td>Tivall (OCEM/Nestle)</td>
<td>Soya and Wheat</td>
<td>Israel, Netherlands, Sweden, Belgium</td>
</tr>
<tr>
<td>Boca (Kraft)</td>
<td>Soya</td>
<td>USA</td>
</tr>
<tr>
<td>Linda McCartney (Hain Celestial)</td>
<td>Wheat and Soya</td>
<td>UK, Australia</td>
</tr>
<tr>
<td>Alpro (Dean Foods)</td>
<td>Soya</td>
<td>Belgium, Netherlands</td>
</tr>
<tr>
<td>SojaSun (Family)</td>
<td>Soya</td>
<td>France, Italy, Portugal, Spain</td>
</tr>
<tr>
<td>Vegetalex (Family)</td>
<td>Soya</td>
<td>Argentina, Chile</td>
</tr>
<tr>
<td>MorningStar (Kellogg’s)</td>
<td>Soya and Wheat</td>
<td>USA</td>
</tr>
<tr>
<td>Valess (Friesland)</td>
<td>Soya</td>
<td>Germany, Sweden, Netherlands</td>
</tr>
<tr>
<td>Lite Life (Conagra)</td>
<td>Soya and Wheat</td>
<td>USA</td>
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</tbody>
</table>
How can diets rich in mycoprotein contribute to health and wellness?

What is the impact of our food and of our organisation on the environment and how do we compare?

How do we create flavours and texture in Quorn products that make it irresistible?

How can we collaborate to address these key issues and contribute to the debate?
• In summary
Thank you!