Product Quality of Fresh and Further Processed Meat Products & Gaps in the Literature

Dustin Boler
The Ohio State University
Global concern with food supply and demand

By the year 2050

*The global population will be 50% greater than in was in the year 2000

*But food demand will double over the same time period

Tilman et al., 2002
The Challenge
Feeding the world

1 in 6 People in the World went hungry in 2010

The Solution
Developing and employing new technology

Jeff Simmons; Elanco Animal Health, 2011
Factors in Food Purchasing Decisions

95% of consumers are food buyers

Food buyer - either neutral about or supportive of using efficiency-enhancing technologies to grow food.

- Taste – 43.48%
- Cost – 31.51%
- Nutrition – 23.02%
- Other – 1.99%

Global sales of food produced with limited technology make up < 2% of all sales

Simmons, 2011
2006 Farm Foundation Report

7 Basic Challenges Facing Animal Agriculture

– 1) Economics of production
– 2) Processing and marketing
– 3) Consumer demands
– 4) Global competitiveness and trade
– 5) Food safety and animal health
– 6) Environmental issues
– 7) Animal welfare
2012 National Pork Board General Call for Proposals

• A) Environment
• B) Swine Health
• C) Animal Welfare
• D) Pork Safety – Pre-Harvest
• F) Pork Quality
• H) Public Health
Research Questions from a Packer’s Perspective

• Low cost production

• Meeting consumer demands

• Providing a safe quality product
Where do academics come up short?

- Growth performance and production efficiency
- Carcass characteristics (Loin muscle area, fat thickness, carcass lean)
- Loin muscle quality characteristics
- Carcass cutability
- Further processed product characteristics
In-Home Pork Consumption

Over $\frac{3}{4}$ of pork consumed in the U.S. is in some way further processed.

Should our research focus (at least from a meat scientist perspective) be allocated similarly?

Quick Facts The Pork Industry at a Glance (www.pork.org)
Variety Meat and By-products

Everything but the squeal!

• Offal value for a 250 pound pig at 74% dressing percentage


• $13.28/pig = $1.46 billion /year revenue
2012 National Pork Board General Call for Proposals

• A) Environment
• B) Swine Health
• C) Animal Welfare
• D) Pork Safety – Pre-Harvest
• F) Pork Quality
• H) Public Health
### U.S. Pork Prices week ending 22 Oct, 2011

<table>
<thead>
<tr>
<th>Primal</th>
<th>$/CWT</th>
<th>Rank</th>
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<tbody>
<tr>
<td>Loins</td>
<td>110.34</td>
<td>2</td>
</tr>
<tr>
<td>Picnics</td>
<td>80.52</td>
<td>5</td>
</tr>
<tr>
<td>Boston butts</td>
<td>102.46</td>
<td>3</td>
</tr>
<tr>
<td>Hams</td>
<td>86.04</td>
<td>4</td>
</tr>
<tr>
<td>Bellies</td>
<td>128.12</td>
<td>1</td>
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</table>

(Weekly National Carlot Meat Report)
Fat Quality

• What will be the new feedstuff in U.S. Swine diets as corn prices continue to increase?

It is projected 5 billion bushels of corn will be used for ethanol production
How do we analyze fat quality?

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Belly flop</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Belly thickness</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Iodine value</td>
<td>10</td>
<td>8</td>
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</table>

<table>
<thead>
<tr>
<th>Pearson Correlation Coefficients*</th>
<th>Belly Flop</th>
<th>Belly Thickness</th>
<th>Iodine Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slice yield</td>
<td>0.12</td>
<td>0.10</td>
<td>???</td>
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</table>

Kyle et al., in progress

*data includes barrows and gilts harvested at a representative market weight
Is an Iodine Value the Answer

<table>
<thead>
<tr>
<th>Barrow</th>
<th>Live Wt (kg)</th>
<th>Fat Depth (cm)</th>
<th>Loin Depth (cm)</th>
<th>IV</th>
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</thead>
<tbody>
<tr>
<td>Pig 1</td>
<td>126.2</td>
<td>1.7</td>
<td>6.7</td>
<td>71.4</td>
</tr>
<tr>
<td>Pig 2</td>
<td>125.8</td>
<td>1.8</td>
<td>6.5</td>
<td>71.4</td>
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<table>
<thead>
<tr>
<th>Barrow</th>
<th>C16:0</th>
<th>C18:1</th>
<th>C18:2</th>
<th>C18:3</th>
<th>SFA</th>
<th>MONO</th>
<th>POLY</th>
<th>UFA:SFA</th>
</tr>
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<tr>
<td>Pig 1</td>
<td>21.5</td>
<td>46.4</td>
<td>14.3</td>
<td>0.0</td>
<td>32.6</td>
<td>51.6</td>
<td>15.3</td>
<td>2.1</td>
</tr>
<tr>
<td>Pig 2</td>
<td>22.1</td>
<td>42.2</td>
<td>15.4</td>
<td>0.8</td>
<td>33.2</td>
<td>47.2</td>
<td>17.2</td>
<td>1.9</td>
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<tr>
<td>Difference</td>
<td>-0.5</td>
<td>4.3</td>
<td>-1.1</td>
<td>-0.8</td>
<td>-0.6</td>
<td>4.5</td>
<td>-1.9</td>
<td>0.1</td>
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Boler et al., 2011
## Is an Iodine Value the Answer

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|        | -0.5  | 4.3   | -1.1  | -0.8  | -0.6 | 4.5   | -1.9  | 0.1     |

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<tr>
<th>Barrow</th>
<th>Flop</th>
<th>Average Thickness</th>
</tr>
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<tbody>
<tr>
<td>Pig 1</td>
<td>23.37</td>
<td>3.24</td>
</tr>
<tr>
<td>Pig 2</td>
<td>20.83</td>
<td>3.84</td>
</tr>
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2.54  -0.60

Boler et al., 2011
Current further processed research at Ohio State

• Fresh belly characteristics
• Production techniques
• Brine retention

Affect sliceability and bacon yield of cured and smoke bellies

And what parameters can be used to predict slice yields
Other influencers on fat quality

• Inclusion level of alternative feedstuffs

• Timing of dietary changes prior to harvest

• Additional feed additives to circumvent negative effects of alternative feedstuffs

• ????????
In-Home Pork Consumption

Over 3/4ths of pork consumed in the U.S. is in some way further processed

Should our research focus (at least from a meat scientist perspective) be allocated similarly?

Quick Facts The Pork Industry at a Glance (www.pork.org)
Reduced and lower sodium products

- **RACC** (reference amount customarily consumed)
- “No sodium”, “sodium free”, or “free of sodium” if <5 mg/RACC
- **Reduced sodium** – must contain at least 25% less sodium than an appropriate reference
  - Sodium chloride
  - Sodium phosphate
  - Sodium nitrite
Potential Sodium Substitutes

• Reduced sodium hams
  – Reduction of salt in brines and sausage products

• Sodium alternatives such as potassium chloride
  – Bitter aftertaste
  – Managing water holding capacity
  – Binding characteristics
  – Food safety
What about beef?

• The motivations are the same as pork
  – Manage the cost of production

The challenges are little different!

* National cow herd numbers are down
* Cattle are spending shorter time on feed due to higher feed costs
* Increasing the number of green fed cattle
* Causing a larger choice / select spread
Opportunities

• Palatability parameters are still most important to consumer acceptance
  – Tenderness
  – Juiciness
  – Flavor

**Basic meat science principles**
Evaluate chilling rates
Contractile state of the sarcomere
Monitor pH decline
Continue to learn about post mortem proteolytic activity
Emerging Technologies

Improvast® (Pfizer Animal Health)

• Anti-GnRF immunological used to suppress testicular function (immunological castration) and control “boar taint” in intact male pigs

• Developed in Australia

• Approved in over 60 countries
Emerging Technologies

• Improvest® (Pfizer Animal Health)
  – Improves growth and performance (Dunshea et al., 2011)
  – Improves carcass cutability (Boler et al., 2011)
  – No issues with using raw materials for further processed products (Boler et al., 2011)
  *Total Paradigm Shift to the Industry*

• Others that may be on the horizon
  – Growth enhancers
  – Further processed technologies
  – Meat quality manipulators
Emerging Technologies

Since 1977, efficiency enhancing technologies have reduced...

- Water usage by 14%
- Land usage by 34%
- Manure production by 20%
- Carbon footprint by 18%

per pound of beef

http://www.sustainablebeef.org/

Simmons, 2011
Conclusion

• Manage fat quality as new feedstuffs emerge and carcass composition evolve
• Continue to evaluate fresh meat quality
• Investigate further processed product characteristics and quality
• **Develop and employ new technology**

that will allow us to...
Thank you! Questions?