

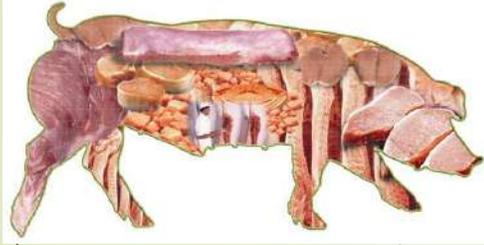


***Demands of Global Pork Supply Chain for High
Quality Pork in 2019 and Beyond
(Produced at Least Cost)***

Andrzej A. Sosnicki, Ph.D
Director, Global Technical Services
GenusPIC

PIC[®]

©Pig Improvement Company. |

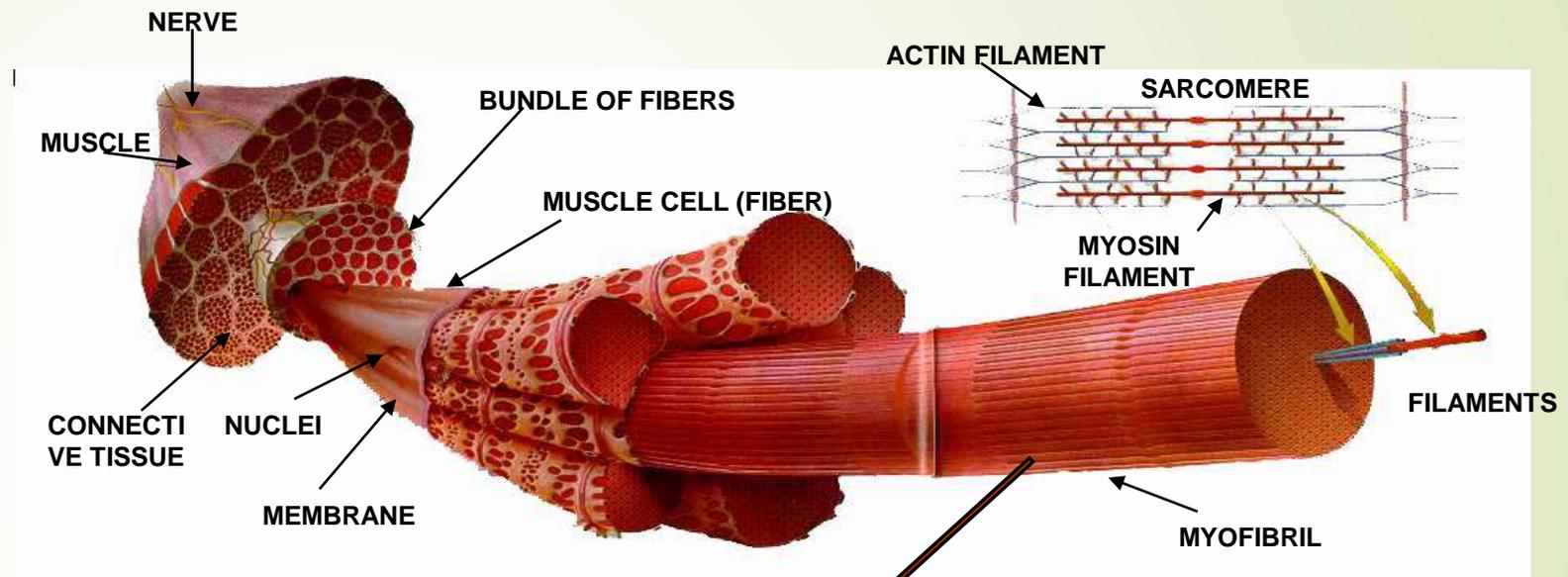
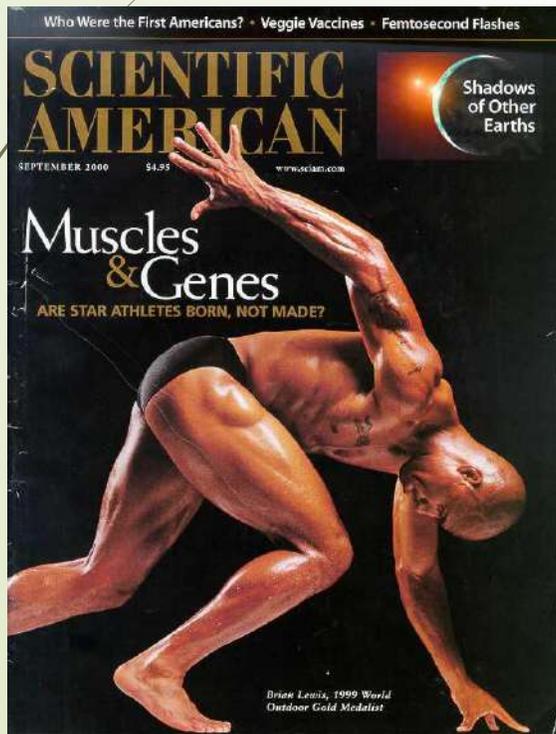


Demands of Global Pork Supply Chain for High Quality Pork in 2019 and Beyond *(Produced at Least Cost)*

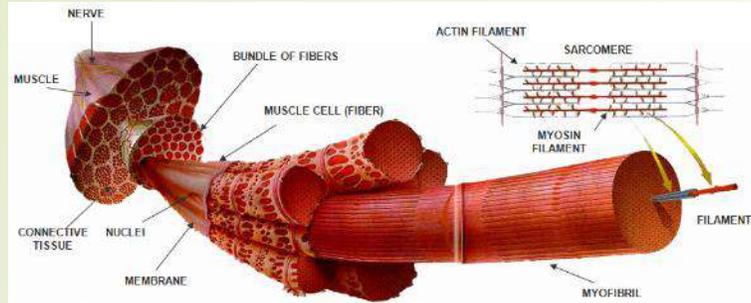
SYNOPSIS

- **Pork Quality: What is it and what is it NOT:**
 - *Post-mortem Conversion of Skeletal Muscle to Meat & Its Practical Implications for Pork Quality*
- **The Global Meat/Pork Industry:**
 - *Key Industrial Characteristics*
 - *Key Business/Sustainability Characteristics*
 - *Global Meat Trade in 2018/2019 YTD (& in the Foreseeable Future)*
- **Closing Comments**

“The cellular biology of muscle helps to explain why a particular athlete wins and suggests what future athletes might do to better their odds.”



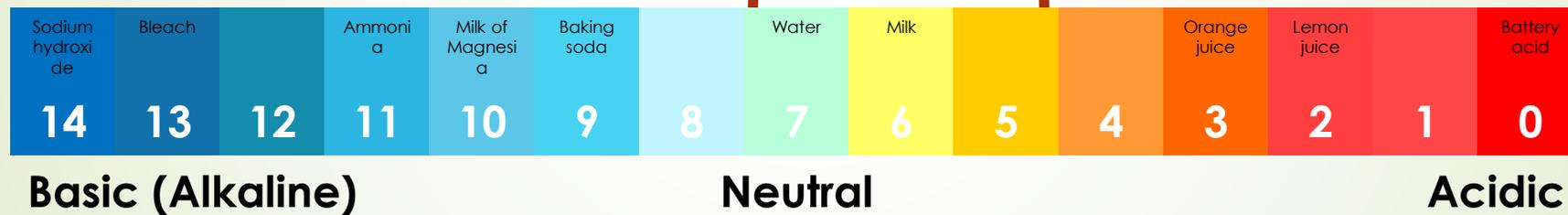
Conversion of Muscle to Meat



Glycogen  Lactate



pH scale

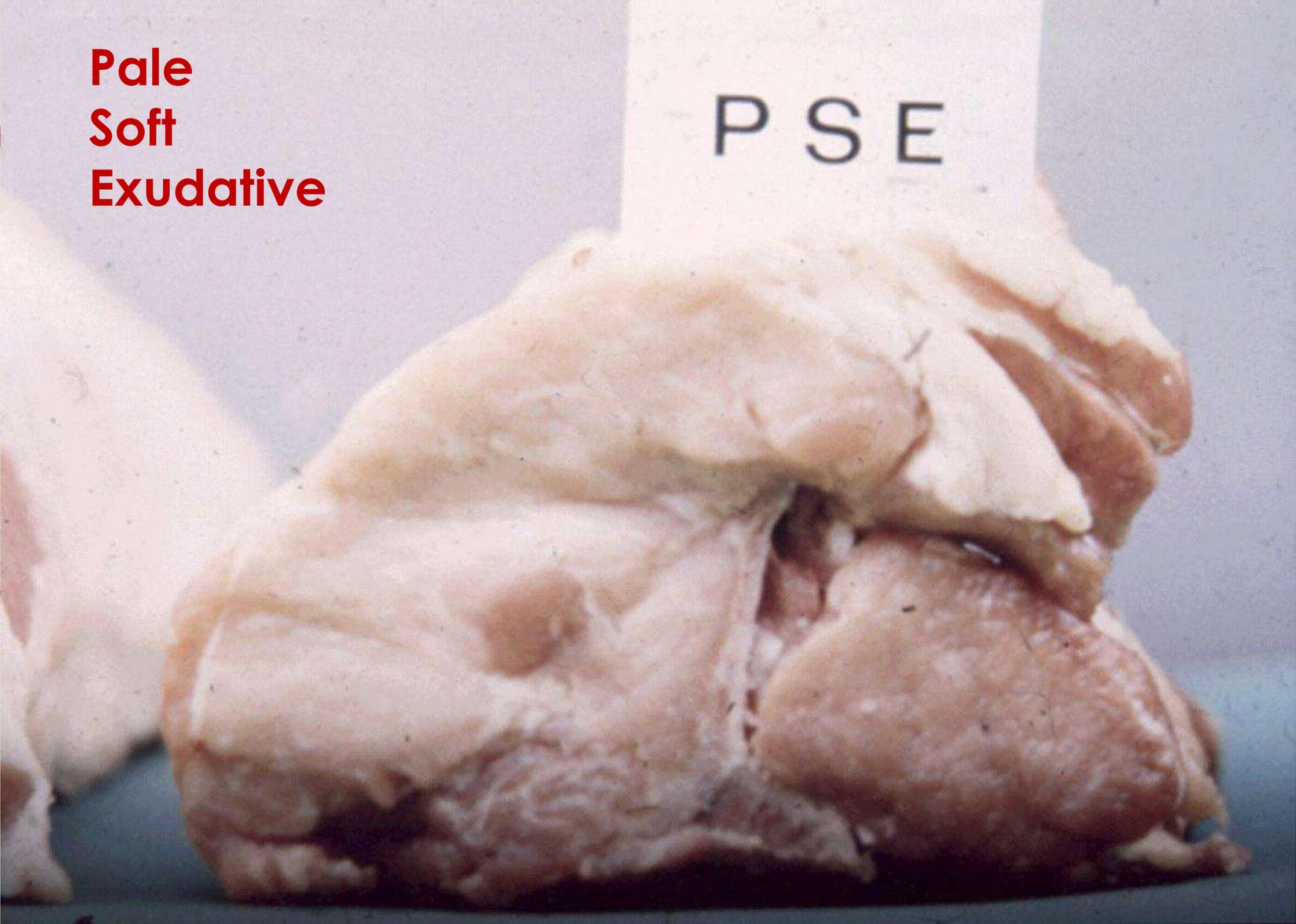


Rate and extent of pH decline influenced by:

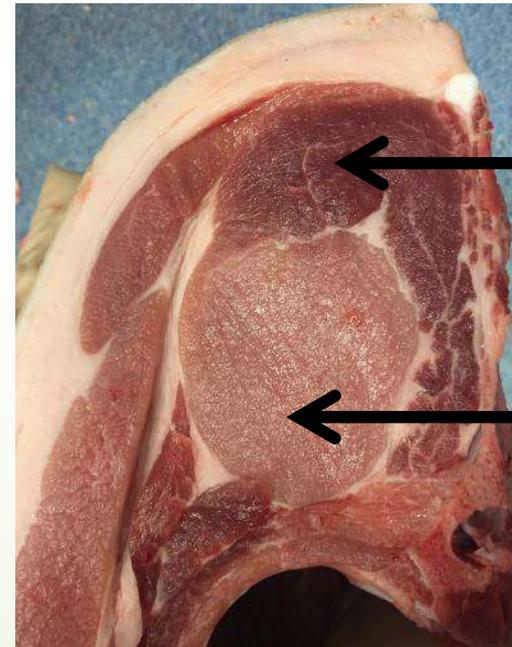
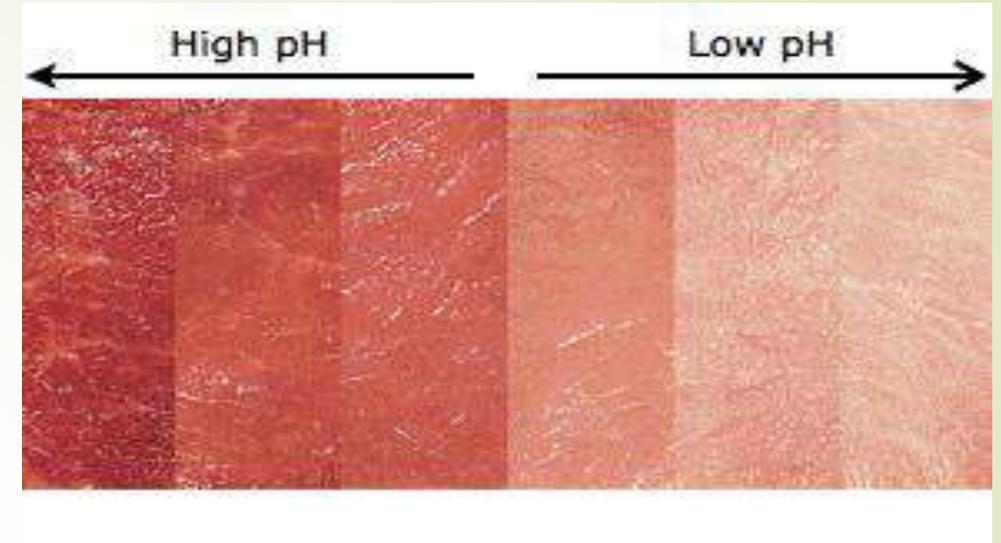
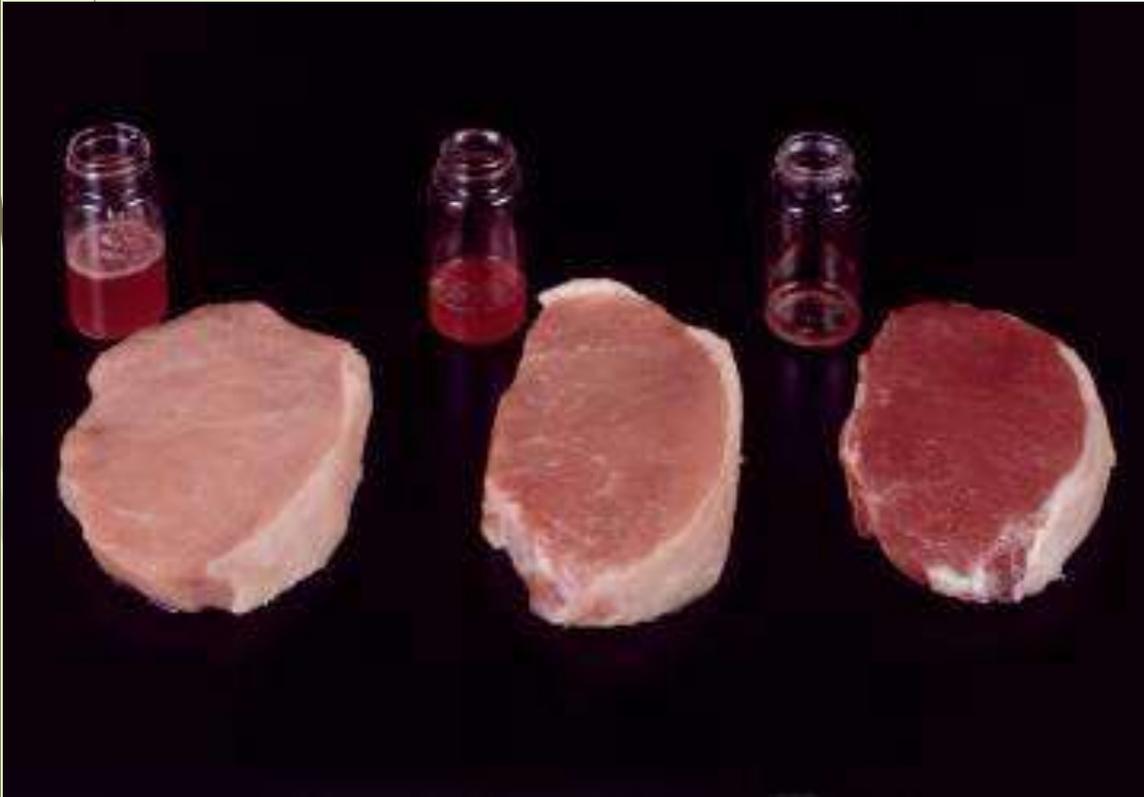
- glycolytic potential
- enzymatic processes
- carcass temperature
- stress

Pale
Soft
Exudative

P S E



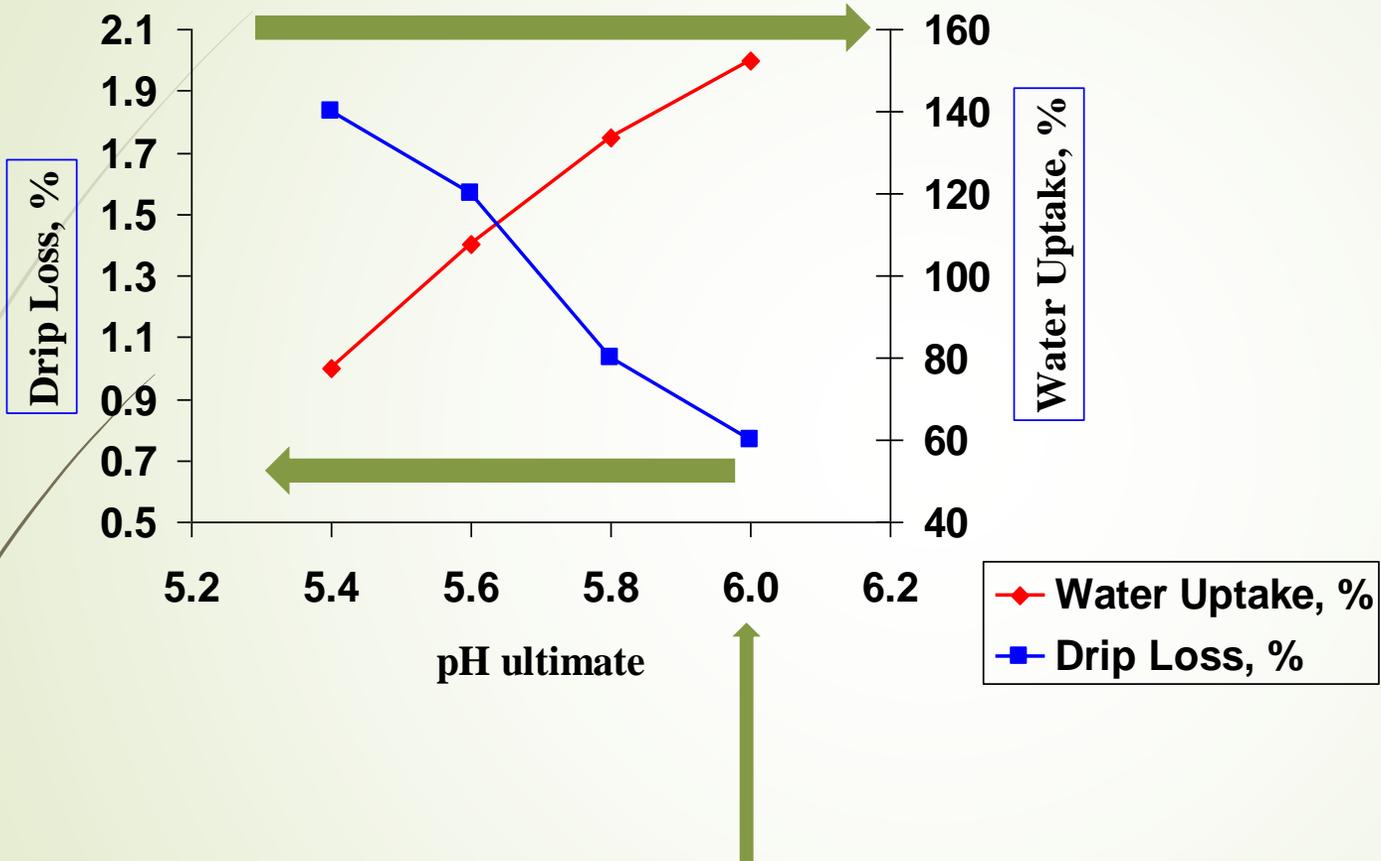
pH Relationships



pH = 6.50

pH = 5.45

Relationship of Drip Loss and Water Uptake to pHu

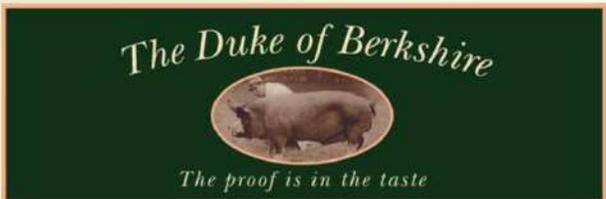


Adapted from: (Eikelenboom et al., 1995)

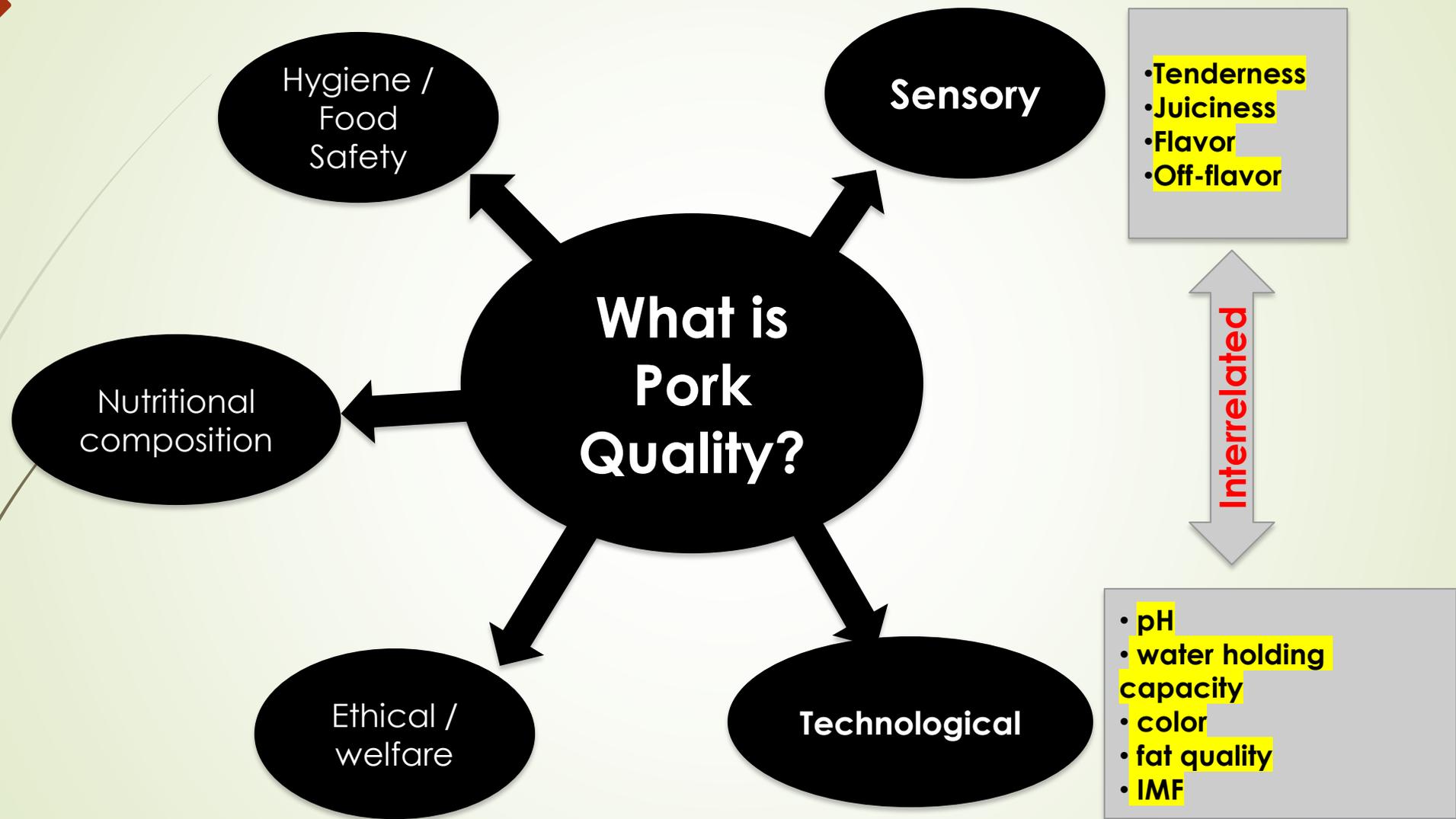
Pick your Pork.....



Pork Quality Around the World...



How do We Define Pork Quality?



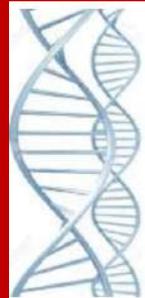
FACTORS AFFECTING PORK QUALITY: The Puzzle.....

**Non-systemic
Environmental
Factors
= Not Well
Understood
± 10%**



**Systemic Environmental
Factors = Manageable
60 to 70%**

**Genetics
15 to 30%**



Pork is NOT Beef OR Chicken

BEEF



- **Ruminant**
- ~ 24 months at slaughter
- More “red” fibers
 - Type I
- More collagen
- Difficulty getting pH to go down
- Fatty acid profile more saturated



PORK



- **Non-Ruminant**
- ~ 6 months at slaughter
- More “white” fibers
 - Type II (mostly IIb)
- Less collagen
- Difficulty keeping pH from going down
- Fatty acid profile less saturated

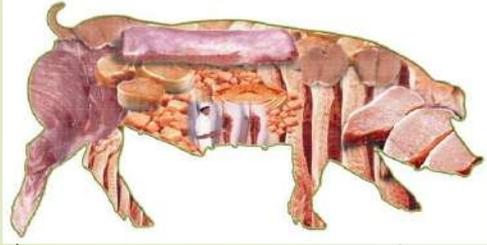


CHICKEN



- **Non-ruminant**
- ~ 40 days at slaughter
- All “white” fibers (in breast)
 - Type II (~99% IIb)
- Less collagen (barring defects)
- Difficulty keeping pH from going down
- Fatty acid profile less saturated





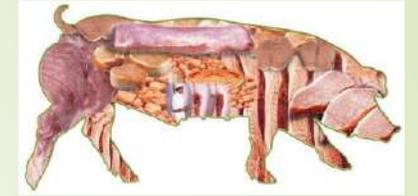
Demands of Global Pork Supply Chain for High Quality Pork in 2019 and Beyond (Produced at Least Cost)

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Meat Industry: VALUE DEFINED:

$$\begin{array}{c} \uparrow \\ \text{QUALITY + SERVICE} \\ \hline \text{COST} \\ \downarrow \end{array}$$

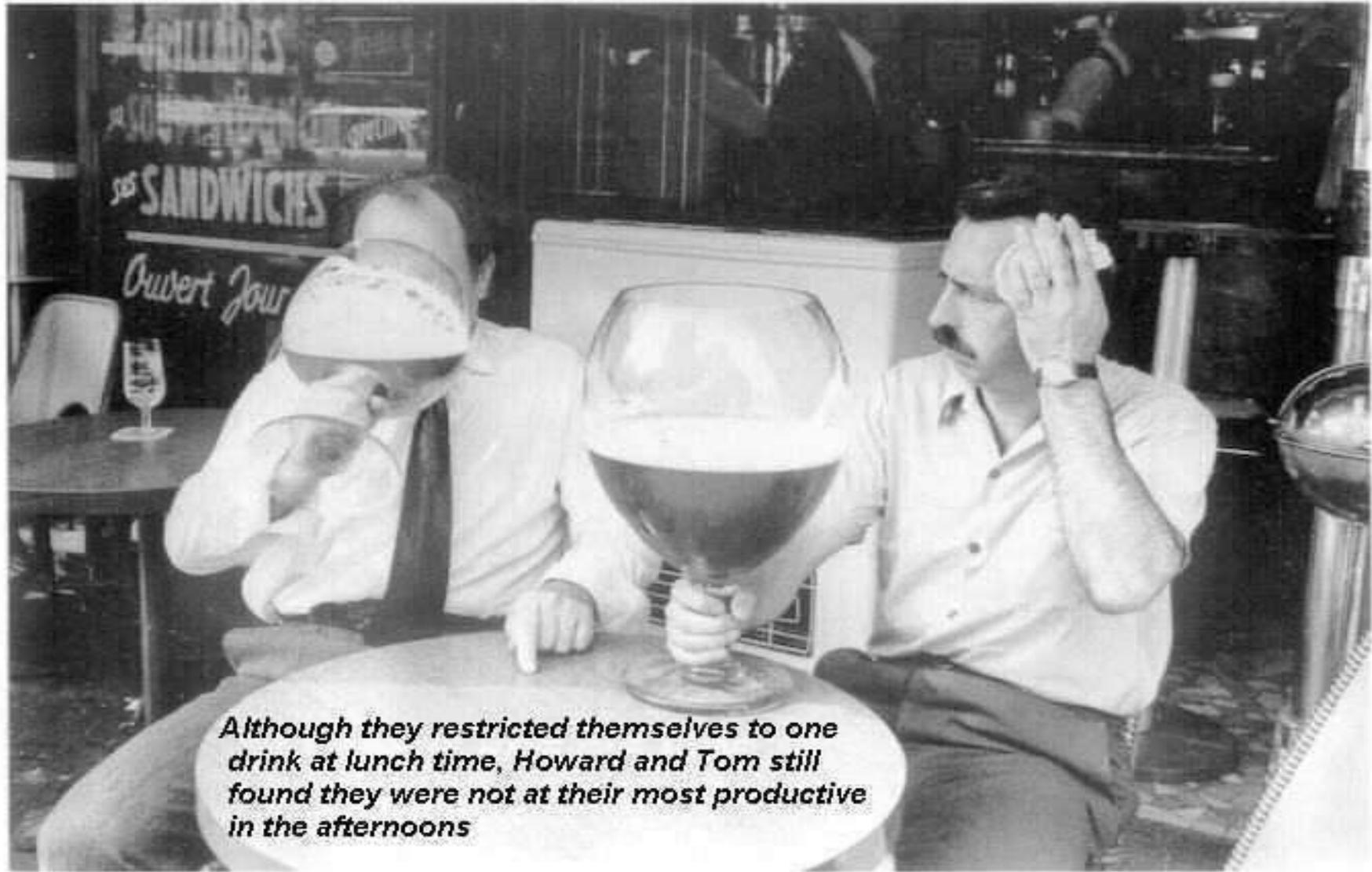


- **Meat industry is a competitive, high-volume, commodity-driven, low-margin business**
- The global meat market is highly complex & can be segmented by:
 - *Governance*
 - *Species (beef, pork, poultry)*
 - *Distribution channel (retail, food service, commodity, international)*
 - *Type of processing (slaughter, further processing)*
 - *Type of products (bulk parts, retail packaged, raw meat, packed processed meats)*
 - *Geography (country, continent, export, global)*

Meat Supply Chains vs. Meat Value Chains

- Supply chain management focuses mostly on increasing the efficiency of current operations
 - its core focus is on **reducing costs** while retaining the systems and processes already in place
- Value chain management is based on creating value from consumers' perspective
 - its core focus is on developing the systems necessary to **satisfy consumers' expectations**
 - **cost reduction is an outcome of this approach**, as is superior quality and competitiveness through focusing resources on efficiently producing goods that offer superior consumer-recognized value
 - A closely-aligned value chain often contains vertically and horizontally linked players such as genetics and genetic improvement program(s), farmer(s), processor(s), distributor(s), and retailer(s)

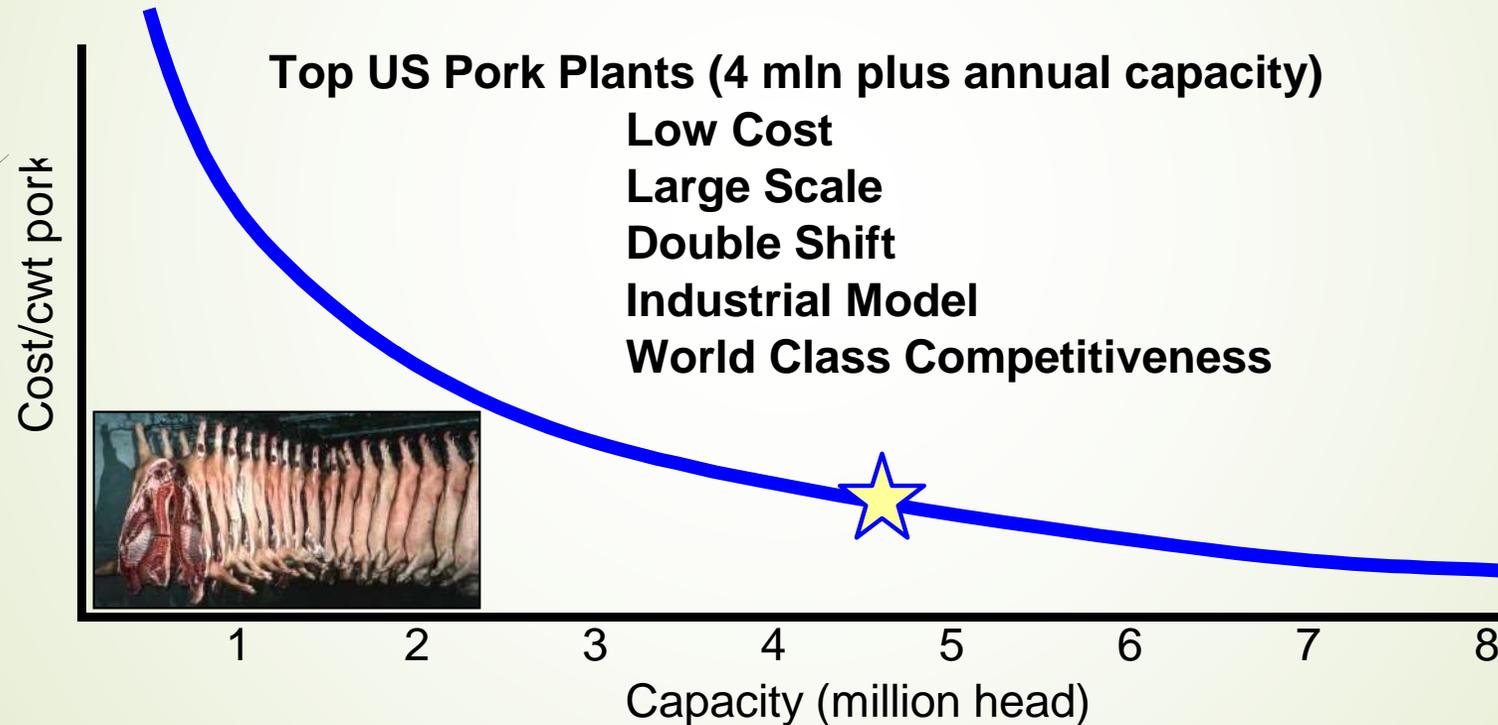
Bigger is Usually Better!



Although they restricted themselves to one drink at lunch time, Howard and Tom still found they were not at their most productive in the afternoons

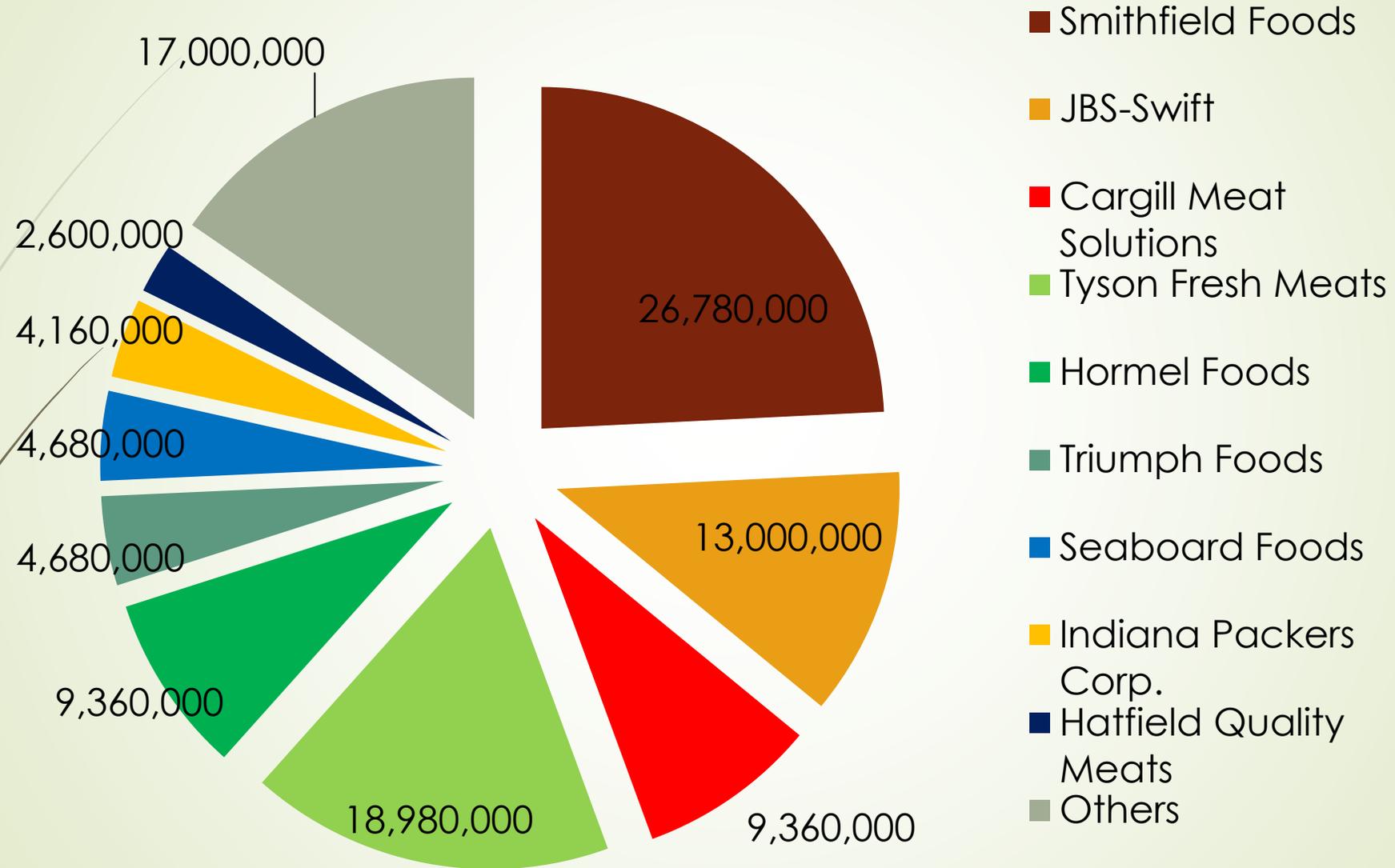
INTEGRATED players with Strong Upstream Linkages & Downstream Distribution are the BEST Positioned to take Advantage of Growing Global Meat Demands

The Large-Scale High-Throughput Model



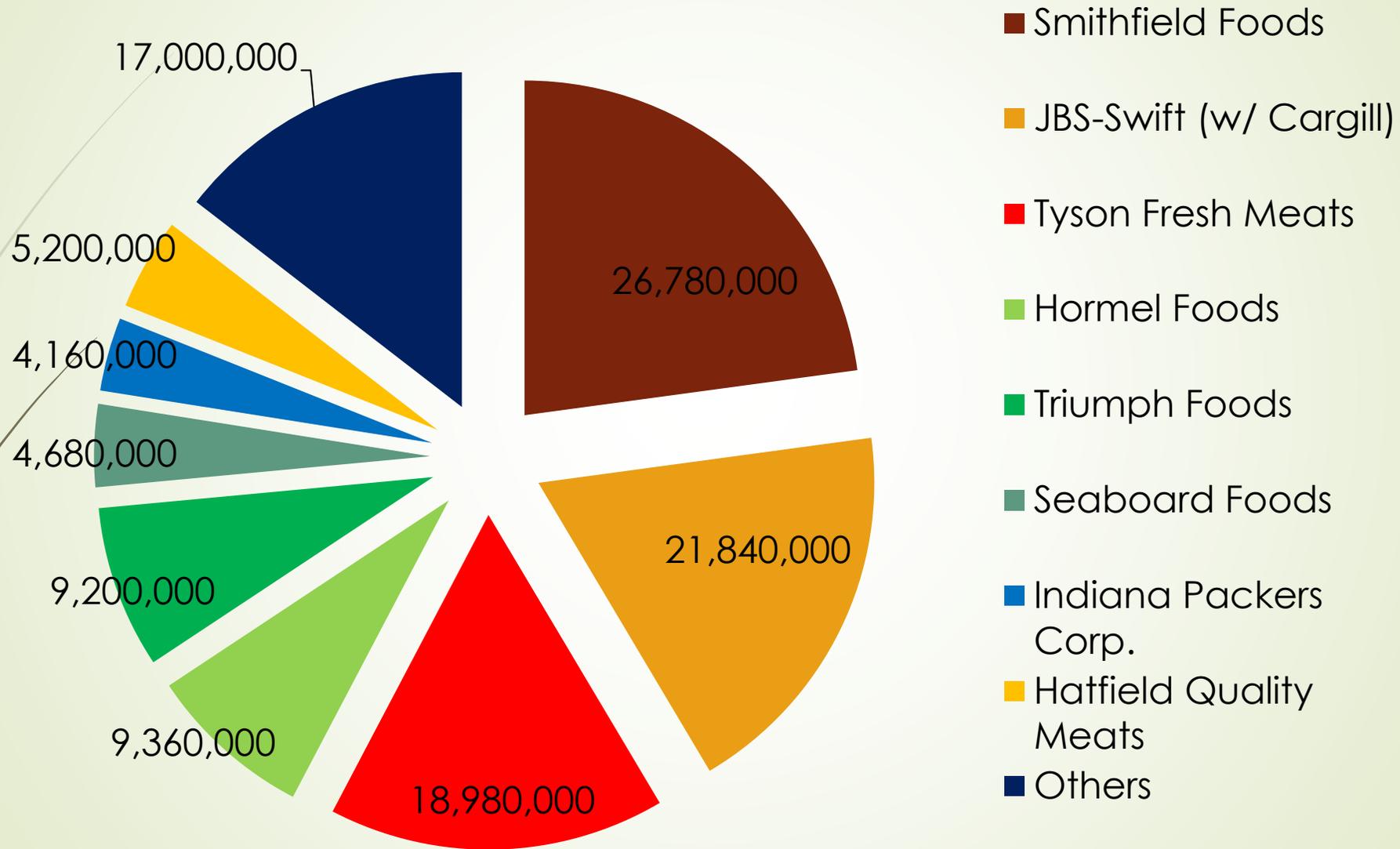
US Average Line Speed= 1,000=1,200 Pigs/hour

Annual FI Pork Harvest - 2015



~110 Million total

Estimated FI Pork Harvest - 2019



~117 Million total

Carcass Weight Trends

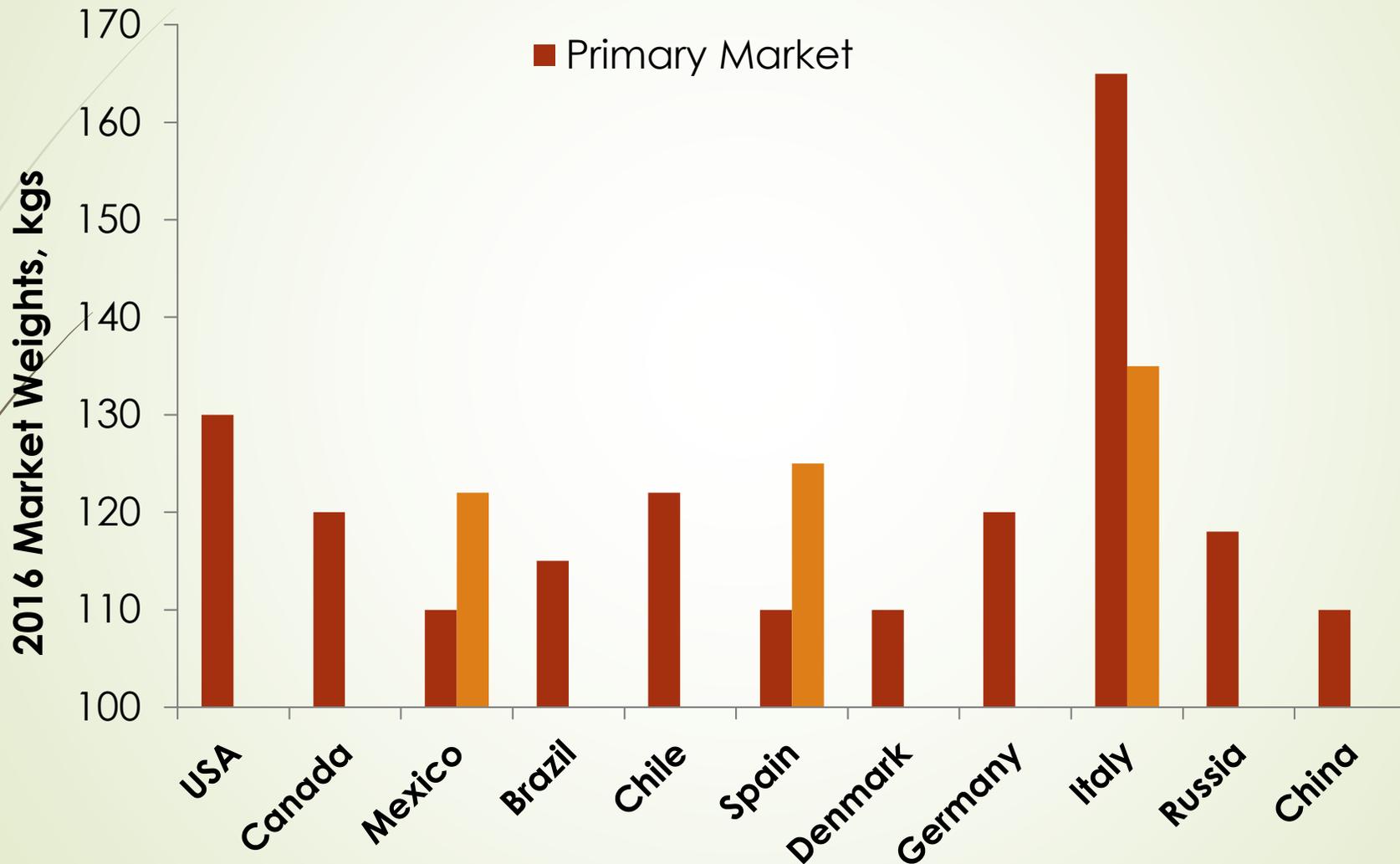
22



How Big of a Pig Should we Produce?

- How does genetic improvement=*pig biology* impact pig performance at heavy weights?
- How do they perform on the farm?
- How do they perform at the plant?
- What do the consumers think of them?
- **What do we do with sales people who say “I can’t sell product from big pigs!!”**

“Heavy” is Relative



Data gathered by: PIC Global Technical Services

How Heavy Can We Go? Never Stop Improving

National Pork Board Research Proposal General Call 2017 Proposal Cover Page



It is our policy to honor the confidentiality of each research proposal to protect investigators from having their ideas exposed to unnecessary critique and discussion. However, during review, the reviewer may make discrete inquiries on protocol mechanics if it improves the quality of his/her evaluation, so long as the source and nature of the work is undisclosed.

IS THIS A REQUEST FOR SECOND OR THIRD YEAR FUNDING? _____
IF SO, PLEASE INDICATE ORIGINAL PROJECT NUMBER: _____

Project # (NPB use only)			
Category:	FORK QUALITY		
Project Title:	Projecting changes in pig growth, pork quality, eating experience, and muscle physiology due to increasing live and carcass weights		
Requested Funding Amount:	\$199,111	Project Duration:	1 year

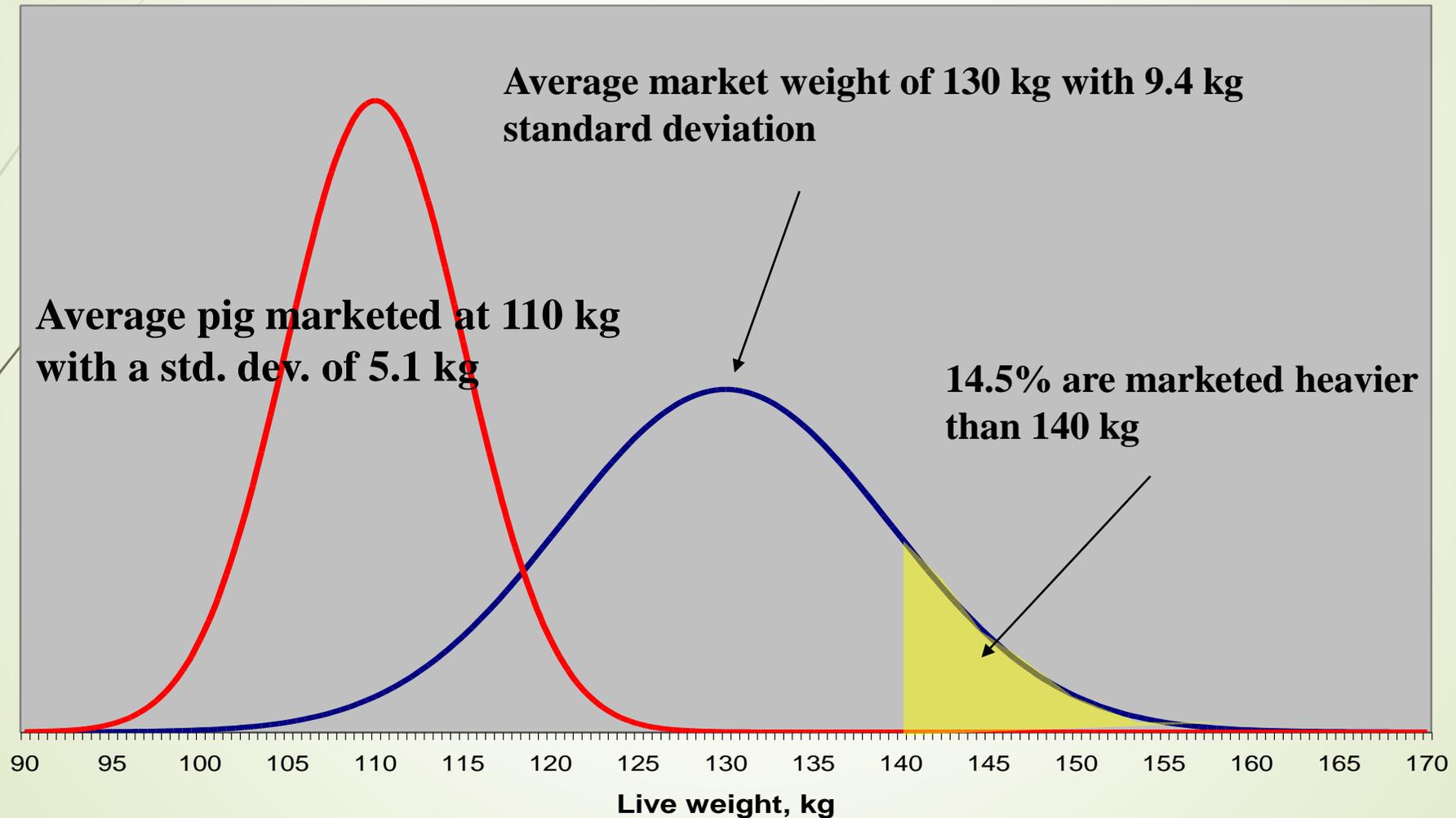
Principal Investigator and Title:	Dustin Boler Assistant Professor		
Institution:	University of Illinois Urbana-Champaign		
Address:	1503 S. Maryland Drive		
City, ST ZIP	Urbana, IL 61801		
Phone:	(217) 300-4847	FAX:	N/A
Email:	dboler2@illinois.edu		

Co-Investigator(s)	Institution, City, State	Email address
1. Jason Woodworth	Kansas State University	jwoodworth@ksu.edu
2. Anna Dilger	University of Illinois	adilger2@illinois.edu
3. Steven Shackelford	U.S. Meat Animal Research Center	steven.shackelford@ars.usda.gov
4. Brandon Fields	Pig Improvement Company (PIC)	brandon.fields@genusplc.com
5. Travis O'Quinn	Kansas State University	travisquinn@ksu.edu
6. Steve Dritz	Kansas State University	dritz@vet.ksu.edu

Heavy Pig Project – Key Findings

- **Average weight in project = 119kg carcass (159kg live)**
 - **Max live weight = 193kg**
- **Growth rate increased until 155kg**
- **As weight increased:**
 - Iodine value decreased (fat got firmer)
 - Meat was more tender
 - Lower SSF and WBSF
 - Higher tenderness scores from trained panel
 - Higher tenderness scores from consumer panel
 - **Consumers preferred loin chops from heavier carcasses**
 - Higher juiciness scores and “overall liking” scores

Variation in Live Weight – Example



Plant Carcass Boning Yields

	Range	Wtd. Average
Live Weight, lbs	n/a	285.5
Carcass Yield, % of Live wt.	75.2 – 77.3	75.8
Cutting Yield ^a , % of Live wt.	72.2 – 74.5	73.5
Primal Yield ^b , % of Live wt.	63.8 – 68.4	67.0
Primal Yield ^b , % of HCW	95.1 – 99.2	97.0
Ham Yield, % of HCW	23.5 – 25.1	24.4
Loin Yield, % of HCW	20.4 – 25.0	22.9
Shoulder Yield, % HCW	19.0 – 22.8	20.5
Belly + Rib Yield, % of HCW	18.0 – 22.8	20.7
Misc., % of HCW	6.0 – 11.2	8.6
Condemnations, % of Kill	0 – 0.05	.02
Deads, % of Kill	0 – 0.28	0.10

^a Yield of total saleable products from the carcass (essentially, this is cold carcass weight minus cutting losses).

^b Yield of primal ham, loin, shoulder, belly, and misc. parts.

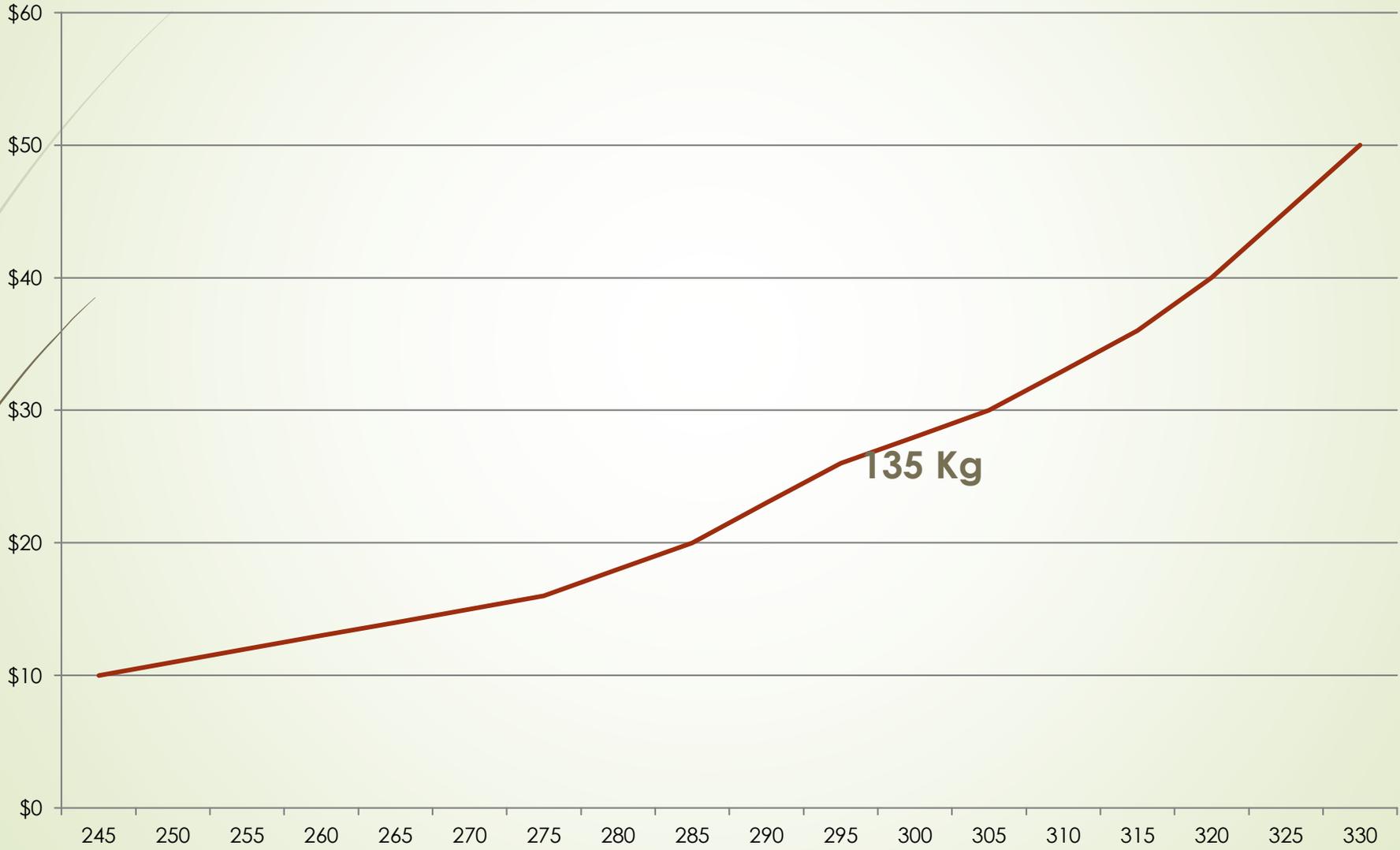
Total Plant Costs

	Range	Wtd. Average	Top 25% Avg.
Total cost / pig, \$	23.23 – 44.31	30.92	26.40
Labor costs, \$	13.36 – 26.04	18.26	15.04
Fixed costs, \$	n/a	12.66	11.36
Total cost / lb, ¢	11.08 – 22.45	15.17	13.10
Labor costs, ¢	6.63 – 13.20	8.95	7.77
Fixed costs, ¢	n/a	6.22	5.33

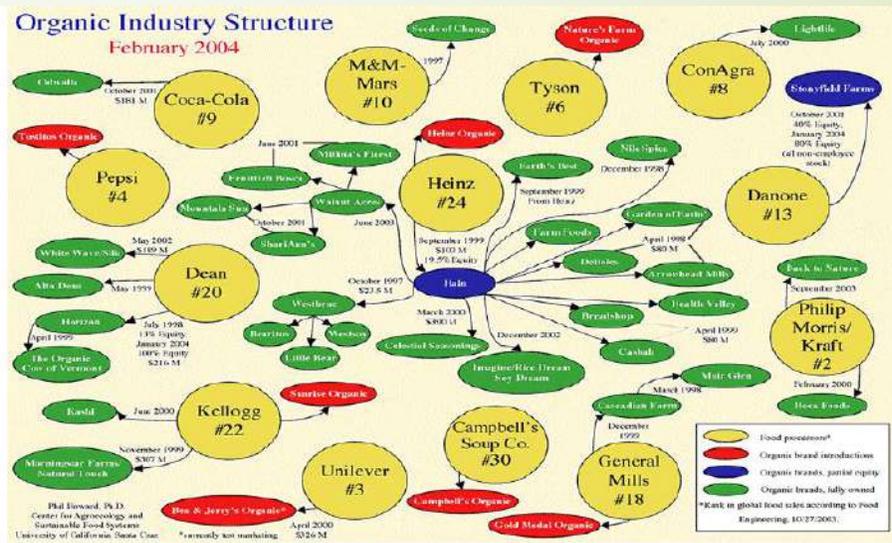
Processing Costs

	Range	Wtd. Average	Top 25% Avg.
Kill cost / pig, \$	3.19 – 4.68	3.85	3.30
Labor costs, \$	1.80 – 2.91	2.41	2.26
Fixed costs, \$	n/a	1.44	1.04
Kill cost / lb, ¢	1.54 – 2.22	1.84	1.58
Labor costs, ¢	0.88 – 1.41	1.15	1.09
Fixed costs, ¢	n/a	.69	0.49
Cut cost / lb, ¢	5.95 – 12.28	7.86	6.62
Labor costs, ¢	2.60 – 6.00	3.98	3.58
Fixed costs, ¢		3.88	3.04

Estimated Net Value to Packer for Heavier Weights (Canada)



The ('Western') Consumer Attitude



We are a Big Country



55% of shoppers say they are carrying at least a few extra pounds.

For Boomers it's 66%

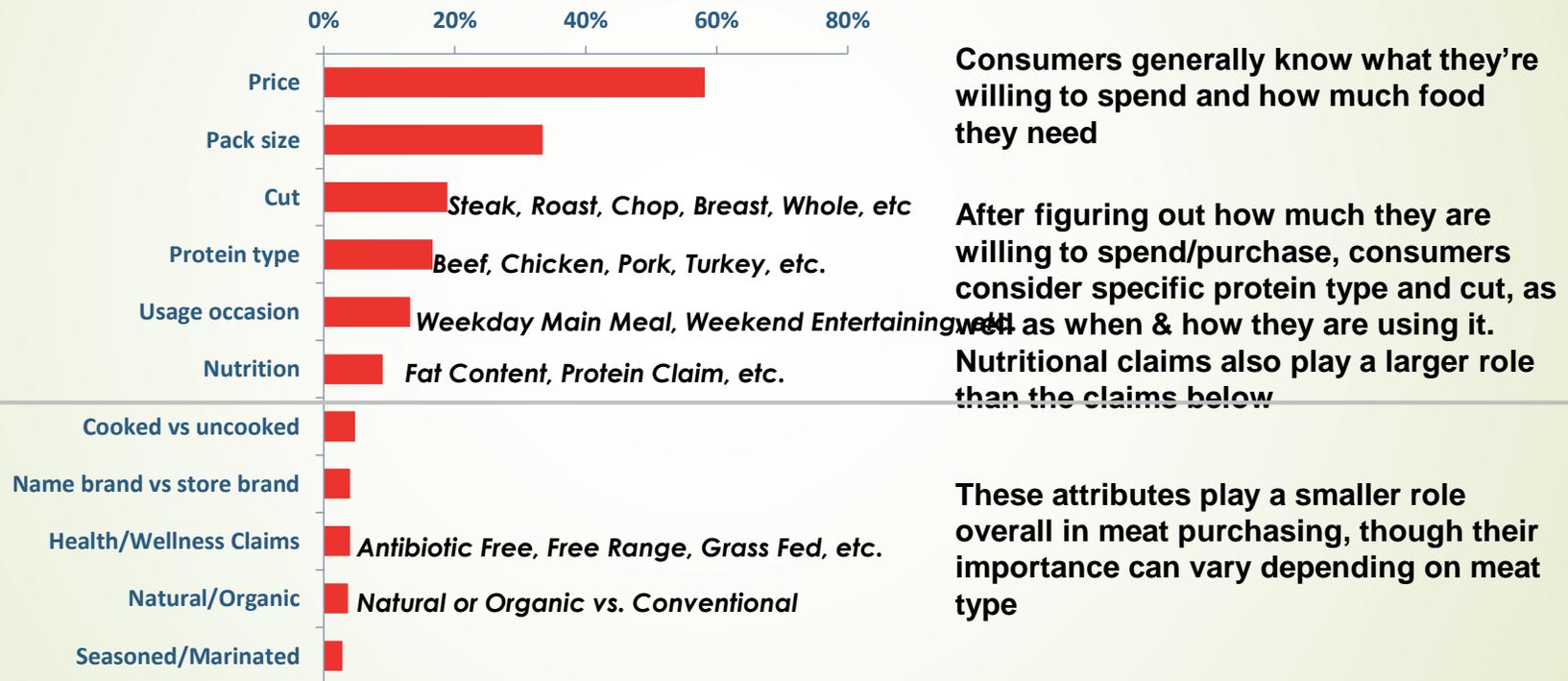
28% of parents say they have an overweight child aged 6 to 18.

Source: Prevention SFH 2006



Price is Most Important Criterion for US Consumers of Fresh Pork

% of respondents that said an attribute played a role in their decision process (fresh meat)



Consumers generally know what they're willing to spend and how much food they need

After figuring out how much they are willing to spend/purchase, consumers consider specific protein type and cut, as well as when & how they are using it.

Nutritional claims also play a larger role than the claims below

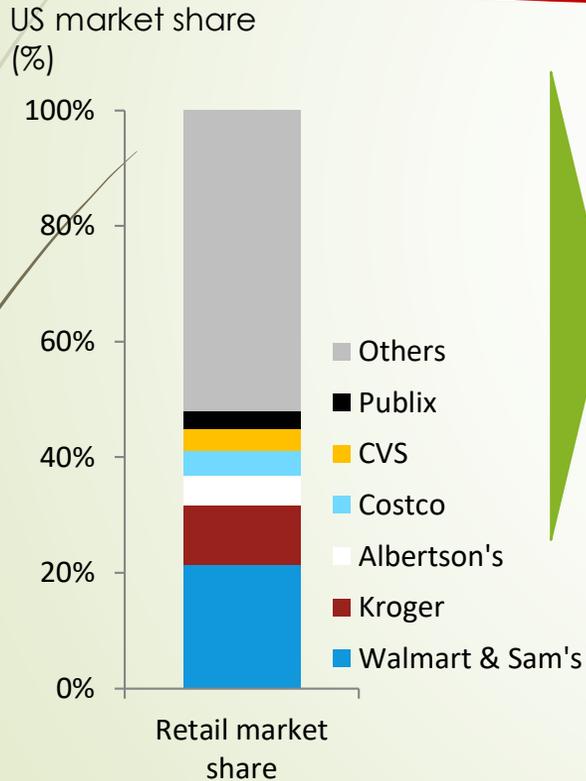
These attributes play a smaller role overall in meat purchasing, though their importance can vary depending on meat type

Most meat cuts are highly price sensitive with a unit elasticity below -1 (i.e. a 10% increase in price causes >10% decline in volume)¹

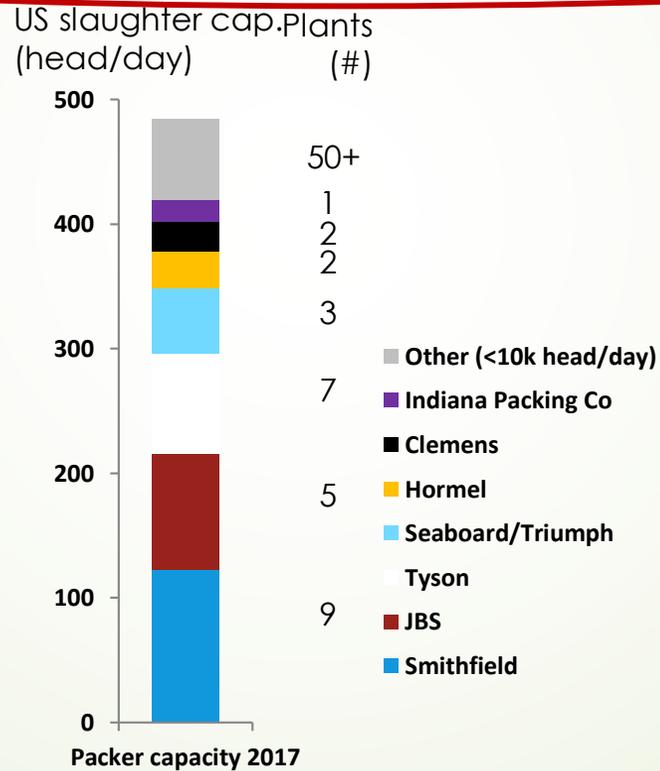
1. Nielsen Perishables Group 2014
Source: The fresh meat landscape – consumer decision hierarchy research – over 14,000 respondents - 2017 (Nielsen);

In a Consolidated US Landscape, **Few Players** Drive Market Shifts

Changes by 1-2 of the dominant retailers...



...can drive shifts with 1-2 large integrated packers...



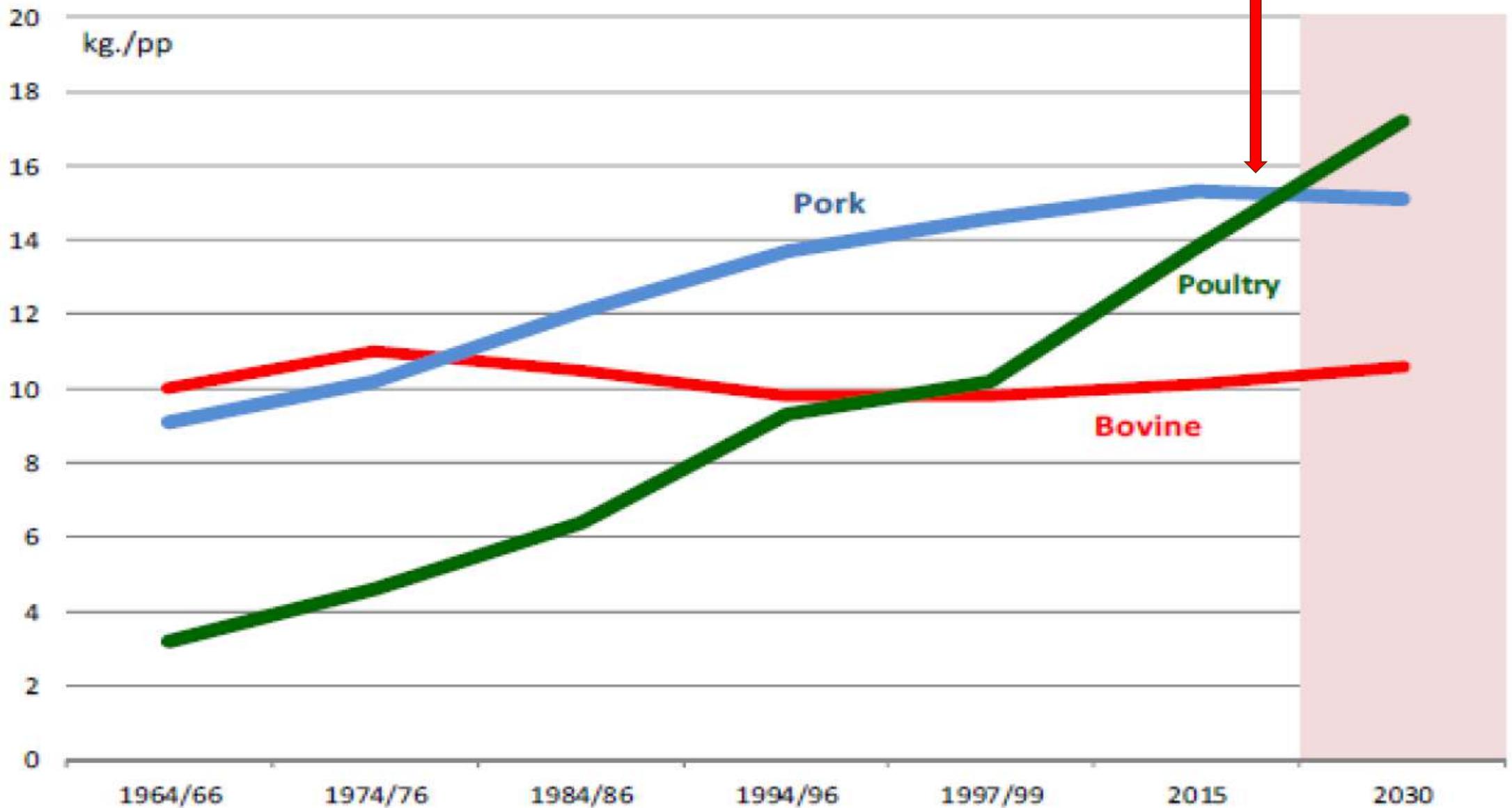
...which can cause large shifts in pig production

Implications of consolidated landscape:

Shift of 1-2 retailers can have significant impact on producers

WORLD MEAT CONSUMPTION TRENDS

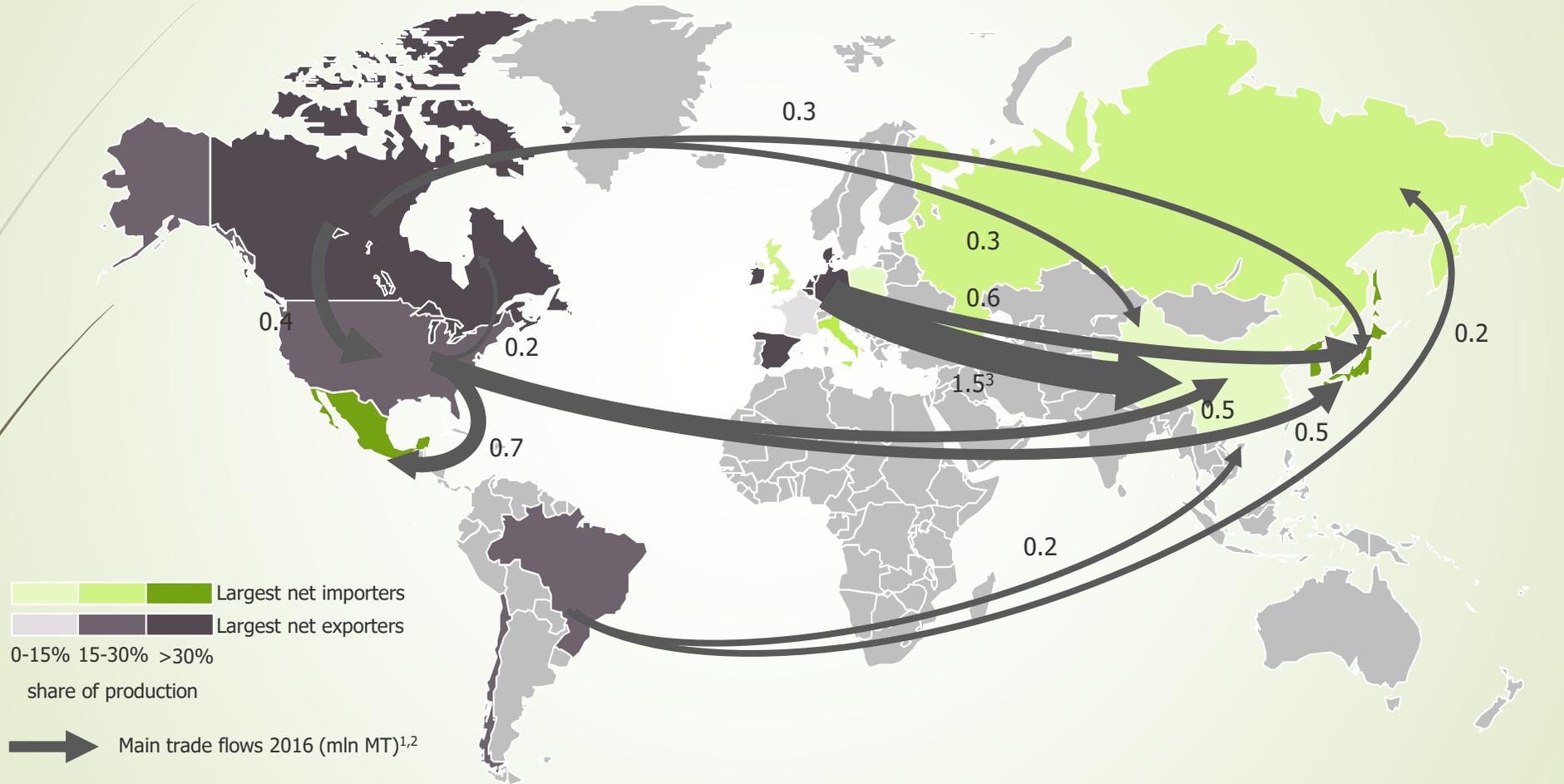
Per Capita Consumption. CWE. Kg. Per Person. Source: FAO





Globalization of Pork Trade

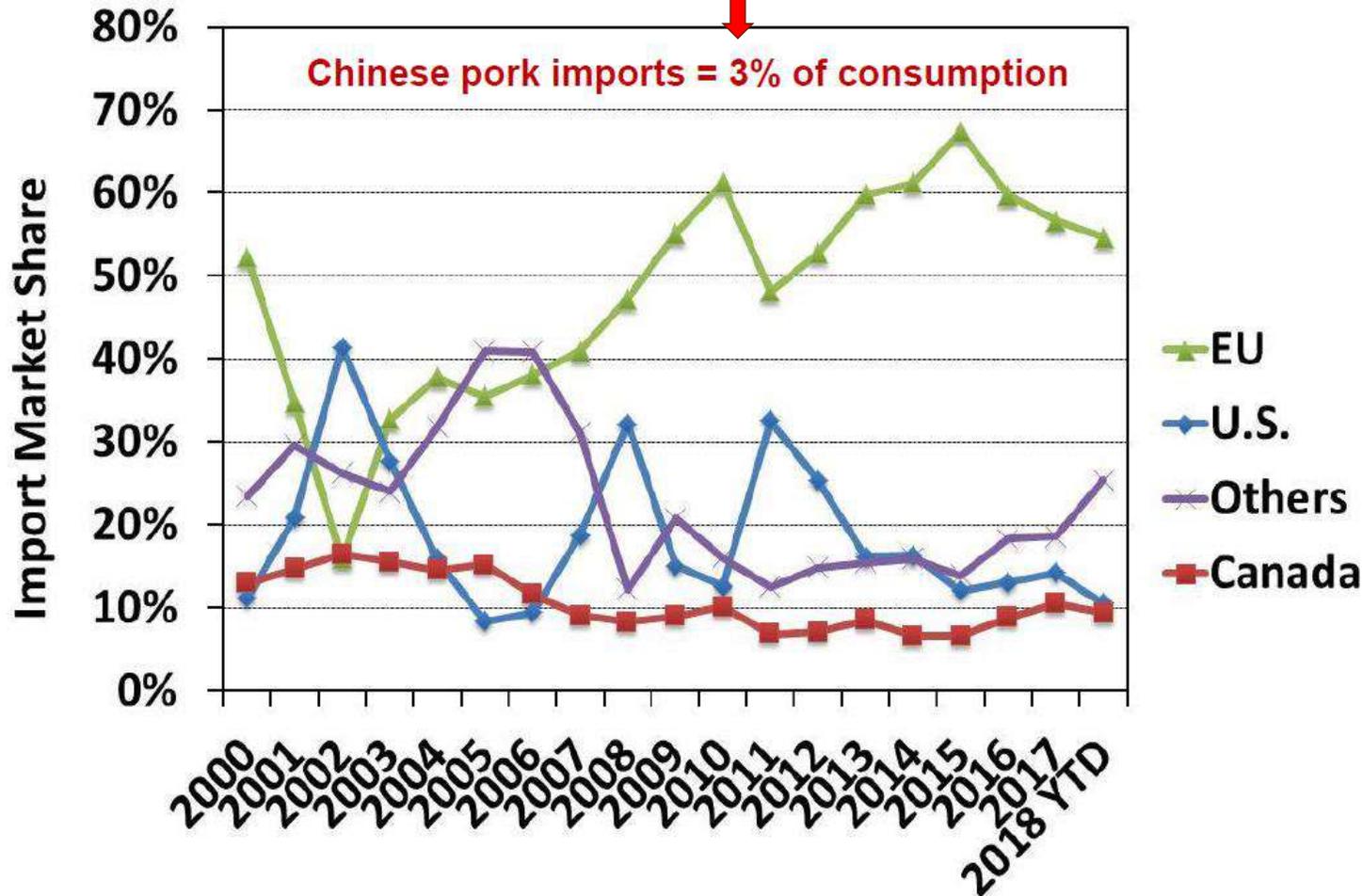
~7% of Pork is Traded;
Trade is Key to Producers in EU, the Americas



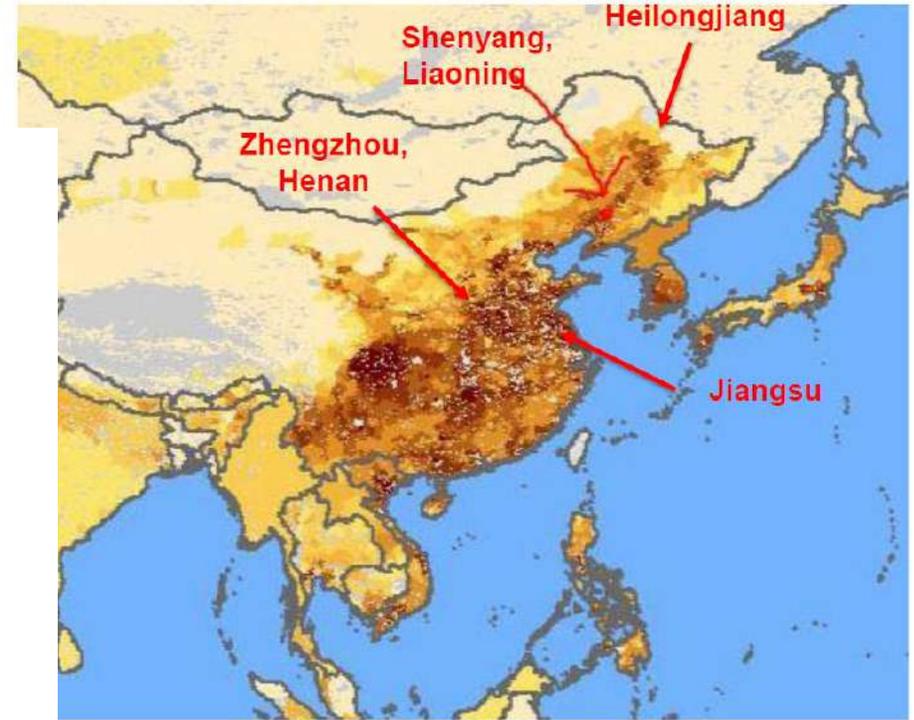
1. Arrows representing 5.4mT (2/3 of global trade flows of 8mT excluding intra-Europe flows), Largest flow not show: Intra-Europe flow (>4mT); 2. flows to Japan/Korea combined, flows from Europe combined; 3. from Europe to China is the average from numbers reported by China (1mT) and reported by EU (2mT)

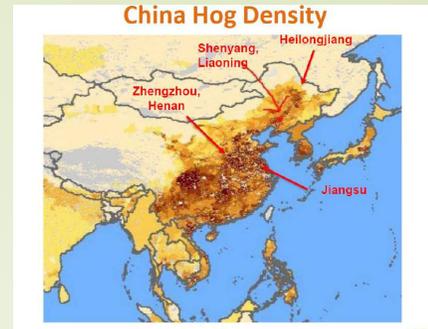
Source: US Meat Export Federation, Canada Pork, Boyar, European Commission, ABPA Brazil;

China/H. Kong Pork Imports



China Hog Density





BEIJING, China – Pork prices have been sent soaring and herds devastated as **African Swine Fever** tears through China's massive pig-farming industry, forcing the country to ramp up imports to satisfy demand – but analysts warn worse is yet to come.

More than 1.1 million pigs have been killed or culled so far as authorities scramble to contain a virus that has spread to neighboring countries since the first cases emerged in August 2018 and for which there is no vaccine.

But the figure is widely believed to be much higher, as official data show China's pig herd totaled 347.6 million in the first half of the year, **down 60 million** from the same period last year. **Pork prices soared by a fifth in June alone.**

"The worst is yet to come," said Jan-Peter Van Ferneij, who monitors foreign markets at the French Pork Institute.

Agence France-Presse

@afp Published **4:25 PM, July 21, 2019;** Updated 4:25 PM, July 21, 2019

Global Pork Quality Markets

Commodity Pork
'Protein Source'



'Eating Quality'
Japan & Korea
Food Service & Retail
Niche Markets



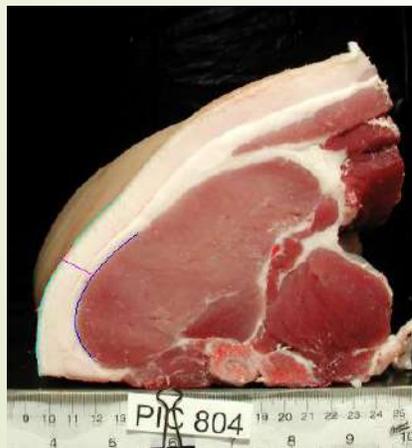
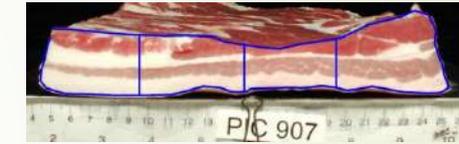
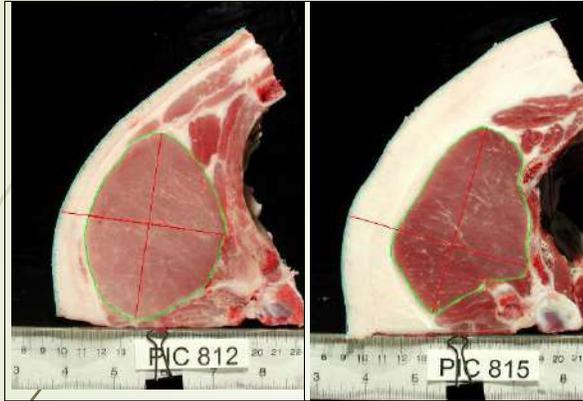
Dry-cured Ham Quality
Serrano, Bayonne
Parma, Prosciutto



Processing Quality
Enhanced/Marinated Products
Hams, Bacon, Sausage

Can we Economically Supply All Global Markets Using One Type of Pig/Carcass/Pork?

HOW MANY SIRE LINES & WHY ??



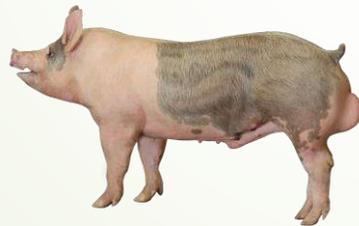
PIC Sire Lines

All PIC sire lines are selected based on the total economic value their market pigs will contribute to the pork production chain

- Robustness
- Efficient lean growth
- Carcass and meat quality



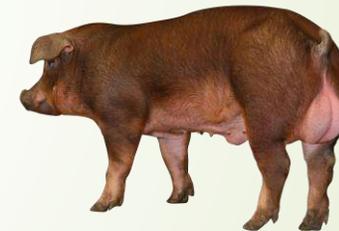
PIC@337
Total Profitability
Lean Gain Efficiency
Carcass Value



PIC@359
Balanced Total Profitability
& Robust Lean Gain



PIC@327
Robust Lean Gain
Heavy Weight Efficiency
Carcass % Lean



PIC@800
Livability
High IMF &
Primal Quality
Robust & Durable

From 2018 – Ongoing: *Direct Genetic Improvement of Primal & Sub-primal Weights*

PAST Milestones

- Visual assessment
- Backfat
- Ultrasound – fat and loin depth

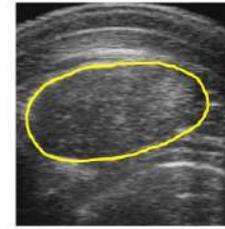


Figure 16. Measuring Loin Muscle Area

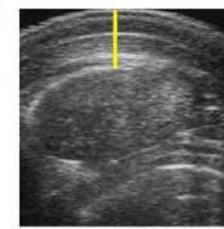


Figure 15. Measuring Backfat thickness

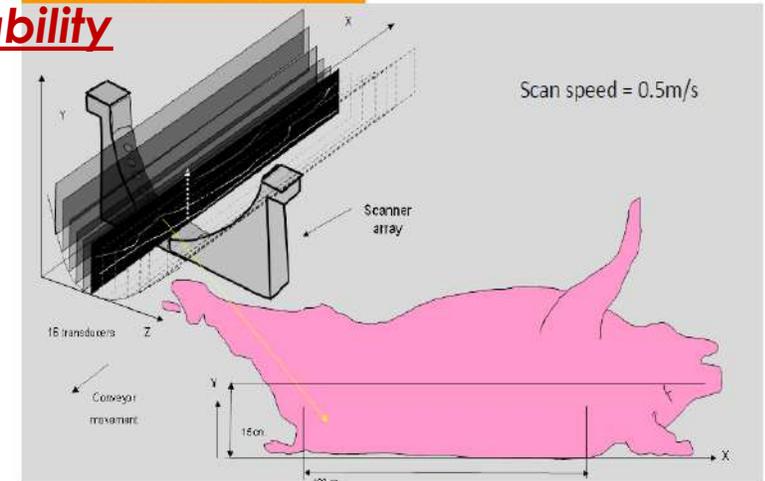


TODAY into the Future: AUTO-FOM –based Carcass Value Predictability



AutoFomIII

Data Acquisition – 3-D scanning



From 1998 - Ongoing:

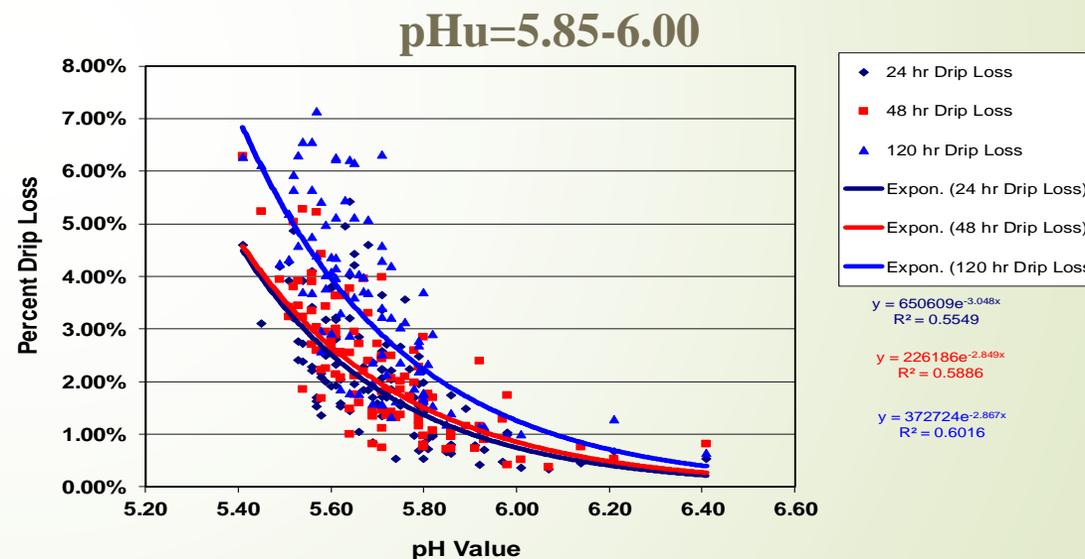
Direct Genetic Improvement of pHu to Maximize Processing & Eating Quality



➔ Half-Sibs & GNX: Data Collection at Processing Plants:

- ➔ *Ultimate pH*
- ➔ *Water-holding capacity*
- ➔ *Meat Color*

Relationship Between % Drip Loss
and pH 24-hour PM (E. & S. Lonergan, ISU)



2018- Ongoing:

FIRST BREEDING COMPANY THAT IMPLEMENTED *Direct Genetic Improvement of Pork Tenderness*

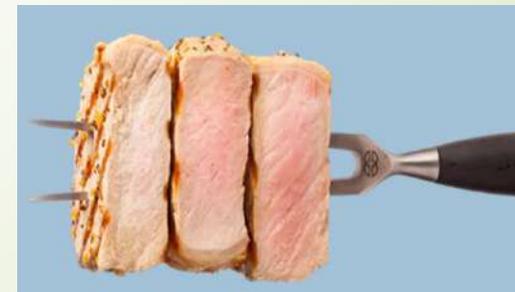
- Built on the GNX program
- Objective tenderness evaluation
 - Cooked Loin chop
 - Cores
 - Shear Force

Food Texture Fixtures

Warner-Bratzler Shear
Catalog Number 2830-013



Warner-Bratzler shear fixture with support frame and dip tray



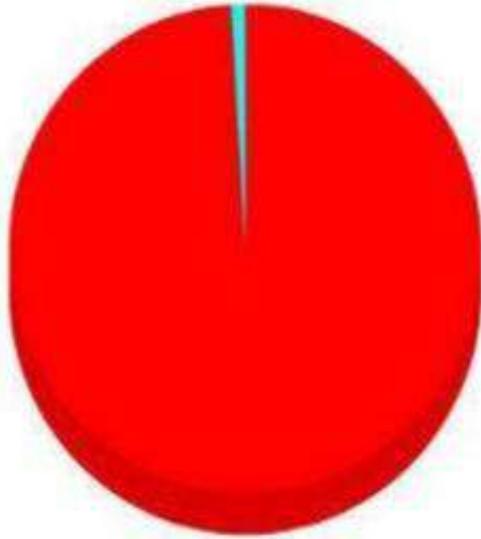
Thoughts to Ponder

*GLOBAL Pork Production Evolution**

- ▶ 1970s: More Pigs
 - ▶ 1980s: More but Lean Pigs
 - ▶ 1990s: More but (Japanese) Quality Pigs (at Least Cost)
 - ▶ 2000s: Even More Pigs but Production Focused on Throughput & Heavy Slaughter Weights
 - ▶ 2005s: Cost/Kg of Carcass
 - ▶ 2008-2010 Cost of Cal/Kg of Carcass
- ▶ **2010+: 2018 YTD – from COST to VALUE UPON DEMANDS of DOWN-STREAM PLAYERS**
- ▶ Cost of Cal/Kg of Primals & Subprimals
 - ▶ Cost of Cal/Kg of 'Quality Differentiated' Primals & Subprimals /FRESH MEATS
 - ▶ Cost of Cal/Kg of 'Quality Differentiated' Primals & Subprimals for 'Value Added' Consumer products
 - ▶ What's next (?)

* Cost/Value focus; Environmental, Animal Welfare/ Societal issues are not included

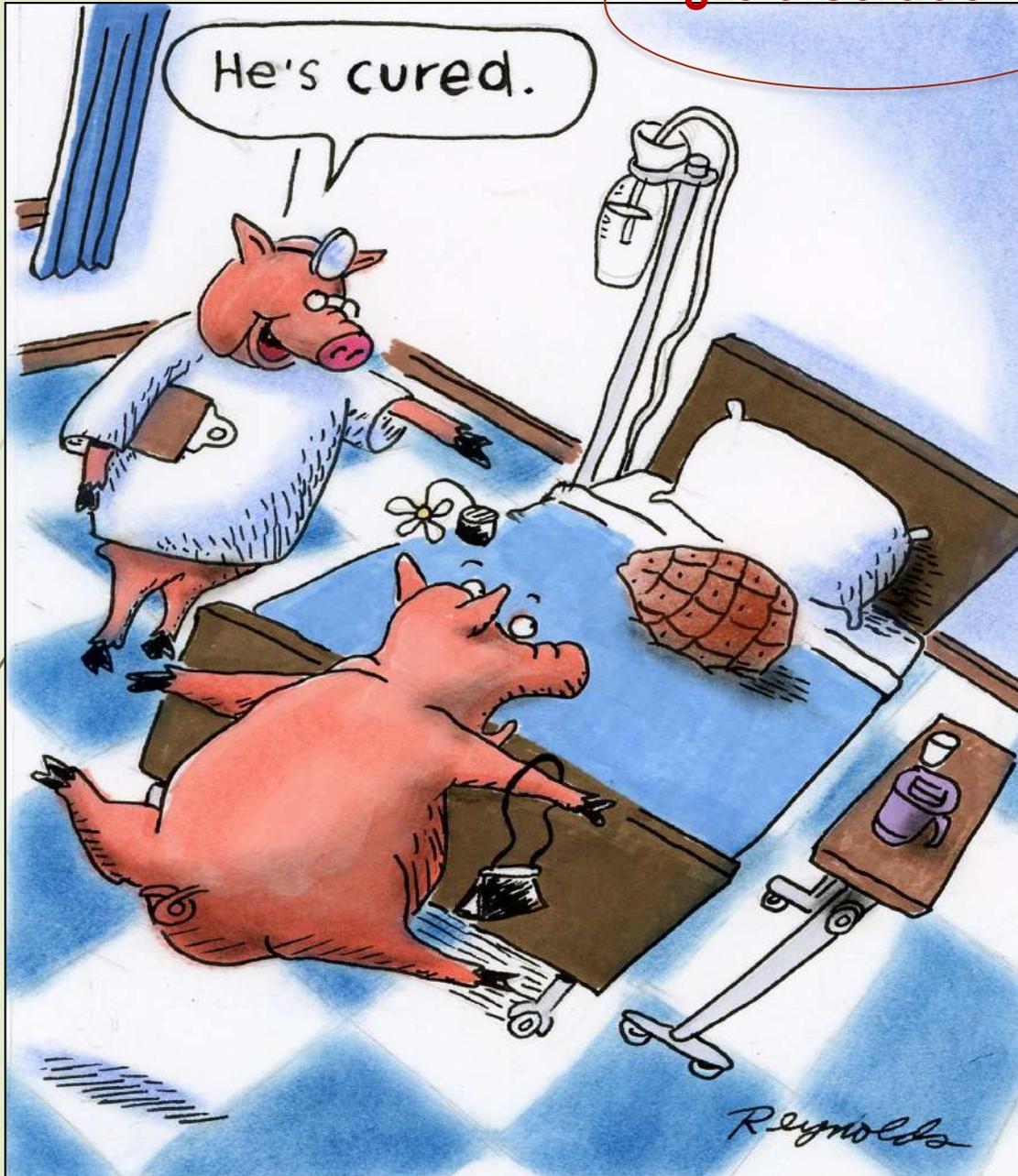
Bacon.



- People that like bacon.
- People that are wrong.



¿Está curado



¿Preguntas?
¿Comentarios?
¿Crítica?