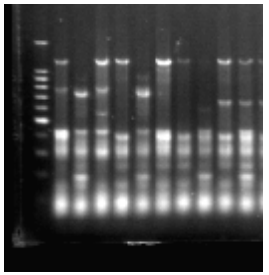
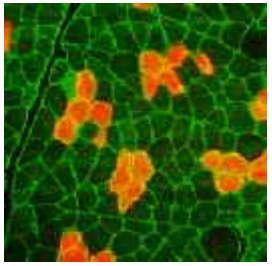
Pork Meat Quality Research at the University of Guelph





putting together the pieces

Interdisciplinary research group:

Tina Widowski	(behaviour/handling)
Ira Mandell	(post mortem & meat quality)
Peter Purslow	(biochemical mechanisms)
Andy Robinson	(gene expression-muscle)
Jim Squires	(gene expression-brain)
Phil McEwen	(nutrition and production)
Kees de Lange	(nutrition)

Jennifer Brown (graduate student) & **technicians**

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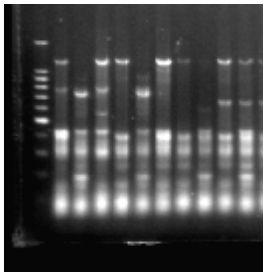
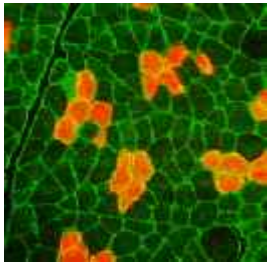
The issue:

Poor water holding capacity and sub-standard quality of pork affects profitability across the Ontario pork industry, due to deleterious effects on:

- **Product yields**
- **Appearance of pork in the meat case**
- **Eating quality**





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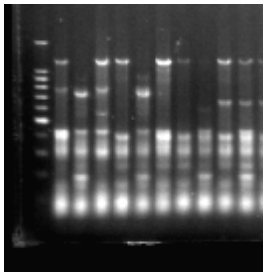
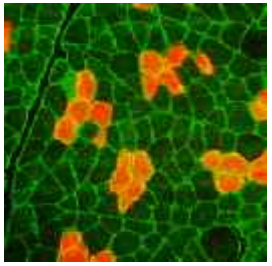
Aim of Research:

1. Identify the variability in pork meat quality among typical producers in Ontario

2. Better understand the contributing factors & mechanisms that contribute to poor pork quality

3. Develop management programs (breeding, behavioral and nutritional) that can reduce stress & increase consistency in pork meat quality





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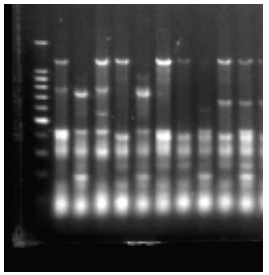
I. Variability in Ontario Pork Quality

20 commercial producers + 6 lines raised at UofG
x 24 animals each = 624 pigs

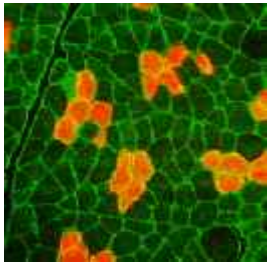
Behaviour from unloading to stunning (CO_2)
Blood stress indicators



Routine carcass measurements

Loin + Ham:

- **pH & temp monitored to 24 hr**
- **Extensive meat quality evaluation***
- **Metabolites (glycogen, lactate)**
- **Calpains & cytoskeletal proteins**
- **Proteomics & gene expression**



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*Backfat & loin eye size, Colour (L,a,b), Drip loss, Total lipids, Cooking loss, Warner-Bratzler Shear (LL & SM), Processing yield (SM)

Meat quality measures & sources of variation

(19 farms & 6 pig types raised at the Univ. of Guelph)*

	Mean	Min	Max	SE
Loin**				
Initial pH	6.12	5.45	6.60	0.01
Final pH	5.67	5.29	6.27	0.01
Colour (L)	44.8	35.5	54.4	0.23
Drip loss, %#	7.42	2.69	12.5	0.14
Shear force	4.21	2.08	7.66	0.13

* Substantial between and within farm variability

**Identical data set for Ham

Target value in Denmark: less than 3.0% drip loss

Meat quality measures & sources of variation

(19 farms & 6 pig types raised at the Univ. of Guelph)

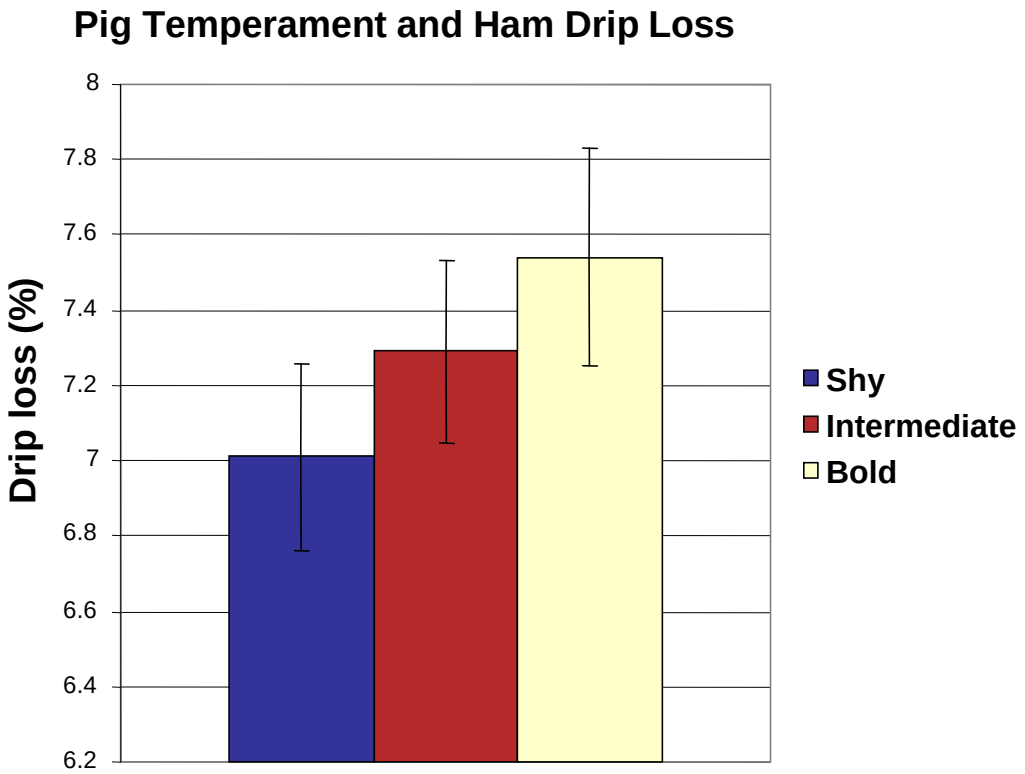
Key findings – behavior:

- **Temperament à Stress à Meat quality**

Current study:

‘walking the pens’, twice a week prior to shipping……

….to reduce the pigs’ stress response and reduce drip losses

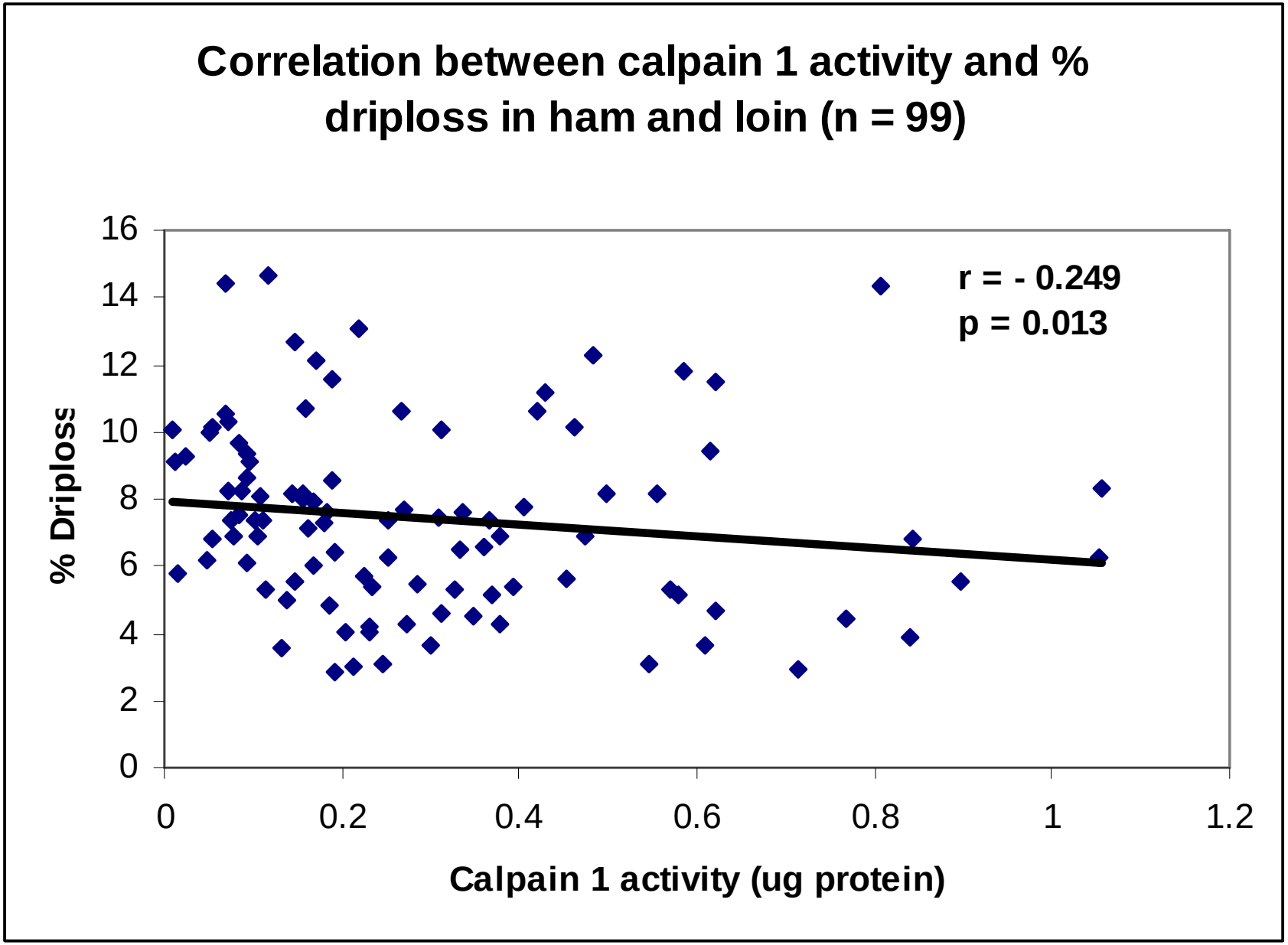


Genes associated with meat & carcass quality

- (Preliminary) candidates*:
  - *FABP3* associated with intramuscular fat content, body weight gain and tenderloin lean
  - *FABP5* associated with backfat thickness, loin fat, loin eye area and loin dry matter
  - *HDAC5* associated with loin fat and ham pH
  - Glyceraldehyde-3-phosphate dehydrogenase associated with glucose metabolism (glycolysis)
  - Adipose tissue differentiation protein

* Based on 4 micro-arrays and previous studies

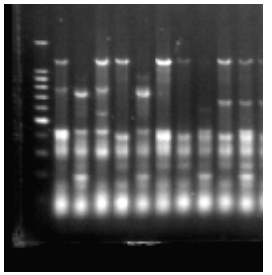
Robinson et., unpublished

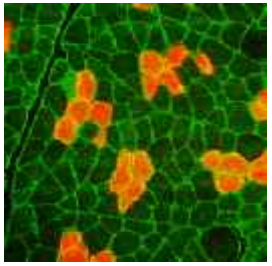


Calpain enzymes: primary enzymes for postmortem tenderization

Purslow et al., 2006

II. Limit Feeding, Growth Performance & Pork Quality





Research at Ridgetown College (Phil McEwen):

- **Limit feeding during the growing phase induces compensatory growth, reducing feed costs and possibly enhancing meat quality**

- **Effects seems mediated through diet effects on the muscle Calpain system and need further exploring**

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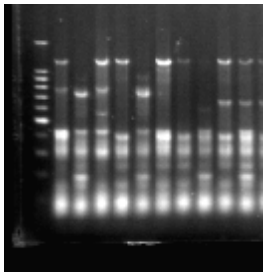
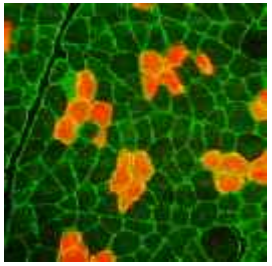
Limit Feeding, Growth Performance & Pork Quality

	Control	% of Control Intake - Grower phase -	
		85%	70%
Days to market (25 to 110 kg BW)	73.0	74.2	72.4
ADG (kg), overall	1.03	1.03	1.05
ADG (kg), finishing phase	1.02	1.06	1.16
Total Feed usage (kg/pig)	197.2	197.3	183.0
Yield index	61.0	60.1	59.8
Loin color, L*	48.1	48.7	48.9
Drip loss, %	7.0	7.4	6.8
Shear force, kg	4.7	4.2	4.2

McEwen et al., unpublished

III. Feeding Supplemental Tryptophan, Growth Performance & Pork Quality





- Feeding extra tryptophan has been shown to elevate brain serotonin levels when the amino acid, was increased in the diet…...which may provide a sedative effect reducing stress and improving meat quality

- **Evaluate:** amount and duration of feeding supplemental tryptophan

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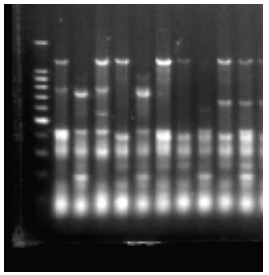
III. Duration of Feeding Added Tryptophan, Growth Performance & Pork Loin Quality

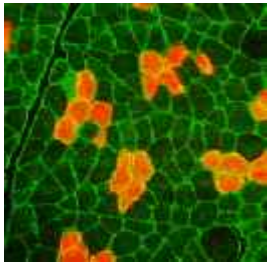
		0.5% TRP			1% TRP		2% TRP
	Control	5 days	10 days	15 days	5 days	10 days	15 days
Average daily gai							0.85
Feed to g							2.41
Marbling							2.5
Loin pH							5.56
L value							51.8
Drip loss							9.1
Shear force	3.98	4.06	4.10	4.36	4.24	4.01	4.07
Cooking loss,%	20.9	21.3	21.7	22.2	20.0	20.9	19.9

No effect of short term feeding of tryptophan on pork meat quality, consistent with other recent studies

Mandell et al., unpublished

IV. Effect of Short Term Protein Restriction on Growth Performance and Pork Quality





- In rats, brain serotonin levels increased due to short-term withdrawal of protein from purified diets, resulting from increased tryptophan levels in the brain
- Feeding, purified low protein diets to pigs is not practical
- **Evaluate:** short-term withdrawal (1 or 3 days pre-slaughter) of supplemental protein (soybean meal) from the diet

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Effect of Short-Term Feed Protein Restriction, Growth Performance & Pork Quality

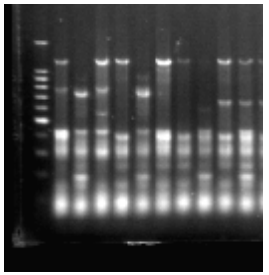
		Days of Protein Withdrawal	
	Control	One	Three
Daily C			1.12
Yield I			60.5
Marbli			2.50
Loin p			5.50
L valu			50.1
Drip loss, %	8.2	8.0	7.6
Shear force	4.64	4.84	4.88

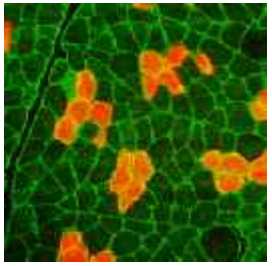
No effect of short-term withdrawal of supplemental feed protein on any growth performance or meat quality parameter

Mandell et al., unpublished

Main Findings (1/2)

- Tremendous variability in Ontario Pork Meat Quality, especially drip losses
- Substantial pig (geno-) type effects, not related to PSS gene, but to:
  - pig behaviour
  - the pigs' response to stress
  - muscle Calpain systems
  - a select number of candidate genes





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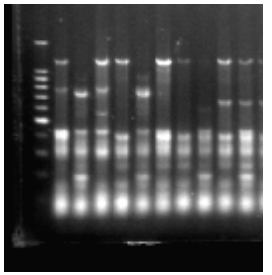
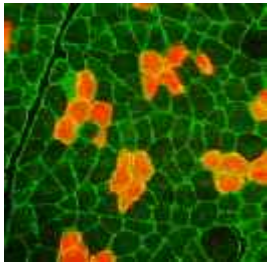
Main Findings (2/2)

- Compensatory growth, represents a means to enhance feed efficiency and pork meat quality, but requires further exploring
- Manipulating tryptophan intake or short-term protein intake restriction appears not effective in enhancing pork meat quality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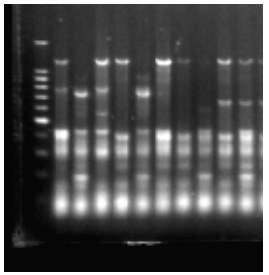
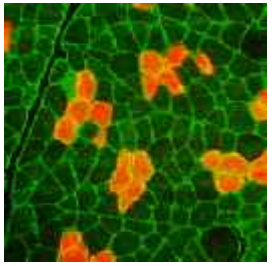
Next steps

Further exploring of:

- **Gene expression & muscle physiology**
- **Behavioural strategies to reduce response to stress in pre-slaughter pigs**
- **Diet effects (PayleanTM; diet glucogenic effects; feeding level) on pork meat quality**
- **Interactions between pig genotypes and management strategies**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Thank You

Financial support:

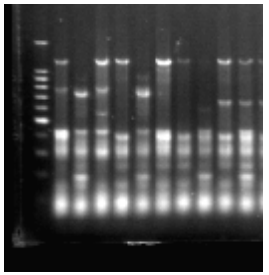
Ontario Pork

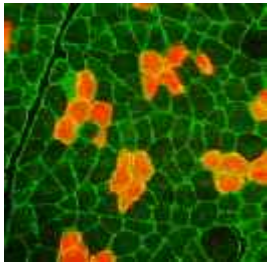
NSERC

Collaborators:

Conestoga meats

Quality meats





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