

Improving beef eating quality

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Livestock Genetics and Management for Product Quality and Sustainability

Strand 1
Improving product quality

Sub-strand 1.1
Improved measurement techniques for
carcass and meat eating quality
in beef and lamb

Sub-strand 1.2
Designing and testing breeding programmes
to improve carcass and meat eating quality

Investigate improved measurement techniques for carcass and meat quality in beef

and

their optimal use in breeding programmes

in order to

substantially improve the efficiency of Scotland's livestock farmers in an increasingly competitive food chain.

- Investigate techniques for prediction beef carcass and meat eating quality from

- live animal measurements



- carcass measurements



- Investigate the influence of marker genotypes on predicted and direct measures of meat eating quality.

- Identify the most cost-effective breeding programme designs to achieve genetic improvement of carcass and meat eating quality in beef
- Investigate the use of canalised selection to reduce variability in meat eating quality
- Test the use of novel selection criteria to improve meat eating quality in the target livestock species

Beef meat quality experimental research



Jul 2006

- Pilot trial of 44 beef cattle
 - SAC experimental farm Easter Howgate
 - Limousin sired crossbred animals
 - Aberdeen Angus sired crossbred animals

Oct 2006

Nov 2006

- Three slaughter batches at Scotbeef

Jul 2007

- Main trial of 150 beef cattle (Easter Howgate)

Sep 2007

Oct 2007

Nov 2007

- Five slaughter batches at Scotbeef

Jan 2008

Feb 2008

- Three slaughter batches at Scotbeef

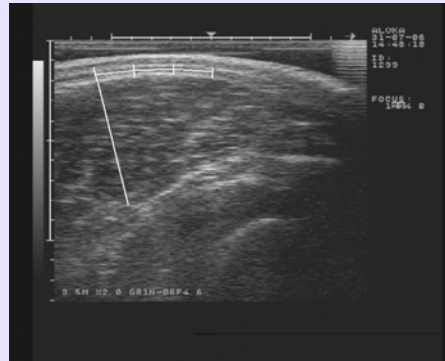
Pilot trial to establish the improved measurement techniques



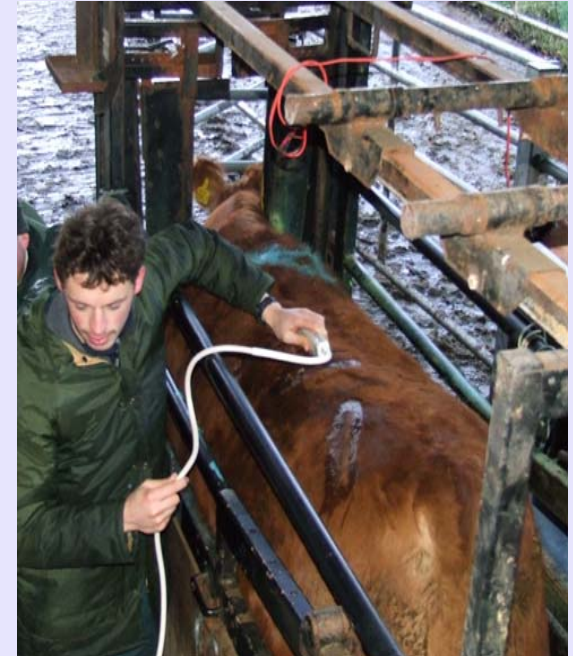
- Use of numerous measurement techniques
 - Live animals
 - Carcass cuts
- Sensory (taste) panel
- Analytical determination of fatty acid
- DNA samples for molecular analysis

Prediction of meat quality on live animals

- Ultrasonic measurements



- Video Image Analysis (VIA)



*SAC experimental farm
Easter Howgate*

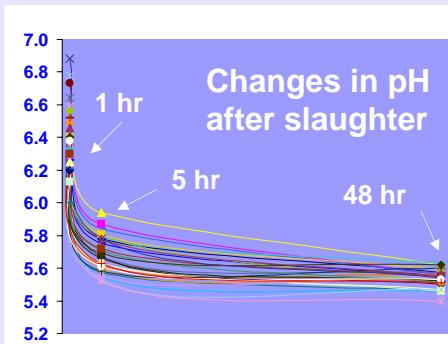
Sire breed differences in ultrasonic measurements at slaughter day (Signet)



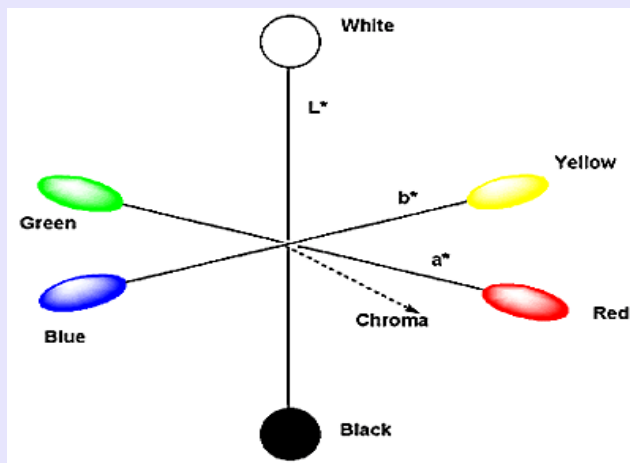
	Aberdeen Angus	Limousin	Significance
Live weight (kg)	632	611	**
Carcass weight (kg)	347	352	
Muscle depth (mm)	66.7	72.7	***
Fat depth (mm)	9.3	6.1	***

Prediction of meat quality on the carcass at Scotbeef

- Measurements of pH and temperature profiles



- Meat colour measurements



Prediction of meat quality (tenderness)

- Slice shear force



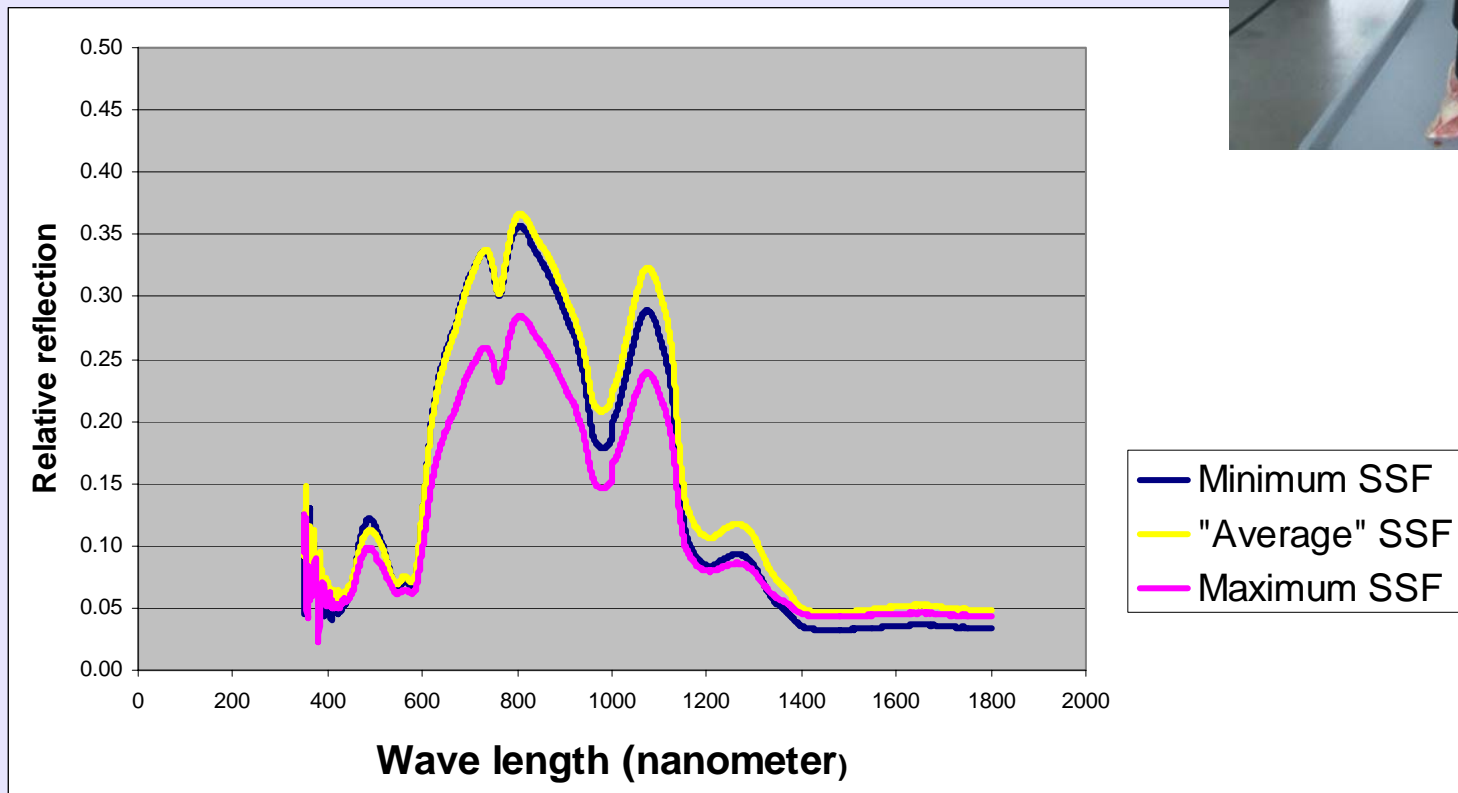
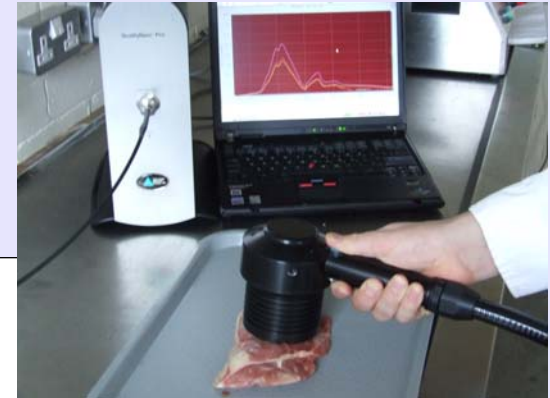
- MIRINZ tenderometer



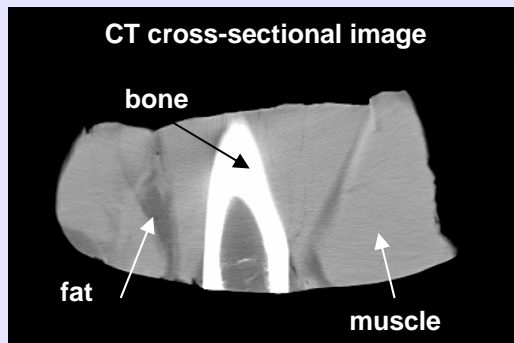
Prediction of meat quality on a steak

- Near-Infra-Red (NIR) scanning for meat quality prediction

Slice shear force (SSF) and NIR scanning

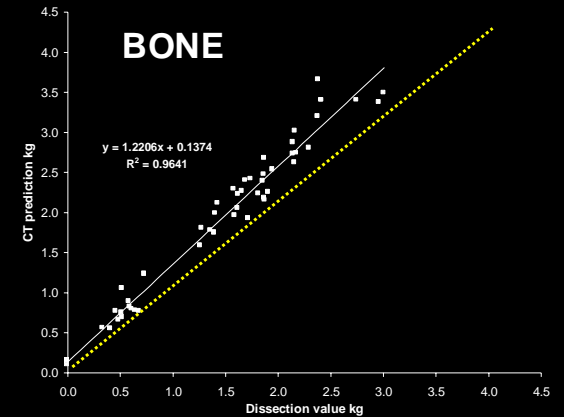
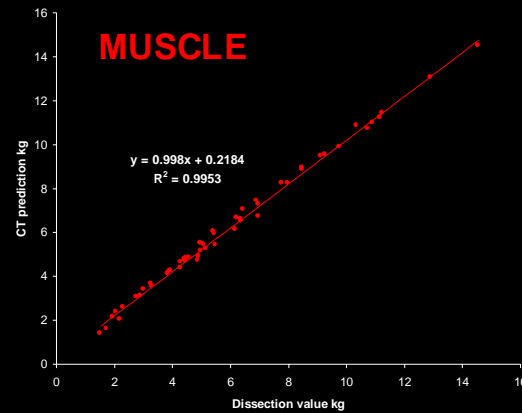
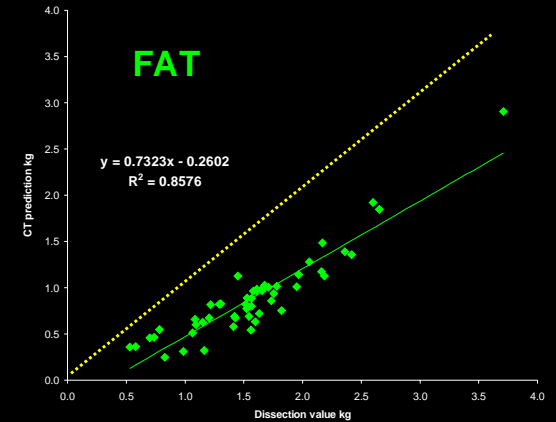
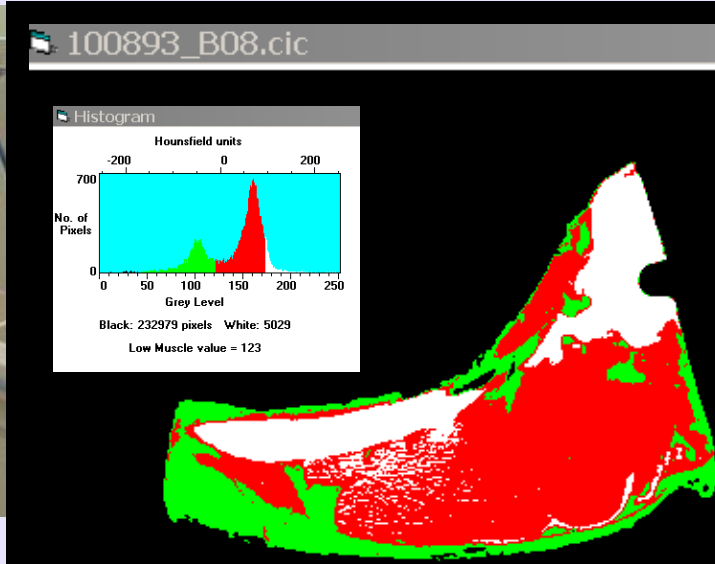
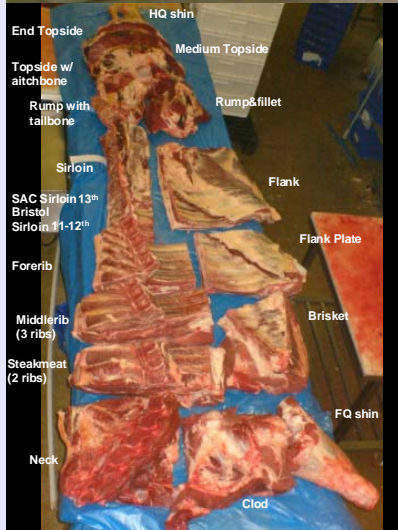


- Scanning of primals using X-ray Computer tomography (CT) at SAC



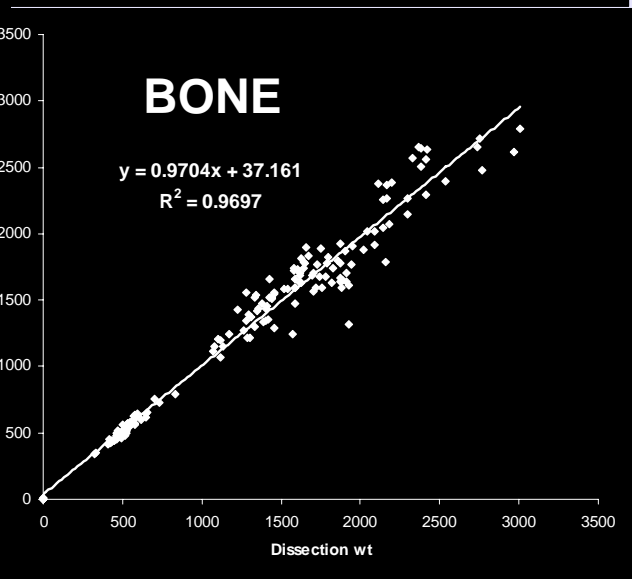
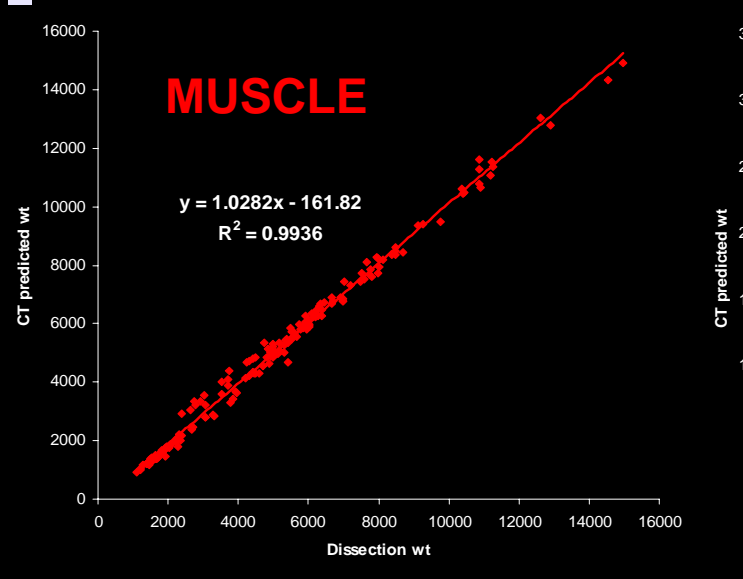
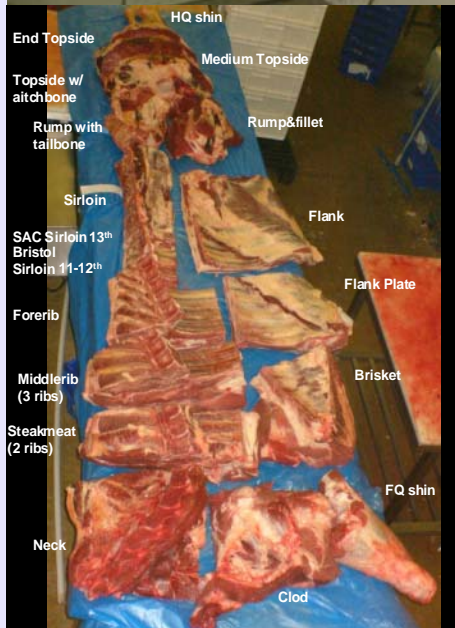
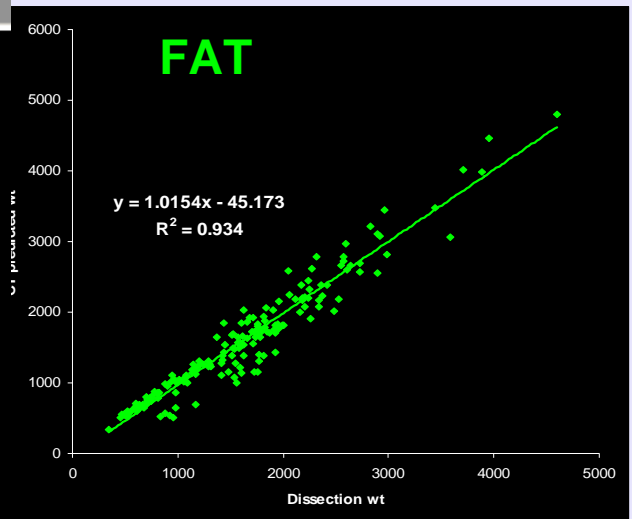
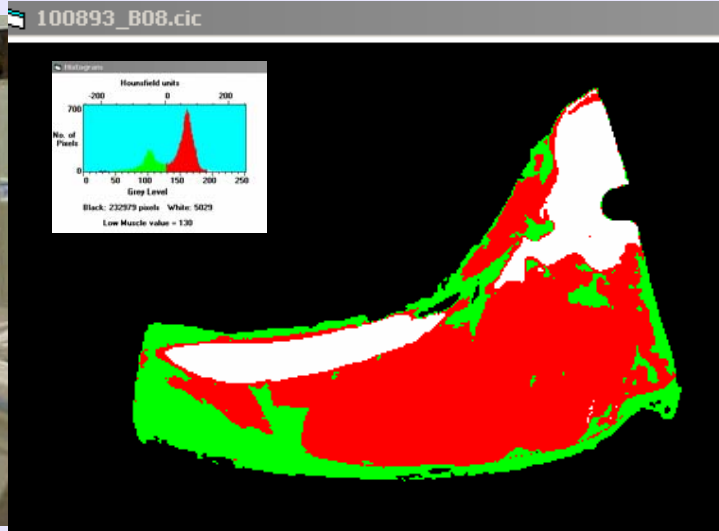
**Muscle density measured by CT:
Good predictor for main components
of meat quality in sheep (beef?)**

Prediction of beef carcass composition by CT using tissue thresholds used for sheep



E. Navaias & K. McLean

Development of tissue thresholds to predict beef carcass composition by CT using new beef data



Determination of carcass composition by dissection

- Dissection of all primals in lean, fat and bone tissue at the University of Bristol



- Development of prediction equations to determine entire carcass composition from dissection of the loin
- Development of prediction equations to determine entire carcass composition by using computer tomography

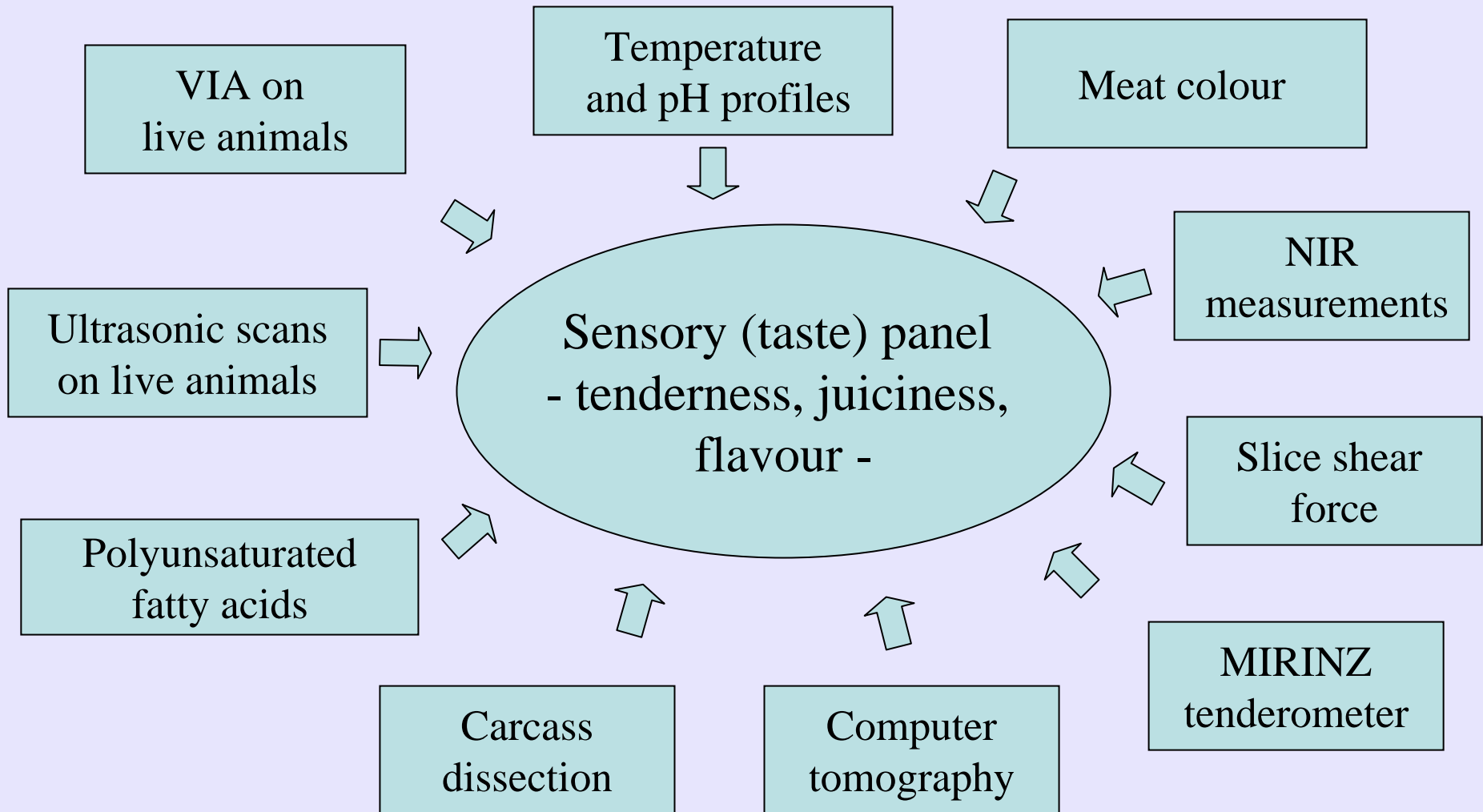
Determination of meat eating quality by taste panel

- Trained assessors evaluate beef eating quality at the University of Bristol

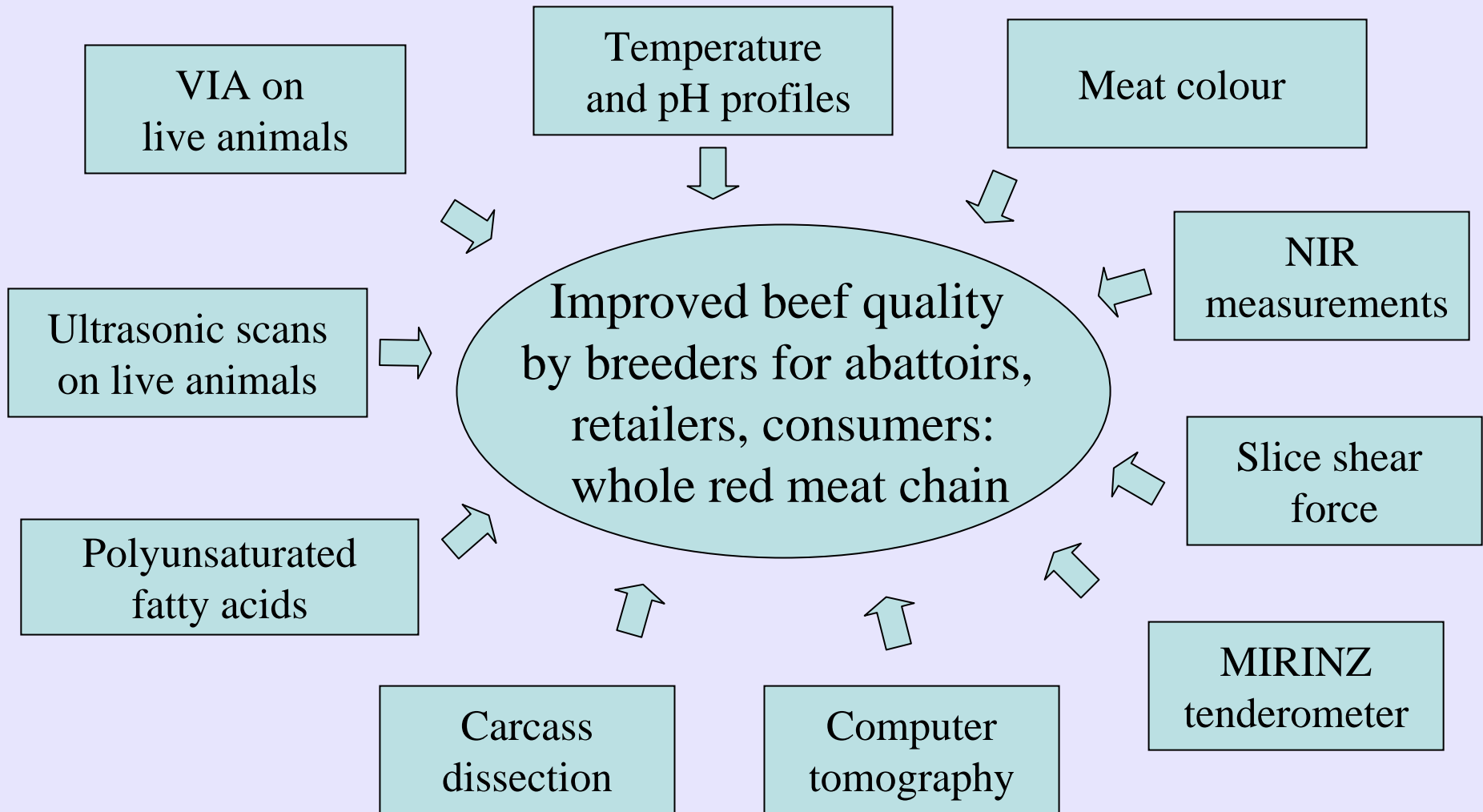


- Analytical methods to determine polyunsaturated fatty acid (PUFA) and saturated fatty acid (SFA)
 - Fatty acid composition is a major factor in the nutritional value of meat
 - Ratio of PUFA to SFA of 0.4 or above advised for human nutrition
- Analysis of phenotypic associations between fatty acid composition of beef and its eating quality (sensory panel and or laboratory techniques)
- Association of total intramuscular fat and meat eating quality

Associations of improved measured techniques to meat eating quality



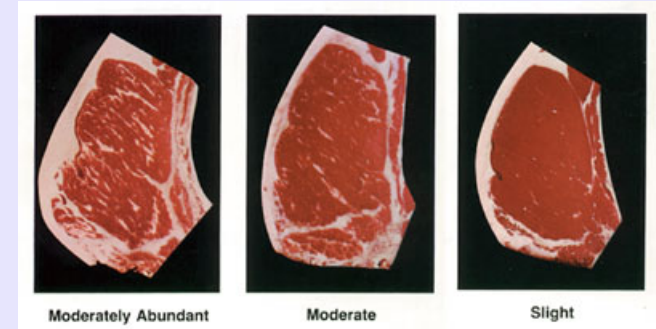
Associations of improved measured techniques to meat eating quality



Commercial markers of beef meat quality

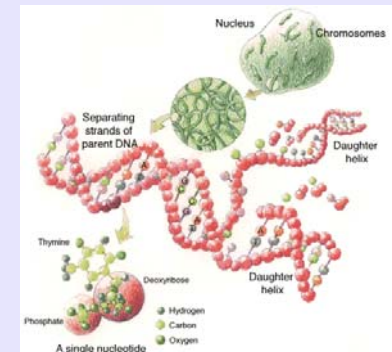
- Genetic solution

- Genstar tenderness: 4 markers
- Genstar marbling: 4 markers



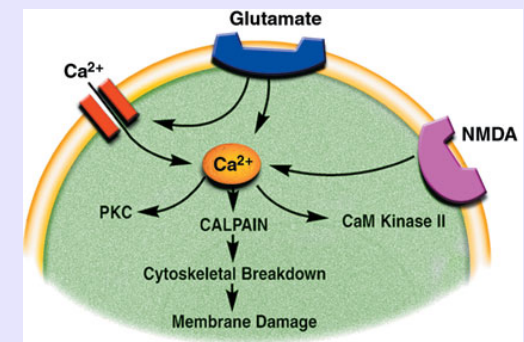
- Merial

- Igenity L: Leptin
- Igenity Tender Gene: Calpain (two mutation)
Calpastatin (one mutation)
- OptiGrid: multiple marker genes



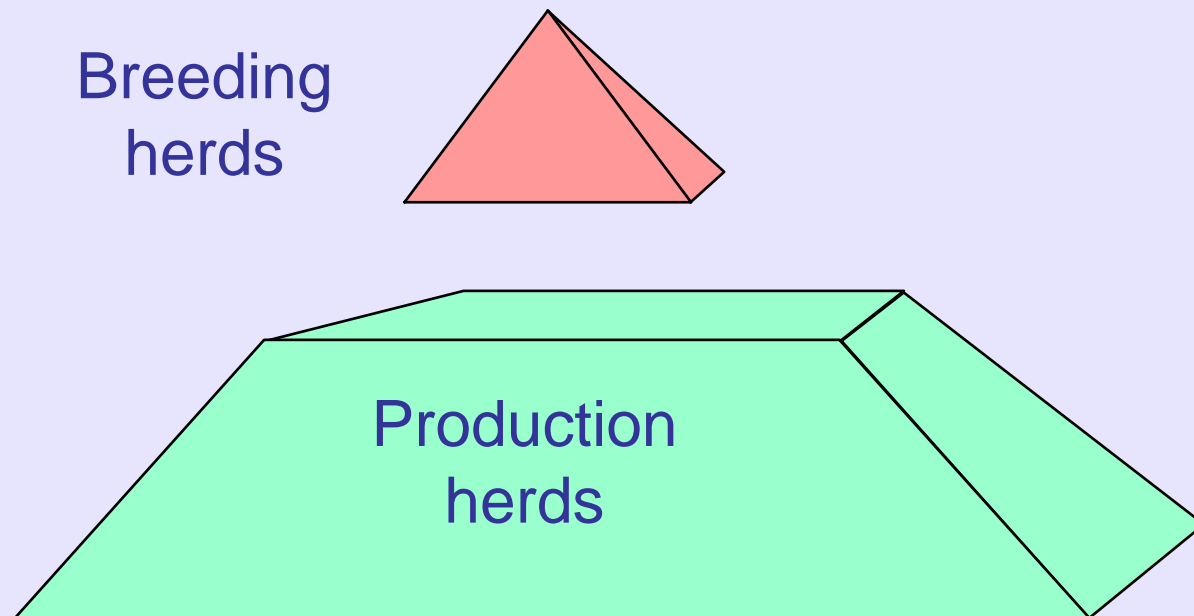
- Prescribe Genomics Co.

- GH1: Marbling
- SCD: Fatty acid ratio



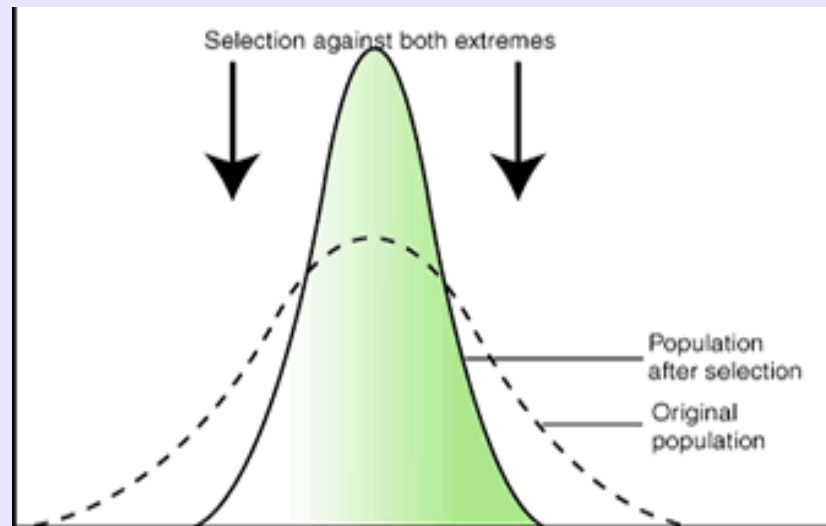
Optimal use of improved measurements in breeding programmes

- Investigation of the optimal integration of improved measurement techniques into breeding programmes
- Genetic improvement is permanent, cumulative and ideally disseminated over the entire population and therefore highly cost-effective



Optimal use of improved measurements in breeding programmes

- Genetic improvement of the uniformity of carcass and meat eating quality using canalised selection



- Optimal integration of molecular and conventional quantitative genetic information into breeding programmes
 - genomic markers have been shown to be of particular interest for genetic improvement of meat quality traits

‘For the future, livestock farmers will need to adopt **practices and technologies** that enables them to **operate effectively** as the first link in an **increasingly competitive food chain**, contributing to the **production of safe, high quality food** at the **right price** and adapting to changing market signals’

Strategic Research for SEERAD, Environment, Biology and Agriculture 2005-2010.

Policy Relevance (Illustrative Outputs)



- Technical advice on appropriate and optimal use of animal breeds
- New technology and decision support tools to enable production of consistent and high quality livestock
- Knowledge leading to advice on genetics on product quality attributes.

Strategic Research for SEERAD, Environment, Biology and Agriculture 2005-2010.

Cross-Cutting Themes (CCT)

CCT 1: Responding to Climate Change



CCT 2: Protecting Biodiversity and Genetic Diversity



CCT 3: Environmental, Social and Economic Sustainability of Rural Scotland



Key KT activity to date



- Animal Welfare Open Day - June 2006
- SAC KT week workshop - Sept 2006
- SAC Beef Open Day - Oct 2006
- SAC Sheep Open Day - Oct 2006
- SSPCA Staff conference - Oct 2006
- Scottish Animal Health & Welfare Conference - Nov 2006
- Sheep and Beef News article - Feb 2007
- Advice to SAC consultants, breed societies and individual farmers
- Visits from Deputy Agriculture Minister, SSPCA

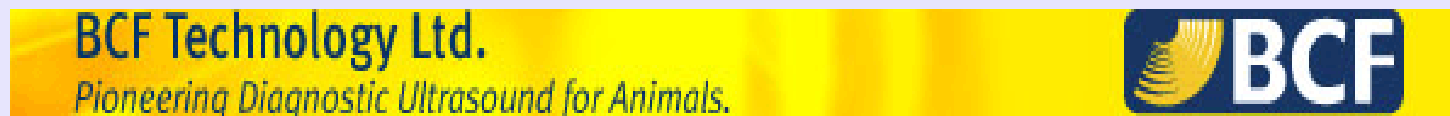
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Thank you very much!