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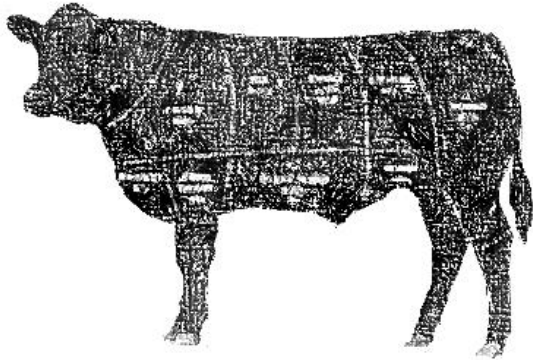
The Irish Agriculture and Food Development Authority

# **New methods for adding value to beef**

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**Sustainable Beef Quality for Europe- II**  
**A Workshop for Industry and Scientists**  
Milan, 1-2 February 2017

# Products from cattle



Makeup



Paint



Toothpaste



Ice-Cream



Sports Equipment



Brushes



Leather



Pharmaceuticals



Porcelain



Confectionary

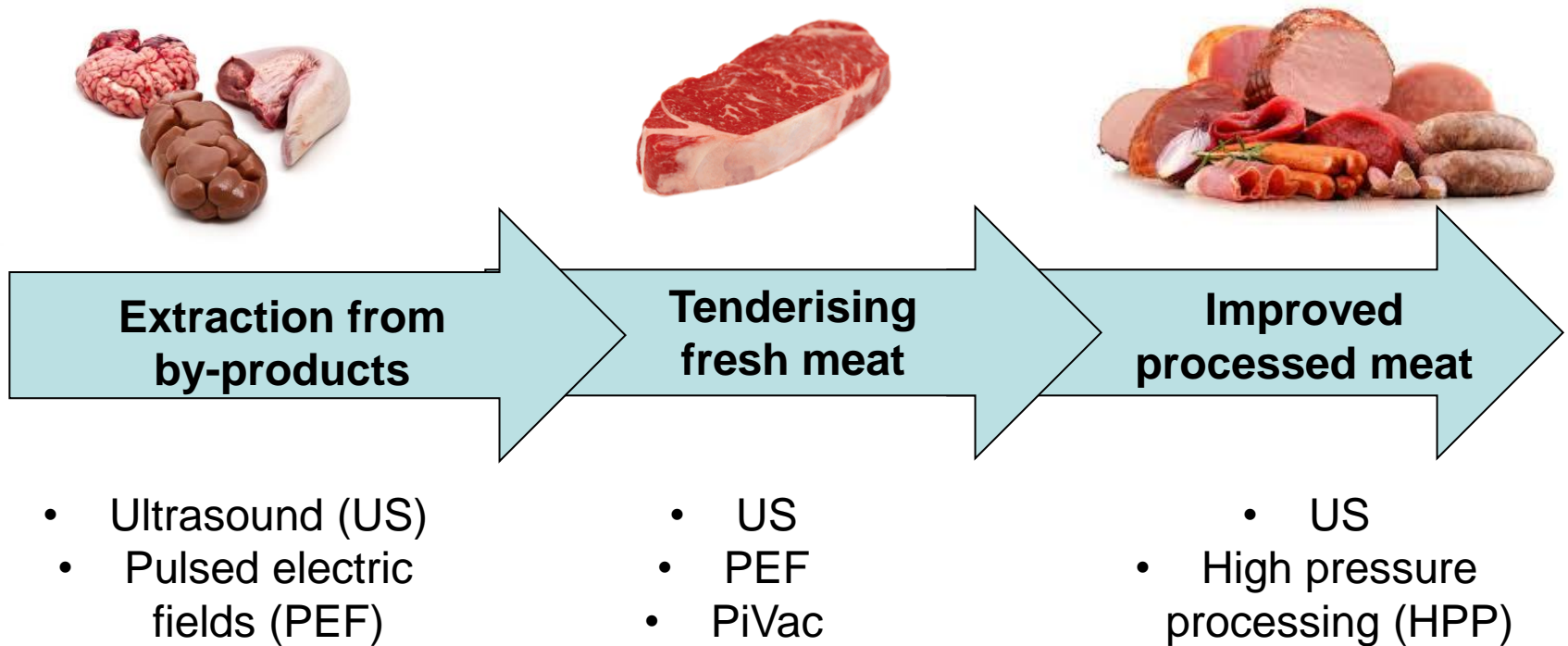
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# Advantages of Novel Processing Technologies

- ✓ Reduce processing times
- ✓ Enhance yield
- ✓ Clean extraction method (reduce or eliminate solvents)
- ✓ Reduce microbial load
- ✓ Improve shelf life
- ✓ Nutrient and bioactivity retention
- ✓ Improve product quality
- ✓ Improve consistency

# How do we ensure innovation and added value?

- Novel processing technologies and novel applications

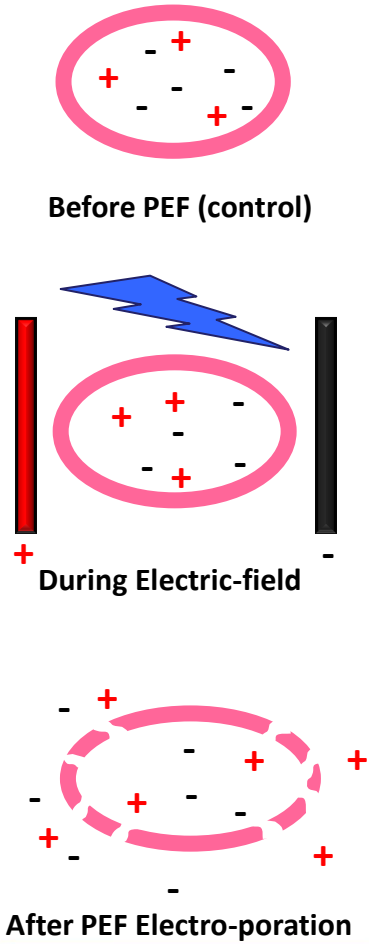


# By-Product Innovation

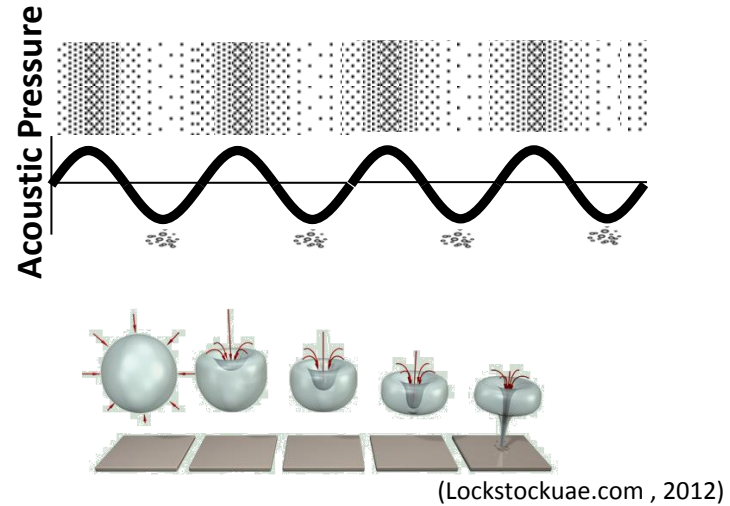


# US and PEF Mechanisms

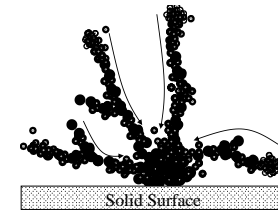
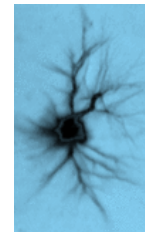
## Pulsed Electric Fields



## Power Ultrasound

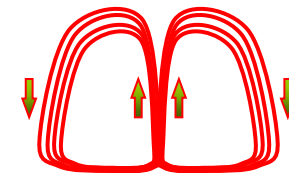
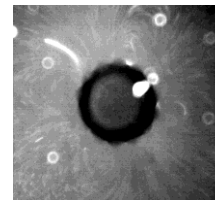


Micro-streaming



(Lee et al., 2007)

Acoustic Streaming



(Leong et al., 2011)

# Novel technologies for extraction



Example of PEF & US on by-products:

- Pancreatin from pancreas as dietary supplement for sufferers of pancreatic insufficiency
- Studies on the ReValue Protein project in the University College Dublin lab assessed:

PEF and US to inactivate microorganisms without affecting enzyme activity

- ✓ Optimisation with Response Surface Methodology (RSM) indicates that:
- ✓ Lipase enzyme is more resistant to US conditions than protease
- ✓ Important to optimise amplitude and temperature to avoid enzyme inactivation

Other potential areas for novel extraction technologies on this project:

- ✓ Extraction of bioactive compounds for sports nutrition and medical science
- ✓ Techno-functional proteins for increased WHC, gelation, texture, etc.

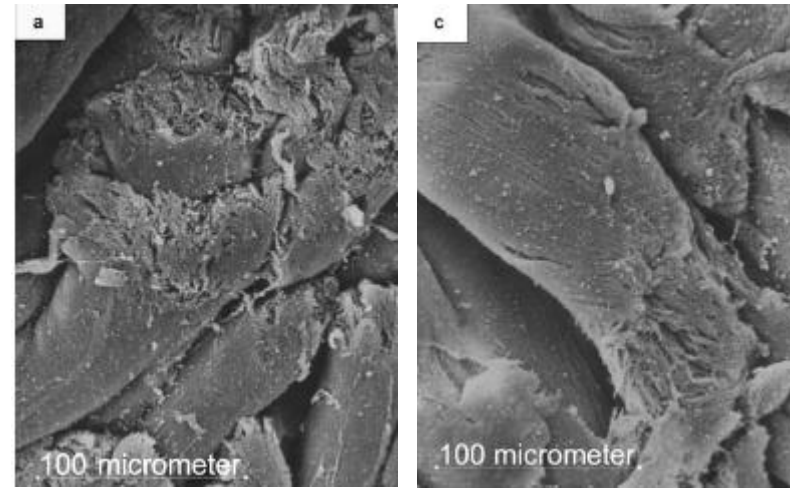


# Fresh Meat Innovation



# Ultrasound: meat texture

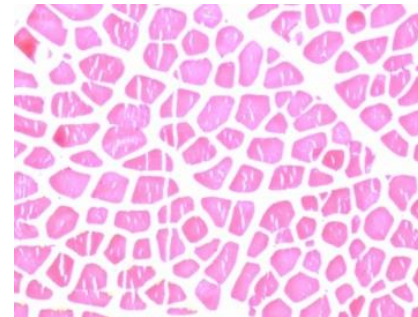
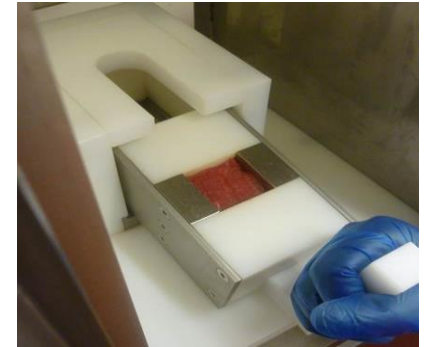
- US for tenderisation
- Studies conducted over past 3 decades on meat
  - Pre-rigour
  - Post-rigour
  - Ageing effects
  - High-frequency
  - Low-frequency
  - High- intensity
  - Low- intensity
- Between all studies there is variety in results
- Some authors report tenderising effect (Jayasooriya et al. 2007; Smith et al. 1991)
- Others report no effect (Lyng et al. 1998; Got et al. 1999; Sikes et al. 2014)
- Important to optimise variables. New tools such as RSM could lead to improvements in output
- Importance of measuring acoustic field



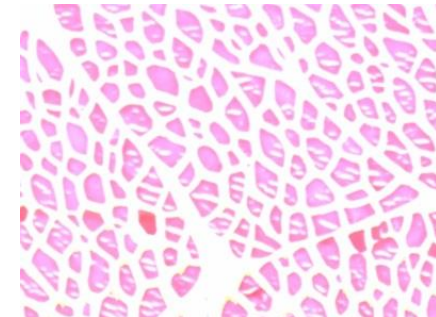
SEM of control versus sonicated ( $4 \text{ W cm}^{-2}$ , 20 kHz, 90 min), Siró et al., (2009)

# PEF for tenderisation

- Fewer studies in this area
- Many interacting variables: frequency, time, temperature, pulse shape, pulse width, muscle type etc.
- Care must be taken to optimise treatment within muscle type
- PEF treatment (20-90 Hz; 10 kV/cm):  
↑ WBSF for *longissimus lumborum* but  
↓ WBSF for *semimembranosus*  
(Suwandy et al. 2015; Bekhit et al. 2016)



Control



PEF

(O'Dowd et al. 2013)

# PiVac – Novel hot-boning

- Prevents contraction post-chilling
- Involves wrapping the meat in elastic sleeve by pressure inside packing chamber
- Potential advantages
  - Increased yield (1-2%); reduced drip
  - Improved texture consistency
  - Ability to chill at lower temp; reduced microbial load
  - Improved eating quality
- Evidence of increased sarcomere length (Hildrum et al. 2000; O'Sullivan et al. 2003)
- Offers an alternative to electrical stimulation with improved tenderness by WBSF and sensory panel (Korzeniowska et al. 2003)



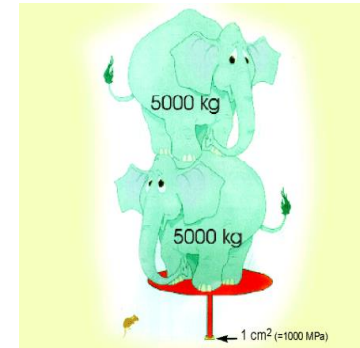
# Processed Meat Innovation



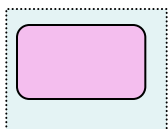


# Mechanism of HPP

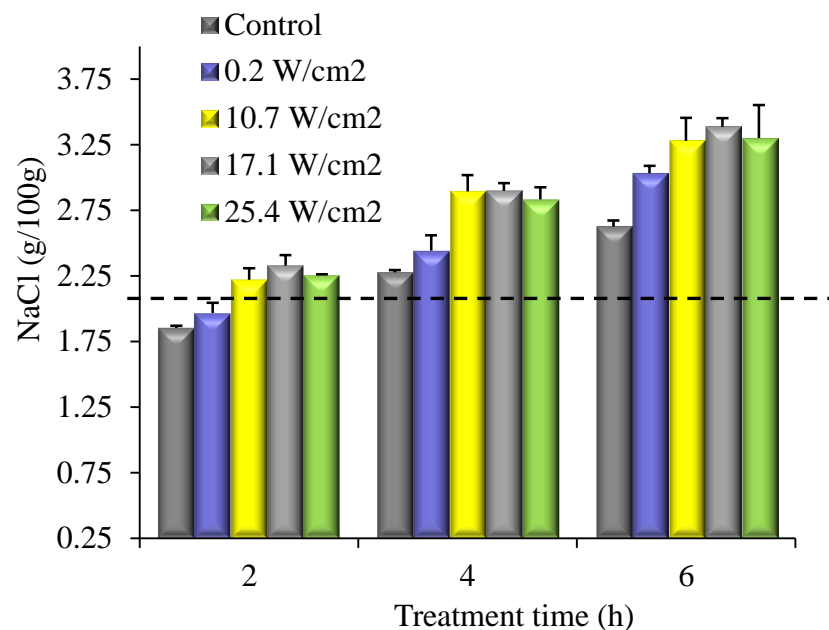
- Mechanism based on applying isostatic and uniform pressure at or above 100 MPa to meat
- Affects structure and function of proteins
- Can be applied at low, medium or high temperature, pre- or post-rigour
- Outcome depends on range of parameters: time, muscle, rigour, pressure.
- Can tenderise fresh meat (Schenkova et al, 2007; Ichinoseki et al, 2006; McArdle et al., 2013)
  
- Number one trend in processed meats is clean label
- Reduced or removed chemical ingredients
- Pork meat HPP treated prior to sausage manufacture: 150 MPa and 0% phosphate compared to control sausages (0.25-0.5% phosphate)
- Improvement in perceived saltiness, juiciness and overall flavour (O'Flynn et al., 2014)



# Ultrasound for accelerated curing: Pilot-Scale Results



Pork sample cut and placed into sealed bag with 18.4% w/w Nitrite salt



US treatments reached >2% NaCl in 2 h, the control required 4 h

(McDonnell et al., 2014)

- No effect on quality
- Similar results found by others (Carcel et al., 2007; Siro et al. 2009)

# Novel food processing technologies in Teagasc

High pressure processing

Ultrasound Processing



Microwave plasma



Non-thermal Technologies



Airborne acoustics



Cold Plasma



Ozone processing



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Questions??

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