The importance of milk quality for the infant milk formula industry

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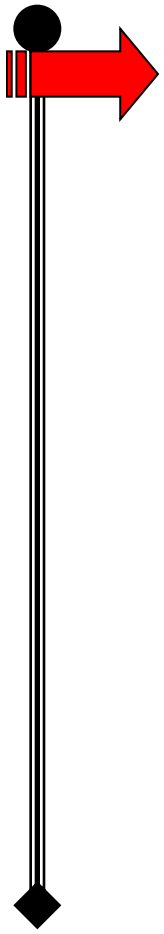
Food Chemistry and Technology Department, and
Food Safety Department Teagasc, Moorepark

Milk Quality & IF - Presentation Guide

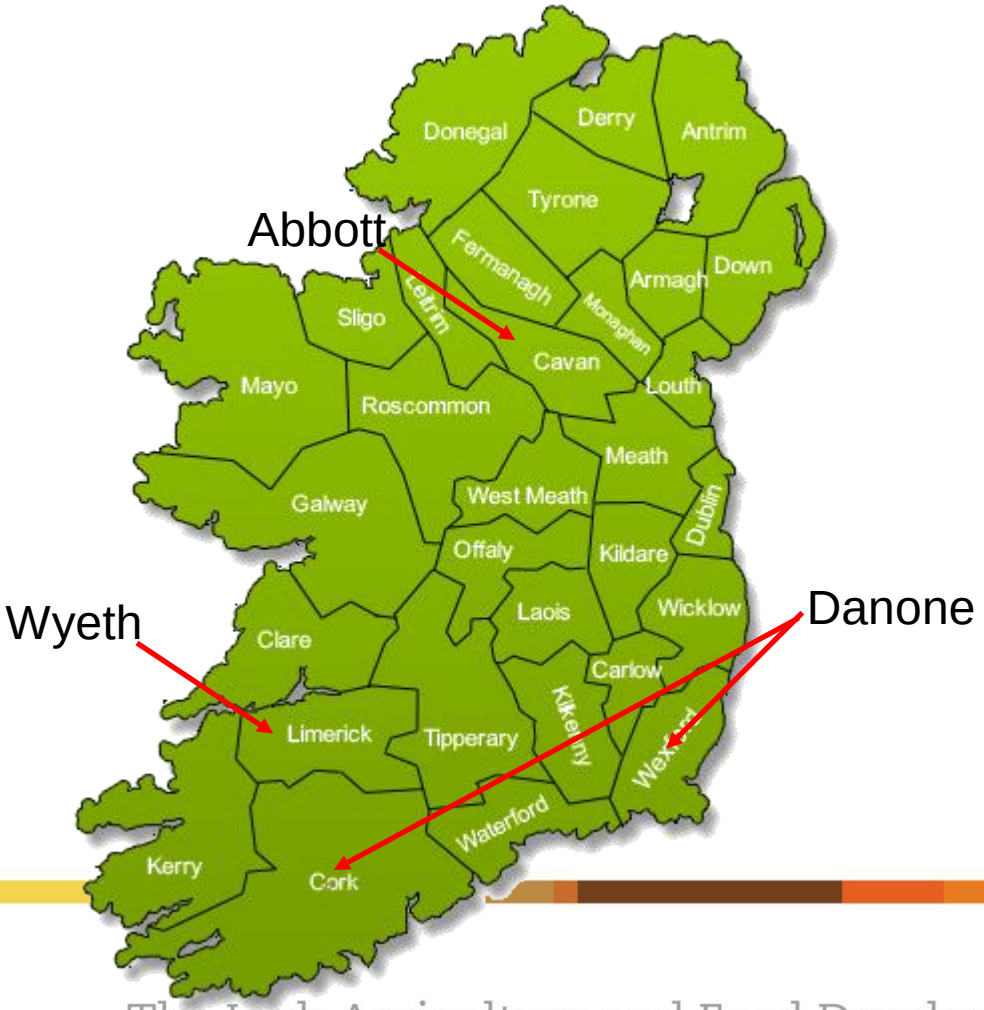


- Importance of Milk Quality for IF manufacturers
- Milk Composition / Protein Quality
- Microbiological Quality
- Residues
- Conclusions

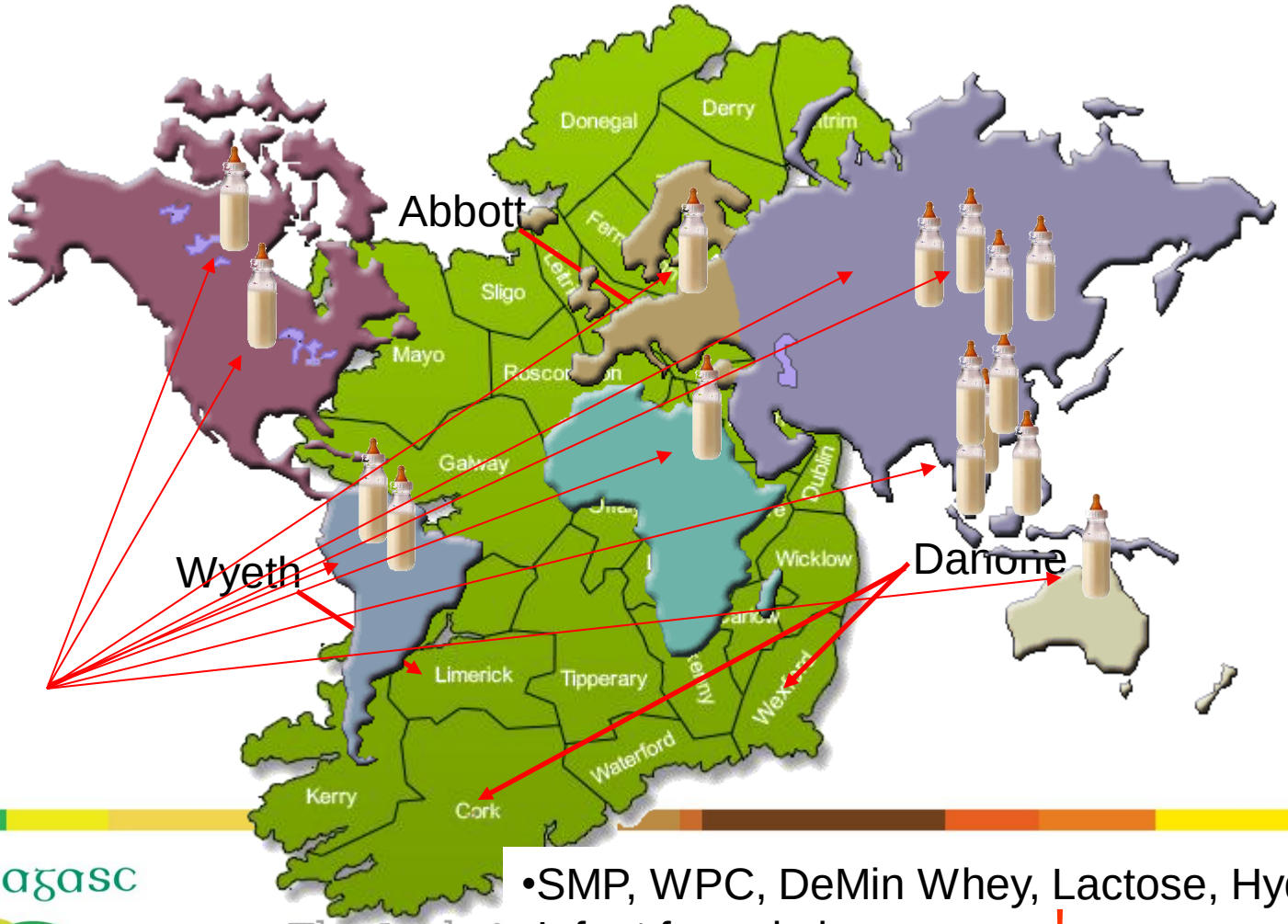
Why is Milk Quality so Important!

- Ireland has an international reputation for manufacture of the highest quality infant formula and ingredients used therein
- Reputation is built on the quality of our milk
- Ireland is 'Strategically Committed!' to the infant formula sector

Infant Formula Manufacturing in Ireland



Infant Formula Manufacturing in Ireland

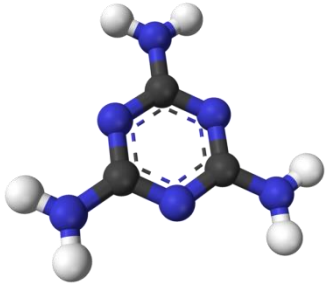


- SMP, WPC, DeMin Whey, Lactose, Hydrolysates
- Infant formula base !

Teagasc
Agriculture and Food Development Authority

The Irish A

Recent ‘Quality Issues’ in the Global infant formula sector



- **Melamine scandal - (linked to milk)**

  Nitrogen-rich and has been illegally added to food products to increase apparent protein content

- **NZ botulism scare triggers mass global recall - (linked to whey)**

  China suspended imports of all milk powder from Australia and New Zealand, after global dairy giant disclosed that whey protein concentrate contains a strain of Clostridium

Testing Methodologies Disputed

- **Dicyandiamide (DCD) – (linked to milk)**

  Milk powder withdrawn under orders from the Sri Lankan authorities - traces of the toxic agricultural chemical dicyandiamide (DCD)

Drivers of Quality Standards in the Infant Formula Sector

- Quality (Compositional, microbiological, functional)
- Regulations / New Markets *(changing across the world)*
  - As new scientific data emerges, nutritional limits can change (tightly regulated)
- Requirement for robust formulations
  - Variation in milk composition
  - Increased auditing of ingredient supplier
- Advances in analytical techniques
  - More accurate determination of regulatory limits for individual nutrients
  - New biotechnological techniques
- Global competition between ingredient suppliers
- Ingredient functionality *(protein quality)* ⬅

(Milk processors required to respond with melamine free statement!)

Impact of Regulations on Quality Standards
(nutrients and/or contaminants)

- Finished product : meet the regulations of the supplied country
- Milk Processors can meet (e.g., EU) regulations for skim milk, however, allowable levels are determined by finished product specifications. (e.g., GB regulations for infant formula)

e.g. Nitrate (100 ppm for 1st age formula infant formula). Levels in skim can't exceed specifications for finished product

- Infant formula companies work with ingredient suppliers; general EU is the benchmark
  - Look across global regulations – combination of 1) codex, 2) EU and 3) Individual country regulations

Milk Quality Attributes
(What can the producer/processor influence?)

- Composition
  - Protein/Fat/CHO
  - Minerals / Vitamins
  - SCC's
- Micro-organisms
  - TBC / Coliforms
  - Thermodurics
  - *Bacillus cereus*
  - *Cronobacter*
  - Sulphite reducing C*lostridia*
- Residue testing
  - Antibiotics
  - Anthelmintics – flukicide
  - NSAIDS (Nonsteroidal anti-inflammatory drugs)
  - Hormones
  - Pesticides
  - Nitrates / Nitrates

- Functionality
  - Protein quality
  - True protein (Seasonality)
  - Physical stability (Heat & emulsion)
- Disease Status
  - Johnes Disease (MAP)
  - IBR
  - BVD (Bovine viral diarrhoea)
  - Leptosporosis
  - Salmonella infection
  - Fluke and Worms
  - BSE

Contaminants
Environmental
Veterinary drugs
Plasticizers
Detergents
Lead
Arsenic
Mercury
Cadmium
Melamine
Fluoride
Thiocyanate
Protein mimetic's

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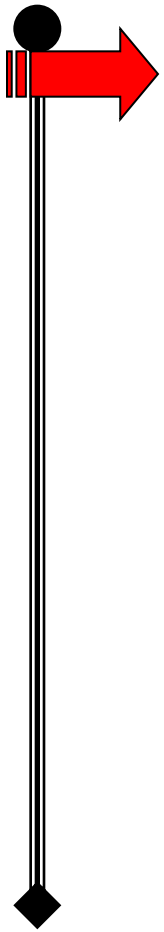

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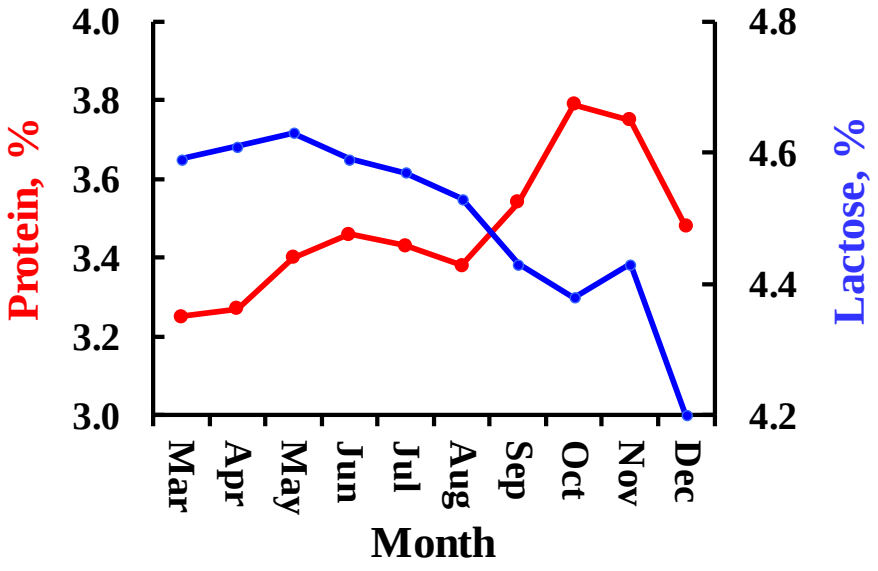
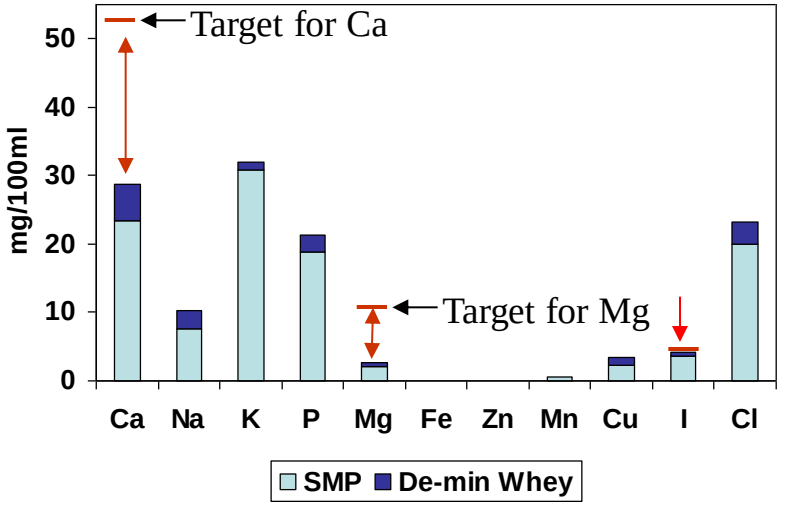
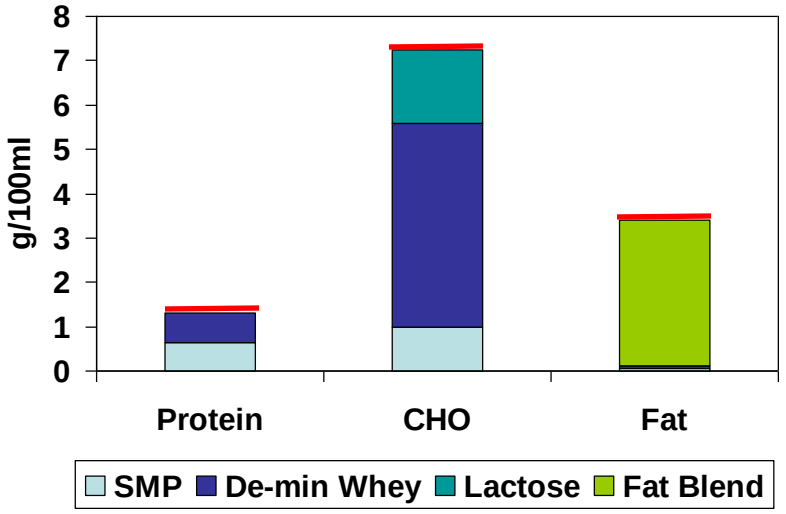
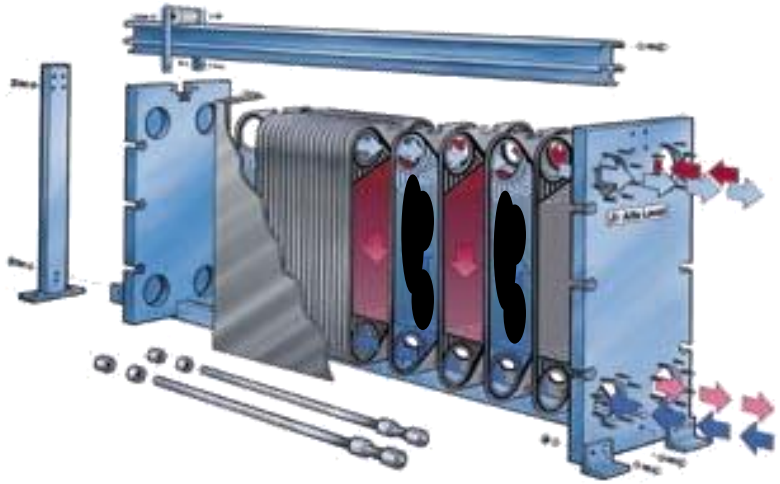
Milk Composition & Protein Quality







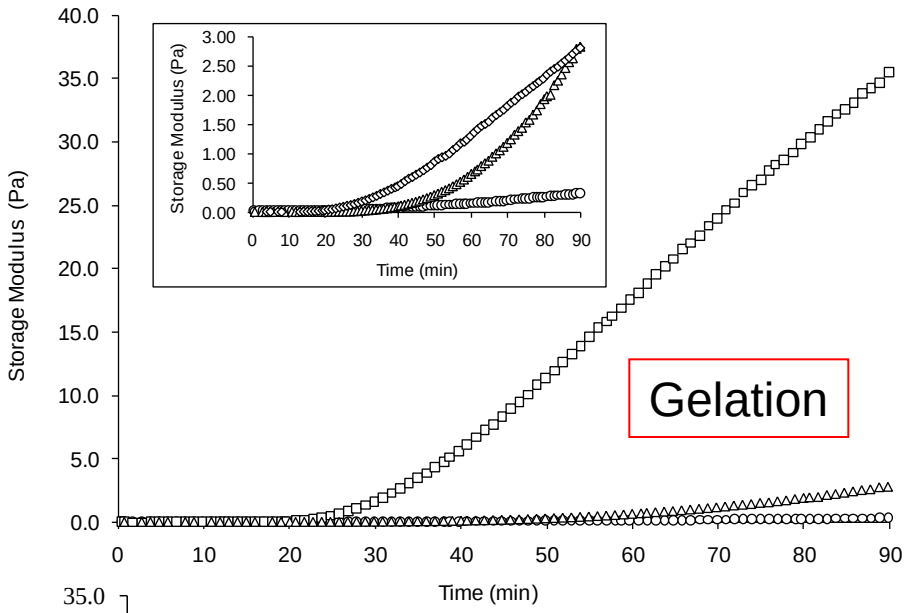
Milk Protein Quality – Ingredient Functionality

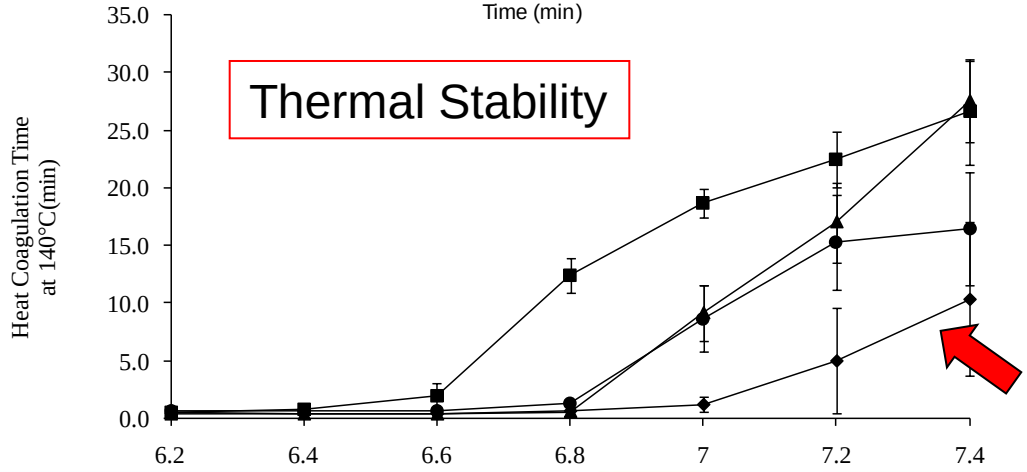


- Poor processability
  - Manufacturing downtime

Evaluating Thermal Stability of Dairy Ingredients used in IF

Protein Quality Key!





What's the Solution to ensuring good processablity

- Consistent composition (protein, fat, lactose, minerals and vitamins)
- Good microbiological quality (e.g., psychrotrophs)
  - Low residual enzyme activity (Bacterial proteinases)
- Low SCC, plasmin
- Selected milk from optimal part of the season
- Implement functionality testing regime (heat stability, gelation etc.)

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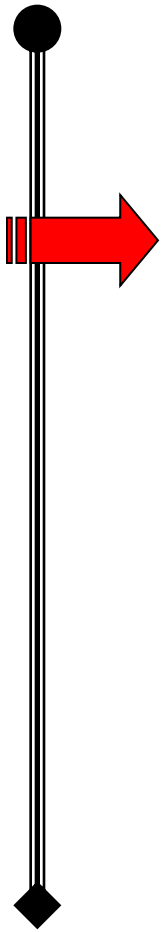

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Microbiological Quality ⟶ What are they?
Where do they come from?
How do you control them?

- TBC – should not be an issue if controlled
- *Bacillus cereus*
- Sulphite Reducing Clostridia (SRC)

Dr Kieran Jordan (Teagasc, Moorepark)

New Strategies at Teagasc to Support IF Sector

Project 1

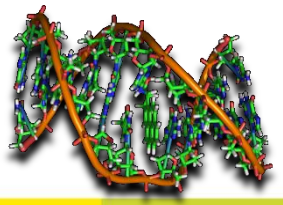
Thermodurout: Identification and characterisation of the spore-forming bacteria most common in Irish milk processing plants

Project 2

Dairybiota: Molecular approaches to more accurately investigate factors which influence microbiota of milk - rapid diagnostic approaches (SRCs and SRBs)

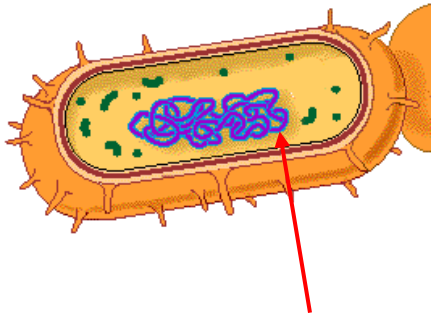
SRCs/SRBs: New classification techniques - microbes have been solely identified on the basis of their phenotype (i.e. ability to reduce sulphate). Genetic analysis of these strains will allow new rapid assays to be developed

Dr. Paul Cotter (Teagasc, Moorepark)



Evolving Quality Standards – Global influences

Ingredient manufacturers
are using (Biotechnology). i.e.,
PCR / Pyro-sequencing techniques to
determine microbial history in dairy ingredients



Thermal treatment = low microbial growth on agar

Microbial loading of milk tracked back to farm gate
(extrapolation to residual enzyme loading !)

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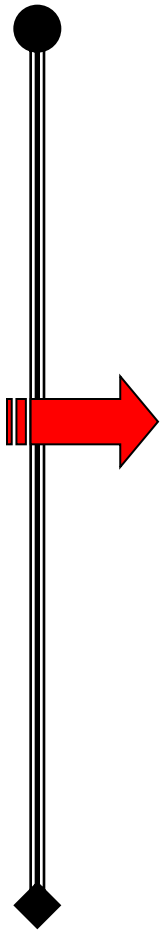

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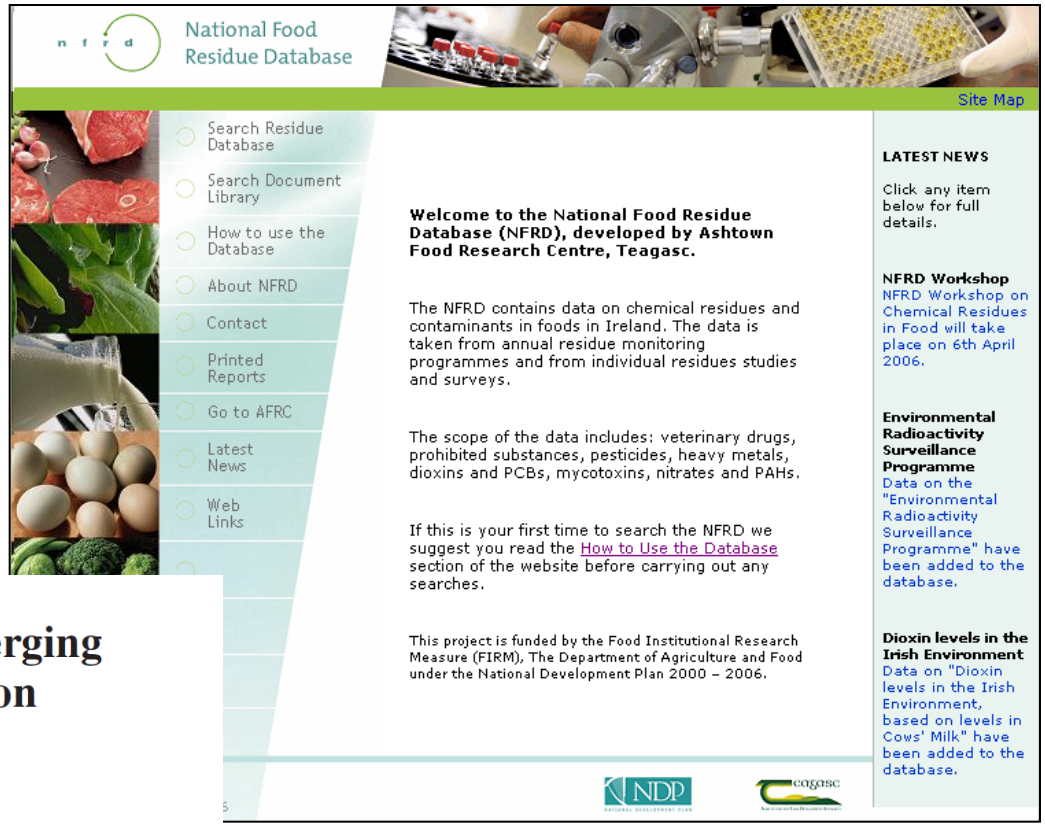
Residues



Identification of existing and emerging chemical residue contamination concerns in milk

Martin Danaher[1†] and Kieran Jordan[2]

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[2]*Food Safety Department, Teagasc Food Research Centre, Moorepark, Fermoy, Co. Cork, Ireland*

Web address http://nfrd.teagasc.ie (Dr. Martin Danaher)

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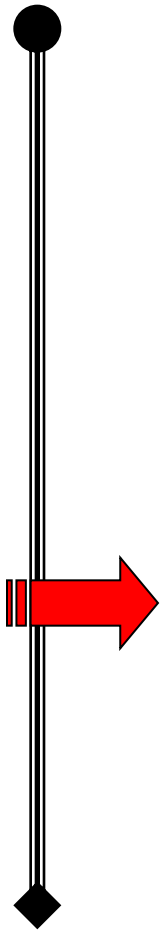

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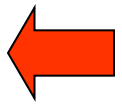
Conclusions / Future Direction

- Rapid tests for processability
  - Milk quality and protein functionality
- New thermal processes
  - reduce activation of vegetative cells from spores
- Milk quality
  - Manage evolving quality standards for IMF
- Validation methods: microbial & chemical quality
  - Methodologies that could initially be deployed at milk intake to segregate milk for infant formula applications
- Breeding strategies for protein quality
- **We have the good reputation – we need to keep it**



Thank You

for your attention

Milk Quality

Ensuring Irish Dairy Processors Produce the highest Quality Ingredients for infant milk production for the world market