

# A historical perspective on “processing” of food: the case of dairy

Alan L. Kelly

*School of Food and Nutritional Sciences,  
University College Cork, Ireland*

E-mail: [a.kelly@ucc.ie](mailto:a.kelly@ucc.ie)



IUFoST

International Union of Food Science and Technology



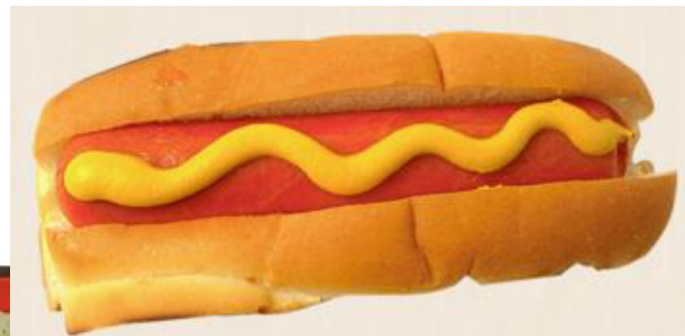
**UCC**

**Coláiste na hOllscoile Corcaigh**  
University College Cork, Ireland

# (Ultra)Processed Food in the media today

'Ultra-processed' products now half of all UK family food purchases

Exclusive: health experts warn increasing popularity of industrially-made food will lead to negative effects such as obesity and poor health



## Top Ten Toxic Food Ingredients in Processed Food

*Any food that has been canned, dehydrated, or had chemicals added to it is a processed food, and these foods make up about 60 percent of the average American diet.*

Industrial formulations typically with 5 or more and usually many ingredients. Besides salt, sugar, oils, and fats, ingredients of ultra-processed foods include food substances not commonly used in culinary preparations, such as hydrolyzed protein, modified starches, and hydrogenated or interesterified oils, and additives whose purpose is to imitate sensorial qualities of unprocessed or minimally processed foods and their culinary preparations or to disguise undesirable qualities of the final product, such as colorants, flavorings, nonsugar sweeteners, emulsifiers, humectants, sequestrants, and firming, bulking, de-foaming, anticaking, and glazing agents.

## Declarations:

Extensive industry funding and interactions (Nestle, Kerry, Tirlan, Arla, others)

Demonising trust in science

December 9, 2019 2:46pm GMT

Lisa B/Shutterstock

Email  
Twitter  
Facebook  
LinkedIn  
Print

21

974

I have  
pro

With so many diet plans and nutritional instructions offering such varied advice on how to eat healthily, a simple message like avoiding processed food is understandably attractive. As a result, some journalists, social media influencers and even health charities and academics have gathered behind the idea that processed food is bad for you – and so-called ultra-processed food is even worse.

Alan Kelly, Professor, Food Science and Technology, University College Cork

### Disclosure statement

As an applied food scientist, Alan Kelly receives funding both from public sources and from food companies for his research.

Table 1

Food cla

Food s

Group  
minim

Group  
or food

Group  
food p

\* These l  
the gene

## Issues with the NOVA system (or public representations of it)?

1. No reference to food safety
2. No reference to level of consumption
3. Stigmatisation of food products on the basis of numbers of ingredients or processing steps
4. Anti-food-industry bias (tobacco?)
5. No historical context





**What is food processing?**

**Or**



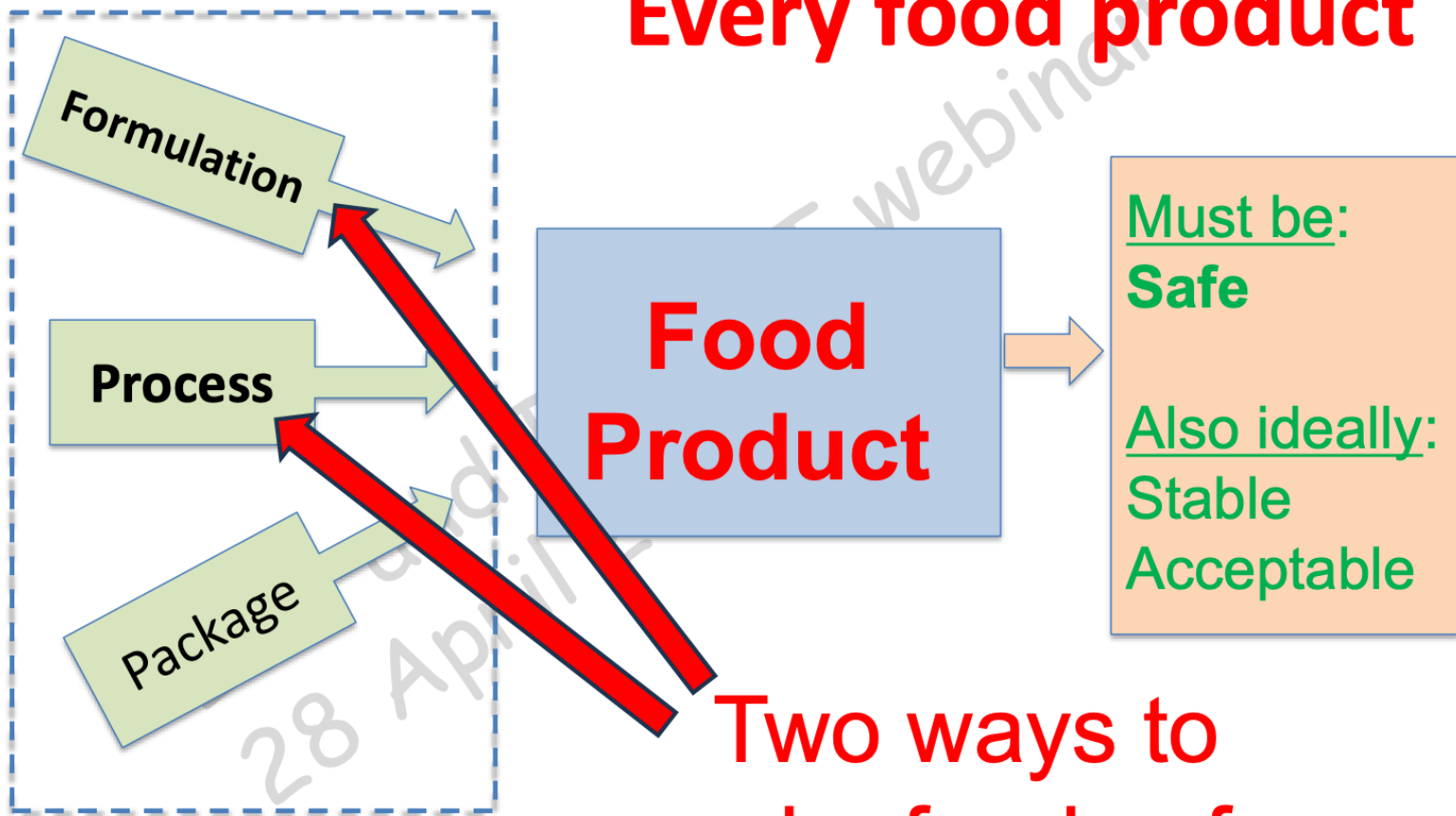
# What is food processing to me?

- Making **SAFE**, sustainable, stable, desirable, nutritious food

# What is food processing not?

- About salt, sugar, fat, additives
- Primarily about nutrition
- Something new

**Every food product**



**Two ways to  
make food safe**

# False kitchen-factory dichotomy

Package

Process

Formulation

## SPINACH, MUSHROOM & TOFU OMELET

Serves 1 - Prep Time: 5 mins - Ready in 2 mins



**Directions**

1. Combine the garlic, tofu, nutritional yeast, olive oil, cumin, and salt in food processor. Blend the mixture until smooth and well combined. Add the cornstarch and flour and pulse to combine. Heat a large non-stick skillet over medium-high heat and lightly grease with cooking spray.
2. Pour about 1/2 cup of the batter into the skillet and spread to about 6-inches wide. Cook for 3 to 5 minutes until the top is dry then flip and cook for another minute. Transfer the omelet to a plate and repeat with the remaining batter. Heat the oil in a small skillet over medium heat.
3. Add the onion and mushroom and cook for 3 minutes until the onion is translucent. Stir in the spinach and cook until the spinach is just wilted. Divide the spinach, onion, and mushroom mixture among the omelets and serve hot.

**Ingredients:**

- 1 Tbsp of salt
- 1/2 Tbsp of cumin
- 1/4 Cup of organic coconut flour
- 1 Tbsp of cornstarch
- 1 Tbsp of coconut oil
- 1/2 small onion
- 1 Cup of mushroom slices
- 2 Cups of spinach

**Nutritional Information:**

TOTAL CALORIES: 631  
Protein: 44g  
Carbs: 54g  
Fats: 28g

PLANT-BASED RECIPES COOKBOOK

# How is any food product processed and preserved (today and through history)?



## Hurdles

Formulation or process

- High temperatures
- Low temperatures
- Fermentation
- Smoking
- Dehydration
- Chemical preservatives
- Packaging
- Others....



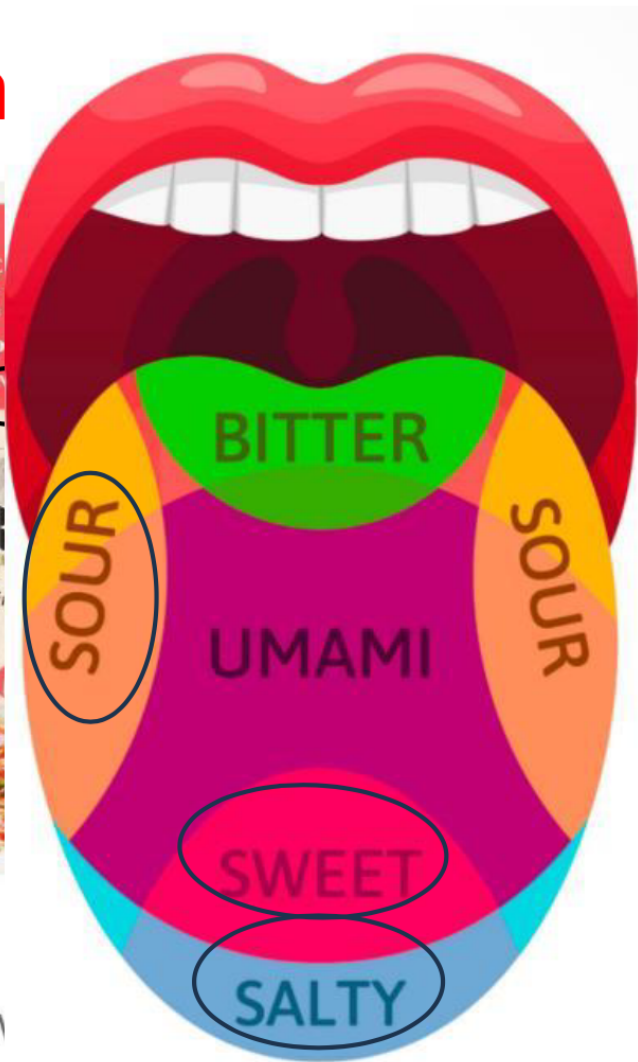
Chem

es or not?



Ingredients

Wheat Flour, W



t!  
nut oil and vitamin B12  
dairy, soya, gluten, lactose, nuts  
preservatives  
or vegans and vegetarians  
iK

200G

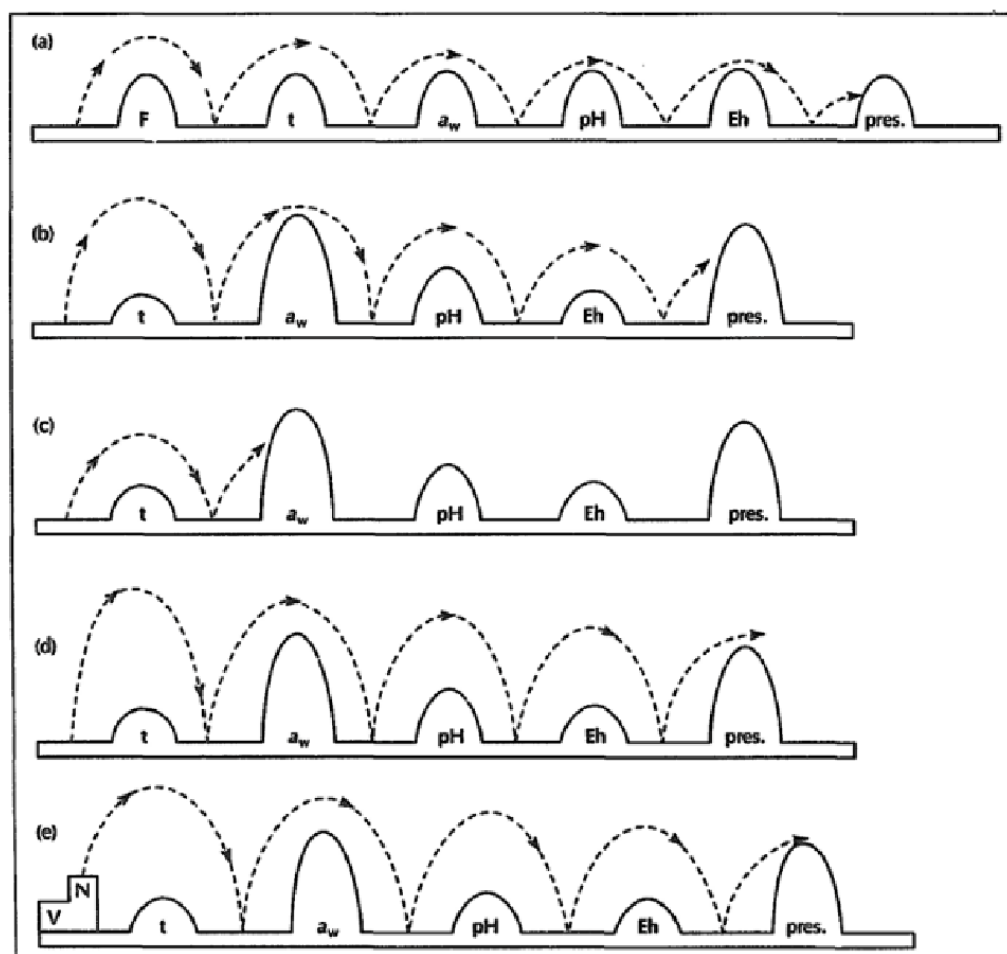
ts

Penut Oil (23%), Modified Starch\*,  
a Salt, Flavourings, Olive Extract,  
Carotene, Vitamin B12, \*Not to be  
with GMO (Genetically Modified)

Ingredients

## Review

Hurdle technology is a concept for food preservation that combines different hurdles (physical, chemical, biological, and nutritional) to achieve the desired level of preservation. This approach is often used in food processing to reduce the need for high temperatures or long storage times, which can affect the quality and nutritional value of the product. The hurdles are typically encountered sequentially or simultaneously, depending on the specific food and processing method.




**Fig. 1**  
Five examples of the hurdle effect used in food preservation. The individual hurdles may be encountered simultaneously or sequentially, depending on the type of hurdle and the overall processing. Symbols have the following meaning: F, heating; t, chilling;  $a_w$ , low water activity; pH, acidification; Eh, low redox potential; pres., preservatives; V, vitamins; N, nutrients. See text for details.

# Milk, nature's perfect food but... a fragile treasure



Safety risks, physical separation,  
microbiological spoilage  
Prevent with processing

A photograph of various dairy products arranged on a light-colored wooden surface. In the background, there is a glass pitcher filled with white milk. To the left of the pitcher, there is a block of Swiss cheese with holes, a wedge of cheddar, and a small glass jar containing butter. In the foreground, there is a block of butter, a bowl of cottage cheese, a small bowl of white yogurt, and a glass of pink yogurt. The text "Every dairy product is a different solution to the question of how to deliver the nutritional benefit of milk safely" is overlaid in red, with the word "safely" underlined.

**Every dairy product is a different solution to the question of how to deliver the nutritional benefit of milk safely**

**Every dairy product has evolved through a pre-science testing of combination of hurdles**



## Irish bog butter proven to be '3500 years' past its best before date

Posted 14 March 2019



## Ancient solutions to preserving nutritional value

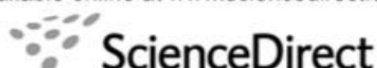


15th–16th-century bog butter found near Enniskillen, County Fermanagh





Available online at [www.sciencedirect.com](http://www.sciencedirect.com)



International Dairy Journal 17 (2007) 1011–1020

INTERNATIONAL  
DAIRY  
JOURNAL

[www.elsevier.com/locate/idaairyj](http://www.elsevier.com/locate/idaairyj)

## Composition of ancient Irish bog butter

T. Cronin<sup>a,b</sup>, L. Downey<sup>c</sup>, C. Synnott<sup>b</sup>, P. McSweeney<sup>b</sup>, E.P. Kelly<sup>d</sup>,  
M. Cahill<sup>d</sup>, R.P. Ross<sup>a,e</sup>, C. Stanton<sup>a,e,\*</sup>

<sup>a</sup>*Teagasc, Moorepark Food Research, Biotechnology Centre, Fermoy, Co. Cork, Ireland*

<sup>b</sup>*Department of Food and Nutritional Sciences, University College Cork, Cork, Ireland*

<sup>c</sup>*Department of Food Science, University College Dublin, Ireland*

<sup>d</sup>*National Museum of Ireland (NMI), Dublin, Ireland*

<sup>e</sup>*Alimentary Pharmabiotic Centre, Cork, Ireland*

Received 24 July 2006; accepted 29 January 2007

### Abstract

Thirteen samples of Irish bog butter from various locations were selected, of which nine were dated to the Iron Age (400 BC–500 Cal AD), three to the Medieval Period (1100–1600 Cal AD), and one much later (1520–1800 Cal AD). These contained 94–100% (w/w) fat in crystalline form, and >0.6% (w/w) moisture, and fatty acid profiles were characteristically different, and in particular much simpler than fresh butter, consisting predominantly of free fatty acids of C<sub>16:0</sub>, C<sub>14:0</sub> and C<sub>18:0</sub>. Bog butter contained significantly less ( $p < 0.05$ ) proteinaceous material than fresh butter, primarily peptides <0.5 kDa and free amino acids and were devoid of salt. The data indicate that most of the decomposition of the protein to simpler molecules in the ancient butter occurred in the first two hundred years of storage in the bog environment, while approximately half the bound fatty acids were released during this time.

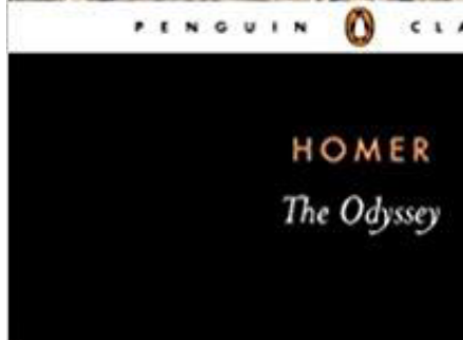
© 2007 Elsevier Ltd. All rights reserved.

**Keywords:** Butter; Bog; Fatty acids; Protein



## Archaeologists Find 3,200-Year-Old Cheese in an Egyptian Tomb

Share full article



Also solved another societal health problem along the way by pre-science means

# Spoilage vs fermentation

Just a matter of historical choice and marketing



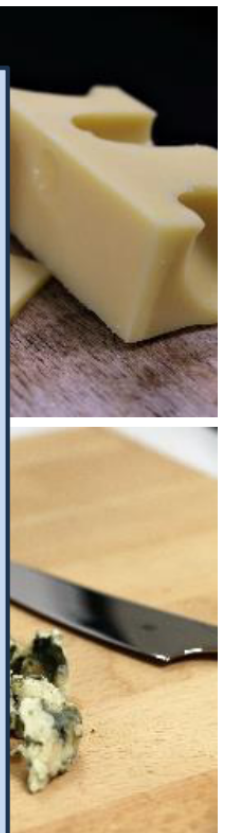
# The hurdles of dairy processing

1. Heating (pasteurization, UHT, canning)
2. Removal of water (milk powder, butter, cheese, condensed milk)
3. Acidification (cheese, yoghurt)
4. Addition of chemicals like salt (cheese, butter), sugar (sweetened condensed milk) or smoke
5. Refrigeration

# Dairy products and hurdles

- Acid
- Fermentation
- Low
- Salt
- Dehydration
- Smoking
- Packaging
- If not
- hurdles
- Two

- More acid
- Fermentation
- Low temperatures
- Heat treatment





## The mitigating effects of consumer views

- High temperatures
- Packaging
- Low temperature storage
- Very high temperatures
- Packaging



**BUT: Consumer resistance in some countries on flavour/nutrition grounds**

# The transformation of butter

## Traditional/ancient

- Dehydration
- Salt
- Low temperatures
- Acid (lactic butter)

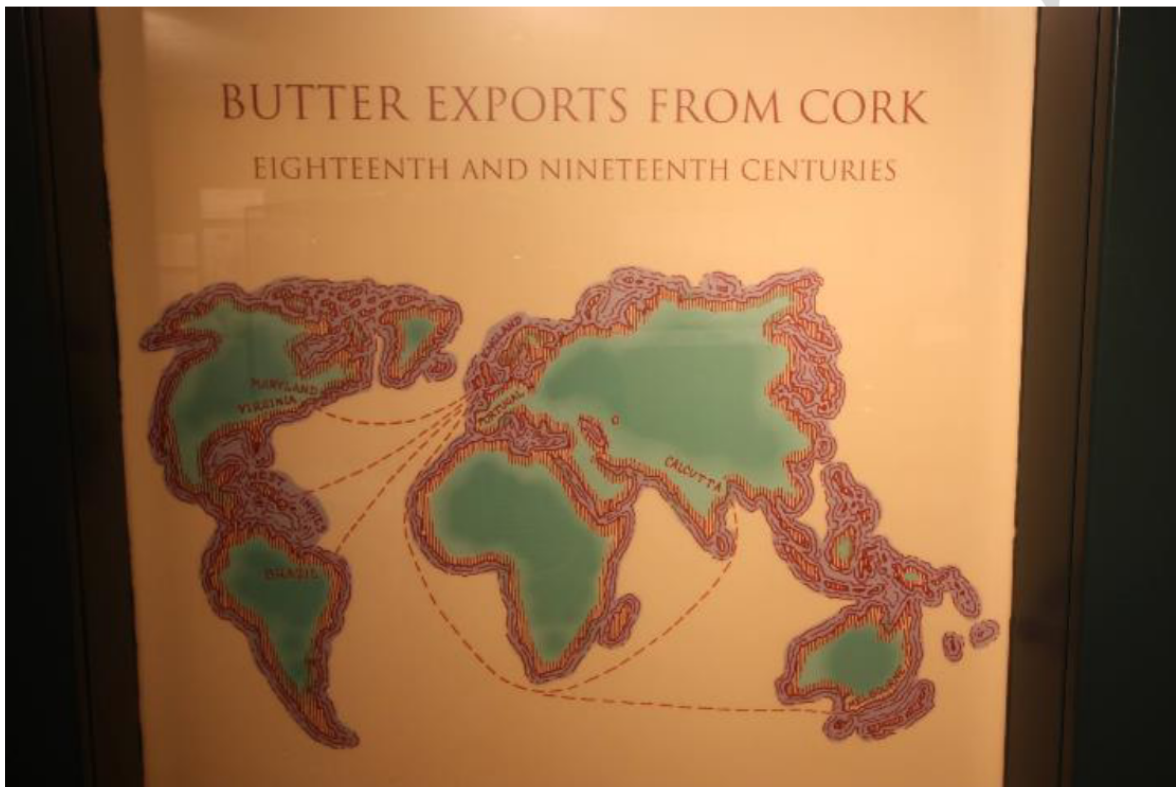


## Modern

- Pasteurisation
- Dehydration
- Less salt
- Low temperatures
- Hygienic production



## Processing and shelf-life



Gives us variety, convenience, export potential, food security in times of scarcity and much more

## Summary: The problem with 'processing'

- Negative consumer perception of 'processed food'
- Negative consumer perception of chemicals in food
- Consumers want: (1) fresh, natural, long shelf-life, safe, variety
- Consumers don't want: (2) processed, chemical preservatives, multiple ingredients
- How has the food industry achieved (1) through history? By using (2)!
- UPF debate not helpful – sensationalist, classist, political, anti-industry, social elements?
- What if UPF were called UFF (ultra-formulated foods)?
- **When did food processing become the problem, not the solution?**

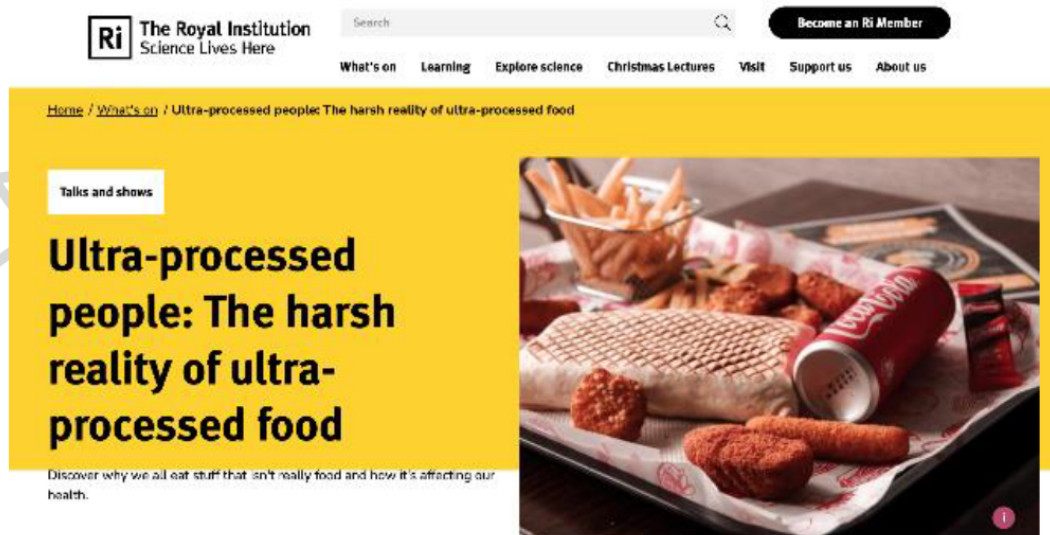
# Food processing today

1. Nutritional understanding improved
2. Processing understanding improved
3. Hygienic production improved
4. **Highly regulated food sector**
5. But....
  - Number of steps/ingredients nothing to do with quality/safety
  - False factory/kitchen contrast

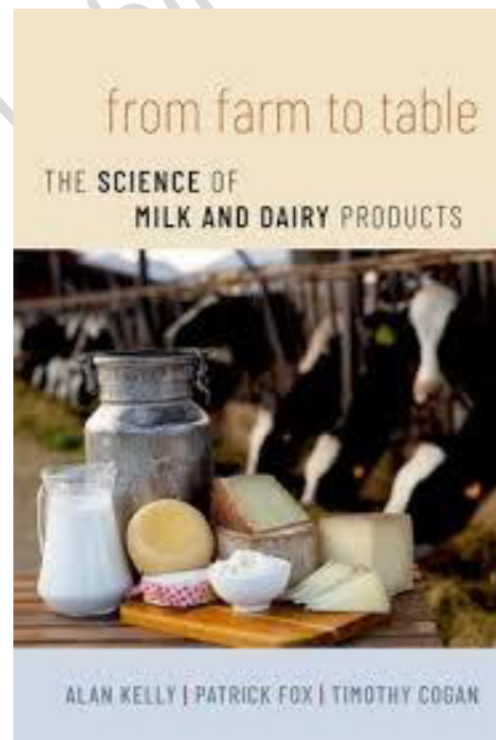
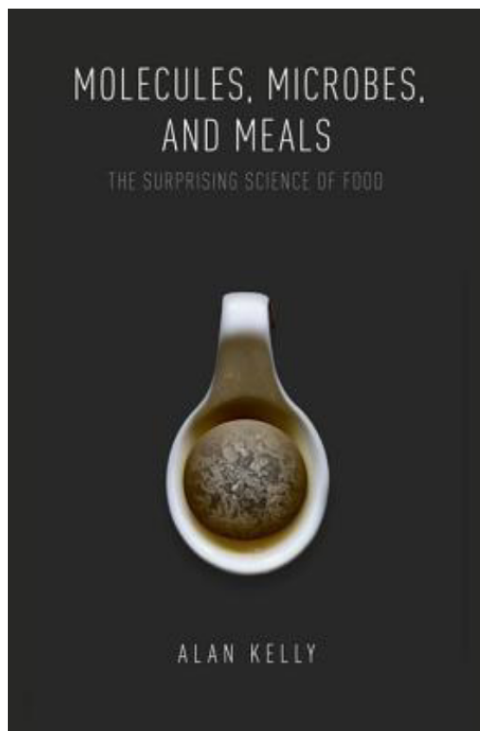


# Key final point

1. Need public communications as well as scientific ones
2. Who can be trusted voices on 'this' side of the debate?
3. How do we reach consumers?



# Thank you!



[a.kelly@ucc.ie](mailto:a.kelly@ucc.ie)