Advancing Food Design
Shelf-life – Past & Future

Dr. Declan Bolton, Teagasc
Overview

• Safety and Shelf-life in the context of food design
• Shelf-life past: A brief history of food preservation
• Shelf-life future
Food Design

Eating quality: appearance, taste, texture
Convenience: availability, ease of preparation
Cost: affordable
Stability: quality retention, shelf-life
Wholesomeness: safety, purity
Nutritive value: nutrient content, nutrient availability, caloric value
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Shelf-life Past: A brief history of food preservation
Sir, A freshness sensor has been invented that can tell if food has gone off (News, Jun 6). I do not need one as I inherited an infallible method from my mother. I suspend a gold ring on a piece of string over doubtful food. If it goes round, it is fine; if backwards and forwards it is off. Others have ridiculed the latter and suffered the subsequent discomfort. No doubt I would have been burnt as a witch 300 years ago.

Chris Platford
Malmesbury, Wilts
Cooking – (9000 BC) – stone age technology.

Chilling
• Stone age technology
• 1700 BC - ice houses built near the Euphrates.
• 1809 (AD)- Jacob Perkins patented the first refrigerating machine.
Curing: drying (12000 BC), salt (3600 BC) or smoke (3500 BC).

Biopreservation
Lactic acid bacteria – metabolites – lactic acid, acetic acid, hydrogen peroxide and peptide bacteriocins - yeast, bacteriophage.
Pickling – India 2400 BC

Sugar (preserves) – Roman cookery book, De Re Coquinaria (The Art of Cooking) – 1st century AD
Canning
Nicholas Appert (1809) French confectioner

MAP & Controlled Atmosphere Storage
• 1821, Jacques Etienne Berard, France, delayed ripening of fruit and increased shelf life in low-oxygen storage conditions.
• 1930s, CAS, ships transporting fresh apples and pears, high levels of CO$_2$
• 1970s, MAP bacon & fish in retail packs.
Pasteurisation - Louis Pasteur (1862)

Irradiation
• Henri Becquerel’s discovery of radioactivity in 1895.
• First food applications 1950s - beta particles and gamma rays.
• WHO and FAO – 500,000 tons/40 countries.

High Pressure
• 1899, B. H. Hite (USA) first to demonstrate the inactivation of microorganisms by pressure.
• 1914, Hite et al. release a detailed report.
• 1990, commercial products preserved in Japan.
Freezing
Clarence Birdseye (1924).

Food Additives
Spices (3000 BC) to 20th century – artificial substances to improve taste, shelf-life, appearance, etc.

Non-thermal Plasma/Cold Plasma
1960s & 1970s, add energy to a gas, electrons leave its atoms, ‘flame’ or ‘flow’ of ionized gas molecules (helium or nitrogen).
Hurdle technology

Leistner (2000) – ‘an intelligent combination of hurdles that secures the microbial safety and stability as well as the organoleptic and nutritional quality and the economic viability of food products’
Many years of R&D
Shelf-life: Future

1950+: Chemical Preservation
1809: Canning
1784: Refrigeration
3500 BC: Smoking
3600 BC: Salting & Curing
10000 BC: Fermentation
12000 BC: Drying
50000 BC: Cooking

The Irish Agriculture and Food Development Authority
Personalised Nutrition

- Using genetic tests to provide foods tailored to the group or individual.
- Tailoring the product to the needs of the group (age, race, religion, health status, lifestyle, etc.).
- Including shelf-life (shop once a day, once a week, once a month..., consumer preference, etc.).
Bioengineering

- White carrots, salty peaches, small, hard, bitter watermelons.
- More nutritious.
- Safety & shelf-life.
Neurogastronomy

• The science of taste perception. Combining our understanding of neurology and food science to enhance the eating experience.
• Sound of the sea increased saltiness of seafoods, desserts taste creamier when served in a round bowl, background hissing or humming makes food taste less sweet, etc.
• Aromatic mists, sound effects, controlled lighting, augmented reality headsets that superimpose digital imagery, etc.
Nanoscience & Nanotechnology

- The study and application of extremely small things and can be used across a range of scientific fields including food science.
- Polymer nanomaterials in food packaging, antimicrobial applications.
- Encapsulation of nutraceuticals and functional anti-microbial ingredients for preservation and bioavailability.
- Nanoparticles that give delayed bursts of flavour.
- Tiny magnetic particles that bind to and remove off-tasting flavour compounds (e.g. red wine) while preserving aroma, etc.
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