

A collage of various food items including bread, fruit, vegetables, and dairy products. The items are arranged in a dense, overlapping manner, creating a rich and colorful background. The text is overlaid on this background.

**Food Revolutions:
How Science Changed the Way We Eat
1700 - present**

**Ingolf Gruen
Food Science**

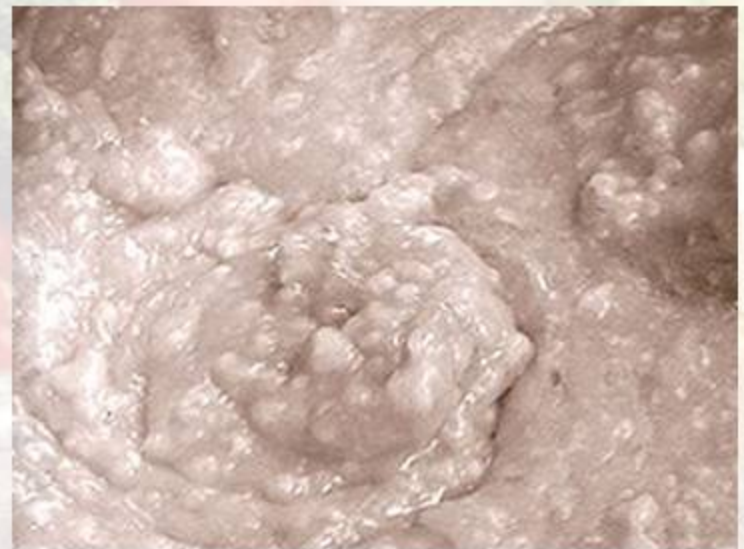
What did YOU eat this morning?

- Cereal?



What did our Great-great-great-great-great-great-great grandparents eat?

- Well, how rich were they?
- Coffee? No; cider, beer, or water (well) or even milk
- Porridge, or gruel
- Dried fruit
- Fresh fruit in season
- Similar vegetables
- But also various greens
- Bread, butter, jams,...
- And yes, occasionally a little bit of meat




So, what really changed?

- A few foods they did not have:
 - Spices (just salt)
 - Sugar (molasses or honey)
 - “Exotics”: bananas etc.
 - Ice Cream... 😊
- Today: Food is safer (so I claim!)
- Processing → improved preservation
- Longer shelf-life
- Are some of you longing for the good old days?



How did we get here?

- Our knowledge doubles in how many years?
- Food and Civilization
- Hunters and Gatherers
 - Nomads
- Agriculture
 - Settlements
- Industrial Revolution
 -  Ag workers

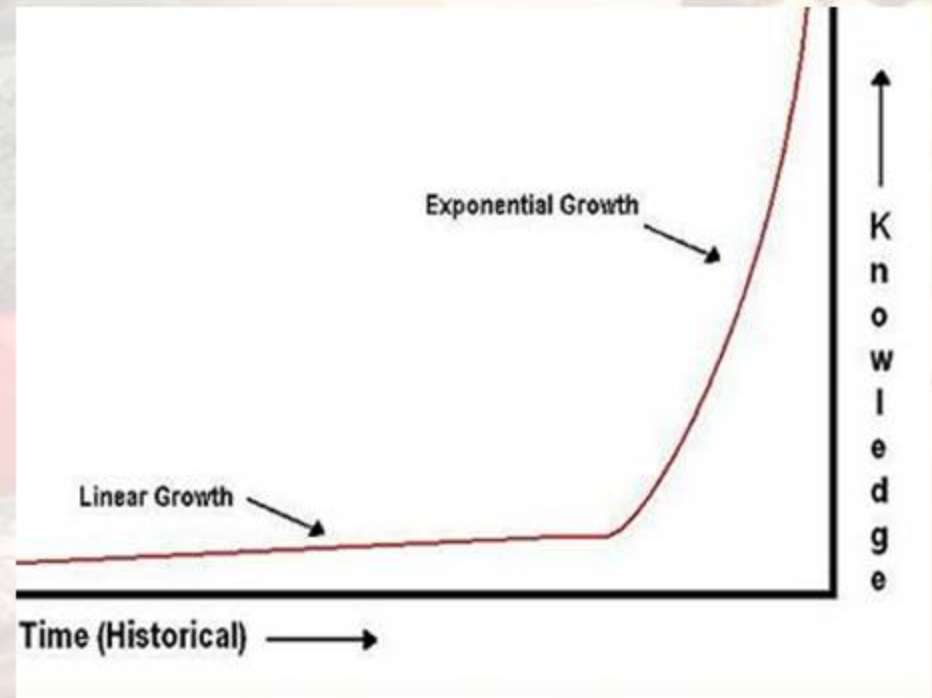


Figure 1 - The Knowledge Doubling Curve

What are the big inventions in Food Science

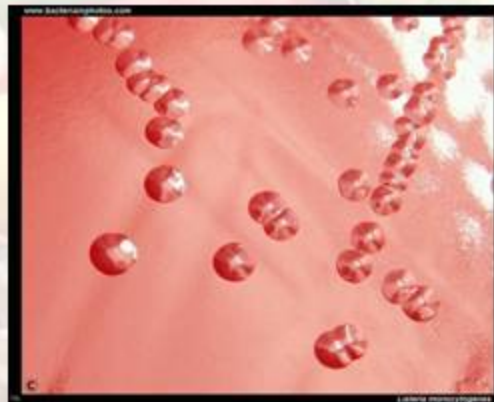
- We don't invent anything, we apply inventions
😊
- Food Science is an applied science!
- Food Scientists are opportunists!



What are the big scientific discoveries that found application in Food Science?
(majority revolves around preservation)

The 4 Areas of Food Science

- Food Processing
- Food Microbiology
- Food Chemistry
- Sensory Science



Nicolas Appert (1749 – 1841)

Paris, France

- Confectioner and Chef
- 1810 Cookbook: *The Art of Preserving Animal and Vegetable Substances*
- Father of Canning
 - “appertisation” (boiling)
 - Glass, not tin (Peter Durand)



Louis Pasteur (1822 – 1895)

University of Strasbourg, Strasbourg, France

- Lost 3 of 5 children due to typhoid (*Salmonella typhis*)
- Physicist
- Chemist (tartaric acid)
- Microbiologist (germ theory)
 - diseases → sterilization (UHT)
 - food spoilage → pasteurization
 - High Temperature Short Time
 - also Pasteur Effect:
 - Facultative anaerobes



Pasteurization

Destruction of pathogenic microorganisms
Temperature – Time (& Fat) Relationship!

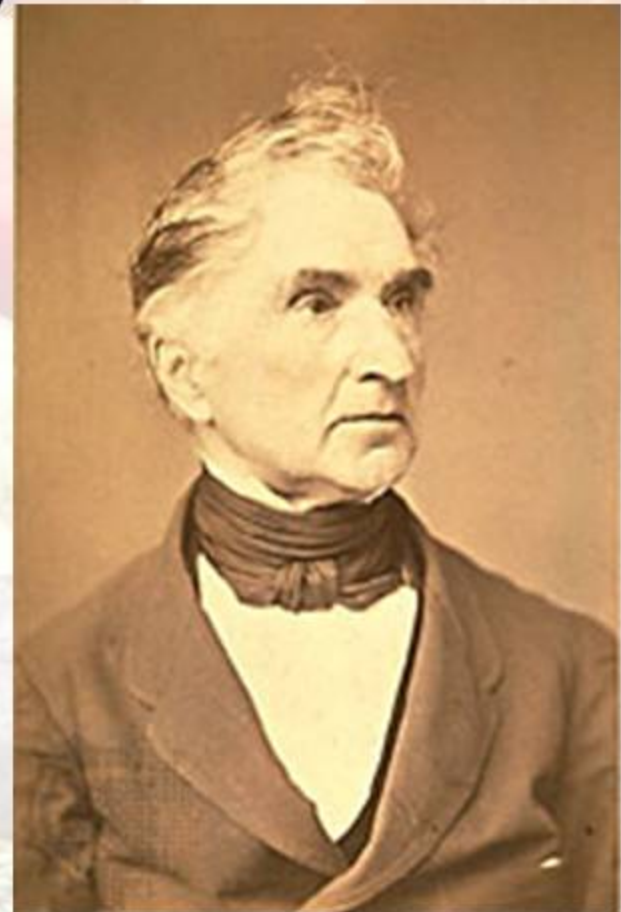
Temperature	Time
63°C (145°F)*	30 minutes
72°C (161°F)*	15 seconds
89°C (191°F)	1.0 second
90°C (194°F)	0.5 seconds
94°C (201°F)	0.1 seconds
96°C (204°F)	0.05 seconds
100°C (212°F)	0.01 seconds
69°C (155°F)	30 minutes
80°C (175°F)	25 seconds
83°C (180°F)	15 seconds



Justus 'von' Liebig (1803 – 1873)

Justus-Liebig University, Giessen, Germany

- 1816 – “year without a summer”
- Organic → Agricultural Chemist
 - Father of the Fertilizer Industry
 - Nutrients are chemicals
- Liebig Extract of Meat Company
 - Oxo Bouillons
 - Concentration of nutrients
- Justus Liebig's Annalen der Chemie und Pharmacie



Liebig's Teaching Laboratory

- Established first Chemistry School in Giessen
- Introduced laboratory for chemistry education
- Taught over 700 students in laboratories
- “Despised” teaching (1852 to Munich):
 - “...and I shall leave Giessen in September. ... What depresses me here and saps my strength is the practical course. ...I shall be 50 years old next year and if I still want to achieve something in science I must limit my activities. ... I shall get 30,000 thalers for a completely new laboratory, 5,000 thalers for equipment, a salary of 2,250 thalers per year, 2,000 thalers for current expenditure and no practical students! Can one refuse a thing like that? Impossible.”

Liebig Condenser and Kali Apparatus

- Did NOT invent the Liebig Condenser (Liebig Kühler)
- Did invent the Kali Apparatus
- ACS Founders



Norman Borlaug (1914 – 2009)

Cresco, IA, USA

- The World Food Prize
- Father of the Green Revolution
 - Technology Transfer
 - High-yielding varieties
 - Hybridized seeds
 - Irrigation
 - Modern management practices
 - Fertilizer
 - Pesticides



David R. Peryam (1915 – 1992)

Chicago, IL, USA

- Father of Sensory Science
- Food Acceptance Testing
- Quartermaster (1944)
 - Food Acceptance Branch
 - Headed by Peryam (49-64)
- 9-point hedonic scale



9 – Point Hedonic Scale (Liking or Acceptance, NOT Preference)

Hedonic Scale



Taste the sample and check the box that best describes your liking opinion.

- Like extremely*
- Like very much*
- Like moderately*
- Like slightly*
- Neither like nor dislike*
- Dislike slightly*
- Dislike moderately*
- Dislike very much*
- Dislike extremely*



Refrigeration (not one person)

maybe Clarence Birdseye (1886 – 1956)

- Ice box
- Liquefaction of gases
 - dimethyl ether
 - ammonia
- Refrigerators
- Freezers





In February 1882, in 98 days, the Dunedin sailed with 4331 frozen mutton, 598 lamb, and 22 pig carcasses, 246 kegs of butter, as well as hares, pheasants, turkeys, chicken and 2226 sheep tongues from New Zealand to London.

Food Laws (not science, but...)

- 1906 - Pure Food and Drug Act
- 1938 - Food, Drug and Cosmetic Act
- 1958 - Food Additives Amendment
- 1960 - Color Additives Amendment
- 1990 - Nutritional Labeling and Information Act
 - *Mandatory nutritional information in uniform format and authorized use of “health claims”*
- 1994 - Dietary Supplement Health and Education Act
 - *Defined and established scheme for regulation of Dietary Supplements*
- 1997 - FDA Modernization Act



Food Laws (not science, but...)

- **Pure Food and Drug Act of 1906**

an act for preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious food, drugs, medicines and liquors....

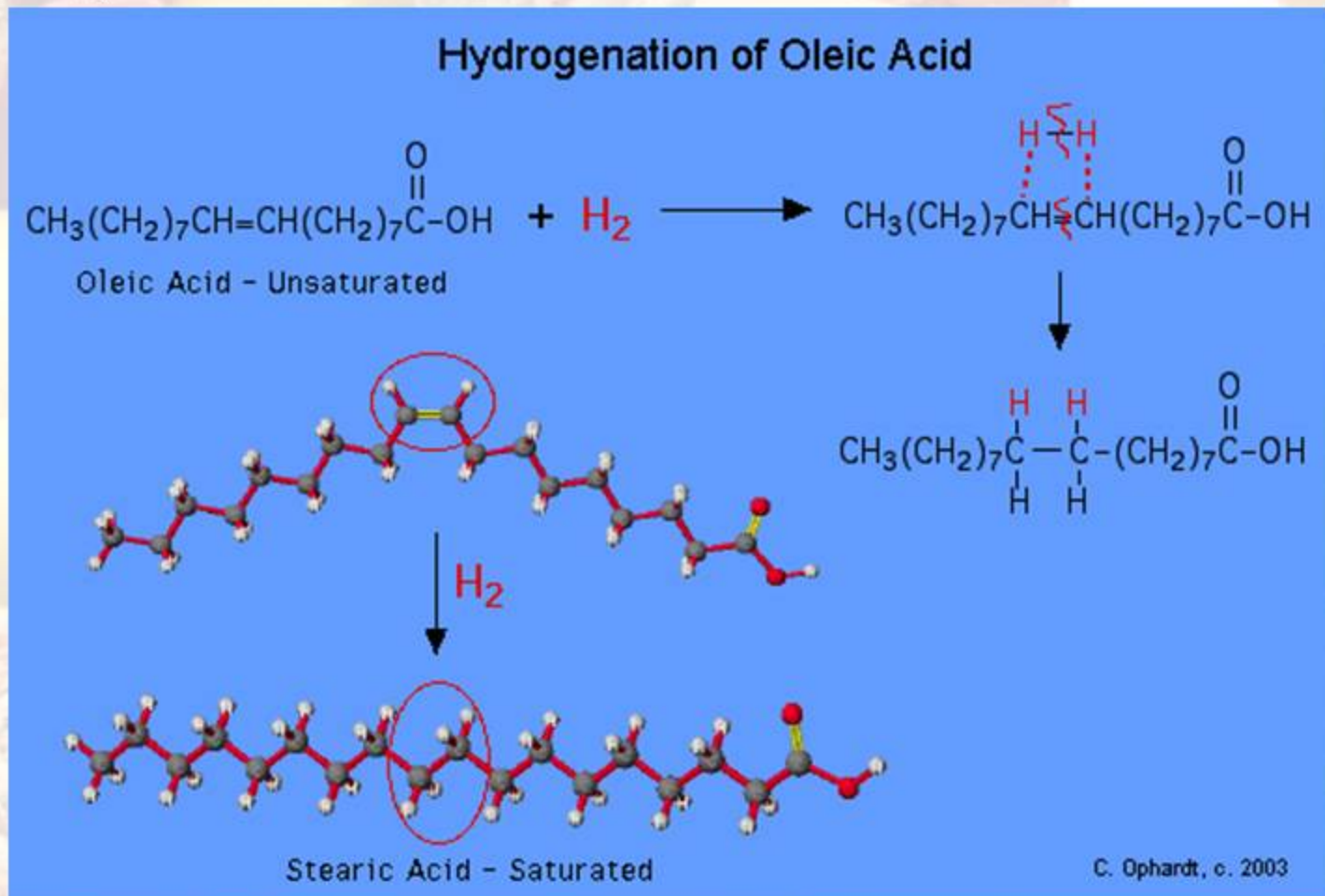
Weakness: Lack of standards for food products

- **Food Drug and Cosmetic Act of 1938 (plus Food Additives Amendment of 1958)**

200 Food Standards applied to articles used as food and components of food intended for consumption by humans or other animals, whether or not in edible form; Under FDCA, standards of identity, fill, quality and grade became mandatory for any product in interstate commerce

BIG Flops: Hydrogenation

- Margarine from plant fats in 1940s



More Recent Developments

- Irradiation of Foods
 - A “flop”?
- GMO Foods
 - Verdict still out!
- Nanotechnology and Foods
 - Part of our future!?
 - “the ink is not dry yet”



The Future of Food ?



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THANK YOU!

QUESTIONS / DISCUSSION?