CA18105

RIBMINS

Risk-based meat inspection and integrated meat safety assurance

Paradigms in meat safety assurance systems

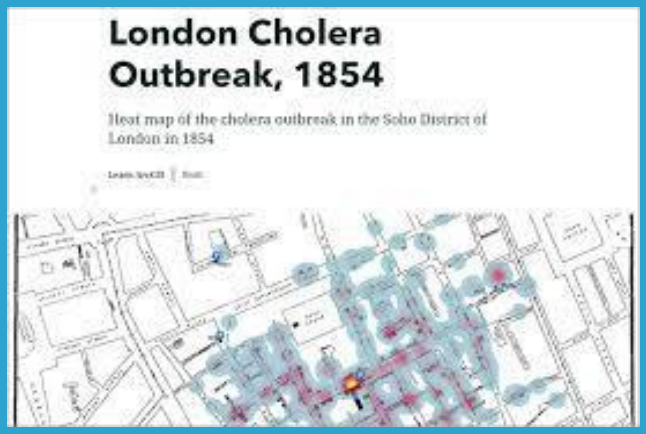
Ole Alvseike | 3. Feb 2021 | WG4 Virtual Training School

cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Funded by the 2020 Framework Programme of the European Union

www.cost.eu

Disease, Philosophies, Technology & Measures

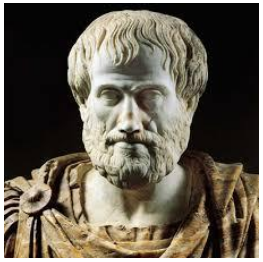


RIBMINS

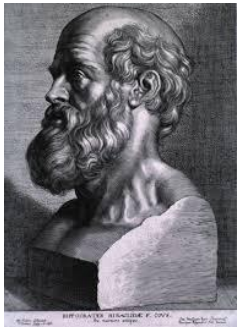
Ancient roots of medicine

- About 4000 BC:
  Domestisised plants and animals – Civilizations – Communicable Diseases
- Religious rules (Hindu, Jewish)
- 600 BC: Sushruta's ayurvedan text (India) describes infectious diseases spread from one person to another by sexual union, physical contact, eating together, sleeping together, sitting together, and the use of same clothes, garlands and pastes.
  Nutton, Vivian (1983) "The seeds of disease: an explanation of contagion and infection from the Greeks to the Renaissance," Medical History, 27 (1) : 1–34

- "The pig is the only animal known to be subject to measles (cysticerci)" Aristotle (385-323 B.C.)
  McLachlan, Richard S. "Julius Caesar's late onset epilepsy: a case of historic proportions." Canadian journal of neurological sciences 37.5 (2010): 557-561.



- Hippocrates (460-377 B.C.) tried to explain disease as imbalances of humours in our bodies (black bile, yellow bile, blood, and phlegm).



RIBMINS

Ancient – Middle Age: mediterrainian

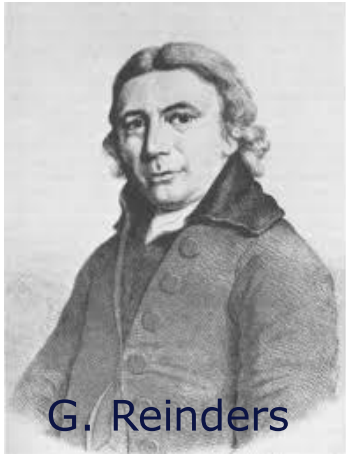
- The Romans: Non-contact airborne disease some of which “semina” could sicken a person
- Aelius Galenus (approx. 130 AC): Theories on miasma, or noxious bad air, but also "seed of the disease“.
- Isidore of Seville (560–636) Pestifera semina.
- Ibn Sina, bridged miasma theory and contagious disease theories.
  The Rules of Medicine (El-Kanun Fi't-Tıb,1025)
  Islamic scholars referred to contagious substances as najasat ("impure substances").
- Ibn al-Haj al-Abdari (1250–1336) Contagion can contaminate water, food, and garments

RIBMINS

Middle age to modern sciense

- «De contagione et contagiosis morbis», Girolamo Fracastoro (1546)
- Infectious particles «Li Qi» (pestilential factors), Wu Youke (1582–1652)

- Technology
  - Microscope: Athanasius Kircher may have observed microorganisms first in 1646.
  - Taxonomia: *Taenia solium,* Carl Linné (1758)
  - Variolation against smallpox: Ottoman Empire approx. 1670
  - Immunity from exposure, maternal immunity and inoculation (rinderpest), Geert Reinders (1768)
- Specific etiology, contagious, endemic, epidemic: Marcus Antonius von Plenciz (1762)


G. Reinders

RIBMINS

Pioneers of medicine

- Technology:
  - Handhygiene, Ignaz Semmelweis (1847)
  - Analytic statistics and epidemiology, John Snow (1849)
  - Fermentation, Louis Pasteur (1857)
  - Disinfection and antiseptics, Joseph Lister (1865)
  - (Breeding and heredity, Mendel (1865))
  - Tuberculosis infectious from inoculation, Villemin (1865)
  - Pasteurisation, Louis Pasteur (1865)
  - Cultivation on gelatin gels, Brefeld (1872)
  - Fixation and staining, agars, petri dishes, Robert Koch, Walter and Fanni Hesse (1870'ies)
  - Tubercle bacilli cultivated, Robert Koch (1982)
- Etiology of communicable diseases - Koch's postulates (1892)

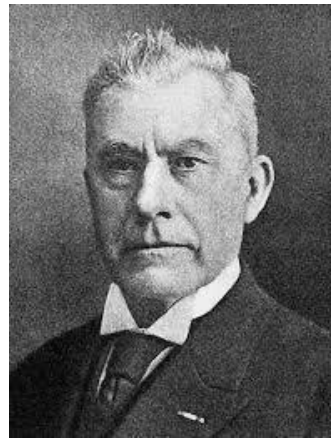
Julius O. Brefeld

RIBMINS

Comparative medicine

- Technology:
  - Immunology
    - Phagocytosis, Elie Metchnikoff (1884)
    - Passive serology (anti-toxin), Emil v. Behring and Shibasaburo Kitasato (1890)
    - Serology and immunochemistry, Paul Ehrlich (1891)
  - Filtration (anthrax), Edwin Klebs
    - Viral diseases – «belong to a quite different group of micro-organisms» (Robert Koch)
    - Rabies - micro-organism infinitesimally small (Pasteur 1884).
    - Foot and Mouth disease - a small agent that can multiply, Friedrich Löffler and Paul Frosch (1898)
    - Virus – term and its nature, botanist Martinus Beijerinck

S. Kitasato

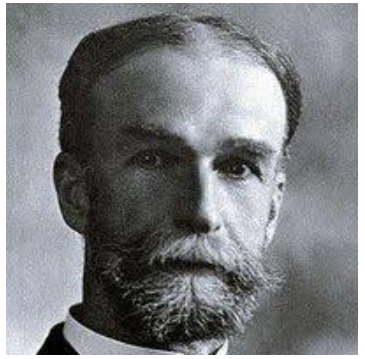


M. Beijerinck

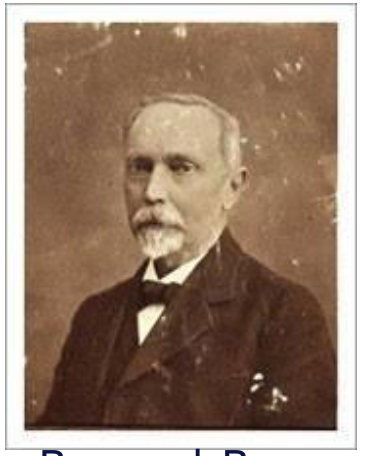
RIBMINS

Comparative medicine gold age

- Brucella melitensis, David Bruce (1887)
- Salmonellosis (Hog Cholera/Classical Swine Fever), Theobald Smith (1894)
- Brucella abortus, Bernhard Bang (1895)
- Mycobacterium bovis a zoonosis, Theobald Smith (1898)
- Arthropod transmission
  - Texas cattle fever, Theobald Smith and Kilbourne (1889)
  - Trypanosomiasis in cattle, Bruce (1896)
  - Malaria, Ross (1897)
  - Yellow fever, Reed, Carroll, Agramonte, & Lazear (1900)
  - Typhus, Nicolle, Comte, & Conseil (1909).
- Yersinia enterocolitica, McIver & Pike (1934)
- Campylobacter, Dekeyser, Gossuin-Detrain, Butzler, & Sternon (1972)



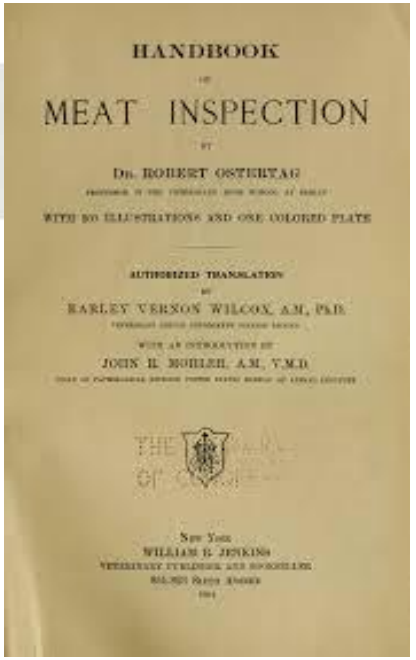
Theobald Smith



Bernard Bang

RIBMINS

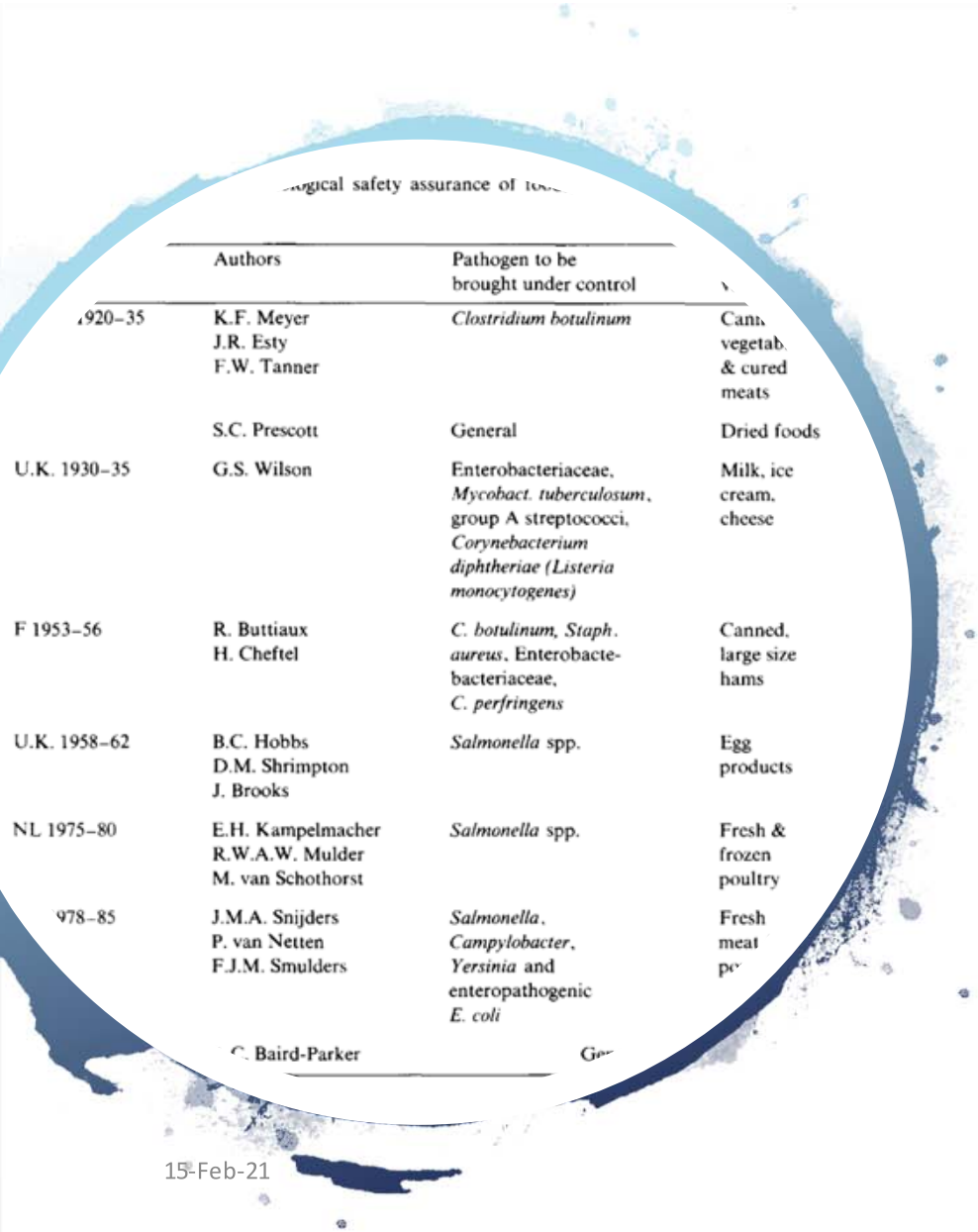
The birth of Public health systems


HANDBOOK
OF
MEAT INSPECTION
BY
Dr. ROBERT OSTERTAG
WITH 80 ILLUSTRATIONS AND ONE COLORED PLATE
AUTHORIZED TRANSLATION
BY
EARLEY VERNON WILCOX, A.M., PH.D.
WITH AN INTRODUCTION BY
JOHN R. MOHLER, A.M., V.M.D.
New York
WILLIAM R. JENKINS

- Sand filtration of drinking water, (1804)
- First public water supply: Chelsea Water Company, London (1829)
- Clean water supply and sewage systems (typhoid fever) (1891) and…
- Public health systems (1902), William Thompson Sedgwick
- Canning (1896), from reaction to prevention, Samuel Cate Prescott
- Meat inspection, Robert Ostertag (1899)
- Ecology of pathogens, holistic approaches to food production and public health, e.g. The Zoonoses in their relation to Rural Health (1955) – Karl Friedrich Meyer
- Pasteurisation of milk, Wilson's triad - Food security, food safety and food defence, public health laboratory service, Sir Graham Wilson (1940)

Resistance to Food processing and safety systems linked to resistance to gamma-irradiation. Toxicology philosophy: Survey and react, doesn't function.

RIBMINS



...gical safety assurance of ...

	Authors	Pathogen to be brought under control	
...920–35	K.F. Meyer J.R. Esty F.W. Tanner	*Clostridium botulinum*	Can.. vegetab. & cured meats
	S.C. Prescott	General	Dried foods
U.K. 1930–35	G.S. Wilson	Enterobacteriaceae, *Mycobact. tuberculosum*, group A streptococci, *Corynebacterium diphtheriae (Listeria monocytogenes)*	Milk, ice cream, cheese
F 1953–56	R. Buttiaux H. Cheftel	*C. botulinum, Staph. aureus*, Enterobacte-bacteriaceae, *C. perfringens*	Canned, large size hams
U.K. 1958–62	B.C. Hobbs D.M. Shrimpton J. Brooks	*Salmonella* spp.	Egg products
NL 1975–80	E.H. Kampelmacher R.W.A.W. Mulder M. van Schothorst	*Salmonella* spp.	Fresh & frozen poultry
978–85	J.M.A. Snijders P. van Netten F.J.M. Smulders	*Salmonella*, *Campylobacter*, *Yersinia* and enteropathogenic *E. coli*	Fresh meat pr
	C. Baird-Parker	Ge...	

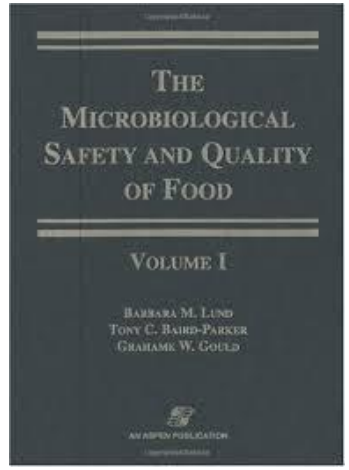
The way to HACCP

- **Mossel, D. A. A.** "Adequate protection of the public against food-transmitted diseases of microbial aetiology: Achievements and challenges, half a century after the introduction of the Prescott-Meyer-Wilson strategy of active intervention." International Journal of Food Microbiology 9.4 (1989): 271-294.

Post WWII Public safe food systems

- HACCP, Howard E, Bauman (1974) Bauman, H.E. (1974) The HACCP concept and microbiological hazard categories. Food Technol. 28,(9) 30-34; 74.
- Risk analysis, meaning validation of final product (safety science), D.A. Mossel (1979)
- Microbiological reference values and ranges, D.A. Mossel (1980)
- Farm to fork, Longitudinal integrated safety assurance (LISA), D.A. Mossel (1983)
- Microbiological criteria for meat and meat products, Baird-Parker (1987)
- Sustainability, Precautionary principle & Risk analysis (assessment, management and communication) (Rio Earth **Summit** in 1992)
- The World Trade Organization Agreement on the Application of Sanitary and Phytosanitary Measures, WTO (1995)
- Meat safety assurance system, Berends and von Knapen (1999)
- Responsibility for ensuring the safety of meat should lie with the Food Business Operator (FBO), SCVMRPH (2000 and 2001)
- Food chain information, EU (2004)
- Meat safety assurance system, ends with chilled carcasses. EFSA (2011,2012,2013)

David Mossel



RIBMINS

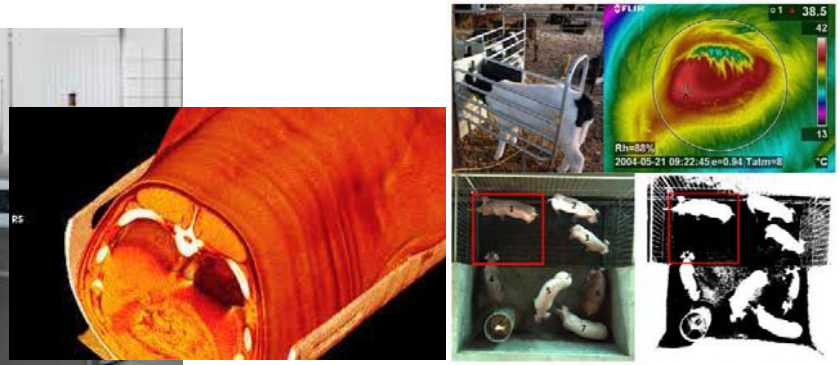
1876-2019: **Disease** or **Methodology** driven shifts

Concept	**Methods**	**Regime**
Pathology (Ostertag 1899)	Knife, fingers, eyes, nose	**Product control - Inspection and approval (1900)**
Bacteriology (Koch 1876, Pasteur 1878)	Cultivation	Product control - Spot tests on indication (1922)
Antibiotic residues (Fleming 1928)	Cultivation	Product control - Spot tests on indication
Medicine residues	Advanced spectroscopi	National surveillance - Spot tests
Xenobiotics	Advanced spectroscopi	National surveillance - Spot tests
Heavy metals (Wheatstone 1835)	Advanced spectroscopi	National surveillance - Spot tests
Immunology (Perlman & Engvall 1971)	Serology – automated	Product control – economical fines (salmonella)
HACCP (1959 Pillsbury Company)	Process control – audit	**Process control – audit**
Microbiological Criteria (UN-ICMSF 1962)	Cultivation	Food safety: Product - control, Processing - verification
Prions TSE (Prusiner 1982)	Western blot, serology, PCR	National surveillance - Spot tests
Fraud – species origin	PCR	National surveillance - Spot tests
Food chain information	Data	Food chain information

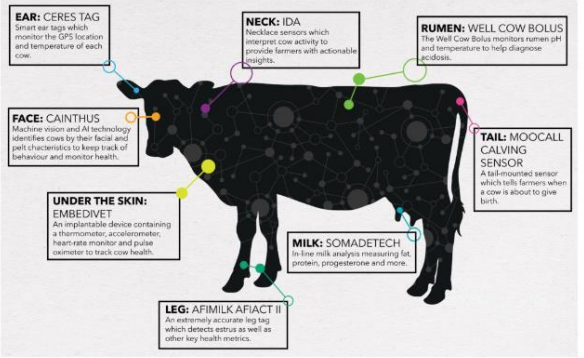
Are we missing something?

Here is some:

- Electromagnetic waves
  - X-ray (CT)
  - Vision systems
  - Near infra red
  - Infrared
  - Microwaves
- Ultrasound/MRI
- Electronic nose
- Gait
- Whole genome sequencing
- Internet of Things (IoT)
- Blood analyses
- Artificial intelligence

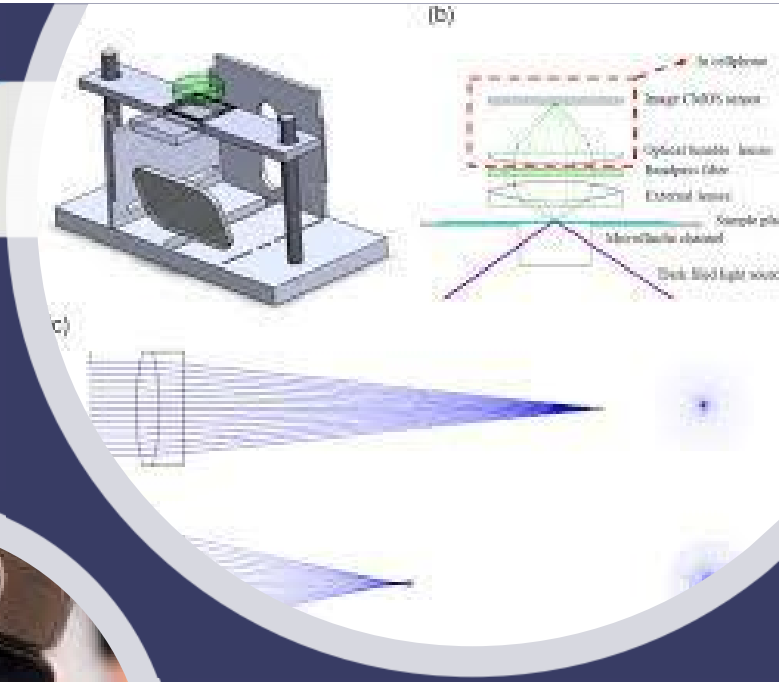


Research into IR use for early detection of disease in calves by AgResearch, New Zealand (top), and development of 3D imaging systems for pig drinking detection, China (bottom).

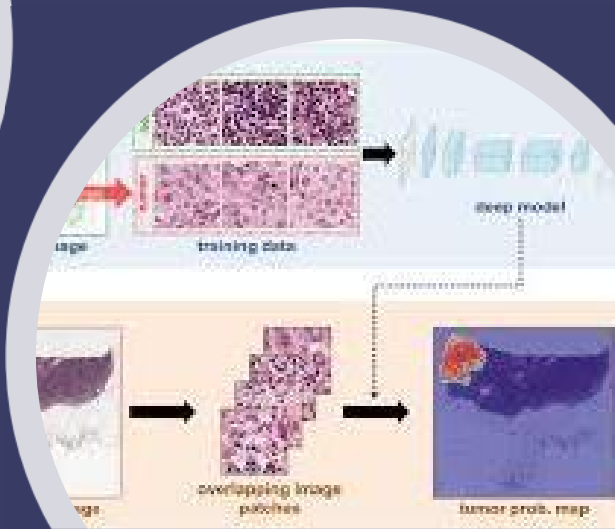


Source: Agrichecker.com, 2018.

Cardinal symptoms 5.0



- Calor: Fever or hyperthermia?
  - Acute phase proteins?
- Dolor: Lameness – camera or sound?
- Rubor: Skin lession score in pigs – camera+AI?
- Tumor: Detection by AI?
- Functio laesia



RIBMINS

Thank you for the attention.

Please join us at

RIBMINS

Funded by the 2020 Framework Programme
of the European Union

www.cost.eu

www.ribmins.com
scan this