

Concepts of Hygiene and Sanitation

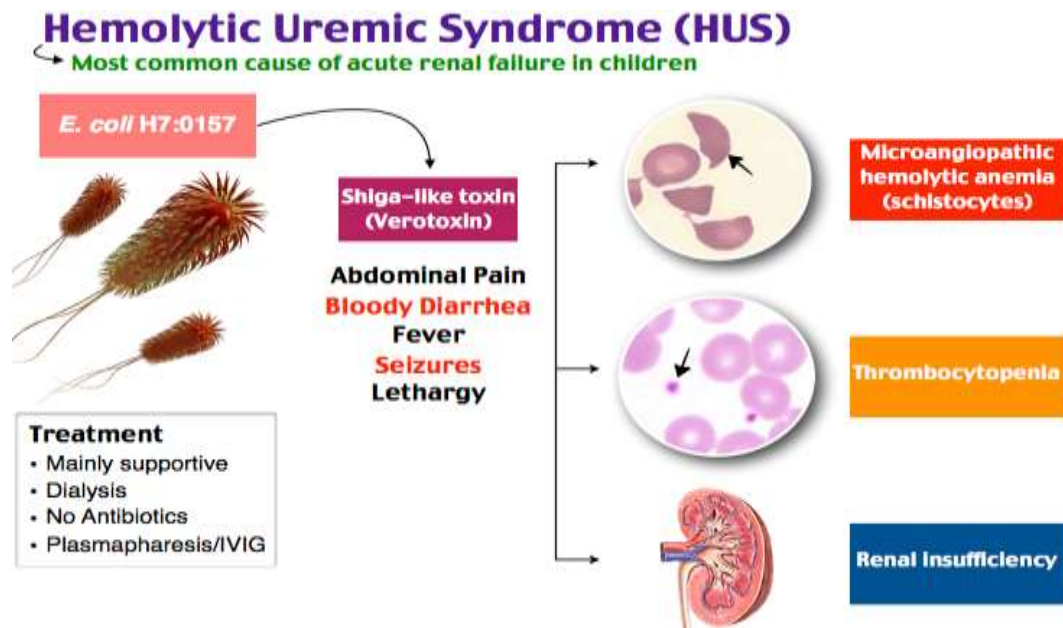


- ✓ **Medicine and hygiene** have always been counterparts in healing diseases and considered as cornerstone of safe food production.
- ✓ **Ignác Fülöp Semmelweis (1818-1865)**, Hungarian physician demonstrated that puerperal fever 1 ("childbed fever") was contagious and could be drastically reduced by enforcing appropriate hand-washing behavior by medical care-givers.
- ✓ Additional use of chlorinated lime reduced death rate caused by puerperal fever to zero level.
- ✓ In 1865, **Louis Pasteur** suggested decay in wounds was caused by living organisms in the air, which on entering matter caused it to ferment.
- ✓ **Joseph Lister (1827-1912)** in Germany met **Robert Koch** who demonstrated in 1878 the usefulness of steam for sterilizing surgical instruments and dressings.

Tragic story of the doctor who first said: wash your hands

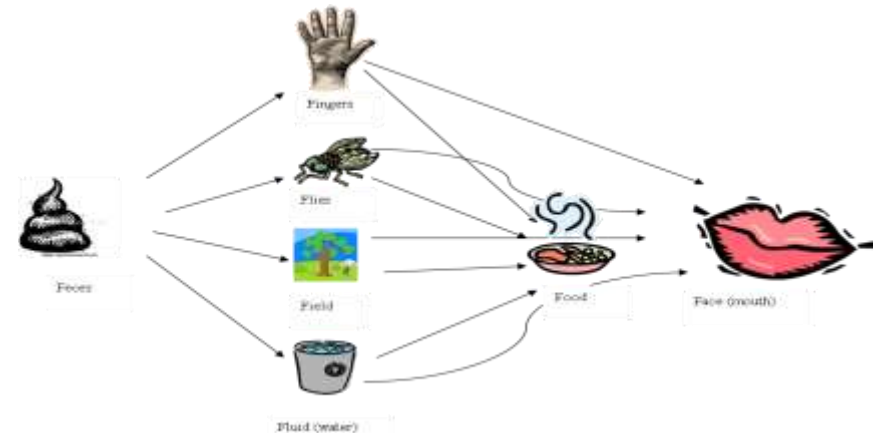


- ✓ Koch and his assistants devised techniques for culturing bacteria outside body, and formulated rules for showing whether or not a bacterium is cause of a disease.
- ✓ Identification of agents involved in food borne diseases began at end of 19th century when **Van Ermengem** clarified botulism in man (Van Ermengem, 1897).
- ✓ Around 1980-1985, *S. enteritidis* re-emerged via the internal contamination of chicken eggs.
- ✓ New emerging pathogen *E. coli* O157:H7 (Willshaw et al., 2000) caused hemorrhagic colitis and in young developed hemolytic uremic syndrome (HUS) characterized by renal failure and hemolytic anaemia.



Hygiene and Sanitation

1. Around 1880, food thought to be important source of disease-causing organisms, investigations started on reservoirs and routes of transmission of pathogens.
2. Presence of pathogenic bacteria in intestines of animals, as source of food contamination, and foods of animal origin, as routes of transmission to humans.
3. **Savage (1909)** observed faecal contamination of food must be very common and milk is a vehicle of infection.
4. **Theodor Escherich**, German paediatrician devoted his efforts to improving childcare, heat-processing of milk to prevent infant diarrhoea.
5. **Esty and Meyer (1922)** developed concept of heat treatment of low-acid, canned food-products to reduce risk of botulism.
6. **Enright et al. (1956, 1957)** established performance criteria for pasteurization of raw milk that provided an appropriate level of protection (ALOP) against *Coxiella burnetii* (Q fever).



USA introduced Meat Inspection Act in 1906 (brought reforms to processing of cattle, sheep, horses and goats for human consumption)

1.

- All animals were required to pass an inspection by US Drug Administration prior to slaughter

2.

- All carcasses were subject to a post-mortem inspection

3.

- Standards of cleanliness were established for slaughterhouses and processing plants

Food and Drug Act introduced in UK, 1938 (use hygienic conditions in handling, wrapping and delivering food, and adequate hand-washing facilities for food handlers).

Definitions of Hygiene.....

- The first definitions of 'hygiene' are derived from work of the Goddess Hygeia: 'Healing through cleanliness'
- 'The science dealing with preservation and promotion of health'
- By beginning of 20th century, preventive measures were only way to produce safe food, and discipline of food hygiene was born.....

Definitions of food hygiene in current use

Definition	Reference
Conditions and practices that preserve the quality of food to prevent contamination and food-borne illnesses.	http://www.nlm.nih.gov/medlineplus/ency/article/002434.htm
All measures necessary to ensure the safety and wholesomeness of foodstuffs. EU's General Food Hygiene Directive	Anonymous, 1993
All conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain.	Codex Alimentarius Commission (Anon., 1997) CAC/RCP 1-1969, Rev. 3 (1997), Amended 1999
The measures and conditions necessary to control hazards and ensure fitness for human consumption of a foodstuff, taking into account its intended use	Environmental Health Journal, 2000, 108/9 http://www.ehj-online.com/archive/2000/september/sept10.html COM (2000) 438. Final. Brussels, 14 July 2000.

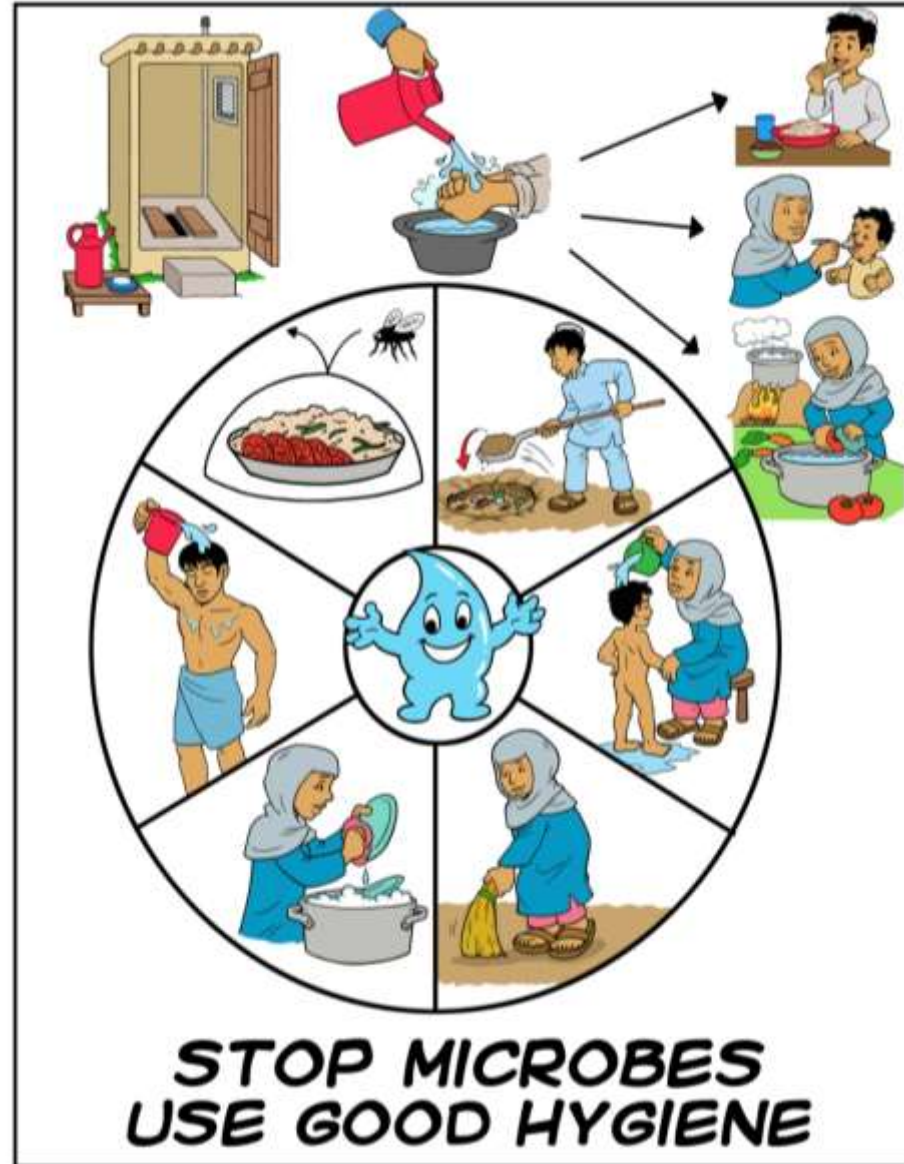
Food Sanitation

- Sanitation is a term for hygienic disposal or recycling of waste materials, particularly human excrement.
- A public health measure essential for prevention of disease.
- In USA, concept of food sanitation may be defined as ‘the hygienic practices designed to maintain clean and wholesome environment for food production, preparation and storage’ (Marriot, 1999).
- In microbiology, sanitation is defined as ‘a cleaning and disinfection process that results in 99-99.9 % reduction in number of vegetative bacteria present’



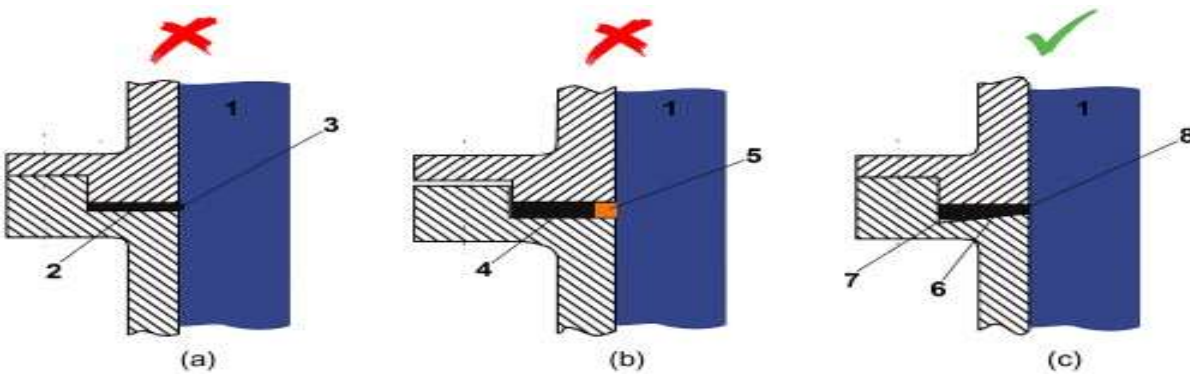
Personal Hygiene

- Personal hygiene is of great importance for maintenance of health.
- Human beings are natural carriers of micro-organisms and sources include hair, skin, mucous membranes, digestive tract, wounds, infections and clothing.
- Good personal hygiene is primarily directed towards preventing both disease and discomfort.
- Hand washing, dental care, avoidance of spitting, daily showering, disposal of waste etc, as well as clean is also important.



Hygienic Design of Facilities and Equipments

- Hygienic design of food-production facilities, processing equipment etc. is most important factor in ensuring safe and wholesome food.
- Poorly designed farms, factories, and equipment can result in contamination of food products and lead to food-poisoning incidents. Design deficiencies result in losses of product due to spoilage increased cleaning costs and reduced production time.
- Essential that both manufacturers and users of food-processing equipment are aware of hygienic design principles and requirements described in EU Directives 98/ 37/ EC and 93/ 43/ EEC, and Hygienic Design DIN EN 1672/ 2 (1997).
- Hygienic production of food depends upon combination of food-processing procedures and hygienic design of buildings and equipment, in full compliance with legislation.



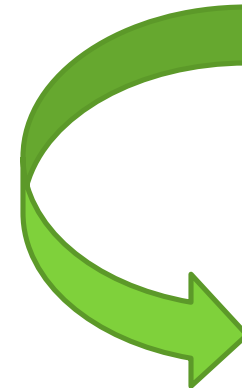
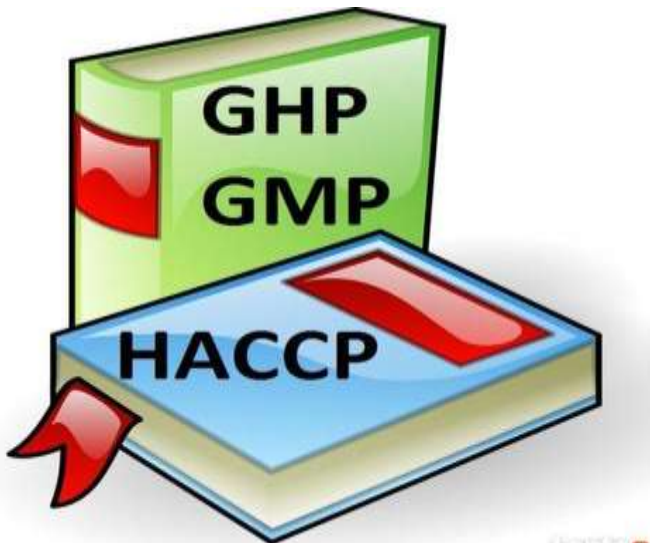


Hygiene control measures in food processing

- ❑ Hygiene in food processing started with introduction of general measures, including cleaning and disinfection, prevention of re-contamination and treatment of food products to kill any microbial pathogens.
- ❑ In 19th century, predictions to processes such as heating, acidification, drying and use of curing agents and its effect on both pathogenic and spoilage organisms.

GHP concept

- ❑ First safety systems developed by food industry was that involving application of Good Manufacturing Practices (GMP), as supplement to end-product testing.
- ❑ GMP covers all aspects of production, from starting materials, premises and equipment to the training of staff and the WHO has established detailed guidelines.
- ❑ GMP also provides a framework for hygienic food production, which is often referred to as Good Hygienic Practice (GHP).
- ❑ GHP concept is largely subjective and its benefits tend to be qualitative.
- ❑ No direct relationship to safety status of product, but its application is considered to be a necessary preventive measure in producing safe food.
- ❑ Effective application of HACCP concept depends upon GHP being used.





Design of premises and equipment

- Includes location and layout of premises to avoid hygiene hazards and facilitate safe food production.
- Food processing and handling equipment should always be designed with hygiene in mind, including ease of cleaning.

Control of the production process

- Control measures are applied throughout supply chain and cover factors such as raw materials, packaging and process water, as well as product itself.
- Key aspects include management and supervision of process as whole, as well as appropriate recording systems.

Plant maintenance and cleaning

- Both processing equipment and fabric of building should be maintained in good order.
- Suitable programmes need to be developed for plant cleaning and disinfection, and their effectiveness monitored routinely.
- Systems are also needed for pest control and management of waste.

Personal hygiene

- Staffs are required to maintain high standards of personal hygiene in relation to wearing of protective clothing, hand washing and general behaviour.
- Visitors must also be strictly controlled.
- Health status of personnel should be monitored regularly and any illness or injuries recorded.

Transportation

- Requirements should be established for use and maintenance of transport vehicles, including their cleaning and disinfection.
- Vehicle usage should be managed and supervised.

Product information and consumer awareness

- Final product is suitably labeled and consumer is provided with all relevant information on product handling and storage, including a 'use-by' date.
- Labelling should also indicate batch and origin of product, so that full traceability is possible.

Staff training

- In relation to food hygiene and safety, all personnel should receive appropriate training and be made fully aware of their individual responsibilities.

Future Aspects

Further development of hygiene control:

- ❑ Certain hygiene controls are very effective in reducing food borne disease, and effects of certain measures.
- ❑ Effects of cleaning and disinfection, steps to prevent cross-contamination in food processing and hand washing and other aspects of personal hygiene.
- ❑ Micro-organisms may sometimes become established in processing equipment and food-production facilities, thus increasing contamination of product.

Building hygiene into the system :

- Aims to improve general hygiene involving nano-technology.**
- This technology is a promising means of developing processes that are inherently hygienic. Eg., coatings based on nanotechnology can make the environment more hygienic by preventing bacterial attachment to surfaces (ceilings, floors and walls of processing facilities, conveyor belts etc.) and/ or bacterial proliferation on these surfaces.**
- Coatings have already been developed and successfully applied to prevent fouling eg., windows, water-closets and tiles.**

Changing pattern of microbial hazards:

- ❑ Society is increasingly confronted with microbial problems that are not susceptible to control by traditional measures.
- ❑ May involve new hazards, including viral contamination of food and occurrence of bacteria resistant to antibiotics and disinfectants.
- ❑ Many of these problems arise from introduction of new technologies, new methods of producing raw food-materials and socio-economic changes in society, including overcrowding, increased traveling and global food-production and trade.