Microbiological Testing Basics

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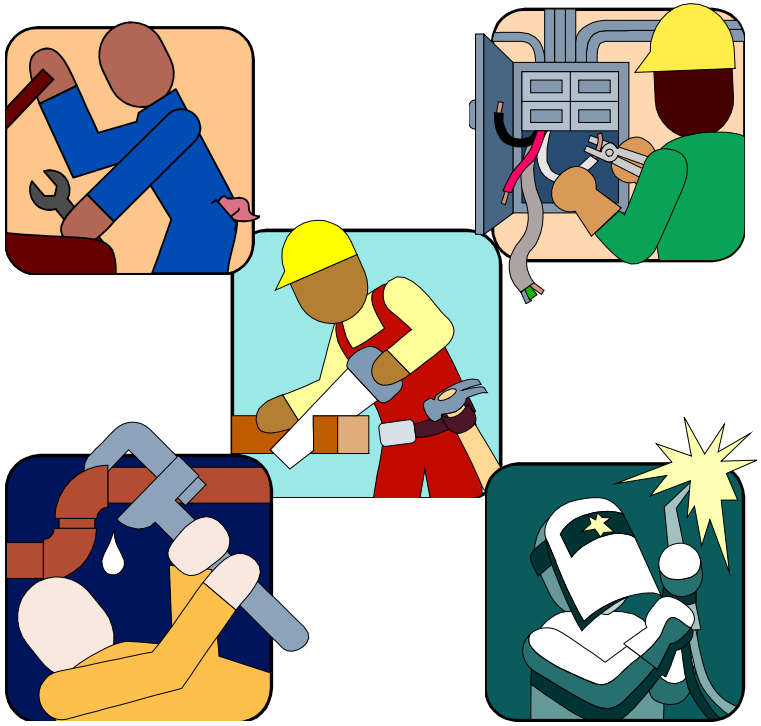
Microbiological Testing of Foods

- Testing foods against a specified "criterion"
  - Pathogens
  - Indicator microorganisms

Microbiological Testing of Foods

- Set of technologically-based, statistically-based tools
  - Safety of “batches”
  - Process control verification
  - Process control validation
  - Investigational sampling
  - Surveillance sampling
- Need right tool for the right job



Microbiological Testing of Foods

- Microbiological testing is inherently "probabilistic" in nature
  - Must consider the likelihood that the target microorganism is in the food sample being examined
  - Cannot prove absence, only disprove it
  - Negative findings are used to determine
    - The likelihood of contamination is below some preset value
    - What level of confidence one can have in negative results

Microbiological Testing of Foods

- Generally works on the assumption that
  - Samples are taken randomly and independently
- Concept of “defect rates” critical to understanding microbial testing of foods

Types of Microbiological Testing

- Two general classes of sampling plans are used to evaluate the microbiological safety or quality of a food batch
  - Attribute:
    - 2-class: ”presence/absence”
    - 2-class: “numerical“ (e.g. ≤100 vs. >100)
    - 3-class: Numerical with inclusion of marginally acceptable (e.g., ≤10 vs. >10 - ≤100 vs. >100)
  - Variables:
    - Direct use of quantitative data

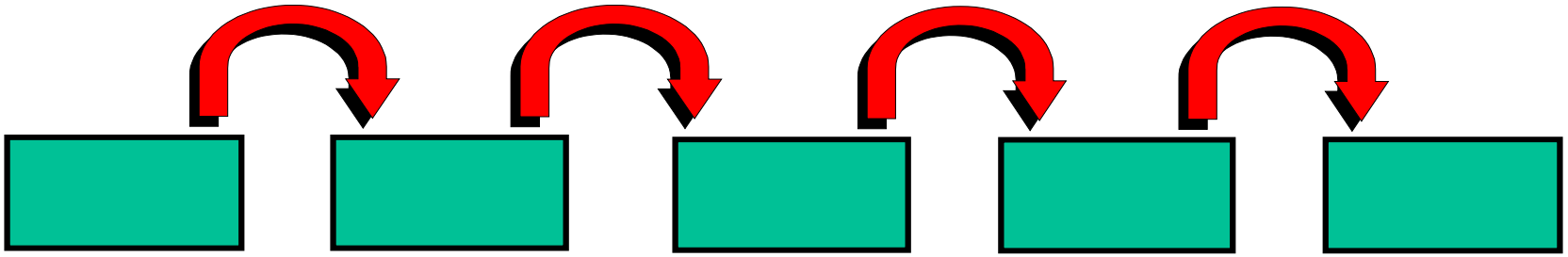
- These basic forms include both cultural and “omics” based testing

Microbiological Testing Stringency

- Utility, effectiveness and cost of testing is dependent on:
  - Inherent cost of analysis
  - Defect rate
  - Distribution (variance) of contamination
  - Number and size of samples
  - Frequency of sampling
  - Method's lower limit of detection (i.e., when is zero zero?)
  - The degree of confidence required (i.e., 90%, 95%, 99%?)

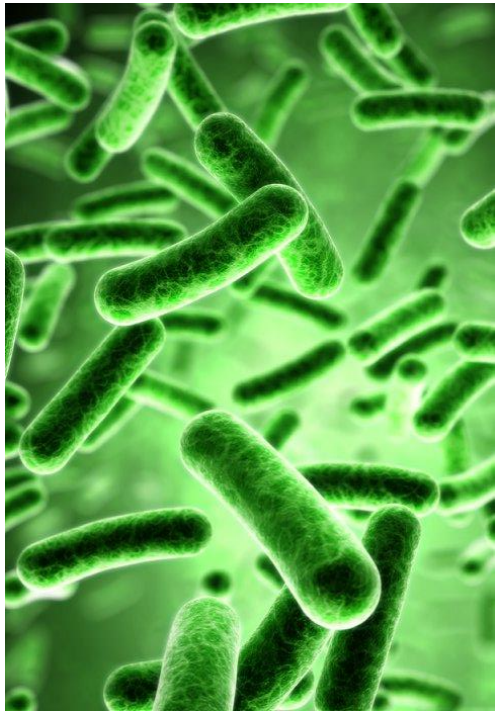
Sampling Site

- Microbiological contamination typically flows with a process
- Microbiological sample integrates all the preceding processing steps
- Conceptually nothing special about end product testing
  - This is the point where regulatory controls start



Requirements for Detection

- Two primary factors determine the lower limit of detection
  - Number of microorganisms needed to distinguish “signal” from “noise”
  - Impact of the particulate nature of microorganisms
    - Bacteria are not chemicals
- Same principles are true for traditional and rapid methods

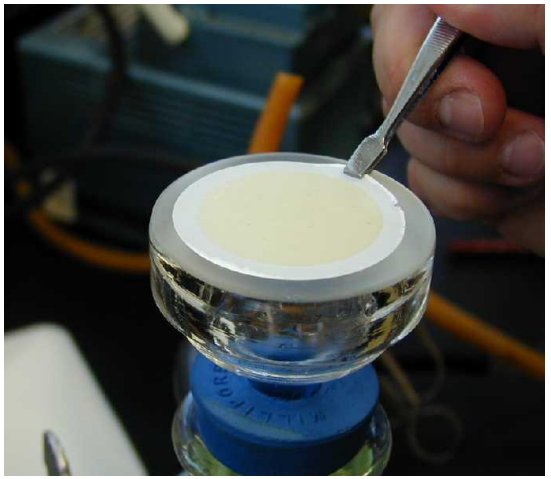


Requirements for Detection

- The size of the analytical unit is a key determinant
- To be 99% confident that at least one cell will be present in the analytical unit, the Mean Log Concentration must be:
  - 1 µl: MLC = 4.3 Log(CFU/ml)
  - 10 µl: MLC = 3.3 Log(CFU/ml)
  - 100 µl: MLC = 2.3 Log(CFU/ml)

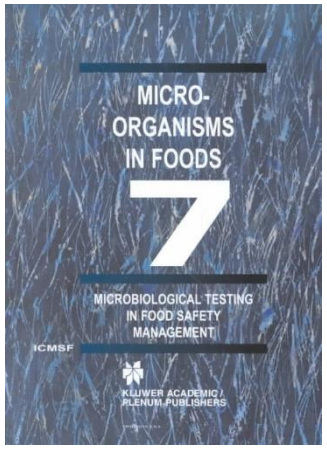
Requirements for Detection

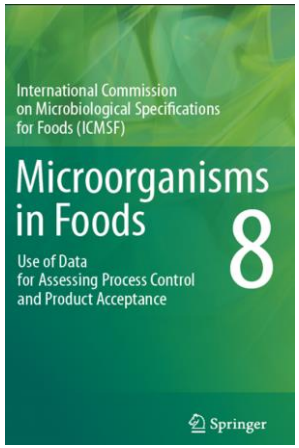
- To get around this key limitation, one can:
  - Increase analytical unit size
  - Increase the number of analytical units examined
  - Concentrate the target microorganism from the sample
  - Enrich the sample to allow target bacterium to increase in numbers



Conclusions

For more information, see www.icmsf.org or consult ICMSF Books 7 and 8.





- **Microbiological Testing:**
  - Is a set of technologically-based, statistically-based tools
  - The sensitivity and effectiveness of these tools are dependent on several factors including the microbial levels in the sample
  - Understanding the principles that influence microbiological testing is key to its effective use