Surface Sampling

Simple Methods to Check Cleaning and Disinfection

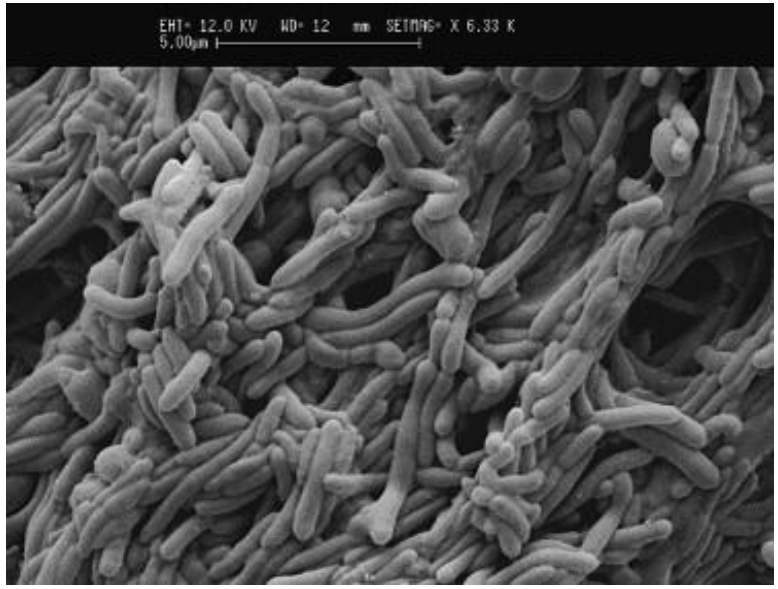
Teacheesy

Farmhouse and Artisan Cheese & Dairy Producers European Network

Erasmus+

Microbes in Surfaces Often Hide in *Biofilms*

- Microbes can adhere to surfaces and ***form biofilms***
- Biofilms may be source of contamination and pose a hazard to health
- Many *Listeria monocytogenes* and *Bacillus cereus* strains are known to have a strong adhesion ability to surfaces
- Biofilms are formed to all wet surfaces with traces of nutrients

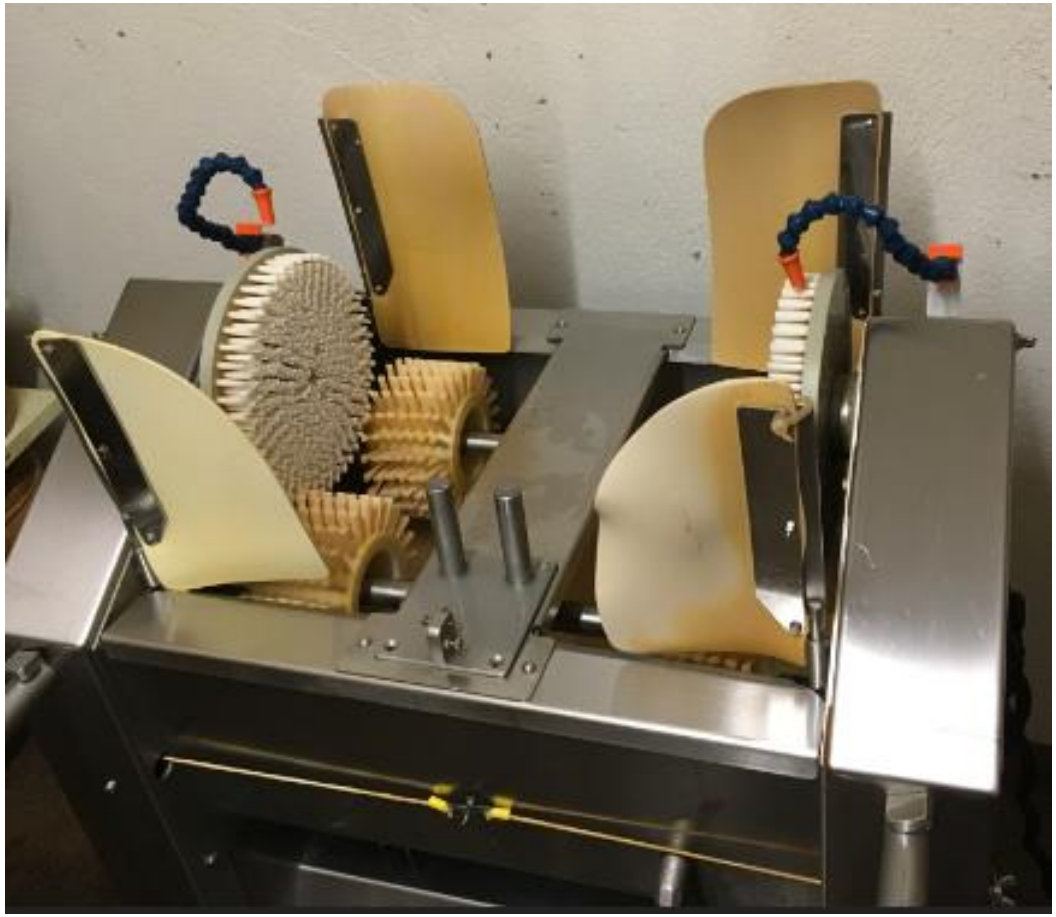


Kuva : Scanning –electron microscope (SEM) image on biofilm formed by *Bacillus cereus* –(scale 5 µm). Source: Simões, M., Simoes, L. C., & Vieira, M. J. (2010). A review of current and emergent biofilm control strategies. *LWT-Food Science and Technology*, *43*(4), 573-583.

- Biofilms protect microbes from cleaning and disinfection treatments

→ ***Biofilms are often difficult to eradicate***

Biofilm is Easily Formed on Moist Surfaces and Splash Areas

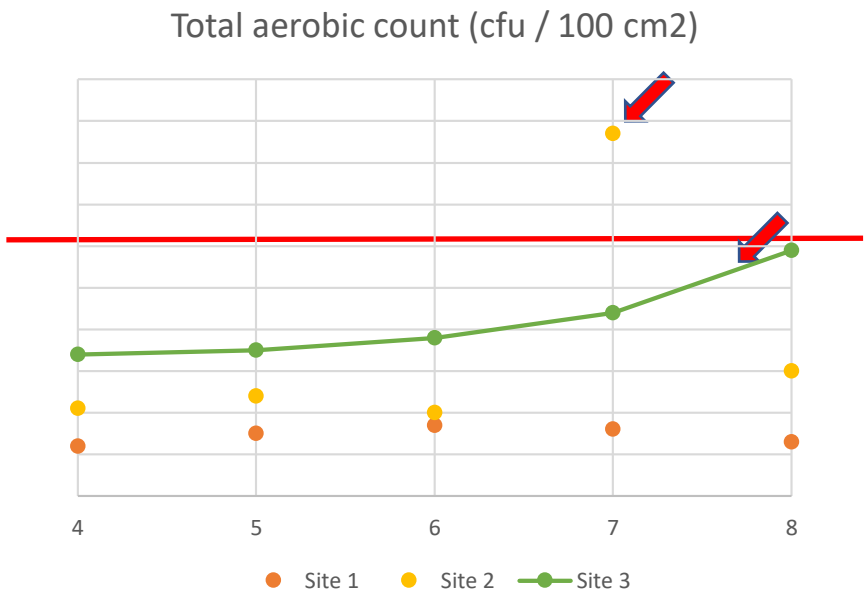


Surface Sampling is Obligatory if a Product poses a risk of Growth of *Listeria monocytogenes*

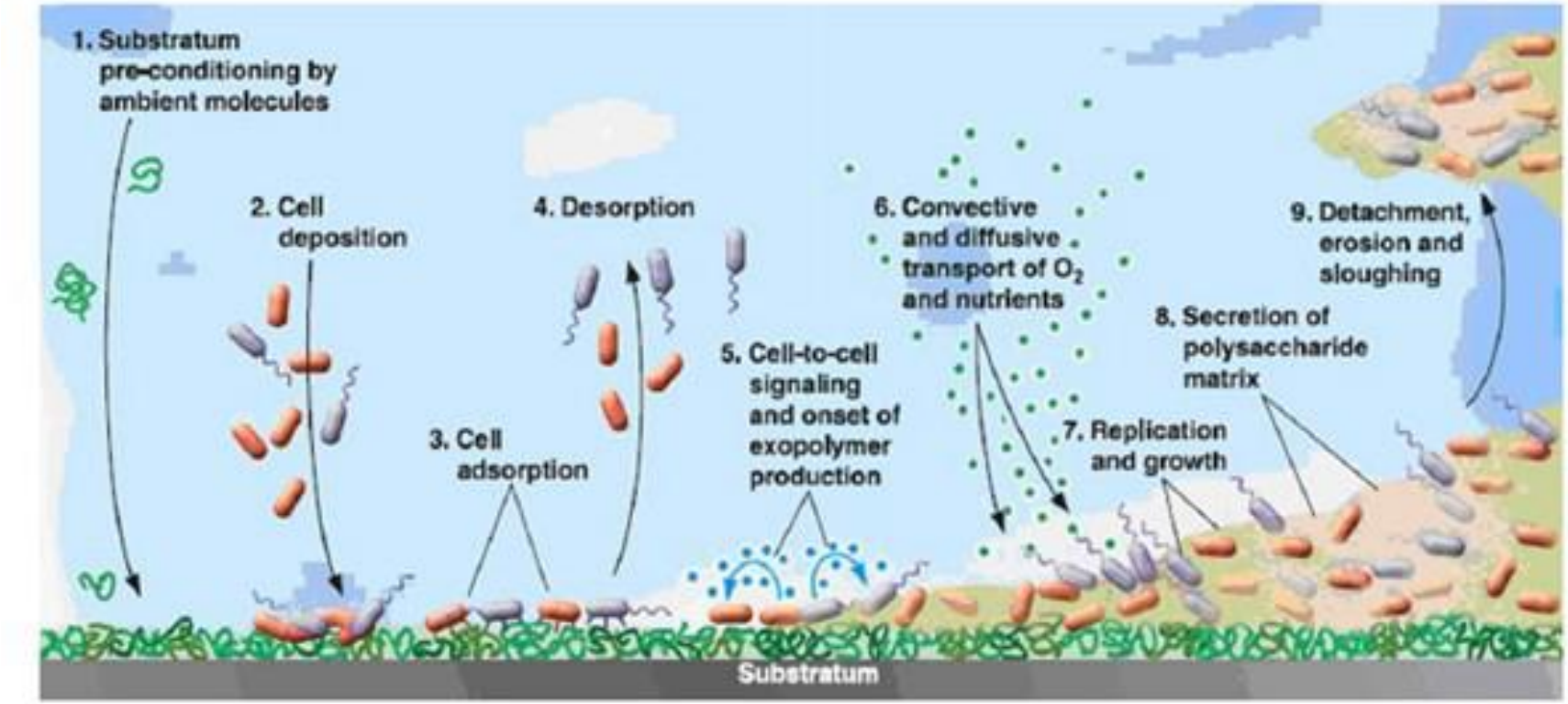
- The aim of these compulsory samples is **to detect the eventual presence of** *L. monocytogenes* in the processing areas and equipment (Reg. No 2073/2005, art.5.2)
- These samples shall be taken **during production**

Surface Sampling for Hygiene Indicator Organisms

- **Recommended** and **useful** to evaluate cleaning and disinfection practices
  - monitor **trends in hygiene indicator microbes** at different sites in the dairy



Formation and Detachment of Biofilms on Processing Surfaces



Source: Simões, M., Simoes, L. C., & Vieira, M. J. (2010). A review of current and emergent biofilm control strategies. *LWT-Food Science and Technology*, *43*(4), 573-583.

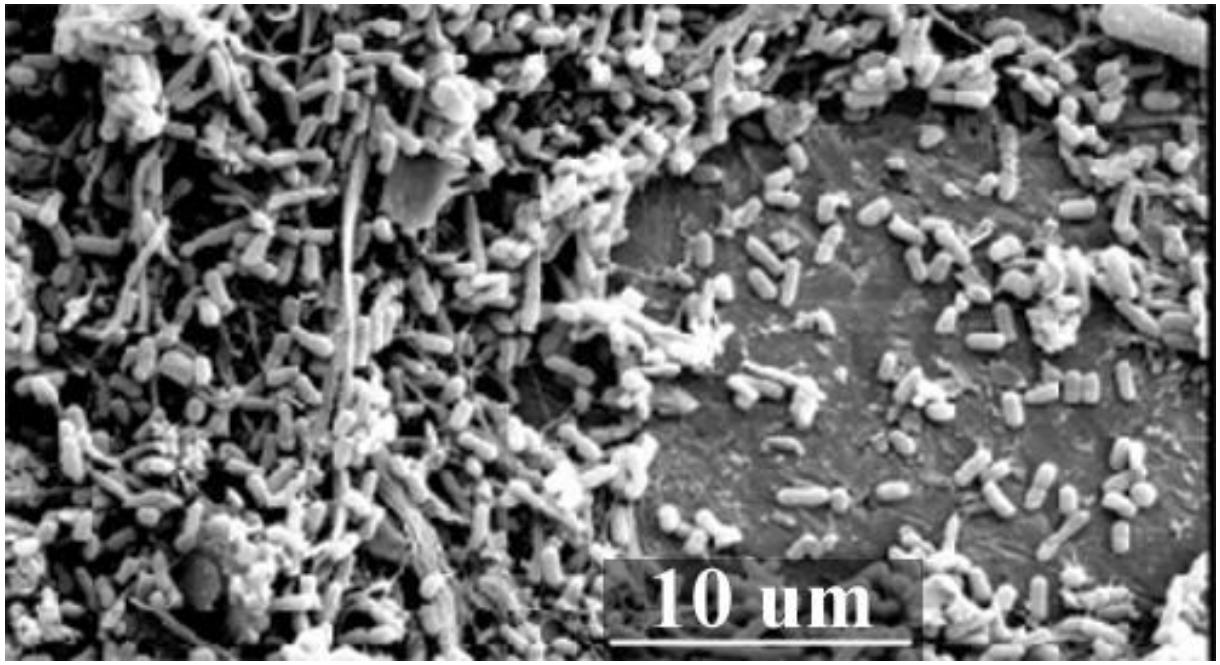
Biofilm Formation Animation (McGraw-Hill Animations 2017)

A Review: Chmielewski, R. A. N., & Frank, J. F. (2003). Biofilm formation and control in food processing facilities. *Comprehensive reviews in food science and food safety*, *2*(1), 22-32.

Importance of Quality of the Surface Material on Hygiene

- Stainless steel is available in various grades and finishes

→various physico-chemical properties



→This has an effect on bacterial adhesion

See examples and scanning electron microscope images: Jullien, C., Bénézech, T., Carpentier, B., Lebret, V., & Faille, C. (2003). Identification of surface characteristics relevant to the hygienic status of stainless steel for the food industry. *Journal of Food Engineering*, *56*(1), 77-87. Retrieved from https://doi.org/10.1016/S0260-8774(02)00150-4

Where, When and How to Take Environmental Samples?

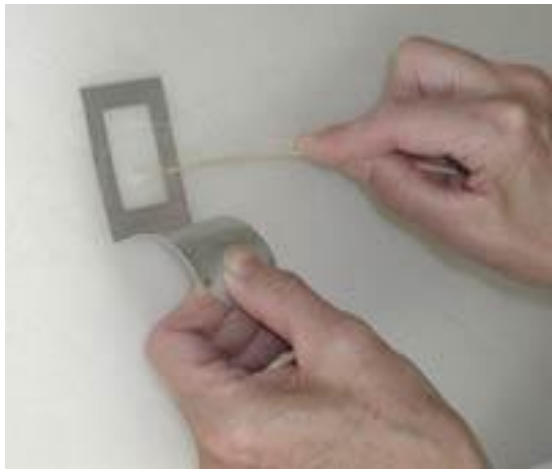
- As described in the the sampling plan of the premise
- Depending on the aim of the sampling, samples shall be taken:

  a) From surfaces after proper disinfection. If surfaces or equipment look dirty → clean them again!

  b) While being used or immediately before it (to detect *Listeria monocytogenes*)

  c) From hands of workers (to check handwashing)

Examples of Surface Sampling and Simple Hygienic Analysis Methods



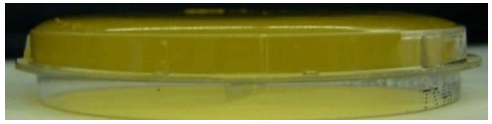
Surface swabbing

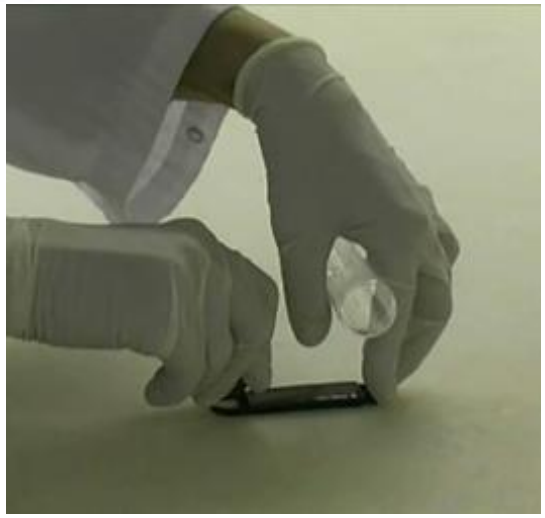
(see videos QuickMedical and Quantiswab)

Petrifilm™ (3M) and related products

ATP

Dip slides and Contact plates





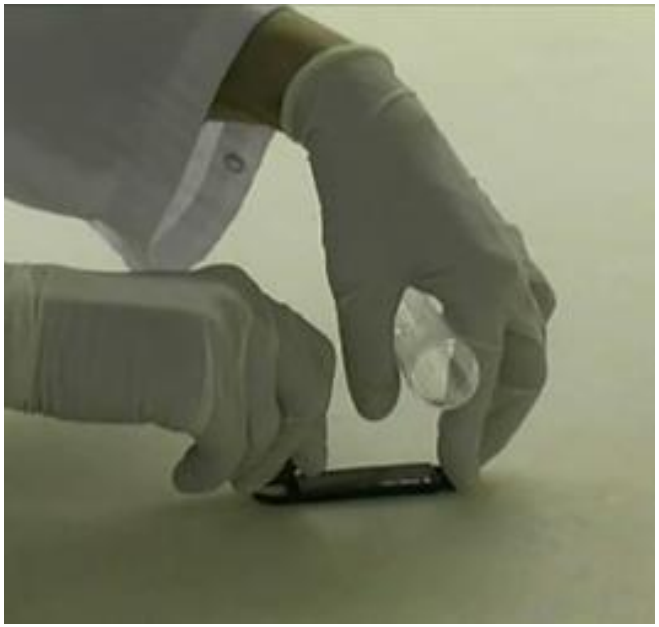
Many Commercial Products are Available for Surface Sampling




Contact Slides

Growth medium for microbes on both side of the slide; for example for total aerobic bacteria, enterobacteria, coliforms, yeasts and moulds etc.

Sampling → Incubation → Interpretation of the results



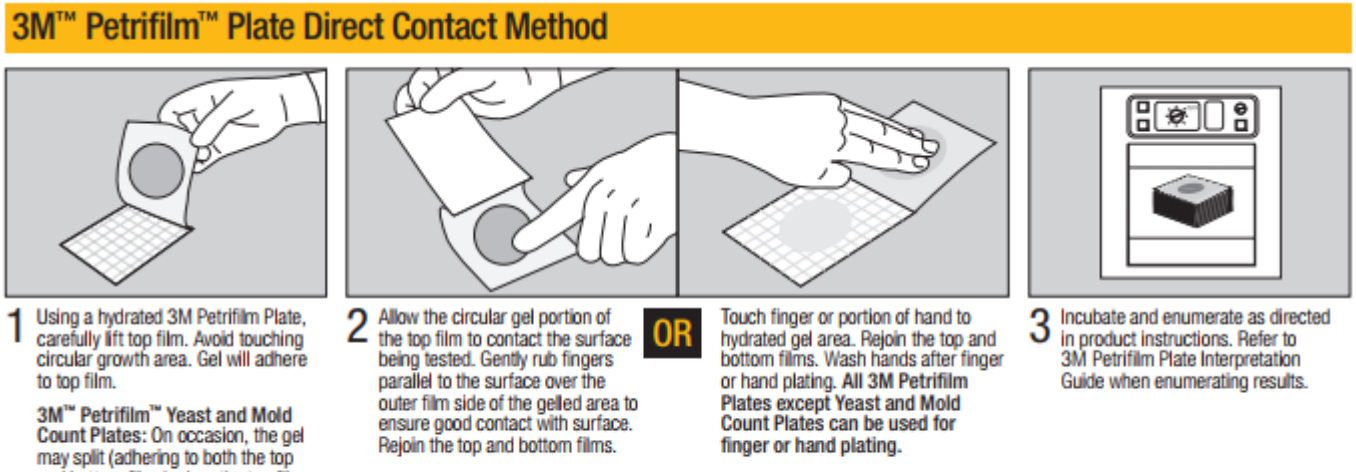
An example of an evaluation table (Microcount®)

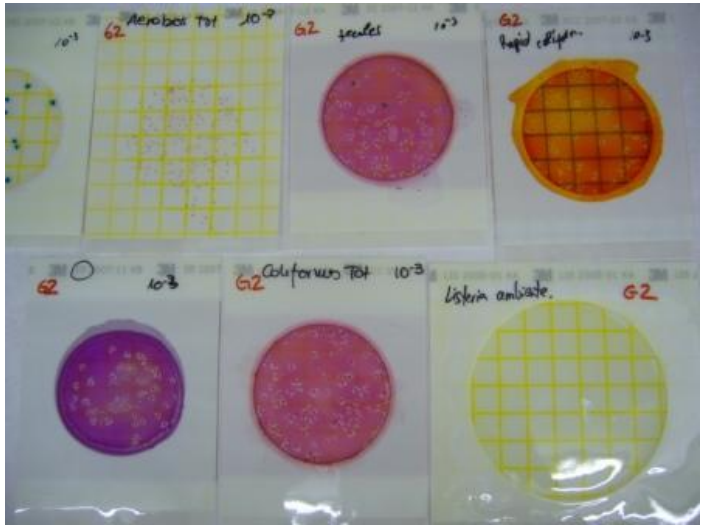
Evaluation table

mikrocount®	TPC	Total plate count			
10^2 CFU/ml	10^3 CFU/ml	10^4 CFU/ml	10^5 CFU/ml	10^6 CFU/ml	10^7 CFU/ml
					
< 1 CFU/cm²	1 CFU/cm²	5 CFU/cm²	45 CFU/cm²	80 CFU/cm²	> 100 CFU/cm²

Several providers and products (Envirocheck®, Hygicult®, Hycheck®, Easicult®, Microcount® …)

Petrifilms™ and Related Products





Source: 3M. Environmental monitoring

Video: 3M Petrifilm Plates for Environmental Testing

Instructions for

- Aerobic Count Plates
- Enterobacteria
- *E. coli* / Coliforms

Interpretation guide for

- Aerobic Count Plates
- Enterobacteria
- *E. coli* / Coliforms

Other products:
Compact Dry, Rida Count

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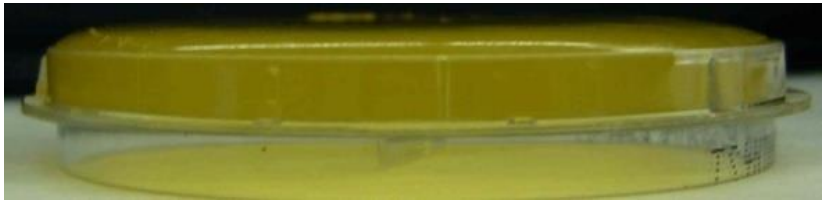
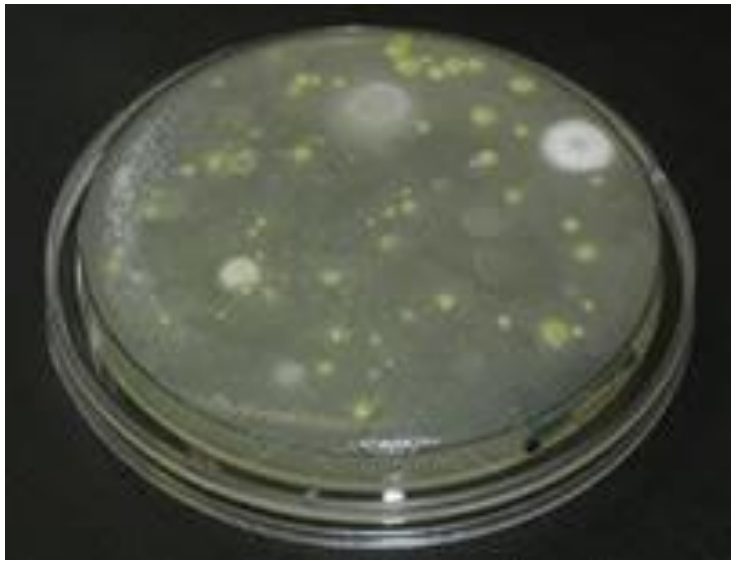
Contact Plates

- Agar surface is pressed against the surface for a short moment
- → Incubation
- → Counting the colonies
- For example RODAC Plates



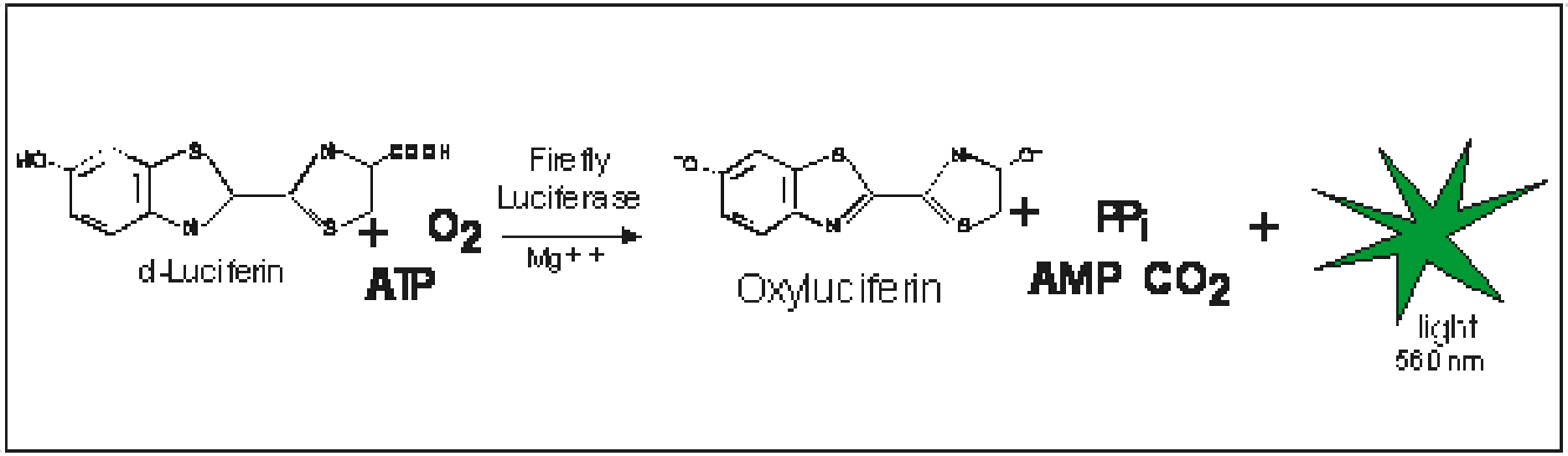


ATP Measurement

- ATP (adenosine triphosphate) molecules are present in all cells (microbial, plant, animal cells) → good indicator of organic contamination
- In hygiene monitoring, a device called luminometer and test swabs with reagents (luciferin, luciferase enzyme) are used
- Many providers and products (3M Clean –TraceTM, Hygiena, Lumitester…)

Principle of ATP Measurement

- ATP reacts with luciferin in the presence of the catalyst (luciferase enzyme) and produces light, which can be recorded by a luminometer



- Rapid method: Result in a couple of minutes
- Suitable tool for checking total surface cleanliness!