



The Relation Between Time and Bacterial Load on Stainless Steel Surgical Instruments

Assoc. Prof. Duygu Percin, MD

Department of Microbiology and Clinical Microbiology
Erciyes University Faculty of Medicine
Kayseri-TURKIYE





Erciyes University Hospital









DEZENFEKSİYON ANTİSEPSİ
STERİLİZASYON DERNEĞİ
SOCIETY OF DISINFECTION
ANTISEPSIS STERILIZATION

John J. Perkins, 1956

“Instruments must be cleaned immediately after use, to avoid rusting or pitting and to remove soil before it can dry and harden in the serrations or crevices”



Levels of naturally occurring microorganisms on surgical instruments after clinical use and after washing.

Articles

AJIC: American Journal of Infection Control. 27(4):315-319, August 1999.

Chu, Nancy S. MS; Chan-Myers, Harriet BS, RM(AAM); Ghazanfari, Nona BS; Antonoplos, Patricia PhD

Abstract:

Surgical instruments exposed to sterile body sites should be contaminated with relatively low levels of microbial contamination or bioburden; however, few studies in the literature have determined the quantitative level and types of contamination. A study was conducted at 2 clinical sites to determine the level of microbial contamination of surgical instruments after clinical use and after washing. Quantitative assays showed that bioburden levels were in the range of 0 to 4415 colony forming units per instrument after clinical use, and 88% of the instruments had bioburden levels lower than 100. As expected, a reduction in counts occurred after washing; however, in some cases, higher counts were found on the instruments after the washing process. Although the washing procedure is effective in reducing the microbial levels deposited on the surgical instruments during use, a recontamination process occurs that results in increased counts after washing. The low bioburden level after washing consists of predominantly vegetative microorganisms that present a relatively low challenge to sterilization and disinfection systems.



Natural bioburden levels detected on rigid lumened medical devices before and after cleaning.

Articles

AJIC: American Journal of Infection Control. 25(6):471-476, December 1997.

Chan-Myers, Harriet BS, RM (AAM); McAlister, David PhD, ABMM; Antonoplos, Patricia PhD

Abstract:

Controversy exists concerning the degree of microbial contamination associated with the use of rigid lumened medical devices, the efficacy of standard cleaning techniques used to remove pathogenic microorganisms from lumen channels, and whether patients are placed at risk of cross infection because of microbial contamination. In this study the level and types of microorganisms found on rigid lumened medical devices before and after cleaning in a hospital environment were investigated. The bioburden level after clinical use was found to be relatively low, ranging from 10 (1) to 104 colony forming units (CFU) per device. After the instruments were cleaned, none of the devices studied contained bioburden levels greater than 104 CFU and 83% had bioburden levels less than or equal to 102 CFU. The bioburden present before cleaning was comprised of organisms derived from the handling of the device, from the hospital environment, and from the patient. The bioburden present after cleaning was comprised of organisms typically derived from the handling of the device and from the hospital environment. The level of bioburden per device was also related to the anatomic site where the device was used, with lower numbers of organisms found on devices exposed to sterile body sites and the respiratory tract. (AJIC Am J Infect Control 1997;25:471-6)

Where does the bioburden derive from?



- Before washing
 - Handling of device
 - Environmental contamination
 - Patient
- After washing
 - Handling of device
 - Environmental contamination

Assesment of biofouling of dental handpieces after use

Handpiece	Mean cfu / ml
Turbine	250
High speed spray channel and turbine	54
Low speed spray channel	42
Surgical	95

Smith Gordon et al. 10th World Congress of Sterilization, Greece, 2009

Assesment of bioburden on surgical instruments

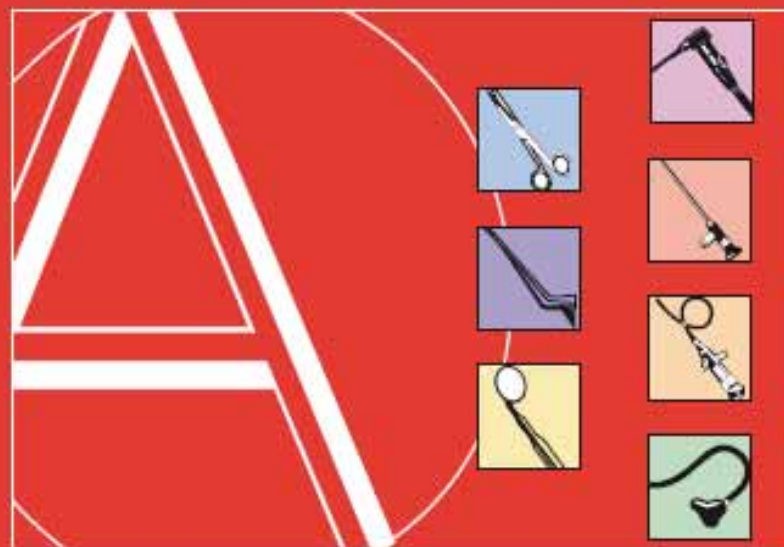
OPERATION	NUMBER OF SETS	(CFU/cm²)
Abdominal Surgery	12	2x10²
Orthopedic Surgery	6	1.8x10²
Reconstructive Surgery	5	2.5x10²
Cardiovascular Surgery	4	60
Gynecologic Surgery	3	10
Neurosurgery	3	10
Pediatric Surgery	2	10
Biopsy	1	No Growth
Others	36	1.4x10²



Cleaning is critical

- Removal of gross debris
- Prevention of cross contamination
- Protection of health care workers
- Maintenance of instruments
 - Proper maintenance prolongs the life of instruments
 - Prevents corrosion
 - Provides a better functioning during surgical operations
 - Ensures patients are given the highest level of care

Proper Maintenance of Instruments



Instrument Preparation
Working Group

8

revised edition

Corrosion risk





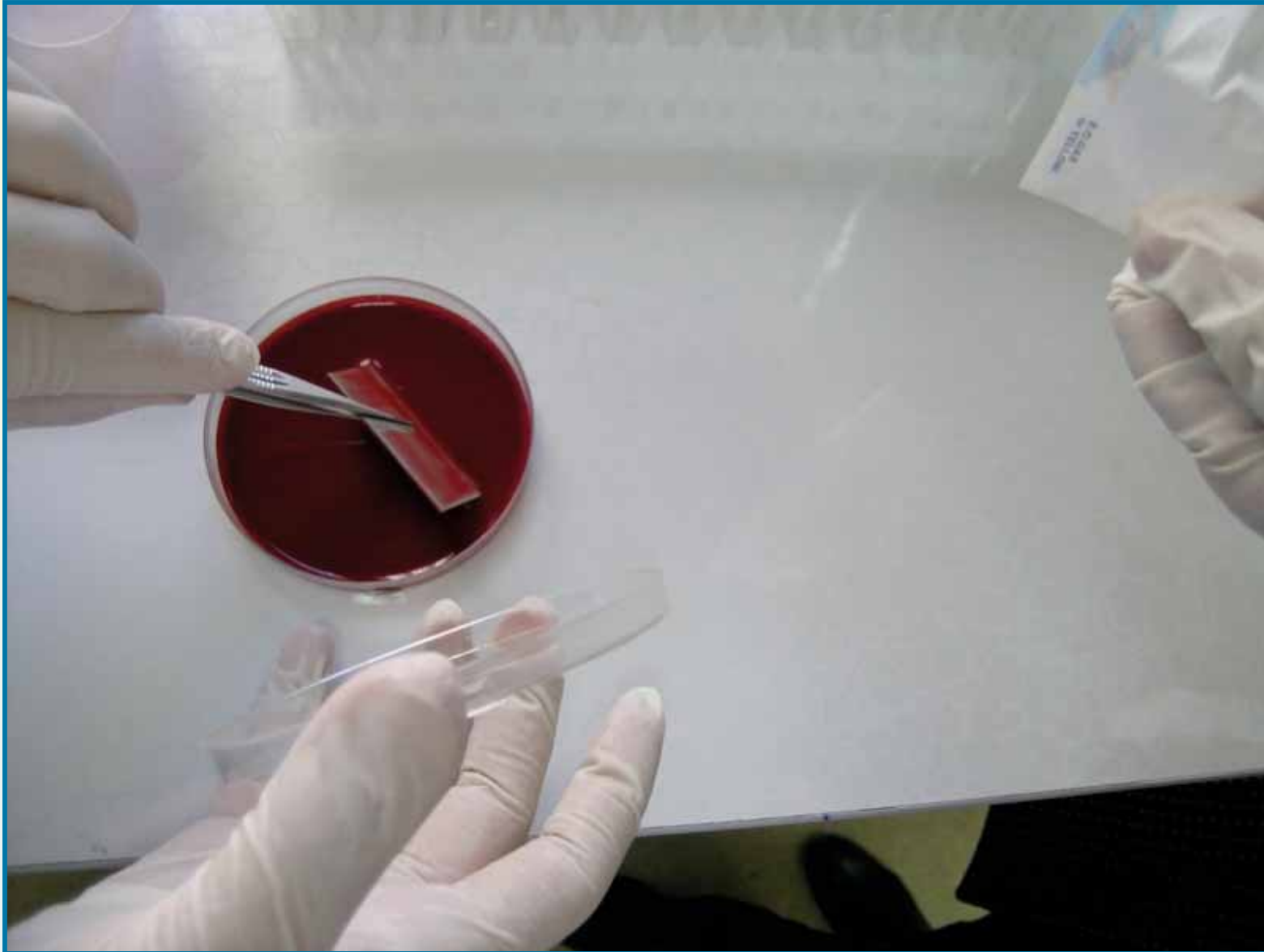
Preparation of inocula



- *Staphylococcus aureus* ATCC 25923,
- *Pseudomonas aeruginosa* ATCC 27853
- *E.coli* ATCC 25922

5×10^3 cfu/mL

Contamination

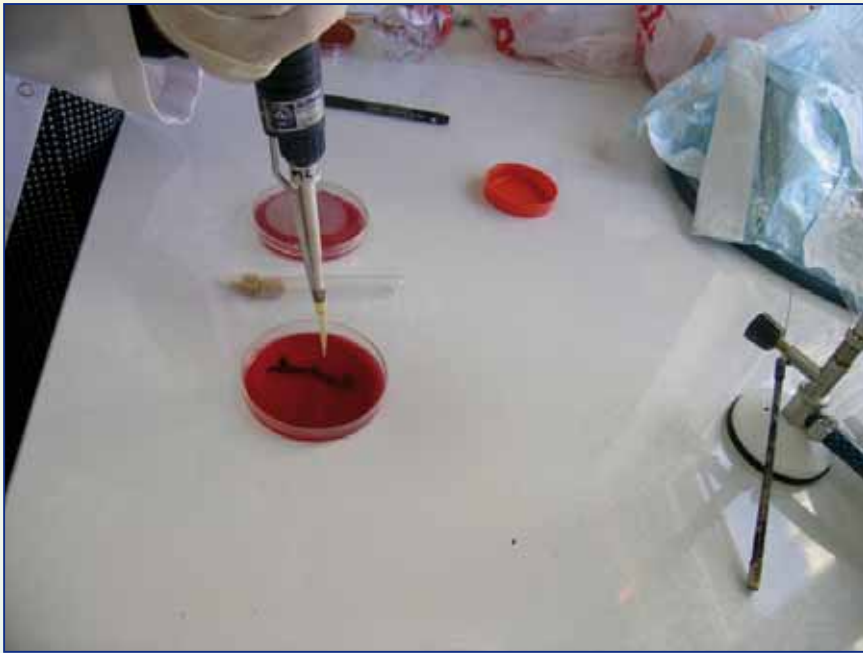


Holding at room temperature



2, 4, 6, 8, 12, 24, 36, and 48th hour

Inoculation and Incubation



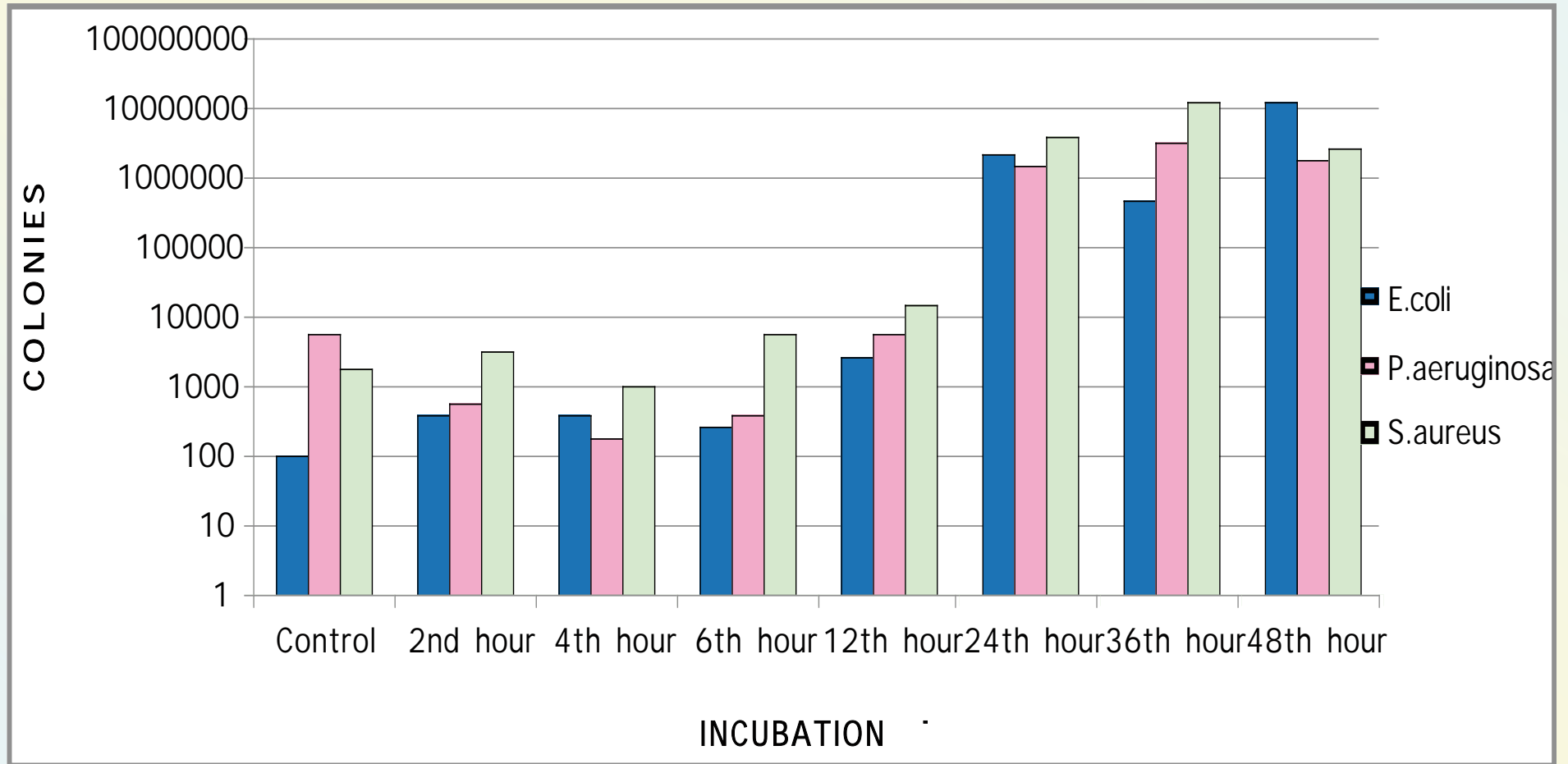
Counting



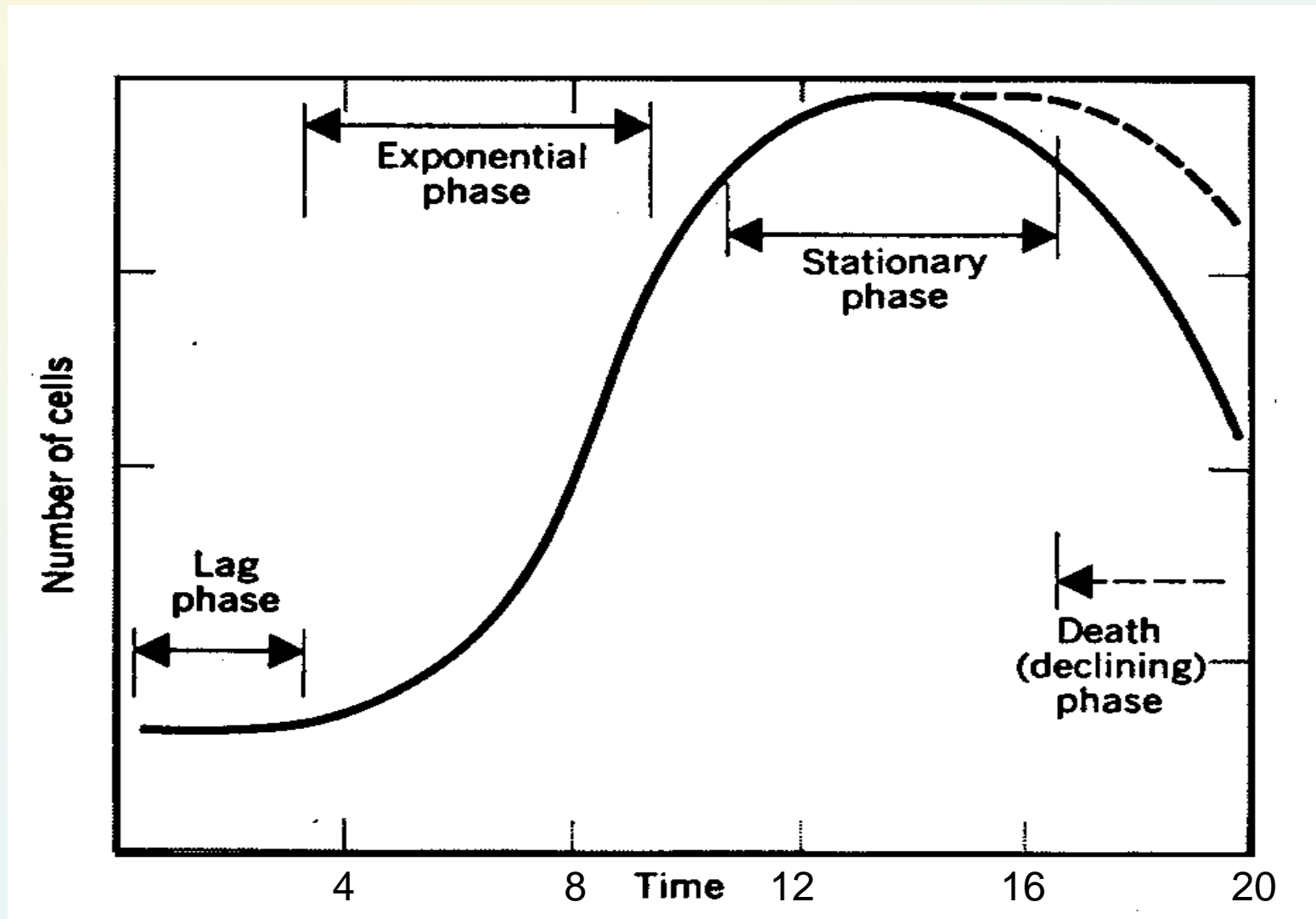
Colony counting results at different hours

	<i>E.coli</i>	<i>P.aeruginosa</i>	<i>S.aureus</i>
Control	$1 \cdot 10^2$	$6 \cdot 10^3$	$1,8 \cdot 10^3$
2nd hour	$4 \cdot 10^2$	$6 \cdot 10^2$	$3,2 \cdot 10^3$
4th hour	$4 \cdot 10^2$	$2 \cdot 10^2$	$1 \cdot 10^3$
6th hour	$3 \cdot 10^2$	$4 \cdot 10^2$	$5,4 \cdot 10^3$
12th hour	$3 \cdot 10^3$	$6 \cdot 10^3$	$1,6 \cdot 10^4$
24th hour	$2,3 \cdot 10^6$	$1,5 \cdot 10^6$	$4,2 \cdot 10^6$
36th hour	$5 \cdot 10^5$	$3,3 \cdot 10^6$	$1,2 \cdot 10^7$
48th hour	$1,2 \cdot 10^7$	$2 \cdot 10^6$	$3 \cdot 10^6$

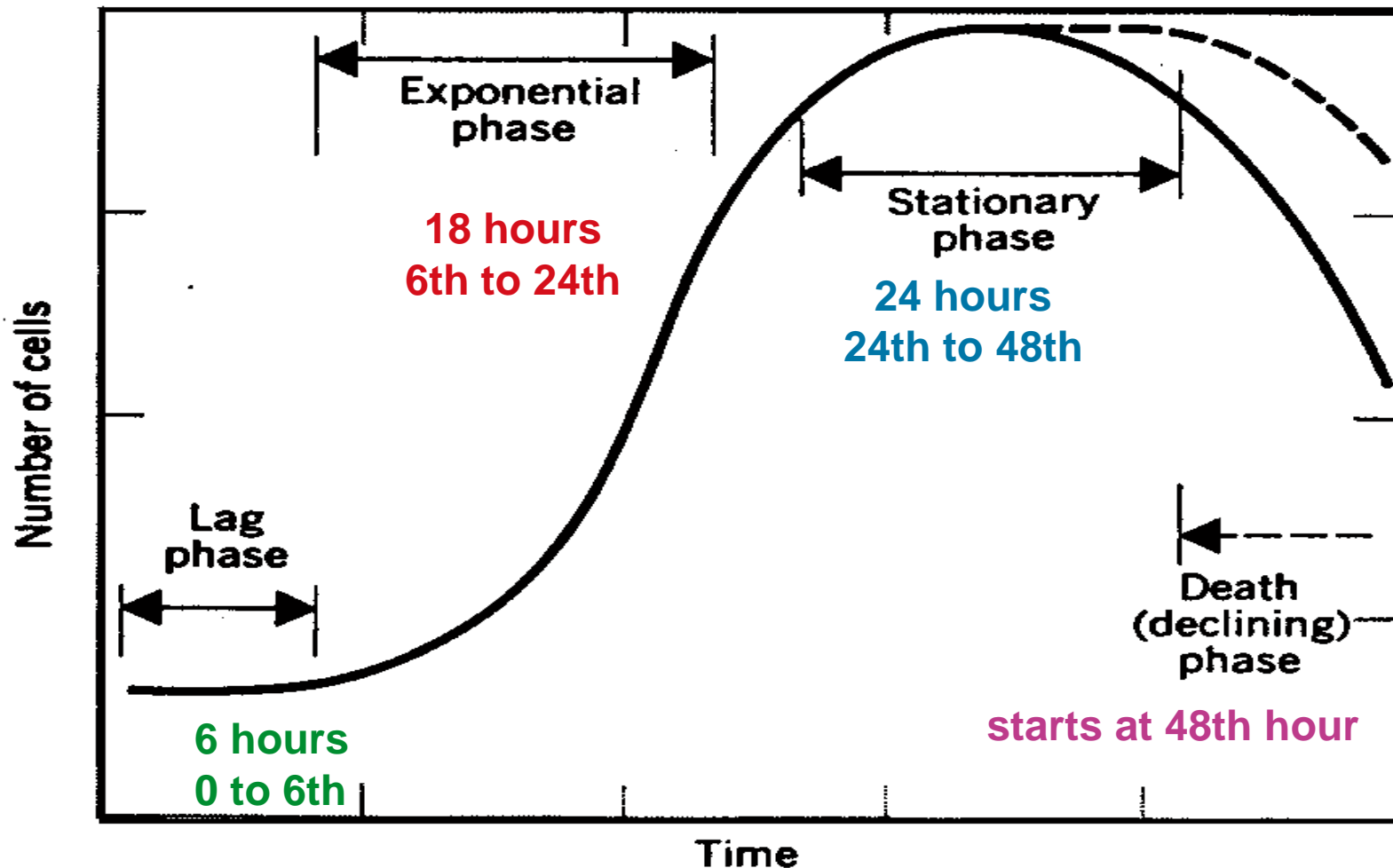
Colony counting results at different hours



Growth and death cycle of bacteria



Growth cycle of bacteria on dry blood stainless steel



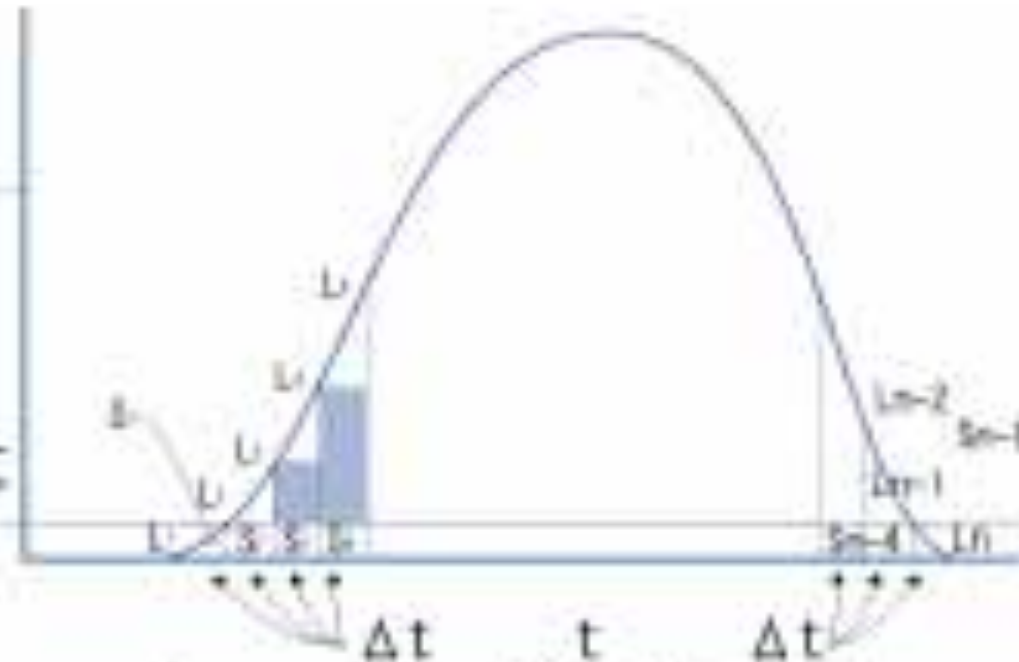
The larger the number of bacteria contaminating inanimate objects, the longer it takes for a germicide to destroy them all

F-value

$$L_i = \frac{1}{\text{Log}^{-1} \frac{T_r - T_i}{Z}}$$

When T_i is constant and considered as Δt

$$F = \sum_{i=1}^n \Delta t L_i$$



Summation of the dimensions becomes F-value.

Effects of numbers of B.Subtilis spores on sporicidal time of 8% formaldehyde-isopropanol

Spore count (per blade)	Test procedure	Positive	Negative
100,000	Dried blood blade	2 hrs	3 hrs
1,000	Dried blood blade	1 hrs	2 hrs
10	Dried blood blade	---	30 min

Data from Spaulding, 1963



In conclusion

Cleaning of the surgical instruments in the first 6 hours after usage is essential

- To ensure effective disinfection and sterilization
- To maintain the instruments properly
- To ensure patients' safety



RESEARCH TEAM

Duygu PERCIN

Hafize SAV

H. Tuna HORMET OZ

Murat KARAUZ

Baris D. ERÇAL

Suleyman DURMAZ

Ismail GULER

