

**Viability of Bacteria on Fabrics**  
**Prof. Jerry Kavouras, Lewis University**  
**A Webber Training Teleclass**



# **Viability of Bacteria on Fabrics**

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Hosted by Paul Webber  
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## **Objectives**



1. To identify factors that affect the viability of bacteria on fabrics
2. To relate the viability of bacteria on fabrics to the transmission of infectious diseases

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## Acknowledgements



Colclasure, V. J. et. al. (2015). *American journal of infection control*, 43(2), 154-158

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## Acknowledgements



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Thomas Lynch

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Corey Knickerbocker

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## Research Question



- How long do coliform bacteria survive on fabrics exposed to different environmental conditions?

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## Previous Work



- Focused on the **viability** of clinically significant microbes on fabrics & fomites, or studied fabrics with antibacterial properties.
- Most clinical studies that focused on the association between fabrics and bacteria, looked at viability of **single isolate species** and survival length.

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## Research Novelty



1. It utilized **environmental isolates** that people may encounter at recreational sites rather than clinical isolates.
2. The focus was on the **number** of bacteria instead of solely viable cells remaining.
3. The environmental conditions **mimicked** common scenarios at which these organisms would be exposed.

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## Bacterial Isolates




- Coliform bacteria are indicator organisms of contamination and pathogens
- Isolates from recreational areas
- Fabric inoculations included three species of coliform bacteria


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## Protocol

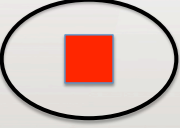




Coliform Suspensions

 Sunlight, Room Temperature  
 Dark, 25°C  
 Dark, 37°C






Tests:

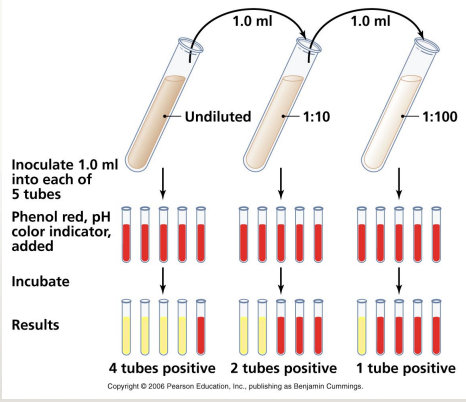
1. MPN
2. Colony morphology

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## Most Probable Number



- Technique allows detection of microbes in low numbers



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MPN DETERMINATION FROM MULTIPLE-TUBE TEST

NUMBER OF TUBES GIVING POSITIVE REACTION OUT OF			MPN INDEX	95 PERCENT CONFIDENCE LIMITS	
3 of 10 ml each	3 of 1 ml each	3 of 0.1 ml each		LOWER	UPPER
0	0	1	3	<0.5	9
0	1	0	3	<0.5	13
0	2	0	4	<0.5	20
0	3	0	7	<0.5	21
0	4	0	11	<0.5	23
0	5	0	14	<0.5	26
0	6	0	15	<0.5	27
0	7	0	20	<0.5	30
0	8	0	21	<0.5	34
0	9	0	23	<0.5	37
0	10	0	28	<0.5	44
0	11	0	29	<0.5	47
0	12	0	32	<0.5	48
0	13	0	35	<0.5	50
0	14	0	37	<0.5	52
0	15	0	39	<0.5	54
0	16	0	43	<0.5	57
0	17	0	45	<0.5	58
0	18	0	47	<0.5	60
0	19	0	49	<0.5	62
0	20	0	52	<0.5	64
0	21	0	55	<0.5	66
0	22	0	57	<0.5	68
0	23	0	60	<0.5	70
0	24	0	63	<0.5	72
0	25	0	65	<0.5	74
0	26	0	68	<0.5	76
0	27	0	70	<0.5	78
0	28	0	73	<0.5	80
0	29	0	75	<0.5	82
0	30	0	77	<0.5	84
0	31	0	80	<0.5	86
0	32	0	83	<0.5	88
0	33	0	85	<0.5	90
0	34	0	88	<0.5	92
0	35	0	90	<0.5	94
0	36	0	93	<0.5	96
0	37	0	95	<0.5	98
0	38	0	97	<0.5	100
0	39	0	100	<0.5	100
1	0	1	3	0.5	9
1	1	0	3	0.5	13
1	2	0	4	0.5	20
1	3	0	7	0.5	21
1	4	0	11	0.5	23
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1	41	1	95	0.5	98
1	42	1	97	0.5	100
1	43	1	100	0.5	100

FROM: STANDARD METHODS FOR THE EXAMINATION OF WATER AND WASTEWATER, TWELFTH EDITION. (NEW YORK: THE AMERICAN PUBLIC HEALTH ASSOCIATION, INC., p. 656)

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## Colilert® reagent



- IDEXX Laboratories



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## Fabrics



- Cotton
  - Retained 99% of coliform suspension
- Blended cotton
  - Retained 86% of coliform suspension
- Silk
  - Retained 73% of coliform suspension

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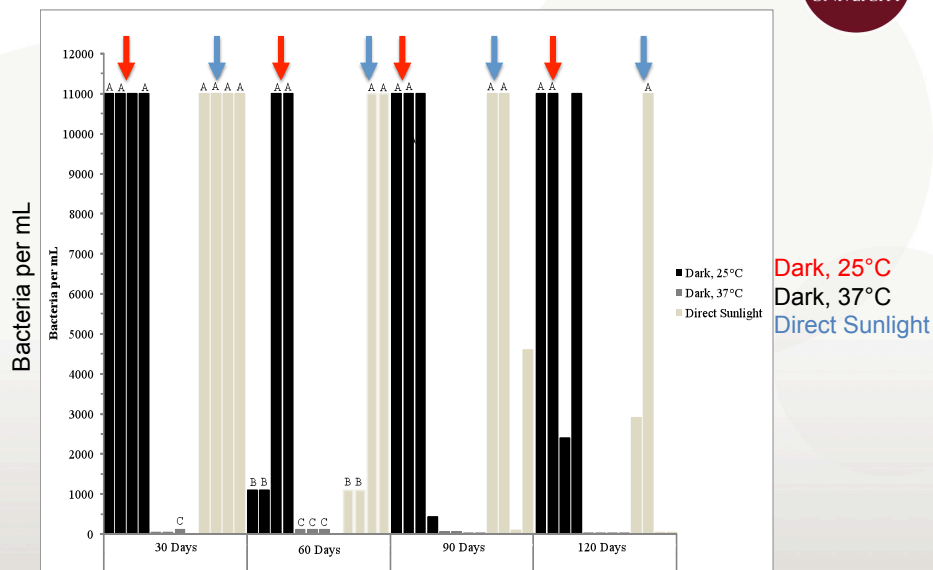
## Environmental Conditions



- Sunlight, Room Temperature
  - Coliforms inactivated by sunlight
  
- Dark, 25°C
  
- Dark, 37°C
  - Optimal growth temperature

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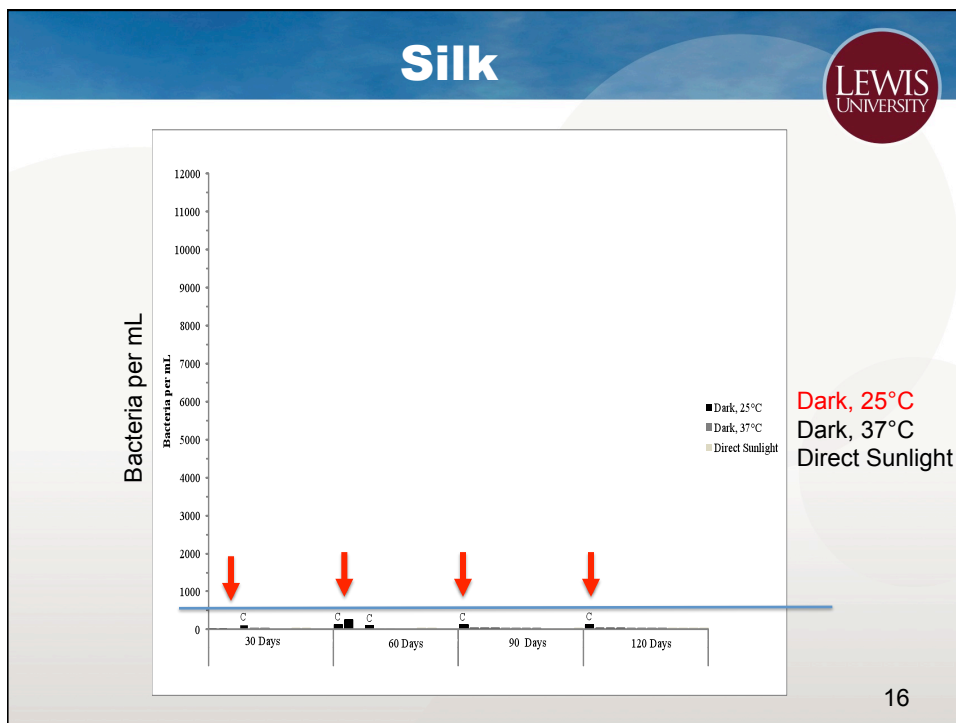
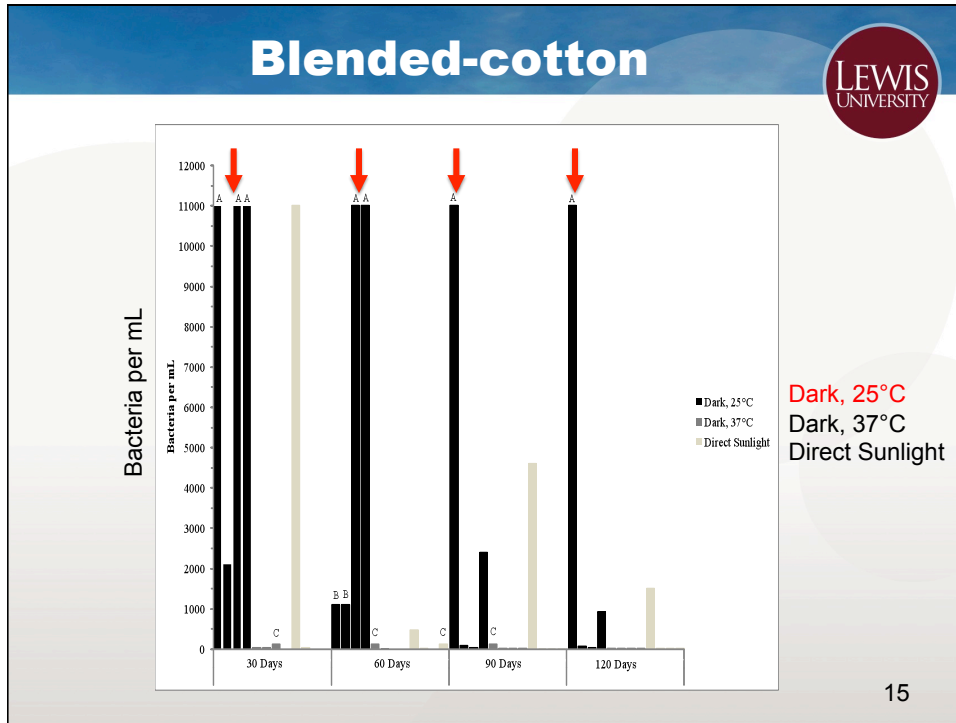
## Cotton



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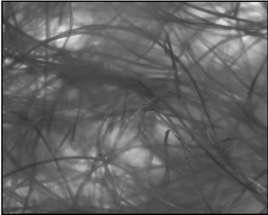
## Fabric Architecture



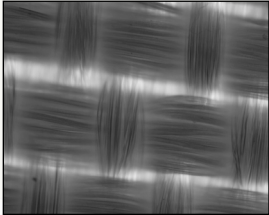
Cotton



Blended-cotton




Silk



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## Conclusions




1. It appears that coliform bacteria **can survive on fabrics longer than previous studies** have reported.
2. Coliform bacteria survive better in the **dark**, at **lower temperatures**, and on fabrics that can **retain moisture**.
3. These findings can be applied directly to the viability of bacteria on clothing and potential human exposure to fecal pathogens

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## Infected Dose



Enteric Pathogen	Dose
<i>Shigella</i>	10-100 organisms
<i>E. coli</i> O157:H7	<10 organisms
<i>Campylobacter jejuni</i>	10 <sup>2-6</sup> organisms
<i>Salmonella</i>	10 <sup>5</sup> organisms

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## Thank you



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